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**Sharing economy and socio-economic transitions: an application of the
multi-level perspective on a case study of carpooling in the USA (1970-
2010)**

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Abstract: The study deals with the emerging concept of sharing economy using the development of carpooling as example. It is based on the multi-level perspective framework, developed by Frank Geels, which is designed to explain and analyze processes of novel technology development. The present paper analyzes the new institution, carpooling, through the lens of this framework in order to understand its potential to be a landscape-changing innovation. This case study also attempts to illustrate how the multi-level perspective can be used to analyze not only technological innovations, but also novel ways of doing business, which can arguably be viewed as radical innovations on their own. The aim is thus to find out whether the emergence of carpooling follows the same patterns and shows the same features as emergence of conventional technological radical innovations.

Key words: sharing economy, carpooling, socio-technical transition, multi-level perspective, innovations

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1. Introduction

It is widely known that globalization processes and technological advances are rapidly changing the world economy in many different ways. With the emergence of Internet and smartphones, connectedness of all members of society has become unprecedented. Changes in society and technological breakthroughs led to the emergence of many innovations in various sectors of economy. Internet-based trade, electronic commerce, social networks and cloud computing are only the tip of the iceberg and numerous alterations in the economy's structure itself are likely yet to come.

One of the examples of a modern, novel and in some ways revolutionary phenomenon is a so-called "sharing economy" or "peer-to-peer economy", a new decentralized, technology-based approach to connecting consumers and providers of services (Lehrer, Moylan, 2014). This is to a large extent an umbrella definition, which encompasses numerous companies in various industries. The exact meaning of the term is still coining, but the generally accepted interpretation is "sharing economy is an economic model in which individuals are able to borrow or rent assets owned by someone else" (Investopedia, 2013). Thus the focus shifts from production of new to the sharing of existing assets. The most vivid examples of this emerging sector are carsharing services like Zipcar, space sharing websites like Airbnb and task sharing platforms like TaskRabbit.

In general, the great potential of sharing economy is widely acknowledged. Some academics, like Gansky, one of the pioneer researchers in the field, see it as the future of global services and trade (2012). On the other hand, there are also those who claim (Asher-Schapiro, 2015) that similar ways of doing business have existed before and sharing economy does not offer anything radically new. However, with the plethora of existing views, sharing economy lacks in-depth theoretical investigations; therefore the nature of the phenomenon and its potential need to be examined further in order to provide thorough understanding.

The present paper attempts to contribute to the process of exploration of sharing economy utilizing the triple-embeddedness framework, also sometimes referred to as multi-level perspective, developed by Frank Geels (2005). The framework was

initially created for investigation of complex socio-technical transitions and explanation of processes of radical development of new technology whose diffusion pattern produces a new set of socio – technical relations, which eventually replace the existing general social practice (Genus, Coles, 2007). It highlights co-evolution and multi-dimensional interactions between industry, technology, markets, policy, culture and civil society. This paper is going to apply this approach, which is initially tailored for technological changes, to the analysis of the emerging way of doing business – sharing economy. Thus one of the aims of this thesis is to explore opportunities of this framework for the examination of non-technical, institutional innovations.

Since the phenomenon of sharing economy is very broad and heterogeneous and is encompassing multiple industries, the case of carpooling companies in the US is chosen for the analysis in order to narrow down the study and provide a more detailed examination. Carpooling is selected as an example case mainly since it is one of vivid manifestations of sharing economy and incorporates its main feature – utilization and sharing of existing assets instead of producing new ones. The chosen time frame is 1970 till 2010 since the relevant developments have occurred around that time.

The structure of the paper is as follows: first aims of the paper and research problem will be explained. Then the history, nature and potential of the sharing economy will be discussed. The fourth section presents a literature review, focusing mainly the research body dealing with sharing economy. In the fifth section the multi-level perspective framework will be described in more detail and the choice of the theory will be motivated. The sixth section will articulate the chosen method more thoroughly. The seventh section will focus the history of carpooling, observed within the framework of multi-level perspective. In the eighth section the paper will analyze whether the development patterns of carpooling follow the phases suggested by the multi-level perspective. This will be followed by the discussion about the applicability of the method and implications for the sharing economy as a whole, ending with limitations and conclusion.

2. Research problem and aims

As mentioned in introduction, sharing economy as a phenomenon needs more research since understanding of the dynamics behind it is crucial for predicting its development pattern. Many academics works exist, but they often lack historical perspective or theoretical basis. In addition, theoretical instruments for the analysis are somewhat lacking. Sharing economy is mostly observed from the point of business development and social or environmental impacts. Thus a study of sharing economy from the perspective of system innovation and technological transition could shed more light on its economic potential and prospective development trajectory.

Why is it important to understand sharing economy? Firstly, the explosive growth of such platforms as Airbnb and Uber (Schor, 2014) and many others shows that it is probably here to stay. Simultaneously, it provokes many heated debates - some see the great potential in terms of minimizing environmental damage and promoting cooperation between people (Gold, 2004). Others however are more skeptical and cautious, arguing that it can lead to unwanted negative results, such as deterioration of labor standards (Bernhardt, 2014). Juliet Schor (2014) states that the truth is somewhere in the middle and “these new technologies of peer-to-peer economic activity are potentially powerful tools for building a social movement centered on genuine practices of sharing and cooperation in the production and consumption of goods and services”.

The present paper aims to contribute to the existing research body with a study focused on system innovation perspective. The goal is to analyze the carpooling branch of sharing economy taking into the account landscape transitions, socio-technical regime changes and niche development. This thesis is going to assess the historical perspective and investigate growth of carpooling in the US from 1970 to 2010 through the lens of multi-level perspective, developed by Frank Geels. The research question is therefore: in what ways does development of carpooling in the US from 1970 to 2010 follow the pattern of technological transition, suggested by the

multi-level perspective framework? Finding similar patterns could contribute to the understanding of the phenomenon and help predict its development in future.

The secondary question is: is multi-level perspective suitable for analysis of institutional innovations? Thus the secondary aim of the paper is to test the framework, initially developed for the analysis of technological innovation, on an institutional innovation. If the paper finds that the theory is appropriate for the analysis of such phenomena as carpooling, this could provide additional instruments for the study of sharing economy as a whole. Consequently, the general hypothesis of the thesis is that development of carpooling follows more or less same phases as radical technical innovations, described by Geels (2005).

3. Sharing economy

This section is dedicated to explanation of what sharing economy is, how it emerged and what opportunities it provides. It also discusses existing views and opinions on the phenomenon, both positive and negative, in order to highlight the problematic nature of the notion.

3.1. Sharing economy in a nutshell

Since sharing economy is still relatively vague concept, this section will attempt to clarify the nature of the phenomenon, taking into the account definitions given by different authors. There are a number of other terms used to define the same concept, such as peer-to-peer economy and collaborative consumption and even the grassroots economy, but this paper uses the expression “sharing economy” since it is the most widely used in thematic literature. Since the concept is largely lacking precision and clear definition it is crucial to outline how this paper is defines it.

Gansky (2012) calls businesses that follow sharing economy principles Mesh Businesses and provides their core characteristics:

- The core offering is something that can be shared, within a community, market, or value chain, including products, services, and raw materials.
- Advanced Web and mobile data networks are used to track goods and collect usage, customer, and product information.

- The focus is on shareable physical goods, including the materials used, which makes local delivery of services and products valuable and relevant.
- Offers, news, and recommendations are shared largely through word of mouth, amplified by social network services.

Botsman (2013) also attempted to break down and define such notions as collaborative consumption, peer-to-peer economy and sharing economy. According to Botsman, collaborative economy is an “economy built on distributed networks of connected individuals and communities versus centralized institutions, transforming how we can produce, consume, finance, and learn”. Peer-to-peer economy is characterized by “person-to-person marketplaces that facilitate the sharing and direct trade of assets built on peer trust”. Sharing economy is then “an economic model based on sharing underutilized assets from spaces to skills to stuff for monetary or non-monetary benefits”. The present paper is thus dealing specifically with the sharing economy definition provided by Botsman (2013).

Consequently, sharing economy focuses mainly on efficient use of existing goods, skills and services, which are not used or are underused, and utilizes them in efficient ways. Such services as Airbnb and Couchsurfing utilize temporarily empty living spaces, Uber utilizes people’s time and free car seats, TaskRabbit outsources household chores to strangers utilizing their skills and free time – the examples are countless (Figure 1).

Figure 1. Collaborative economy honeycomb



Source: Owyang, J. (2014).

3.2. Historical perspective

Advent of sharing economy was accompanied by numerous technological and social developments, including expansion of Internet and smartphones, growing globalization and general attitudes shifts. This section is going to observe these

developments from a historical perspective and discuss the factors behind the emergence of sharing economy.

The end of the 20th century was marked by a triumph of the capitalist paradigm, which was a consequence of the fall of the Communist regimes in Eastern Europe. This was accompanied by a great belief in the forces of free market and global trade, fueled by this belief, had grown on an unprecedented scale. There was a wave of optimism that the end of communism had laid the foundation for a new age of international collaboration and solidarity (Gold, 2004).

The initial wave of writings on the globalization of the world economy emphasized the fact that globalization had a potential to lead to “the end of geography”, to “time-space compression” (Harvey, 1989, cited in Gold, 2004) in a sense that economic transactions could be fulfilled in spite of different geographical positions – geographical proximity had lost its importance.

Another important paradigm shift happened during the course of the twentieth century. Adam Smith’s rational economic man idea has been contested – the assumption of a rational actor, who constantly seeks to maximize his or corporate utility, and who in so doing benefits the economy in the whole, has been widely criticized (Gold, 2004). Some criticized the notion of perfect information, others argued that human actions are not always motivated by a desire to maximize profits and that human behavior is more complex. The idea of highlighting the more social and cultural aspects of economic action led to a virtual rediscovery of the “capitalism with a human face.”

Additionally Hebermas developed an idea of economic colonialism (1988, cited in Gold, 2004), which claimed that within capitalist society all human-human and human-thing relationships eventually incorporate the instrumental logic of profitability. This implied that all human interactions could be counted as economic, and every sphere of human life was commodified, including family, health and leisure time. To counter-balance this view, such “non-market” spaces other logic than the market logic is dominant – instead of selling and buying goods exchange is normally expressed in sharing and gift-giving (Putnam, 1993). A different set of assumptions should be applied to such interactions – giving and sharing normally implies certain personal relationship between the actors. Dore (1983) calls this phenomenon

“goodwill” and Sen (1993) underlined the role of such interactions in generating trust, which is an important pillar of the economy.

Such existence of “moral economies”, which did not exactly follow the rationale of the orthodox market economy, was an important prerequisite for the emergence of the sharing economy. Moreover, globalization along with the spread of Internet seems to have expanded the scope of such economies beyond local communities and families. The and especially social networks have made it possible to communicate and get to know people from distant lands and decreased a distrust to a stranger, embedded in human nature. They have extended our social circles and general trust to unprecedented levels, which made sharing economy possible.

In addition, uncertain and sluggish economic environment is encouraging people to seek new channels of income on the one hand and cheaper services on the other hand (Gansky, 2012). Economic crisis of 2008 has led to a certain distrust of older brands and models, and such times have historically favored the emergence of new companies and the remaking of old ones (Gansky, 2012)

Growing population and depleting resources make it increasingly more expensive to produce and do business in the old way (Gansky, 2012). People have become more aware of environmental problems and resource scarcity, thus the idea of sharing the goods we already have instead of constantly producing new ones has been warmly welcomed. The density of population has increased dramatically, which made sharing services more convenient - car- or bike- or tool-sharing business can offer a “greater variety of products and services in neighborhoods where there are more people nearby to take advantage of them” (Gansky, 2012).

Rapid development of Internet as a place for exchange of goods and services has made emergence of sharing economy businesses almost inevitable (Gold, 2004). First web-based companies specialized in providing services that facilitated sharing information between users – such as selling emails (Gansky, 2012). Gradually, businesses realized the high value of information, beginning to sell customers’ search information to third parties, like Google does today. Finally, Web 2.0 has changed the interaction between customers and companies in numerous ways - customers can communicate with suppliers through recommendations, requests, or complaints. This more tailored communication has led to successful companies cooperate directly with

customers and “giving prospective customers tools to design and refine their products and services, tailored to the individual, and delivered where and when the person wants them” (Gansky, 2012).

Also, trust for the Internet transaction has increased manifold – people use their credit cards online without much hesitation and trust cloud services with their private information, photos and documents (Gansky, 2012). Thus today an idea of hiring a stranger on TaskRabbit to do the groceries or to assemble an Ikea table does not seem as irrational as it did as little as 10 years ago. Systems of reputation and customer reviews, and insurances, provided by virtually all Mesh businesses, make such transactions even safer.

Thus technological advances have indeed played a big role - sharing economy businesses thrive on the growth of social media, wireless networks and smartphones. Connectedness is crucial in their development – we are today more connected to other people, organizations and businesses than ever before. This is basically the first time in human history when this kind of far-reaching, constant, and relatively inexpensive connectivity has existed (Gansky, 2012). In addition, more spheres of physical world are constantly joining data networks, including GPS, tracking systems and more, which gives greater potential for safe interactions and exchange of goods.

3.3 Potential of the sharing economy

Sharing economy encompasses numerous potential benefits. Lets take the environmental perspective. It is widely known that humanity is consuming goods at an increasing pace, resources are depleting and volumes of waste are growing. Thus an opportunity to use the goods we already have and minimize unnecessary consumption is very valuable. It also saves money increasing the consumer surplus. It provides alternative income flows, redistributes wealth and provides jobs. It creates valuable and personal between people and enriches their lives. It unlocks the value inherent in sharing spare resources with people who want them and match demand and supply in real time on a global scale (Malhotra, Alstynne, 2014).

There is a lot of enthusiasm in the literature, but it is also important to pay attention to the problematic sides of sharing economy. For example, the legal side and safety

regulations are quite unclear. But the most concerns are connected with the fact that such services as Uber and Airbnb are threatening traditional taxi services and hotel chains, and even – economy in general. Today's world is to a large extent built on consumption, thus cutting it can influence producers in a negative way. Some evidence from San Francisco actually supports this argument – according to Kate Toran, director of taxis for San Francisco's transportation authority, average monthly trips per city taxi have plummeted from 1,424 in 2012 to 504 in July of this year—a drop of almost 65% (Times, 2014).

Some are very enthusiastic and say that it is undoubtedly going to develop and grow and will disrupt many industries (Sparks & Honey, 2014). Much is supporting this view, such as extremely high growth rates of certain sharing economy businesses (Shor, 2014) and the sector in general. The view of peer-to-peer economy changing the world generally prevails. Others however say that there is nothing new with what sharing economy has to offer and paying for an Uber taxi or for a room on Airbnb is no different than paying for a regular taxi or a hotel room (Asher-Shapiro, 2015).

In general the question whether sharing economy concept holds features of a potentially disruptive innovation still remains. Thus exploring it from the perspective of global socio-technical transition will give interesting insights into the nature of the phenomenon. Overall global changes of the general system are often referred to as system innovations – a transition from one socio-technical regime to another. It is often argued (Geels, 2005) that new technologies play an extremely important role in this transition. As today innovations are to a great extent institutionalized – with developed networks of R&D laboratories, universities and patent laws – the changes occur rapidly and involve many sectors and industries. According to Geels, it is this web that is playing a largest role of a destabilizing force for the socio-technical regimes.

Researching the nature of such a prominent and growing phenomenon as sharing economy is crucial for understanding of the potential paths the world economy can take and the implications of new businesses for the existing industries. The present paper aims to look at the underlying factors of the emergence of the sharing economy and assess whether it indeed encompasses the features of a disruptive innovation, which is going to change the world. In order to conduct this analysis a triple

embeddedness framework developed by Geels is going to be used – this framework is going to be discussed in more detail below.

Since sharing economy is a broad topic this paper is undertaking a case study of one of its branches: carpooling. System innovations in general involve many elements, but it is normally possible to distinguish the main technologies involved (Geels, 2005). In our case it is not exactly a technology, but rather a way of doing business, an institution.

4. Literature review

The literature review is focused on reviewing existing works on the topic of sharing economy in order to study what instruments and theories have been used in the analysis and from what perspectives the phenomenon was studied. Attitudes towards and assessments of the potential of sharing economy also are of interest and are taken into the account. As noted above, the concept of sharing economy is quite new but interesting and ambiguous thus there is an abundance of newspaper-, magazine- and research articles on the topic.

There are many articles and books, which aim to investigate the origins of sharing economy, trace its development and provide suggestions for its potential. Rachel Botsman and Roo Rogers (2010) address the growing models of collaborative consumption and implications of their growth. They do case studies of the biggest sharing economy businesses, such as Zipcar and Zopa in order to describe how these models come together to shape a new economy of more sustainable consumption. The authors conclude that this new economy will be a fully-fledged economy within the next five years. Lisa Gansky (2012) in her book “The Mesh” studies what sharing economy is and what benefits it offers through analyzing cases of sharing economy businesses. She expresses a strong belief about its power to change the world and the great opportunities it carries.

The two aforementioned books are often referred to as classic in the field of sharing economy research (Johnson, 2012). There are many others, which attempt to expand understanding of sharing economy analyzing it from different perspectives.

Gold (2004) for example follows development of a Focolare Movement in Brazil, which started in 1991 and became famous for promoting and following sharing economy principles. On the example of this case Gold assesses the potential of this developing alternative economy to offer a new perspective on globalization. Charity (2015) observes the impact of rapid growth of sharing economy on the economy of New Zealand, expressing high hopes about the potential of the concept. Jane Wood (2014) explores the appearance of sharing economy on an example of one family in England and tells a story of them inventing sharing economy on their own, also discussing opportunities, which sharing economy provides.

Lahti and Selosmaa (2013) assess the potential of sharing economy from the environmental perspective, concluding that it is an efficient way to decrease environmental damage without sinking living standards. Speth (2013) in his book on economic and political problems in today's America suggests sharing economy principles as one of the solutions to the problematic situation the country is facing today, taking a political economy perspective. The investigation uses theory of change, which provides specific and measurable description of a social change initiative that forms the "basis for strategic planning, on-going decision-making and evaluation" (TOCO, 2015). Castells, Caraca and Cardoso study sharing economy among rising alternative economic cultures from sociological point of view.

Many of the works are focused on potential social problems sharing economy can bring about. There are a number of papers that analyze the hidden pitfalls of the concept and bring up important topics like gaps in legal framework or lack of control, discussed namely in a paper by Malhorta and van Alstyne (2014). Hill (2015) expresses high concerns about the consequences of sharing economy principles for the economy of the US, claiming that the new order is a dead end for American workers, and discusses the issue from the perspective of civil rights. The Economist (2013) shares these concerns and raises such issues as security and legislation. The articles on the "dark side" of the sharing economy are plenty: both The New York Times (2014) and Washington Post (Rampell, 2014) for example have at least one article on the dangers of sharing economy businesses accusing them of ignoring the law and not caring about the security of its users.

The business perspective is also widely discussed: Cusumano (2015) and Botsman (2014) analyze how traditional firms can compete with the emerging peer-to-peer

startups and Gerstner (2014) and Andruss (2015) present some advice for those who want to participate and benefit from the rise of sharing economy. Stephany in his book “The Business of Sharing” (2015) presents interviews with the leading entrepreneurs in the sector and offers a business-insider view.

To sum up this section, sharing economy was researched from multiple perspectives. However, to the knowledge of the author no study from the socio-technical transitions point of view has been done. Thus this thesis aims to contribute to the research body with an analysis from this perspective in order to provide better understanding of the phenomenon.

5. Theory/Conceptual problem

This paper seeks to analyze the potential of sharing economy through assessing the chosen case – carpooling - as a radical or system innovation (system innovation here is a transition from one socio-technical system to another). The idea is to assess whether the phenomenon holds the same features as such important transitions as the one from conventional cars to eco-friendly cars, as analyzed by Geels and Penna (2015), or a shift from horse-drawn transport to automobiles, studied by Geels (2005). Such a transition encompasses changes in many spheres – infrastructure, cultural paradigm, societal attitudes and values, legal regulations, etc. Thus the phenomenon of carpooling will be analyzed with these changes in mind.

5.1. Theories of grand transitions

There are some theories, which offer some tools for the analysis of such transitions, including behavioral economics, evolutionary economics, institutional economics, etc. The literature on grand transitions has paid much attention to the emergence of innovations and lock-in mechanisms that determine stability of the system and path dependence, less attention has been paid to the topics of unlocking and the loss of stability (Geels, Turnheim, 2013). Thus the method suggested by Geels has a virtue of including the notion of destabilization of existing industry regimes. This section is going to shed some light on the some of the present methods of analyzing

technological transitions and innovations in order to better articulate and explain the choice of the Geel's triple embeddedness or multi-dimensional framework.

The mainstream neo-classical economic theory embeds the assumption that when it comes to innovations firms make conscious profit-maximization choices. Nelson and Winter (1985) criticized this orthodox view claiming that it to a large extent neglected the role of technological change in economic growth – “in the case of technical change, neoclassical theory did not specify very well how "large" or important technological change must be - only that there was "something" there”. They argued that evolutionary theory provided better tools for a detailed and thorough analysis of innovations. In general, evolutionary theory, as explained by Winter and Nelson, borrows the concept of natural selection from Darwin's theory in order to build an accurate and detailed evolutionary theory of business behavior. The idea is that firms are indeed motivated by profit and engage in a pursuit for ways of increasing these profits, but these actions are not only profit maximizing. Likewise, according to this theory there is a tendency for the more profitable companies to push the less profitable ones out of business.

When studying technological change evolutionary economics analyzes the factors and non-equilibrium processes that change economy from within. According to Nelson and Winter (1985) firms-in-industry is basically a collection of heterogeneous organizations, which are steered by routines, the evolutionary economic equivalent of genes. Firms search for innovative solutions to increase their profits, and successful firms are growing at the expense of the less successful. The process is inherently dynamic, as firms cooperate and interact creating a competitive environment. Nelson and Winter (1985, cited in Geels and Turnheim, 2013) also proposed the “notion of technological regimes to indicate that firms-in-industries are locked in by cognitive routines and technical knowledge”.

New institutional economics suggests a similar approach but focuses on institutions (more specifically, social and legal norms) and their role in technological change and economic behavior. According to North the institutional are fundamentally different from neo-classical economics in a sense that it “abandons the instrumental rationality - the assumption of neo-classical economics that has made it an institution-free theory”. The aim is thus to make economics more realistic, to turn away from the assumption of bounded rationality and embrace the actual human behavior. In relation

to technological regimes, the theory recognizes the relative stability of industries (Geels, Turnheim, 2013), which it explains with notions such as shared beliefs and industry mindsets (Phillips, 1994, cited in Geels and Turnheim, 2013), regulatory institutions (Scott, 1995, cited in Geels and Turnheim), and shared identities and missions.

“Industrial economics focuses on firms-in-industries, which face Porter's (1980) five industry forces related to suppliers, customers, new entrants, competitors, and technological alternatives”(Geels, 2005). Firms aim to defend their position against these forces (through price competition, product positioning, advertising, R&D, legal tactics, plant investment, merger and contracts). The main drivers for destabilization are competitive and financial resource problems, which can come from shrinking markets, changing markets, or competition from new entrants or new technologies. In response to these problems, firms defend themselves through ‘retrenchment strategies’ (Barker and Mone, 2006), e.g. downsizing, cost-cutting, efficiency improvements, tighter controls. But they can also abandon existing positions or practices when it is no longer in their interest to reproduce them. Because industrial economics has a rational actor view, these ‘positioning strategies’ are seen as relatively unconstrained by routines or institutions.” (Geels, Turnheim, 2013)

5.2. The multi-level perspective

In general, theories described above imply that firms-in-industries are limited by existing regimes. These regimes determine how firms-in-industries view threats, risks and opportunities in their environments, how they come to solutions, and what they consider to be an appropriate action. Geels’ framework broadens this perspective including the question of “how existing templates (regimes) lose their grip on firms-in-industries.” In other words, how exactly the shift happens and what the determining factors are. Geels views the aforementioned theories as complementary, relating to different phases and degrees of destabilization. The framework is particularly suitable for the analysis of large, politically powerful, and scale-intensive industries. For such industries, regime destabilization is likely to encompass not only economic and technical changes, but also political and cultural processes.

As Geels formulates it, “the triple embeddedness framework (TEF) provides a multi-dimensional conceptualization of bi-directional interactions between firms-in-industries and their environments.” Geels suggests that technologies play a prominent role in system innovations and claims that it is a feasible entry point to study system innovations. The present study is focusing on a new “institutional” technology, a novel way of doing business, such as sharing economy, and not on a particular technological innovation. This method is viewed to be appropriate since potentially this change in doing business has similar features as for example a transition from horse-drawn carriages to cars.

The notion of technological regime was developed by evolutionary economists Nelson and Winter (1983), but Geels extends this notion arguing for the term “socio-technical regime” instead. Consequently, the MLP perspective suggests analyzing processes of transformational innovation on macro-level (landscape), meso-level (regime) and micro-level (niche) (Genus, Coles, 2007). The method generally attempts to clarify the process of diffusion of a radical innovation, which produces a new system of socio-technical relations and replace existing practices. One of its main benefits in comparison with the previous approaches is that it draws attention to the previously neglected role of “outsiders” – those who use the technology, and to the role of interactions between various actors, socio-technical systems and “action-conditioning rules” (Genus, Coles, 2007).

Generally the multi-level perspective framework suggests that each technological shift goes through typical stages: “although each transition is unique, the general dynamic is that transitions come about through the interaction between processes at different levels: (a) niche-innovations build up internal momentum, (b) changes at the landscape level create pressure on the regime, and (c) destabilization of the regime creates windows of opportunity for niche-innovations”. It is grounded on the idea that transitions are not determined by a single factor but rather by a co-evolution of many interconnected spheres - technology, industry, markets, consumer behavior, policy, infrastructure, spatial arrangements and cultural meaning. Thus this paper attempts to analyze whether the shift towards the sharing economy has similar features as the technological shift described by Geels.

6. Method

A study of sharing economy is a challenging task for several reasons. Firstly – it encompasses numerous industries and companies, which makes it very heterogeneous. Secondly, it is a new phenomenon, an innovation in the making, thus solid quantitative studies are impossible to conduct – the biggest peer-to-peer companies, like Airbnb or Uber, have been established not more than 6 years ago, which means that quantitative data for the analysis is lacking.

In general, the aim of this thesis is a theoretical study, thus a qualitative approach was chosen as the most appropriate one. Application of theoretical models provide a general framework for viewing reality (Silverman, 2005), and this is what this thesis is aiming to do – to analyze the position of the phenomenon in the general system.

Carpooling, sometimes also referred to as ridesharing, is chosen as the focus of the study. It was selected for several reasons – firstly, it is undoubtedly an example of sharing economy since it employs its core characteristic – sharing existing assets. Secondly, the phenomenon emerged around five decades ago, which provides a good time frame for analysis with meaningful results. The notion of carpooling emerged around 1914, with the rise of jitneys – improvised rideshares to cover the driving expenses. Multi-level perspective suggests that it is up to the author to choose start and end points of the transition along with the main factors in landscape and socio-technical regime developments. Therefore this paper focuses on the timeframe between 1970 and 2010 due to the fact that the main developments have occurred during this time and this timeframe includes the main milestones in carpooling development. In addition, a smaller timeline also allows for greater precision and more attention to detail.

The present research is focused on a thorough observation of a chosen case. The study is based on the steps suggested by Geels in the book *Technological Transitions and System Innovations* (2005). Geels suggests the study of the new technology on three levels: macro (landscape developments), meso (socio-economic regime) and micro (niche development). Landscape developments include changes in attitudes in the society, paradigm and regime shifts along with changes in physical and societal landscapes. Socio-economic regime encompasses relevant technological

developments, market dynamics, policy actions, problems and tensions. Finally, niche development focuses on the emergence of novelties in niches, their transformations, the problems they encountered and the solutions they used. Consequently, this approach will be used in analyzing the emergence of carpooling history and development. The landscape analysis will be mainly focused on growth of environmental awareness and main shifts in general beliefs and attitudes. Exploration of socio-technical regime will take into the account developments of main technologies, which facilitated growth of carpooling, and political actions connected to that. Niche developments will then consider actual steps undertaken by the actors.

After historical assessment, the paper will turn to the analysis of phases of development. Geels suggests that radical innovations follow certain paths and patterns in their expansion. These paths include four stages:

- Emergence of novelty. The new technology appears in a niche and is normally protected by more powerful players, such as governments or large corporations. On this stage the novelty is to a large extent unviable, weak, needs support and can't exist on its own.
- Probing and learning. This phase is characterized by further development of the technology, testing its abilities and limitations and its gradual improvement.
- Breakthrough. On this stage the technology starts diffusing and gaining weight in the society through actively competing with the existing regime.
- Gradual replacement. The technology replace the old ones and becomes mainstream.

This paper will thus analyze carpooling history taking these stages into the account. Additionally, it will be tested whether Geels' form-function pattern, which describes relationship between niche and regime, fits developments in carpooling industry.

Information for the study will be retrieved mainly from secondary sources such as newspapers, journal interviews and academic articles. The main source for carpooling history is the MIT real-time rideshare research, which includes the majority of existing research on the topic. Other available academic articles will also be used to allow for an unbiased investigation. For landscape analysis acknowledged books and

articles on American social, economic and technology history in 20th are used. Since the analysis encompasses social, economic and technical changes, articles from various fields were chosen to observe the chosen timeline from various perspectives.

7. Empirics/Analysis

Usage of private cars as a transportation system has increased dramatically during the twentieth century. However, an overwhelming number of cars is causing various issues, such as air pollution, traffic jams and health problems, and carpooling can be one of the solutions to these problems. Carpooling is a vivid example of sharing economy, as it comprises usage of existing assets by more people – it implies sharing a trip on a private car of a driver with one or more passengers (Graziotin, 2013). Most of the time carpooling occurs between family members or people the driver has personal connections with, but the present paper observes the phenomenon of carpooling between strangers where the matching of drivers and potential passengers is often facilitated by information and communication technologies.

7.1. History of carpooling

In this section phases of the development of carpooling will be analyzed with the help of the stages outlined by Geels (2005) in his triple embeddedness framework. In other words, it observes the history of carpooling and related events in the US history from 1970 to 2010 through the lens of the chosen framework. First relevant landscape developments or societal changes on a macro-level will be observed. On this level the main focus is made on the environmental awareness in the society, social trust and meaningful historical events – factors that are directly or indirectly related to the development of carpooling. Secondly, the paper will turn to main developments in the socio-technical regime - technological novelties that facilitated the expansion of ridesharing, policy actions, problems and tensions. Eventually, I will analyze the emergence of carpooling on a niche-level, including the changes in its organization and structure.

7.1.1. Landscape developments

At the landscape level years from 1970 to 2010 are characterized by a rapid technological development. The level of global cooperation was growing steadily even though the world was polarized between the United States and the Soviet Union – the confrontation only ended with the collapse of the USSR in 1991. In America, the prosperous 1960s generated a sense that high economic growth could be sustained indefinitely had energized liberal efforts to build a Great Society (Whitfield, 2004). Despite the enthusiasm towards technical advances, the decade was also characterized by individualistic attitudes. As the Vietnam war finished “with a whimper, the American zeitgeist retreated to take stock of all that had happened. With a grueling recession forcing individuals to protect their own self-interest, a mindset coalesced that would come to be known as The ‘Me’ Decade” (American Hit Radio, 2015).

Moon landing in 1969 ignited great enthusiasm and showed what humanity is capable of in a technological sense. It proved that humans have the ability to accomplish seemingly impossible things when they work together (Chaikin, 2007). Transmitted images of Earth as a life-supporting integrated system has increased public willingness to protect and preserve nature. Thus people started to realize importance of cooperation and protection of the environment.

Thus 1970s were characterized by growing environmental concerns. The Santa Barbara oil spill was another event that put into question the rush to exploit offshore oil, corporate responsibility for environmental disasters, and the need for environmental conservation (Melosi, 2005). As an illustration to this, the first Earth Day was celebrated on April 22, 1970 and over two thousand colleges and universities and around ten thousand primary and secondary schools participated (Berman, 2015). Environmental concerns in the society have continued to grow throughout 1980s as well, bringing about the Global Warming scare for the first time (Whitfield, 2006).

Lifestyle of the 1980s has become faster, with the society embracing the new and the novel. “Our culture is in warp speed,” observed a media critic. “We live on novelty, with new forms, new subversions generated daily” (Gabler 1995: M1, cited in Whitfield, 2006). Simultaneously, the decade was characterized by an intense public mistrust of government: conspiracies in Vietnam, Watergate, and the Iran-Contra affair did little to boost public confidence (Whitfield, 2006). It was deepened by the emerging neoconservatism, which put new kinds of pressures on the citizens,

“shifting the burden of governance and care from the state onto individuals” (Rose, 1999, cited in Ryan, 2015). 1980s are characterized by the new yuppie culture - individualistic, based conspicuous consumption and obsessed with corporate ladder climbing.

1990s has been a time of great prosperity and peacetime economic expansion in the United States, largely due to the grand advent of the Internet and the explosion of technology industries that came along. The spread of computers was rapid and has had a big influence on how people think: “The computer has benefitted the society 10 times more than we even imagined... people are beginning to realize how important information is” (Whisenhunt, 2009). Importance of sharing information has started to be realized by the society. In addition, a movement against consumerism has began – a Buy Nothing day originated in Canada in 1992 and was picked up by the American society in 1997 (Smith, 2014).

The nature of internet has changed drastically - in the 1980s and 1990s, the it expanded in scope to encompass the IT capabilities of research centers and universities, and even public entities, institutions, and private enterprises from around the world. The Internet experienced enormous growth; it quitted being a state-controlled project, and turned into the largest computer network in the world, comprising over 50,000 sub-networks, 4 million systems, and 70 million users (Dentzel, 2014). The Internet has largely freed people from geographical limitations and gave the humanity an ability to connect at the unprecedented levels. Arguably, Internet has increased common social trust – according to Bouchillon (2004) “learning as well as control are important elements in determining trust” and Tang (2010) states that “core psychology of fear is then reinforced by three other traits: attribution biases, ethnocentrism, and disinclination for systemic thinking”. Internet has a power to overcome these binding conditions and increase learning of others and eliminate ethnocentrism and attribution biases through this learning.

1990s was also a decade when international cooperation for environmental conservation has begun. In 1987 the United Nations published Brundtland Report, which was one of the first steps towards the establishment of environmental governance. In 1992 Rio de Janeiro hosted the Earth Summit, during which a number of countries committed to preserve and protect the environment, signing a Convention on Biological Diversity. Starting from 1995, the UNFCCC organized annual summits

on climate change, which led to the adoption of the Kyoto Protocol in December 1997, which was targeted at the reduction of greenhouse emissions (Geels, Penna, 2015).

The economic growth of the 2000s had substantial environmental consequences, which raised the awareness of and the demand for diminishing energy resources. In addition Global Financial Crisis of the late 2000s showed that the global economic system is still vulnerable. However, the technological advances have continued making increasing the connectedness of the society to unprecedented levels.

7.1.2. Socio-technical regime

As mentioned above, unprecedented technological advances characterize the 1970-2010. One of the major technical development of 1970s is the birth of modern computing – namely the development of Intel's first microprocessor, the 4004, by Ted Hoff and Stanley Mazor (Miller, 2004), and coining of programming C language, was devised in the early 1970s (Ritchie, 1993).

Raising environmental concerns led to action. In January 1974, Nixon signed the Emergency Highway Energy Conservation Act, which mandated maximum speed limits of 55 MPH on public highways (Woolley & Peters, cited in MIT, 2010). The Act was also the first instance where the US federal government began providing funding for rideshare initiatives (MIT, 2010). The early 1970's saw another breakthrough for ridesharing; it was the first time that it was suggested as a tool to alleviate air quality problems (Horowitz, 1976, cited in MIT, 2010). The 1970 Clean Air Act Amendments established the National Ambient Air Quality Standards and gave the Environmental Protection Agency (EPA) considerable authority to control air quality attainment (US EPA, 2008).

Around that time High Occupancy Vehicle (HOV) lanes started to be implemented. For example, a dedicated bus lane was opened on the Shirley Memorial Highway in Northern Virginia, becoming the first highway in the US to provide a special lane for High Occupancy Vehicles (Kozel, 2002, cited in MOT, 2009). From December of 1973, automobiles with four or more passengers were also given a right to drive on bus lanes. HOV lane construction was continuing slowly through the 1970's, with interest increasing in the mid-1980's (MIT, 2010). The government also suggested

development regional computerized carpool matching system (Bland, 1976, cited in MIT, 2010), which was crucial for further development of carpooling.

As noted above, 1973-74 were characterized by the oil crisis, and this Oil Embargo period provoked a considerable interest in ridesharing. As the first ridesharing projects were funded in 1974, the academic study of ridesharing and its potential have started (MIT, 2010). The post-1974 period was also marked by organization of the first metropolitan rideshare agencies (US EPA, 1998).

By the late-1970's, many further initiatives to promote and expand ridesharing were introduced by President Carter, who appointed the National Task Force on Ridesharing with an intention to “expand ridesharing programs through direct encouragement and assistance, and create a continuing dialogue among all parties involved in managing ridesharing programs and/or incentive programs” (Downs, 1980, Woolley & Peters, cited in MIT, 2010)”.

Thus 1970s have seen a rise in ridesharing development, fueled by political support. The two main reasons for that were high gas prices and environmental concerns. However, as the 1980s showed, the oil prices were the determinant – as the oil crisis was over and gas prices went down again, the amount of people sharing rides declined dramatically – if by 1980 around 23 percent of Americans were carpooling, only 11 percent continued doing that by 2011 (Cozza, 2012).

Environmental awareness and concerns, however, remained, with more developments in this sphere taking place. Public attention increased substantially in the late-1980s and early 1990s, partially because of hot summers and record-high temperatures, and partially because of the 1988 Senate Hearing on global warming (Geels, 2015). The newly created (1988) Intergovernmental Panel on Climate Change (IPCC) additionally increased public attention with assessment reports, which reviewed and combined scientific findings (Corfee-Morlot et al., 2007, cited in Geels, 2015).

Global cooperation to resolve climate problems has also increased, which is illustrated by the United Nations Framework Convention on Climate Change (UNFCCC) at the 1992 Rio Earth Summit, which established the goal for controlling greenhouse gases (Geels, 2015).

The technological advances also continued throughout the 1980 with the development of the modern Internet, starting with the specification of File Transfer Protocol in 1980 (Kozierok, 2005). Such modern technology as The Global Positioning System (GPS) became fully operational in 1990. Around that time businesses start to build E-commerce websites: Amazon.com, eBay, AOL, and Yahoo! Emerged around 1990s. Computer usage has also expanded dramatically: between 1990 and 1997, individual personal computer ownership in the US rose from 15% to 35% (Department of Labor, 1999).

As for carpooling, after a long stagnation the ridesharing activity has entered its renaissance, which is occurring in the absence of government support. From a low of 10.1% in 2004, ridesharing has risen slightly and settled around 10.7% since 2005 (US Census Bureau, 2004, 2005, cited in Chan, Shaheen, 2012). One of the reasons for this is probably the rapid rise in oil prices since 2005 accompanied by the decline in disposable incomes as a result of the financial crisis of 2008 (Cozza, 2012). Various social initiatives still appear to expand carpooling, such as that of Creenxc, which encouraged people to share rides in order to reduce carbon footprint.

Today's dynamic carpooling dwells such technological developments as navigation systems, smartphones and social networks (Friginal et.al., 2014). Social networking is in fact a very recent development, with the technology catching its stride with the launch of Friendster in 2002, MySpace in 2003, and eventually Facebook in 2004 (Digital Trends, 2014). Social networking was taken to a whole other level with the advent of smartphones. IBM introduced the first smartphone as early as 1993 – however, the first real breakthrough was the iPhone, which was announced in 2007 and was the first smartphone targeting general consumers market (Sarwar, Soomro, 2013). Today the technology is widely used with around 42% of mobile subscribers in US having Smartphones (Sarwar, Soomro, 2013).

7.1.3. Niche developments

At the advent of carpooling two types of sharing rides existed: these can be conditionally divided into static and dynamic. Static ridesharing of 1970s normally implied employer-sponsored commuter ridematching programs when large-scale employers, confronted with managing congestion and office parking supply, turned to ridesharing (Chan, Shaheen, 2012). It was based on collecting geographical data of

the employees and matching those who were neighbors. Dynamic type of carpooling, casual carpooling or “slugging”, emerged around that time as well. It implied spontaneous rides with strangers. In general, apart from employer-initiated ridesharing, carpooling was unorganized and not centralized.

First organized ridesharing schemes emerged along with the Internet advent and computerization, around 1980s-1990s, creating more dynamic ridesharing applications in the form of telephone- and Internet-based ridematching programmes (Chan, Shaheen, 2012). One of the first schemes was telephone-based ride matching programs, which were introduced in 1990s. For example, The University of Washington alongside the Bellevue Transportation Management Agency conducted the “Bellevue Smart Traveler” pilot from November 1993 to April 1994 (Chan, Shaheen, 2012). However, the first attempts were unsuccessful due to imperfections in the technology. On the other hand, they have paved the road for the future ridesharing smartphone applications.

More reliable ridematching schemes emerged around 1999, often taking online forms - private software companies began developing ridematching “platforms”, providing their services to clients for a monthly fee. This indicates that businesses started attempting to take and commercialize the niche, which before was chaotic and unregulated. However, it did not become more successful than employer-organized carpools, since ride matching programmes are intrinsically best suited for commuters with similar, regular schedules (Chan, Shaheen, 2012).

Thus until 2004 carpooling niche has not been much exploited by businesses due to the application difficulties. It was either situational or employer-based. In 2004, however, another phase of carpooling development began – technology-enabled ridematching (Chan, Shaheen, 2012). Carpooling companies today are often based on networking platforms, such as Facebook, matching the potential rides between friends and acquaintances. Social networks also minimize potential security problems and build trust among users. An example of such service is PickupPal (2011), with over 156 000 members in 120 countries, which allows members to create their own groups based on common area, company, school, and shared interests (Chan, Shaheen, 2012). Three more companies that specialize on social-network based ridesharing are GoLoco, Grot and Zimride. Emergence of real-time ridesharing services is another development in the niche – these services organize shared rides in real time with the

help of smartphones and Internet. Examples of such services are plenty, including Avego and Carticipate. In general, as of July 2011, Chan and Shaheen (2012) estimated that there were 638 ridematching services in North America and the number is still growing.

Thus ridesharing has changed much since its emergence. It has been developing from sharing cars with family, friends and coworkers during the me-culture of 1980s, to sharing rides with complete strangers from all over the city through online applications. Certainly spontaneous carpooling existed in the form of slugging, mentioned above, but its scope cannot be compared to the today's carpooling schemes. There are several core differences between slugging and internet-based carpooling - slugging is organic, spontaneous and needs special circumstances to occur. Internet-based carpooling is organized and spreads to unlimited number of locations. The differences between work-based and internet-based carpooling are also graphic – the main advantages of the latter are lack of rigid schedule, considerable supply of potential partners, no obligations and no need for pre-arrangements. To sum up, carpooling has developed and changed considerably during the last decades.

7.1.4. Challenges

Carpooling today is to a large extent an innovation in the making. The recent revival of the concept and growth of ridesharing businesses show that the potential is massive. However, due to its novelty, it encompasses several challenges, that need to be solved in the future.

One of such challenges is flexibility. Too often carpooling schemes are not flexible enough to accommodate the needs of its users in terms of, for example, unforeseen route or schedule changes. The survey by Jianling et al. (2007) indicates lack of flexibility as one of the leading reasons for not choosing carpool as a transport option. Possible solution for this could be certain guarantees from service providers through agreements with taxi services.

Another concern is safety - many users are concerned about security issues connected with riding with strangers. This issue could be tackled by building trust through social networks and introducing reputation scores and comments option. Reliability of carpooling is also a question, since many services lack a critical mass of users, which

leads to a very limited number of available rides. This can be resolved by the growth of ridesharing and increase in user base.

7.2. Stages analysis

This section will analyze the timeline of carpooling development, described above, from the perspective of development stages, suggested by Geels (2005). The aim is to see whether carpooling history follows the pattern of radical, regime-changing innovations, and if it does, explore the ways in which it occurs. The pattern includes four phases: niche developments, learning and probing, break-through and substitution.

7.2.1. Niche developments

According to Mokyr (1990, cited in Geels, 2005:35), “radically new technologies usually emerge as hopeful monstrosities” in a sense that they can execute a particular function, but the performance characteristics leave much to be desired. According to Geels (2005), because of this feature such novelties can only survive in protected environments, niches, which can be constructed, for example, by incubators or product champions. Such influential and strong actors have an ability to provoke the interest of other players (policy-makers and users) to provide resources and means for further development of the innovation. Geels also distinguishes two forms of niche development - technological and market niches. In technological niches protection and support are provided through subsidies or strategic investments by firms, whereas in market niches the protection comes from “special-purpose performance requirements” (Geels, 2005:47). This stage also includes a lot of improvisation – “actors improvise on the basis of design rules from the existing regime and engage in technical experiments to work out the best design and find out what users want” (Geels, 2005:48).

Even though Geels uses technology as an entry point for the analysis of system innovations, the aforementioned pattern can also be observed in case of carpooling. Its development resembles a path of market niche development in several ways. To start with, it emerged to solve problems in existing regime: shortages of gasoline and environmental damage. At first it was generally inefficient, often spontaneous,

unorganized and small in scope. Therefore at the beginning carpooling schemes were protected and encouraged by the government (1970s) as a part of the solution to pollution and oil crisis.

Government support and participation provoked the interest of other players (large employers and ordinary people) and expanded ridesharing. The local authorities facilitated its expansion namely through providing means for further development in terms of, for example, HOV lanes, organized in 1970s, raising public awareness through media (MIT, 2010) and financing rideshare demonstration projects in 1974 (MIT, 2010). As for experimentation and improvisation – at the beginning actors experimented with phone-based and even computer-based matching of riders. However, these attempts were deemed unsuccessful. The new wave of smartphone applications is more functional and attracts more users – however, more developments are needed to overcome existing problems, such as lack of flexibility and security.

7.2.2. Learning and probing

The second innovation phase, according to Geels (2005), takes place in small market niches. It is characterized by exploration of new functionalities and occurrence of social networks, which sometimes develop into dedicated communities, that support the novelty. This community often attempts to improve the new technology and make it user-friendlier. The actions include probing and learning, “working outward from established practices to explore new ways” (Geels, 2005:84). The learning process eventually results in new design rules and performance of the novelty gradually improves. However, this technical emancipation can only occur with the support of sufficient resources (Geels, 2005). Through dealing with the technology users gradually learn about it - about its potential, usability, and their desires in connection with it. An important aspect of this phase is the stabilization of rules and practices, which is a prerequisite for the wider diffusion of the technology.

In case of carpooling, it is to a large extent undergoing probing and learning phase today. It exists in many forms, such as real-time or social network based ridesharing, since the players are still seeking ways to meet user preferences. Design rules are mostly undeveloped and general practices are still in the making. It is important to note that one of the key differences between the first and the second phases is that the

former is carried out by pioneers and dedicated projects, whereas the latter requires commercialization in market niches – a process that started around the 1980s when the first attempts to commercialize carpooling began. Additionally, as Geels (2005) stated, the second stage is only possible with availability of sufficient resources. Starting from 1980s these resources in form of government spending and support were lacking, and ridesharing lost a great share of its users. However, the new wave started in the 2000s with the availability of new resources as private companies took the lead.

In terms of shaping community, there are carpooling activist groups that push carpooling forward, seeking and discovering new ways to expand and improve it, which is demonstrated by a bulk of emerging research on this topic. Multiple engineering and computer science articles are looking for new and more effective solutions. For example, an article by Knapen et.al. (2014) describes a newly-designed automatic web based global carpooling matching service (GCPMS) for matching commuting trips, which attempts to help carpooling services reach a critical mass of users. A paper by Friginal et. al. (2014) is solving a problem of preserving location privacy in dynamic carpooling. Galland et.al. (2013) explore ways to simulate the interactions and trigger the negotiation process between agents.

7.2.3. Breakthrough

The third phase is generally the breakthrough of the technology, its diffusion and growing influence on the existing regime. Normally, the two phases discussed above happen in niches and remain mostly invisible for the general regime. Thus the third phase grants the technology more visibility. Eventually, the technology enters the general market and starts competing with the existing technologies. Multi-level perspective (Geels, 2005) highlights the fact that the diffusion of the novelty highly depends on certain “circumstances and windows of opportunity” – an idea, also supported by Perez (1988), Staudenmaier (1989) and Summerton (1994). Geels (2005) distinguishes two types of such circumstances: external circumstances and internal drivers. The following set of circumstances refers to the external circumstances:

- Apparent lack of available technology that could solve existing problems. This condition is also referred to as “bottleneck” (Rosenberg, 1976, cited in Geels, 2005) or “reverse salient” (Hughes, 1987, cited in Geels, 2005). Remarkably, it relates not only to existing problems, but also to expected ones – something that Constant (1980) called “presumptive anomalies”. This circumstance is defined as an internal problem of the existing technical regime.
- Negative externalities. This condition is characterized by external problems caused by the usage of the existing technology, such as environmental harm or safety concerns. The problem normally occurs due to fast growth and expansion of the existing technology. The main players often downplay this issue since the internal functioning of the regime is not hampered. Therefore the problem is often brought up by outsiders (for example, environmental organizations like Greenpeace).
- Changing user preferences. This can open opportunities and market niches for new solutions and novel technologies, which can address new needs. In this case novelties can integrate into the new niches and grow along with them.
- Competition between firms can also fuel growth of new technologies. Development of novelty can be a strategic decision, implemented by a firm to surpass a competitor, which is using an old technology.
- Emergence of complementary innovations, which make wider diffusion possible.

These circumstances may be created by the changes in general landscape - for example, changing values in the society can alter user preferences.

As for internal drivers, Geels divides them by disciplinary perspective they fall into, for example, those related to economic perspectives. These internal drivers refer to the improvement of economic qualities of the novelty, such as price-performance ratio, improvement of which often drives diffusion. “Increasing returns to adoption” also fall into this category as it creates additional incentives for the users to utilize the novelty. It is also one of the factors that can facilitate breaking away from path-dependence. Increasing returns to adoption can occur, for example, due to “learning by using or network externalities” (Geels, 2005:145).

There is also a set of internal drivers, which fall into socio-technical perspective category, such as development of additional elements around the innovation – a process that is sometimes called “momentum” (Staudenmaier, 1989, Hughes, 1994, cited in Geels, 2005). These emerging elements can take different forms: it can be groups of people, which aim to protect and expand the technology; or new infrastructures can be “created, designed and maintained by new governmental departments and agencies”. These new elements create multiple linkages with the novelty to the extent where the system becomes so big it leads to irreversibility and eventually path dependence.

This third phase of novelty development seems to be the most complex and varied one, but some patterns in development of carpooling can certainly be observed. It is important to mark, however, that this institution is still in its early development stage and has not diffused completely. At the same time some of the prerequisites for the breakthrough in terms of windows of opportunity can be identified.

External circumstances include negative externalities, internal technical problems, changing user preferences and availability of complementary technologies.

Lets start with negative externalities - in our case it is environmental damage of the conventional car usage, which was caused by the rapid growth of the amount and utilization of personal cars. Carpooling emerged partially as a solution to this problem, with the government trying to promote ridesharing in order to minimize usage of gasoline and consequently improve the environment. As for internal problems, arguably it is the lack of parking spaces, which motivated employers to search for solutions and alternative paths – this also gave a push to the carpooling phenomenon. In addition, lack of public transportation in some parts of the US, for example, in South Carolina (The Post and Curier, 2014) and Chicago (Sudo, 2014) is also a big problem for the regime today. Carpooling in its turn provides a compromise between buying a car and using public transport.

Thirdly, changing user preferences have also possibly played a role. Specifically, as the attitudes in the society began to change towards environmental awareness, people started seeking new, greener ways to travel around. In addition, with growing population mobility and expanding cities, public transport has ceased to provide sufficient level of flexibility (MIT, 2010). Thus carpooling managed to meet the emerging demand for cheap, green and flexible way to travel around. Finally,

availability of complementary technologies has facilitated development of carpooling on its later stages. Increased usage of smartphones and Internet has made it easier to match potential partners and increased safety of the trips.

As for internal drivers, development of carpooling seems to fit the pattern in this regard as well. As for economic perspective, which includes improved price-performance ratio and increasing returns to adoption, - it is difficult to measure in our case, since carpooling is not a technology, and such concepts as scale economies in production or more efficient production process are not applicable. However, increasing returns to adoption seem to be suitable, since with technological development carpooling services gradually become more structured, organized and easier to use.

In general, socio-technical drivers are more visible and traceable. This type of drivers encompasses creation of new infrastructure and new governmental departments and agencies. In case of carpooling, such infrastructure developments are arguably construction of HOV (high-occupancy vehicle) lanes, and appointment of National Task Force on Ridesharing by president Carter in 1970s. As for emerging groups of supporters, users of carpooling smartphone applications can potentially be regarded as such groups, since they participate in the expansion and improvement of the service.

To sum up, carpooling as a novelty does share a lot of aspects of the third development phase, described by Geels. It enjoyed and keeps enjoying many favorable circumstances and internal drivers, that facilitate its development. On the other hand, it is too early to speak about its broad expansion, diffusion and especially substitution of the existing regime. It is still in quite an early development stage, even though it is growing quite rapidly. However, the presence of the aforementioned circumstances and windows of opportunity suggests that carpooling is going to grow and develop in future.

7.2.4. Substitution

Multi-level perspective framework also includes the fourth stage of novelty development – gradual replacement of the established regime. As said above, carpooling has a long way to go before such an expansion can even be considered. However, it could be useful to assess the potential development of the phenomenon through the lens of this framework.

The fourth stage is signified by the new technology gradually replacing the old. The process is slow and takes a lot of time for several reasons. Firstly, the price/performance improvements normally require multiple incremental innovations, which take time to develop. Secondly, “societal domains can consist of many market niches with different selection criteria” (Geels, 2005:258), and the new technology needs time to adjust and conquer all the niches. Thirdly, emergence of a new socio-technical regime requires multiple transformations, including new infrastructures, user practices, organizations and policies – this is a very slow and gradual process. Fourth, “capital intensity of existing technologies may have a delaying effect” (Geels, 2005:246). This has to do with path dependency, when firms attempt to stick to the existing routines to justify expenditures – for this reason, old technologies can hold certain niches for a long time. Consequently, old and new technologies can coexist for long periods.

Thus the relationship between the novelty and society gradually changes through the described steps. If in the early stages it is the environment that shapes the technology, closer to the later stages the technology starts shaping the society through the emerging linkages. As Geels (2005:147) formulated it, “as more elements are linked together technology acquires more momentum”.

This phase perhaps better applies to technology. At the moment it seems unlikely that carpooling is going to substitute public transport/personal cars. However, it is possible that it will coexist with the existing regime and expand its influence considerably.

7.2.5. Form and function pattern

Geels (2005) identifies several forms of the co-evolution of form and function. These patterns in system innovations can also be viewed as characteristic dynamics that “stretch over different phases of the entire system innovation process” (Geels (2005:120). These patterns reflect the relationship between niche and regime and are concerned with technical form and use environment of the innovation. In other words, the focus is on the deviations from the conventional way in form and function. Depending on the deviation/lack of deviation, four types are distinguished:

- Selective substitution, which implies that the technology and usage environment remain similar to the existing one (same form, same function).
- Market differentiation, which keeps the technical form, but adds a new function (same form, new function).
- Leapfrog design for substitution – the function remains the same, but technical solution is radically different (new form, same function).
- Exploration of a possible new regime – invention of a new form (new technology) and a new function for it.

This can be represented in a table where four quadrants represent different experimentation strategies with new technologies in niches (Table 1).

Table 1. Typology of emerging market production strategies

	Technical form	Fit	Stretch
Use environment			
Fit		Selective substitution	Leapfrog design for substitution
Stretch		Market differentiation	Exploration of new regime

Source: Hoogma (2000, cited in Geels, 2005).

Geels suggests further that these distinctions provide a pattern of the co-evolution of form and function in system innovation, which is generally followed by novel technologies. In general, such technologies starting from being a fit-fit technology gradually evolving to become a stretch-stretch technology, consequently changing the technological regime.

This particular pattern is hard to observe on the example of carpooling since its development is not as straightforward as development of technology. However, certain similarities can be detected. At its advent, ridesharing kept both form and function of the existing system – it offered a function of public transport, and the form of obtaining it was either through personal communication/bonds or through an employer. During its gradual development, carpooling kept the function of public transport – however, it has become much more user-oriented, slowly gaining functions of a private car. As for the form, it has changed dramatically with the

development of online services, thus today the process of finding a rideshare is considerably different from how it was before. Personal relations/agreements do not play that much of a role anymore since the rides are synched through dedicated services. This could be viewed as a fit-stretch phase, with remaining function but changing form.

This conclusion seems logical if we take into the account the fact that ridesharing is a relatively new phenomenon and is still to a large extent in its making.

8. Discussion and implications

Analysis of carpooling through the lens of multi-level perspective framework has shown that the pattern of its development is in many ways similar to that of a radical innovation technology. Namely it has shown similar features in terms of novelty development, probing and learning stage and partially in the breakthrough phase. It emerged as a solution to an existing problem and during its initial development phase was often protected and facilitated by the government. Moreover, this stage also included experimentation and improvisation. Today carpooling is arguably on the second stage – probing and learning. Emerging carpooling companies are still seeking ways to adjust the technology to the user demands. As for the third stage, even though ridesharing has not quite reached the diffusion phase, certain windows of opportunity can still be identified.

The patterns found in this study apparently do not imply or prove that carpooling is a radical innovation in the making. However, the fact that such analysis was possible and presence of the phase features described by Geels supposedly show that application of the multi-level perspective framework has a potential in terms of analysis of not only technical innovations, but also institutional innovations. Clearer guidelines on how to choose landscape factors and how to determine transition start and end points would help further improve clarity and precision of the analysis.

The study also suggests some implications for the research of sharing economy as a whole. Firstly, analysis of carpooling as a part of sharing economy was generally successful. Thus the chosen framework, with some improvements, can probably be

used for such investigations, and sharing economy movements in other sectors can potentially be studied from the same perspective as well. Secondly, the analysis of carpooling showed that it arguably is on the probing and learning stage of development. This knowledge might help in making predictions of how the industry is going to develop in future. Thus there is a potential for a more general study of sharing economy using the same method in order to analyze and understand its future.

As a suggestion for the future studies, it would be useful to deepen the inquiry with larger amount of primary and secondary sources, and a more detailed analysis of relevant landscape, socio-economic and niche developments. This would allow for more solid conclusions. In addition, the multi-level perspective framework could be further applied to such branches of sharing economy as space sharing or task sharing.

9. Limitations

The present study has a certain limitations. To start with, the triple embeddedness framework has some drawbacks, which will be discussed below. Genus and Coles (2007) highlight “the paucity of empirical studies on the topic of transition theory/MLP based on the collection of primary data relating to technological transitions now in the making”. Specifically, they criticize the fact that Geels uses secondary data for his research when using the triple embeddedness framework and state that “the case study research in general has been conducted in a very unsystematic way”. This criticism is somewhat justified as it is up to the researcher to choose the focus of the historical analysis and relevant facts. It is possible, that some relevant landscape or socio-economic developments have not been accounted for in the analysis. Thus the present researched can be viewed as an example, and a suggestion for further investigation, of the opportunities of the multi-level perspective when studying non-technological innovations. In general, there is a need for “greater clarity and robustness in the use of multi-level models of technological transition” (Genus, Coles, 2007).

Another issue is the complexity of socio-economic transitions. As Genus and Coles (2007) claim, “reviewing the case studies reported in related research it would appear that the characteristics of transitions differ from case to case, are identified with hindsight and can be represented by different sets of events”. It is true that analysis of

grand transitions is problematic, and certain patterns can be difficult to trace. However, even though relevance of the patterns, suggested by the framework, is questionable for some transitions, they can still be useful for analysis and systematization. It still provides valuable guidelines for the research of complex regime shifts, which can shed some light on the nature of the events.

To sum up, the present study is based on secondary data sources and, due to the nature of the chosen framework, many features – such as selection of the case, transition start and main points, role of the innovation, contingency and specificity of the case – are up to the analyst to decide. This might lead to biased results, and concrete and definite conclusions from the study are problematic. However, the results are deemed appropriate for the aims of the study.

10. Conclusion

With the aforementioned limitations in mind, the study can draw several conclusions. The initial aims were 1) to study carpooling from the standpoint of multi-level perspective framework and find out whether it follows the suggested development phases and 2) understand whether multi-level perspective is an appropriate framework for investigation of institutional innovations. The expectation was that the emergence of carpooling would have similar features to those of radical technological innovations.

Examination of carpooling with the help of multi-level perspective showed that its path resembles multi-level perspective stages in several ways. For example, similarities can be found in niche development and learning and probing stages. According to the Geels' classification, carpooling seems to be undergoing the second, learning and probing phase. Moreover, the study reveals multiple windows of opportunity, which make further expansion of carpooling very likely. Analysis of the form-function pattern in case of carpooling also seems to be valid and shows that carpooling is in a stage of stretch (form)-fit (function) phase. More specifically, the technical form has changed considerably since its emergence, namely in terms of searching for potential partners, which today is implemented through Internet and smartphones. Function of ridesharing, however, remained the same – a combination

of public transport and a personal car, which combines the price of the former and the flexibility of the latter. This appears realistic and logical, taking into the account a young age of the phenomenon.

These findings suggest that the multi-level perspective framework is applicable to such institutional innovations as carpooling. Furthermore, it helps to look at the phenomenon from a new perspective and contributes to the general understanding of its nature and possible paths of development. This potentially gives additional instruments for research of sharing economy, since the same method can be applied to other branches of this broad industry, such as space sharing or task sharing.

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