

Sen meets Schumpeter: Towards an agent oriented theory of inequality and qualitative change

By Dominik Hartmann¹, July 2009

Abstract: This paper aims to combine the basic insights of Amartya Sen's agent oriented view on development and inequality and Schumpeter's concept of economic development as qualitative change driven by the introduction of new combinations. The final goal is to contribute to the elaboration of an evolutionary agent based theory on inequality and development. We consider that the very enriching concept and work of Amartya Sen and other social choice, human development and inequality related authors tend to emphasize insufficiently evolutionary aspects of socioeconomic systems and their impacts on the opportunities of the actors to be active agents in the development processes. The evolution of the variety of local economic activities and social network structures (e.g. power, access to non-redundant information and finance) are decisive determinants for the people to be active agents and to adapt to the evolutionary changes of the socioeconomic systems they are living in.

Key Words: Schumpeter, Sen, heterogeneity, variety and networks

JEL: D63, D83, D85, B52, O15

1 Introduction

The world is complex. Fostered by new opportunities for data storage, computing and analysis, development economics increasingly take this complexity into account and new integral and systemic development approaches have emerged.

The human development and capability approach basically focuses on the individuals, their ability to be and do, their freedom to choose, their capability to determine their own life. Nevertheless, the human development approach could also be viewed as understanding the freedom of people in a complex and evolving environment. The instrumental freedoms distinguished by Amartya Sen (1999) - 1) political freedom, 2) economic facilities, 3) social opportunities, 4) transparency guarantees and 5) protective security - intrinsically indicate to this complexity. Much more than just countrywide growth is needed to provide the people with the substantial capabilities to determine their own life and being agents rather than patients. The freedom of the actors is influenced by a large number of factors, ranging from political, social to environmental and economic aspects. The different levels of analysis are interrelated.

To understand complexity we urgently need to understand how the different elements of a socioeconomic system (people, firms, organizations etc.) are interconnected and what the feedback-loops between the individuals' freedom and the systems' evolution are.

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Furthermore, it is of substantial importance to recognize that both the individuals and the system are evolving. Nor a general equilibrium of the system, nor a fixed level of capabilities of the agents exists. Both are evolving over time. The capabilities and opportunities (might) change over time, as the people are learning and interacting with other individuals. Socioeconomic systems are permanently changing. The simple fact that people are dying and kids are born as well as learning processes and innovations do not allow for a steady state or general equilibrium of the system.

In this paper we propose a theoretical framework to get new insights into the complex relations between the freedom of the agents and the complex evolving system they are living in by combining some essential lessons of Neoschumpeterian Economics with Amartya Sen's capability approach. Specific focus will be put on the need to put more emphasis the role of social networks, learning and innovation driven evolution of economic variety on the freedom of the actors.

The paper proceeds as follows: Chapter two explains the basic ideas and reasons why we aim to combine the human capability approach with insights from Neoschumpeterian Economics. Chapter three discusses some basic concepts of both lines of research, such as interactive learning and structural change on the one hand and basic needs and development as freedom on the other. Chapter four proposes a set of pillars for a viable roadmap to combine both approaches. A common starting base may be an agent-oriented perspective on development, taking the great heterogeneity of human beings serious. Furthermore we indicate to the role of social networks and economic variety evolution on the freedom of the actors and propose to apply a broad concept of entrepreneurship and innovation. Chapter five argues for the need to apply agent-based modelling and social network analysis techniques to realize in-depth analysis on the reproduction of inequalities and the feedback-loops between the agents' capabilities and the systems evolution. Chapter six resumes and derives policy implications.

2 Why combining Schumpeter meets Sen?

Some authors pointed to the promising idea to combine Innovation Economics with Amartya Sen's capabilities approach to get a deeper understanding of structural bottlenecks for innovation and development in less advanced countries (Johnson et al. 2003; Arocena and Sutz, 2005; Lundvall, 2007). In this vein, we aim to explore new theoretical and empirical insights by integrating two different but complementary fields of research:

- A) Amartya Sen's agent oriented view on development and inequality (e.g. Sen, 1995, 1998, 1999) and
- B) Joseph Alois Schumpeter's concept (and subsequent Neo-Schumpeterian work) of economic development as innovation driven qualitative change through the introduction of new combinations (Schumpeter, 1912, 1939, 1943; Hanusch and Pyka 2007ab).

The main point in common between both disciplines is a bottom-up approach, considering the great heterogeneity of people and their capabilities; notably in sharp contrast to mainstream neoclassical economics and the representative agent.

Inequality research and especially the capability approach has made substantive advances for a better understanding, measurement and recognition of the inequality of substantial freedoms of the people (inter alia provided by education, health, income) to determine their own life

and assist actively in the development processes (UNDP, 1990; Nussbaum and Sen, 1993, Sen, 1995, 1999). The expansion of the substantive freedoms of the persons is considered as primary means and ends of development (Sen, 1999). Little emphasis has been made however on the impact of innovation and structural change on the freedom of the people.

Neoschumpeterian Economics analyses the generation, implementation and diffusion of knowledge and technology, putting emphasis on the decisive role and impacts of entrepreneurship and innovation on sectoral dynamics and qualitative change (e.g. Saviotti, 1996; Hanusch and Pyka, 2007). Unfortunately, Neoschumpeterian Economics scarcely analyse the “destructive” part of the “creative destruction” processes nor consider what is happening to the people who do not have the capabilities and opportunities to assist in the innovation and development processes.

The main goal of combining both approaches is a better understanding of the mutual impacts between creative destruction processes and the freedom of the actors. We claim that development and (in)equality should not just be considered as reaching some determined levels of well beings, justice, sustainability or any other specific feature of the socioeconomic systems in determined point of time, but has to take also into account the continuous introduction of incremental and radical innovations, the permanent as well disruptive changes of the system. History has impressively shown that structural change, driven by the introduction of novelties and related co-evolutionary processes, is deeply influenced and has significantly impacted the inequality of capabilities and opportunities of the agents. For example creative destruction processes enabled by the French revolution, the American Civil War, different radical technological and organisational innovations (such as vapour, electricity, Taylorism, Fordism, ICT etc.) have had deep impacts on the life of the people and their capabilities to achieve a considerable life standard. The freedom of the agents to become active through development has been extremely diverse in space and time as well as social classes, sometimes changing disruptively, other times changing slowly but permanently. Persistent novelty and endogenous change is leading to new combinations and organization of the existent resources, set of choices of agents and their interaction patterns. This qualitative change underlying economic development has a decisive influence on the freedom of the agents.

To our best knowledge, there are few works who seriously consider -within an evolutionary framework- the impact of structural change and innovation on the capabilities of the people to be active agents in the development processes (e.g. Carlota Perez, 2007, Arocena and Sutz, 2005).² And there are even less works which analyse the impact of the distribution of the freedom of the actors on the type and direction of the permanent and disruptive creative destruction processes.

² Naturally there are also a large series of analysis who are putting emphasis on the systemic reproduction of inequalities between social classes (Marx and Post-Marxian Economics) and/or the process of structural change within capitalistic systems (e.g. Pasinetti, 1981,1983). But within our agent-based point of view these type of analysis lacks the basic understanding (inter alias promoted by Schumpeter and Sen) on the great heterogeneity and variety of human beings.

3 Development as freedom vs. development as qualitative change

In essence we aim to integrate two different views and insights on development: A) development as the expansion of freedom of the individuals and B) development as qualitative (/structural) change driven by the introduction of novelties. In this chapter we briefly discuss some important concepts and insights of both. While the first approach underlies an ethical, social choice and inequality perspective, the second approach is putting emphasis on entrepreneurship, innovation and changes in the composition, structure and organization of the system.

3.1 *From basic needs to development as freedom*

Starting in the 1970s perception among development practitioners has grown that the efforts put into industrialisation and economic growth have not led to a significant reduction of poverty and inequalities in development countries. They failed to provide the poor parts of the population with the basic requirements such as water, electricity, health care and basic education. In some areas social indicators have worsened while the overall GDP showed considerable growth rates. This discussion was triggered in the late 1970s and early 1980s, setting the basic needs of the people in developing countries into the focus of interest (ILO 1976, Streeten 1979, Steward 1979, Streeten et al. 1981). The purpose of development was seen in reducing mass deprivation and giving all individuals the opportunity to live a *full life* (Streeten, 1979). The concentration of development policy on economic growth and unemployment was considered insufficient. Meeting the basic needs of people should be the first priority of development policy: emphasis on basic education, nutrition, sanitation and health care not only contribute directly to the alleviation of poverty and the reduction of fertility but also improves directly and indirectly productivity and economic growth of countries by using the resources efficiently and helping to increase them (Streeten et al., 1981).

In 1990, a group of economists around Mahbub ul Haq, Amartya Sen, Paul Streeten and Keith Griffin presented the so-called Human Development Index (UNDP, 1990). They combined GDP per capita with life expectancy and levels of education to trace a more comprehensive and broader picture of development, focussing on the social choice and life quality of the people. Whereas former development approaches concentrated almost exclusively on efficiency and growth, the human development concept proposes a switch towards an agent-based perspective. Human development is defined as a process of enlarging people's choices and enhancing human capabilities (the range of things people can do) and freedoms, enabling them to live a long and healthy life, have access to knowledge and a decent standard of living, and participate in the life of their community and decisions affecting their life (UNDP, 1990). This encompasses a focus of development policies on "advancing the richness of human life, rather than the richness of the economy in which human beings live, which is only part of it" (Amartya Sen³).

Amartya Sen introduced the important idea of development as the expansion of the capabilities of the human beings. He asked the important question of "equality of what?" (e.g. Sen, 1995). In Sen's agent-oriented view of development, underdevelopment is unfreedom, while development is an integrated process of profound changes (Sen, 1999). The extensions of freedoms that give humans capabilities, opportunities and choice to assist and actively

³ See cite in <http://hdr.undp.org/en/humandev/origins> [12.06.2008]

contribute to development are at the time the primary goal and fundamental means of development (Sen, 1999). It is worth to state that the human capability approach is a main theoretical contributor of a new perspective, which actually believes in the power, intelligence and determination of the poor to help themselves, when they are just giving the basic opportunities and freedoms to do so (see Yunus, 2007).

Sen's approach has received considerable interest from Neo-Schumpeterian economists. Sen's capability approach provides a theoretical bridge to connect, adapt and apply Neo-Schumpeterian approaches with focus on learning capabilities and capacity for entrepreneurial action to underdeveloped countries and development policy. The human capability approach (as well as the Schumpeter Mark I approach) views the world from the perspective of the individuals and their capabilities to be and do. This is in sharp contrast to the common approach in social sciences, which essentially view the individual from a macro-perspective, where the representative agent is determined by the system. Noteworthy in the real world, there are already a series of policies and practices in work, which combine the understandings of both Sen and Schumpeter. Important examples might be the microfinance revolution and the promotion of social entrepreneurship enabled by Muhammad Yunus, Bill Drayton and others (Bornstein, 2004).

3.2 Neo-Schumpeterian economics and the innovation systems approach

Due to the qualitative changes towards the knowledge based economy, enabled by the ICT revolution and thriving capitalist globalisation, innovation research has rapidly expanded in the last decades (e.g. Fagerberg et al, 2005, Hanusch and Pyka, 2007b). We concentrate on the basic ideas of Joseph A. Schumpeter's theory of economic development and recent theoretical and empirical insights of modern innovation systems research.

3.2.1 Basic concepts of Schumpeterian economics

In his "theory of economic development" (1912) and subsequent work (e.g. Schumpeter, 1939, 1943), Joseph Alois Schumpeter illustrated development as historical process of structural changes, essentially driven by innovation. He defined innovation as new combinations leading to new products, processes, organisation, inputs and markets (1912). Furthermore he divided the innovation process into four dimensions, *Invention*, *Innovation*, *Diffusion* and *Imitation* and put the dynamic entrepreneur in the middle of his analysis (1912). In Schumpeter's theory, the ability and initiative of the entrepreneurs, drawing upon the discoveries of scientists and inventors, create entirely new opportunities for investment, growth and employment. The profits made from these innovations are then the decisive impulse for new surges of growth, acting as signal to swarms of imitators (Freeman 1982, pag.2). Not every imitator makes big profits. When the bandwagon starts rolling, some people fall off, profits are gradually "competed away" until recession sets in, and the whole process may be followed by depression before growth starts again with a new wave of technical innovation and organizational and social change (Freeman 1982, pag.2). In Schumpeter's analysis, the invention stage or the basic innovation have less of an impact, while the diffusion and imitation process have a much greater influence on the state of an economy. The macroeconomic effects of any basic innovation are scarcely perceptible in the first few years and often even longer. What matters in terms of economic growth, investment and employment, is not the date of basic innovation, but rather the *diffusion* of basic innovation,

the swarming process, the period when imitators begin to realize the profitable potential of the new product or process and start to invest heavily in that technology (Freeman 1982, pag.5).

Based upon the concepts of Schumpeter (1912, 1939, 1943) a large series of studies on entrepreneurship, innovation, interactive learning and structural change has been made (for an overview of current approaches of Neo-Schumpeterian and Innovation see for example Fagerberg et al. 2005 and Hanusch and Pyka, 2007). A decisive feature of Schumpeterian analysis is the consideration that structural changes might be driven by the capabilities of an individual entrepreneur (Schumpeter, 1912) and or (the research laps of) big enterprises (Schumpeter, 1943). The emphasis on heterogeneous agents is in sharp contrast to the common perspective of most approaches in economics, where the representative agents are determined by the system. Other interesting features of Schumpeterian economics are the consideration of historic development processes and paths as well as the emphasis on the interaction of the heterogeneous agents (Hanusch and Pyka, 2007ab). Generally, “Neo-Schumpeterian Economics deals with dynamic processes causing qualitative transformation of economies driven by the introduction of various and multifaceted forms of novelties and the related co-evolutionary processes” (Hanusch and Pyka, 2007a). Qualitative change, punctuated equilibria (considering the idea of permanent and disruptive changes) and pattern formation are major characteristics in the Neo-Schumpeterian analysis of economic development (see Hanusch and Pyka, 2007ab).

While the concept of structural change mainly refers to a change in the number and balance of sectors, the Neoschumpeterian concept of qualitative change is broader as it also consider changes on more disaggregated levels (e.g. the organisation structure between and within enterprises of sector) as well as changes in not strictly economic domains such as education or regulation (Saviotti, 1996, 2006). Qualitative change is considered to be basically driven by innovation. And some important drivers of innovation are interactive learning processes and entrepreneurial action.

3.2.2 Innovation, creative destruction and the freedom of the actors

Various technological innovations (e.g. steel, vapour or electricity), organizational innovations (e.g. Taylorism, Fordism and Toyotism) as well as social innovations (e.g. the French revolution, the implementation of social security systems) certainly have had important impacts on the social choices of the actors, their freedom to be and do and capabilities to achieve certain life standards. For example industrialization led to difficult adaptation processes in which some freedoms have been suppressed and other expanded. Many workers got exploited in the industrial production machine and had to live in inhuman conditions. But on the other hand, many people achieved higher incomes, better access to education and new choices and opportunities within the expanding cities. Nascent worker movements and syndicates have been fundamental for many social policies and rights of the individuals today. Industrialization has led to both higher general levels of human freedom - in the sense of an expanding set of social choices - but also to an expansion of inequality between the freedoms of the actors. The same is happening with the information and communication revolution. On the one hand it has opened up the way for expanding knowledge flows, higher global welfare and a large set of new opportunities (e.g. education through distance, health services etc.). On the other hand it provoked a new threat for the poor in form of the digital divide. Hence, the important question occurs how to reduce the negative implication of innovation and creative destruction processes and how to foster the positive ones.

3.2.3 Insights from the innovation system approach

Since the end of the 1980s, the term National Innovation System (NIS) has gained a lot of attention in the academic world. Christopher Freeman (1987) defined the term *innovation system* as “*the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies*” (Freeman, 1987). Several basic elements of the latter NIS-approach appear in this short sentence as it indicates a systemic approach of action and interactions between different institutions at different stages of the innovation process. An important feature of innovation is its predominantly interactive and collective character. Bengt-Åke Lundvall promoted a broad definition of NIS as “*all parts and aspects of the economic structure and the institutional set up affecting learning as well as searching and exploring*” (Lundvall, 1992). There are many other definitions of NIS (i.e. Patel and Pavitt, 1994; Nelson, 1993; Metcalfe, 1995; OECD, 1997; Edquist, 1997), but the essence is captured quite well in the definitions given by Freeman and Lundvall. As argued by Heidenreich (2005), the basic elements of every NIS-definition consist mainly in 1) the central importance of institutions, 2) the systemic underpinnings, considering interactions between different actors, 3) the recognition of the different important stages of the innovation process as well as a 4) a certain conceptual ambiguity. This last characteristic can be considered as the major weakness as well as major strength of the NIS approach (Johnson et al., 2003). Trying to give a better explanation for the complex real world phenomena, the systematic approach of NIS-research considers the importance of manifold interactions and learning processes between the different economic, social and political institutions. The specific history, culture, customs and social interaction structures between the members of a country influence its economic performance and capability to innovate. There cannot be a single definition of an innovation system, whether it is good or bad. The NIS-approach must be adapted to the specific determinants and path dependencies of each single country or region (e.g. Cassiolato et al., 2003).

An interesting effort to analyse innovation systems in the southern part of the world is made by the Global Network for Systems of Learning, Innovation and Competence Building Systems (Globelics). One focus of Globelics is on the interplay between innovation, learning and inequality. E.g. Srinivas and Sutz (2008) argue for the need of a better understanding of scarcity-induced innovation. “*To innovate or to solve problems in a technological universe characterized by scarcity requires the development of a series of skills – learnt by doing, by searching, by interacting and by solving - that are idiosyncratic: we term them capacities to innovate in scarcity conditions*” (Srinivas and Sutz, 2008:135). They claim that local and national efforts have to be made to promote local capacities for endogenous problem-solving and innovation. The South is rich in creative people overcoming daily problems by innovative solutions. These innovative capabilities should be expanded. Arocena and Sutz (2005) argued that a combination of both capabilities and opportunities is necessary to open up the way for evolutionary learning in underdeveloped settings (Arocena and Sutz, 2005). A good formal education is not enough, if the people do not find the possibilities to apply and enlarge their capabilities through learning processes (Arocena and Sutz, 2005). It is fundamentally to understand that it is not just the skills or capabilities of the agents (e.g. provided and fostered by education, health services etc.), but also the lack of opportunities (access to finance, information flows, variety of economic activities) which prevents/hinders many people in developing countries to advance through learning by doing and solving processes and entrepreneurial action.

Johnson et al (2003) argue that a parallel emphasis on basic needs and innovation is necessary for the long-run development of a fertile national system of innovation. Couto Soares and

Cassiolato (2008) claim for the need to integrate innovation and social policies to promote socially oriented innovation. Palliative interventions to tackle extreme poverty might not be sufficient to overcome the systemic reproduction of inequalities. Long-run development requires a fertile national innovation system (and STI policies) oriented to attend the social needs of the people (Couto Soares and Cassiolato, 2008). Naturally, innovation is not the only factor impacting inequality and poverty nor vice versa, but often may have decisive mutual feedback-loops. Cozzen and Kaplinsky (2009) show that the causalities between innovation, poverty and inequality are not unidirectional but multilayered and complex. There is no straightforward answer to the questions if one cause the other, if they just coincident and or co-evolve. Sometimes innovation is reflecting and reinforcing inequalities and sometimes is undermining them. More in-depth analysis on the linkages between of different types of inequalities (e.g. horizontal or vertical inequalities), of innovation (e.g. process, product, functional and chain innovation) and competence building is necessary (Cozzen and Kaplinsky, 2009). Hence inequality and innovation research can and should learn from each other.

4 Bridging Sen and Schumpeter

The integration of Amartya Sen's capability approach and (Neo-)Schumpeterian analysis of innovation driven qualitative change can shed new light on the evolution and reproductions of inequalities, especially with regard to the capability of the people to engage in learning and entrepreneurial action. The basic idea of combining both approaches has already been proposed by a series of other authors and some valuable partial advance has been made (Arocena and Sutz, 2005, Srinivas and Sutz, 2008, Cozzen and Kaplinsky, 2009). Nevertheless the main question remains unresolved: How can we combine both approaches in an integrated theoretical framework which takes the feedback-loops between the agents' freedom and the system's evolution into account? And what could be the theoretical pillars of such an integrated theoretical framework?

We propose the integration of both approaches via the heterogeneity of the individuals, as well as the analysis of how the interactions between the individuals (social networks) and the evolution of economic variety affect the set of opportunities of the agents to be and do, to learn and to determine their own life. The following theoretical pillars maybe essential for a fertile integration of both:

- I. Heterogeneity of the actors and a bottom up approach
- II. A broad perspective on entrepreneurship and innovation
- III. The freedom to innovate
- IV. The role of interaction (networks) and economic variety
- V. The need of applying new methodologies (e.g. ACE)

4.1 Heterogeneity and a bottom-up approach

The qualitative change introduced by Amartya Sen and basic needs related scholars to social welfare theory, by allowing the interpersonal comparisons of well-beings and focussing rather on the freedom of the people to live a life they have reason to value than on mere aggregated economic growth (e.g. Streeten et al. 1981, Nussbaum and Sen, 1993; Sen, 1998, 1999), has opened up the way for:

1. putting the agents into the centre of development policies and treat them rather as agents than patients of the development process (United Nations, 1990);
2. getting in a theoretically innovative as well as empirical, mathematical and ethical sustained way rid of the neoclassical representative agent; and
3. considering human diversity, (eg. in Sen, 2006) and focussing on the heterogeneous capabilities and opportunities of the people to assist, contribute to and benefit from the development processes (Sen, 1999).

Sen's capability approach provides a promising theoretical bridge with the agent-based approaches of Neo-Schumpeterian (especially Mark I) approaches, in which the capabilities and opportunities of the agents to introduce new combinations into the systems are of fundamental importance for their individual success and the development (=structural change, creative destruction processes) of the overall system. The emphasis on the heterogeneity of the actors is a substantial pillar of Neo-Schumpeterian Economics (Dopfer, 2005, Hanusch and Pyka, 2007). Learning processes and innovation can hardly be explained by means of the Neoclassical representative agent and within a general equilibrium framework. Research in cognitive psychology and experimental economics (Kagel and Roth, 1995; Plott and Smith, 1998) shows that a series of Neoclassical assumptions, such as the representative utility maximizing rational agents, are at odds with empirically observed patterns of behavior and interactions on the micro level (Pyka and Fagiolo 2007). In Neo-Schumpeterian Economics learning and the cognition of the agents are central. Heterogeneous and bounded rational actors learn and search experimentally in uncertain and ceaselessly changing environments (Pyka and Fagiolo, 2007). Without a minimum willingness to cope with true uncertainty (Frank Knight, 1921), innovation processes can hardly be understood (Pyka and Fagiolo, 2007). The agents are essentially heterogeneous and bounded rational. They have limited information, make mistakes and engage in trial and error processes (Dosi et al 2005). If the agents would know already everything they need to, there would be no space for true learning processes and innovation (Pyka and Fagiolo, 2007). As Neoschumpeterian economics views innovation as a collective phenomena deriving from the interactions of heterogeneous agents, the heterogeneity of the agents is an important source of novelty (e.g. Saviotti, 1996).

4.2 A broad approach of entrepreneurship and innovation

Several authors argued for the need to apply a broad concept of innovation (e.g. Mytelka, 2000; Cassiolato et al.2003; Lundvall, 2007; Hanusch and Pyka, 2007). Despite the fact that innovation is most visible at the industry level, innovation occurs at all levels and domains of socioeconomic systems, e.g. not just in the industry but also in the public and finance sector of the economic system (Hanusch and Pyka, 2007a). It is important to state that innovation - in a broad sense - does not mean necessarily new high-tech products, Nano-or Biotech, ICT &Co but rather the introduction of new combinations and novelties leading to systemic restructuring and qualitative change into any dimensions of socioeconomic systems (may it be on the global, national or local level). This can happen within high-tech enterprises, regions and sectors, but also in local communities of the Amazon, in small - enterprises in Eurasia or in social organisations anywhere around the world. Therefore, under the term innovation we generally understand the *introduction of novelties or new combinations into the system which leads to a qualitative change of the status quo*. Furthermore, in contrast to the heroic perspective on the entrepreneur (inter alia promoted by Schumpeter, 1912!), we assume that

virtually every human being in working age has the potential for entrepreneurial action.⁴ There might be person with more motivation, intelligence and luck than other, but we cannot define this ex-ante and therefore should give every individual the chance to engage in entrepreneurial action and assist actively in the development processes. Naturally there will be a significant part of population who do not want to engage in entrepreneurial action, but one thing is not want to do something, another very different one is not having the basic freedoms to do so. All over the world we can find examples for entrepreneurial actions in all races and social classes, from the micro business entrepreneurs in Bangladesh or the founders of social organisations elsewhere to the high-tech entrepreneurs in the Silicon Valley. Entrepreneurship and structural change is not just delimited to the economic sphere but happens in all domains and levels of socioeconomic systems. Of significant importance for poverty reduction, higher levels of trust and social welfare might not just be economic entrepreneurship, but also the introduction of novelties and changes to their environment by different agents (individuals, groups and institutions) in the social, cultural, political and environmental sphere of socioeconomic life (e.g. Bornstein, 2004, Yunus, 2007). Therefore we are applying a broad concept of entrepreneurship and consider *entrepreneurial action as the active engagement of people to change the status quo of their lives, families and socioeconomic environment, aimed to achieve higher levels of social welfare, power and wealth for themselves and others.*

4.3 Inequality, networks and economic variety:

In socioeconomic systems, the people and their capabilities and opportunities cannot be properly understood just by considering their individual, physical and mental setup as well as the resources and things they have rights and power on, but it is essentially to understand that each actors is also embedded in a network of social, economic and political interrelations (Granovetter, 1985). The very enriching concept and work of Amartya Sen (e.g. 1995,1998, 1999) and other social choice, human development and inequality related authors (e.g. UNDP, 1990, Nussbaum and Sen, 1993, Bourguignon et al, 2005, Milanovic, 2007) tend to emphasize insufficiently structural and evolutionary aspects of socioeconomic systems and their impacts on the opportunities of the actors to be active agents in the development processes. Inter alia, the evolution of the variety of local economic activities and social network structures (e.g. power, access to non-redundant information and finance) are decisive determinants for the people to be active agents and adapt to the evolutionary changes of the socioeconomic systems they are living in.

Social network analysis (e.g. Granovetter, 1973, 1985; Burt, 1992, Castells, 1996) has shown that each person is embedded in a network of social and economic relations which determine their opportunities for jobs, their access to finance and information, their power and capacity for matching economic and social problems. Inter alia, Manuel Castells (1996) indicated that the modern network society (enabled by the ICT technologies) provides the opportunities for better social inclusion but also implies a threat for further exclusion of the people, depending on their position and access to the social network structures. The position of the individuals in the local, national and global network structures are of essential importance for their social and economic opportunities, their capacity for qualitative entrepreneurship, their opportunities

⁴ In this point we substantially differ from social Darwinist perspective underlying the Schumpeterian entrepreneur and innovator. While there might be differences in the genetically inheritance of different human beings, the importance of education, formation, socioeconomic background and incentive structures are to such exceedingly degree more important that the former actually may not play a decisive role for the capabilities and opportunities of the individuals to engage in entrepreneurial action and innovation.

to engage in learning process and their capabilities to achieve a better life standard (e.g. Castells 1996; Granovetter 1973, 1985; Woolcock and Narayan, 2000; Hoang and Antoncic, 2003; Casson and Della Giusta 2007).

Furthermore, several economists (e.g. Jacobs, 1969; Pasinetti, 1981, 1983 and Saviotti, 1996) have shown that the variety of economic activities is both a driver and outcome of economic development, having a decisive influence on the possibilities of knowledge spillovers, entrepreneurship and the introduction of new combinations into the systems.

Noteworthy social network structures and the variety of economic activities are not static but are following evolutionary development paths, changing with more or less speed over space, time, people and cultures. The type and speed of these structural changes depend on a series of endogenous (and exogenous) factors such as the entrance and exit of agents (e.g. through birth and death), the distribution of wealth and power (implying specific interaction structures), the type of existent technologies, learning processes, accumulation of knowledge and innovation.

4.4 The freedom to innovate

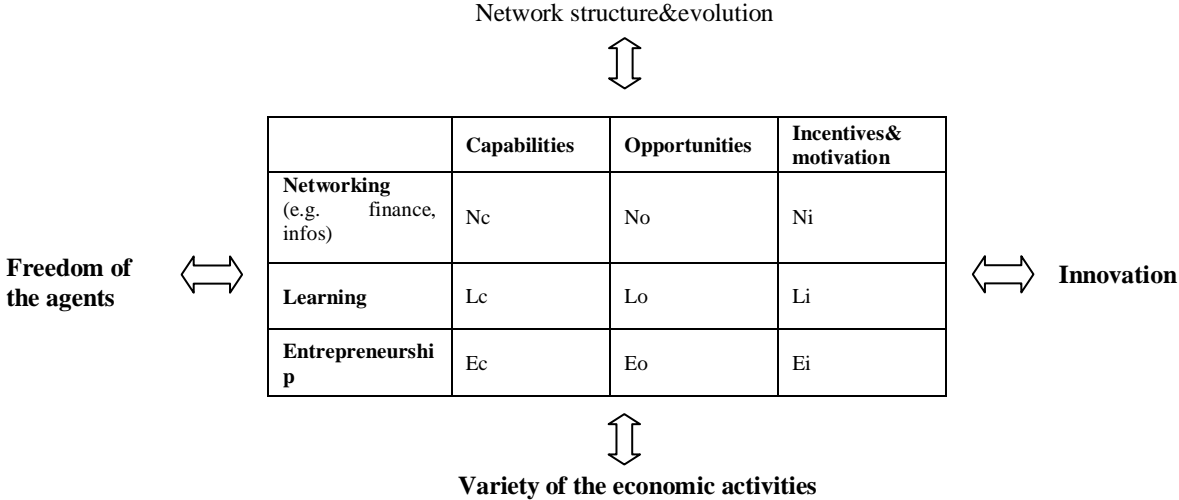
Innovation economics has drawn the attention to interactive learning, networks and entrepreneurship as important drivers and determinants of innovation (e.g. Fagerberg et al. 2005; Hanusch and Pyka 2007ab; Cassiolato et al. 2003). Modern literature on entrepreneurship has shown that entrepreneurs are not heroic individuals but essentially draw on and are embedded in social network structures (Aldrich and Zimmer 1986, Hoang and Antoncic, 2003, Casson and Della Giusta, 2007, Bornstein, 2004). Furthermore innovation system research in developing countries has revealed that it is the combination of both capabilities and opportunities which opens up the way for sustained learning processes and innovation (Arocena and Sutz, 2005).

Based upon these theoretical and empirical insights we propose to consider some new dimensions of the freedom of the people: namely their capabilities and opportunities for *networking, learning and engaging in entrepreneurial action*.

These freedoms are formed and evolving at the interplay between the individuals' capabilities and the systems' structure and evolution. An unequal distribution of the capabilities and opportunities for networking, learning and entrepreneurship essentially contributes to the inequalities of achieving certain life standards. Inter alia, the exclusion from social network structures (e.g. Internet, corruption), the lack of possibilities for qualitative entrepreneurship (e.g. lack of finance) and opportunities for applied learning delimits the freedom of the agents to be and do and introduce qualitative change to their lives. The social network structures and variety of technological and economic opportunities in a system have a decisive impact on the set of social choices of the individuals to be and do, to translate their capabilities into functionings, and to expand their capabilities through learning processes. The other way round, entrepreneurial action, networking and learning of the individuals have decisive impacts on the structure and evolution of the system.

We also have to consider another dimension determining the process of evolutionary learning and the translation of capabilities into functionings: namely the incentives – motivation structure for networking, learning and entrepreneurial action. The individuals might have both the capabilities and opportunities, but lack the incentives and motivation to become active,

engage in learning, networking and entrepreneurial action. Hence, we propose the following working tables for further in-depth discussion and analysis.



No doubt, several of the dimensions mentioned in the rows and columns of the Matrix are overlapping and interdependent. For example qualitative entrepreneurship is dependent on the networking capabilities; or the incentives for networking are dependent on the capabilities for networking (e.g. determined by cognitive skills). We suggest that the capabilities, opportunities and incentives/motivation for networking, learning and qualitative entrepreneurship are interrelated, but not the same. Thus, each of the elements and intersection within the Matrix has to be analysed individually as well as together with the other elements.

Naturally, the importance and interdependencies of these elements might differ from one socioeconomic systems to another, but from a theoretically point of view it is more important to:

- (1) reveal that these elements are existing;
- (2) link socioeconomic inequality directly with the capacity for innovation and structural change; and
- (3) take into account that social networks and economic variety (as structural elements of the system the people are living in) have substantial impacts on the freedom of the individuals.

4.5 Insights from network and variety research

Subsequently we discuss some essential concepts from network and variety research and their implications on the structure, emergence and reproduction of inequalities.

4.5.1 Impact of variety evolution on the freedom of the actors

The interdependencies between the freedom of the agents and the variety of economic activities are multilayered. The freedom of the actors to learn, engage in entrepreneurial action and innovate might lead to a rise in economic variety, whereas a greater variety of economic activities might expand the social choices and opportunities of the individuals. While sometimes used as synonym, a terminological distinction between diversity and variety

is in order. Stirling (2007) distinguishes between three different components of diversity: namely variety, balance and disparity. Variety indicates to the number of categories in a system, balance measures how much of each category exist and disparity analyses how different the categories are⁵.

Imbs and Wacziarg (2003:64) showed that countries diversify over most of their development path. Just at very robust levels of income per capita (aprox. 9000 \$ in constant 1985 U.S. dollars) an increasing sectoral concentration is recognizable. Only very high developed countries show some type of sectoral concentration. It is crucial to state that Imbs and Wacziarg actually measure the balance of employment and value addition between determined sectors. Thus they do not analyse the diversification of economic activities in the sense of a variety growth nor analyse the level of disparity between the activities. Nevertheless the implications are important as it undermines -by strong empirical evidence- the Ricardian suggestions of increasing specialization through the force of comparative advantages. However, the growing global variety of activities, product, processes, intrasectoral diversification and the emergence of new sectors are completely omitted by this analysis, by defining ex-ante the sectors to be considered. Pier Paolo Saviotti (1996, 2006) has argued that growing efficiency and qualitative change enabling variety growth are both drivers and outcomes of long run economic development. Variety growth leading to new sectors and productivity growth in pre-existing sectors are complementary and not independent aspects of economic development (Saviotti, 1996, 2006). Efficiency growth is not enough, because the decrease of required inputs and labour may lead to an important bottleneck for economic development as production would exceed the demand (Pasinetti, 1981,1983; in Saviotti, 2006). Hence, the economic variety has to grow to make capitalist development viable. The other way round, efficiency growth is necessary to allow freeing up of the capital resources needed for search activities. While in the short to medium run, one or another country might specialize by making use of comparative advantages, in the long run, every countries may have to diversify to stay competitive and to not become impoverished (Saviotti, 2006). Hence variety growth is a necessary requirement for long-term economic development. Drivers of economic variety growth may be learning processes, entrepreneurship and innovation.

It is worth stating that innovation and creative destruction processes may lead to the replacement of old activities by new ones, but some of the older activities always survive and continue coexisting with the new ones, thus leading in sum to higher levels of variety and qualitative changes in the composition of the system. Economic development is not just production and productivity growth but essentially implies structural and qualitative changes in the composition, structure and organization of the system. "Economic development has never been a purely quantitative phenomenon, but it has always involved qualitative change in economic systems" (Saviotti, 2006: 1). This qualitative change is essentially driven by innovation, by the emergence of new products, processes, sectors and organisation etc.

There are multiple reasons why the evolution of variety and subsequent changes in the systems composition has an essential impact of the freedom of the actors. Most importantly efficiency growth without variety growth would tend to create high levels of unemployment, as the input requirements would shrink. Within a market economy system, rising efficiency

⁵ The specification of variety and balance are essential influenced by the judgement over disparity. The definition and classification of disparity essentially governs the resolving of categories used to characterize variety and balance (Stirling, 2007). But disparity alone does not indicate to the balance between the elements, it actually requires knowledge of the existent variety and may not consider properly variety evolution.

without diversification of the economy would endogenously lead to higher levels of inequality and unfreedom. Hence, either variety growth and/or strong institutions with the capacity for significant income redistribution are necessary to prevent the system destabilizing levels of inequalities and provide every individual with a minimum level of ethical acceptable freedom in comparison to the other individuals. A very strong version of the second option (e.g. materialized in a socialist system) tends to provoke economic inefficiencies and implies essential unfreedoms for the actors. Hence, within a democratic (and evolutionary) market economy, a continuous diversification and development of the socioeconomic structures is indispensable. There are several reasons to criticize this permanent diversification or economic development (most importantly the exploitation of natural resources and the tendency to undermine the long-run ecological sustainability). However, a larger variety of socioeconomic activities may also amplify the social choices of the individuals, e.g. in which activities they can engage. Furthermore, a higher level of economic variety allows the actors to be more flexible and amplify their knowledge in different searching, exploring and learning activities. Thereby, variety opens up the possibilities for entrepreneurial action and new combinations. Jacobs (1969) indicated that the diversity in cities may provide the actors with opportunities to do old things in new ways. A large variety of economic and social activities may essentially enhance the creativity and freedom of the actors to be and do, to choose and to learn. Freedom and creativity of the actors may essentially lead to new combination (/innovations) and hence expand in a virtuous circle the existing variety and set of opportunities and social choices. A possible downside of this expansionary evolution -we have to discuss in further work- may be a rising levels of requirements and skills of the individuals to match the rising complexity of the environment they are living. In evolutionary and diversifying systems, the actors might have to permanently reach higher levels of human development and capabilities to be free. Anyway, if we see diversification and variety growth as positive or negative, the great impact on the freedom of the actors is obvious and thus has to be taken into account.

4.5.2 Social networks and the freedom of the actors

Social networks analysis (SNA) (e.g. Scott, 1991, Wasserman and Faust, 1994, Borgatti et al. 2002, Mrvar et al. 2005) provide valuable theoretical insights and analytical tools to understand the interrelations between the freedom of the actors and the systems evolution. SNA studies the content, structure and evolution of the network of social relations between agents, as well as the position and power of the agents within these networks. Two fundamental levels of analysis can be distinguished: A) analysis of the overall network structure and B) the individuals' relations and role within a larger network.

4.5.2.1 Network structure and evolution:

The structure of the networks in a socioeconomic system have decisive implications on the cohesion and stability of the system, the absorption and diffusion of knowledge and the distribution of power and social choices within a system. Recent theoretical and empirical evidence suggest that the topology and evolution of real world networks are governed by robust organizing principles such as preferential attachment, small world phenomena and scale free-attribute (Watts and Strogatz, 1998, Barabasi and Albert, 1999, Albert and Barabasi, 2002). We briefly present three common measures of network topologies with

decisive implications for the freedom of the actors: *average path lengths*, *clustering coefficient* and *degree distribution*.⁶

The *average path length* measures the average number of steps along the shortest paths for all possible pairs of network nodes. It can indicate the cohesion of a social network as well as the quickness with which resources can be reached or information can be spread within a network. Innovation may change the average path length and speed of knowledge diffusion. E.g. the ICT revolution led to significant shorter path lengths to get valuable information from and for (!) the people who are connected. It opened up new opportunities but also provoked new threats for the poor. Who is connected to the Internet might have (faster) access to valuable new information, attend education per distance etc. But who is not connected (indeed still a large percentage of people in developing countries) may suffer further social exclusion and comparative disadvantages.

Clustering refers to the fact that in many larger networks exist subgroups bound together forming cliques, circles of friends etc. where everybody knows each other. The degree to which nodes tend to cluster together can be measured by the so-called *clustering coefficient*. This coefficient measures the degree to which tightly knit subgroups with dense and transitive connections exist within a network. Inter alia Watts and Strogatz (1998) illustrated that in many large networks (e.g. power grids, network of movie actors) high clustering coefficients coexist with short average path lengths. In other words: “We move in tight circles yet we are all bound together by remarkably short chains” (Strogatz, 2003). This has important implications on knowledge diffusion and the social capital of the individuals. Information can be spread quite fast throughout the network, but as we will discuss in the subsequent section, the travel path of information depends on some actors which connect the subgroups. These agents may be called broker or hubs and have higher control and power over the flow of resources and knowledge.



Clustering may have positive and negative implications on the freedom of the actors and the groups they are member of. On the one hand it can provide the agents with valuable social capital they can draw upon (e.g. Woolcock and Narayan, 2000), on the other hand it may fix inequalities between different social groups and circles (e.g. Bourdieu, 1983). Furthermore brokerage between groups might provide the bridging agents with higher power and thus introduce interpersonal inequalities.

Degree distribution measures the difference in the number of contacts of the nodes within a network. In a network, different nodes have different numbers of contacts, some having more or less than others (=degree of the node). Albert and Barabasi (1999, 2002; Barabasi and Albert, 1999) have shown that the distribution of the degree distribution in large real world networks (e.g. protein and citation networks, power grids and several social networks etc.) follows a power law distribution. That means that these networks have a long tail of nodes with few connections (green part of the graph) and a few nodes have many connections

⁶ Many terms of (social) network analysis may sound as odd concepts of science, but in substance they may have substantial implications for the freedom of actors, the inequality of opportunities and power. Inter alia, the scale-free character of many social networks implicates large differences in the opportunities of the actors to access to material and immaterial resources, it constraints the social choice and the power the individuals have.

(yellow part). Because there is no typical number of connections per node, these networks are considered to be scale free or scale invariant. This has important implications on inequality, as the actors with many connections have a larger set of opportunities to access resources and information than the actors with just few links. Often the latter are dependent on the former, highly connected and bridging nodes, which have higher power over the systems' resources and knowledge flows.

Endogenous reproduction of inequalities: Barabasi and Albert (1999) proposed to understand the emergence of scale free networks through a mechanism of preferential attachment. Thereby nodes tend to attach with nodes that are popular (having a considerable number of connections yet). This mechanism can be defined as the "rich get richer", as the nodes which have already many linkages tends to receive exponentially more new linkages than the "heavy tail" of weakly connected nodes. This leads to a highly unequal distribution of power in the system, where few nodes exercise large control over the network relations (e.g. information flows) and many nodes are dependent on the former.

4.5.2.2 Position of the individuals

The structural analysis of networks provides important insights in systemic patterns and mechanism of inequality and inequality reproduction. Nevertheless, these types of analyses say little about the impact of type and strengths of the relations of the single individuals. Therefore we aim to briefly present three important concepts from social capital theory, namely the strengths of weak ties (Granovetter, 1973), network closure as social capital (Coleman, 1988) and the so-called structural holes (Burt, 1992).

Granovetter's analysis (e.g. 1973, 1985) revealed that access to valuable new information (e.g. information on job opportunities) might rather be accessed by so-called weak ties. Weak ties are the connections of one person (x) to another (y) who do not form part of the group of people or clique who frequently interact and interchange informations (=strong ties). The information flowing within a clique may be redundant, whereas connections to members outside the clique (weak ties) could provide new ideas and information (e.g. job opportunities). In a related vein, Burt (1992) draws the attention to the role certain strategic network positions play for possibility of individuals, e.g. to achieve better positions and awards within organizations. In Burt's view a strategic position (brokerage) between otherwise unconnected groups provides an individual with power and access to distinct, rather than redundant information. People who are closer to so-called structural holes are expected to achieve greater economic awards and higher probability for advancements. In another vein Coleman (1988) argues that strong and redundant ties, with many mutual interactions are important to reduce opportunistic behavior, enable shared norms and provides a fertile climate of trust which is necessary for fine grained information transfer and to cope with information ambiguity.

From a neutral perspective it may be the adequate combination of strong and weak ties as well as the position and role of a person within the network which provides her/him with different capabilities and opportunities to access and control the material and immaterial network flows. An individual might require both a network of strong ties on which he can trust and rely, as well as access to weak ties able to provide him/her with new information and opportunities necessary for economic success and the integration of new knowledge.

5 What methodological tools will be required?

The important question remains what analytical tools and methodologies we need to analyze and model the complex interrelations between the freedom of heterogeneous actors and the system's evolution. To the best of our knowledge, through the current state of the art of economics, the analysis of the feedback-loops between heterogeneous agents and the system evolution (pattern formations and dynamics) might just be possible within an agent based simulation model (ABM).

Generally spoken, ABMs aim to explain dynamic processes and emergent properties of complex systems (on the meso and macro-level) by the interaction of heterogeneous agents on the micro level (see Fagiolo and Pyka, 2007; Tesfatsion and Judd, 2006). Within ABMs we can model heterogeneous capabilities of the actors (Morone and Taylor, 2006) as well as evolutionary changes of systemic features such as the variety of local economic activities and social network structures (Saviotti and Pyka, 2004; Pyka and Saviotti, 2005). This enables us to combine the profound understandings of Joseph Schumpeter and Amartya Sen:

- A) The Schumpeterian concept of development as historical process of endogenous systemic changes and pattern formations driven by the introduction of innovations and co-evolutionary processes, and
- B) The profound understanding of Amartya Sen on the diversity of human beings and the need to provide every human being with the basic capabilities and opportunities to determine their own life and be active agents of development.

By means of ABMs the human capability approach can be set into an evolutionary model, considering endogenous changes in the individuals' capabilities and the systems structure through learning processes, interacting, competing and cooperating. Inter alia the freedom for entrepreneurship, networking, knowledge transfer and learning can be studied within an agent based model, the reproduction of inequalities be analysed and the impact of different policy measures be simulated (e.g. Pyka et al, 1999; Cantner et al. 2001; Grebel et al., 2003; Morone and Taylor, 2007; Pyka et al. 2007; Pyka and Fagiolo, 2007). Hence, ABMs may be an interesting methodological alternative to understand the evolution of human capabilities in a complex evolving system.

Nevertheless, from a qualitative perspective the derivation of theoretical causalities and interrelations from an analytical analysis combined with agent-based simulation models approaches cannot stand alone, but should to be sustained by empirical data. Theoretical and simulation results have to be sustained in case studies and econometric analysis. To calibrate the model and provide each individual with a different set of capabilities econometric analysis and household data could be used (see e.g. Morone and Taylor, 2004, 2006)⁷.

⁷ So-called history friendly models (e.g. Malerba et al. 1999; Pyka and Saviotti, 2005) are based upon intensive empirical studies of the (sub)system to be studied (e.g. a region, industry). An interesting ABM on knowledge diffusion with complex cognition has been designed by Morone and Taylor (2004, 2006). In the model, the individuals are endowed with different cognitive maps and interact with each other by means of local and cyber networks. Depending on their initial cognitive maps (i.a. determined by the access to education), their contact to proximate agents (e.g. people, organisation etc. in the neighbourhood) and their connections to more distant actors and information through cyber-networks (e.g. highways, Internet), the individuals have different freedoms to engage in learning processes and accumulate knowledge. Thereby learning processes and path dependent formation and reproduction of inequalities can be simulated, analysed and explained within the model. The model has been calibrated by using household data on education, neighbourhoods and access to Internet, in the metropolitan area of Santiago de Chile (Morone and Taylor, 2004)

6 Conclusions and policy implications

In order to get a better understanding of (A) the reproduction and evolution of inequalities and (B) the interrelations between the agents' capabilities and the system's evolution, this paper suggested some theoretical pillars (heterogeneity of the agents, consideration of social networks and variety evolution, a broad concept of entrepreneurship and innovation) to introduce to the inspiring capability approach of Amartya Sen the dynamic and structural features of Schumpeter based analysis of economic development.

The focus on covering the basic needs (in health, education, income etc.) and providing the basic capabilities to assist in the development processes is not enough, but economic and social policies have to understand also the systemic features and evolutionary paths of the respective socioeconomic systems. Structural and evolutionary features have a deep impact on the capabilities and opportunities of the people to be active agents and adapt themselves to the ongoing creative destruction processes. Inter alia economic variety and network structures are important factors of the economic structures and the opportunities of the actors to engage in entrepreneurial action, benefit from economic development and make a change for themselves and others possible. Therefore development policy must not just focus on providing the actors with basic capabilities to live a decent life (e.g. health care, education, food, clothes) but has also to engage parallel in the promotion of fertile and inclusive network structures as well as horizontal and vertical economic diversification and integration which provide more actors with the possibilities to assist, contribute and benefit from the development processes of their socioeconomic environment. Strategic structural intervention and incentives are necessary to provide the people the possibilities to apply and enlarge their knowledge by learning by doing, using and innovating activities (Arocena and Sutz, 2005; Lundvall, 2007) and promote fertile creative destruction processes.

From a theoretical perspective there is still a lot of work to be done to develop a consistent agent based theory on inequality and evolutionary change. Nevertheless we suggest that heterogeneity of the individuals as well as variety and social network structure of the system may be fertile elements of such a theory, which considers the feedback-loops between the freedom of the actors and the systems' structure and evolution. This general framework allows for a large series of possible applications (on the local to global scale, and in different dimension of social, economic and political life) without losing its general validity. While we put emphasis on the need of agent-based modelling efforts, also a large series of theoretical and empirical, qualitative and quantitative studies are possible and necessary to get a deeper understanding on the interrelations between the freedom of the actors and innovation driven qualitative change.

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