Shades of yellow and green: Barriers affecting the liquid biofuels for transport in Romania. A multi-level approach

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Abstract

In the light of (super) wicked problems, as climate change is, a deep transformation of energy and transport systems is needed. Among other technological innovations, liquid biofuels were adopted also in Romania as an innovation that could contribute to the transition towards a more sustainable transport. However, the biofuels sector is not well-developed in Romania, in spite of considerable potential existing, and against the early achievement of the rest of the 2020 targets related to renewable energy. In this study my focus is on the key barriers related to development of biofuels sector in Romania, as perceived by stakeholders, exploring the interactions among the main actors and providing an explanation for the underlying structures that facilitate the emergence of these barriers. For this, I relied on the Multi-Level Perspective framework in order to structure barriers and actors at different levels – macro, meso and micro, and theoretical concepts from Post-communism, Europeanization and Ecological Modernization theories. The data I have used was collected mainly through semi-structured interviews, complemented with literature review and other documents. I have identified the institutional and regulatory barriers as the key category of barriers related to biofuels development in Romania, their emergence being facilitated by state capture, corruption, weak institutions, a weak society and lack of transparency, acting as underlying structures. This allowed me to propose several interventions at different levels, in order to facilitate change and contribute towards a more sustainable transport in Romania. Further research can develop from the findings of this study, as out of all categories of barriers identified, the focus here was only on institutional and regulatory barriers. Through this study I aim to cover a gap in research, contributing to the advance of sustainability science literature. It involves those that affect and are affected by the biofuels development in Romania, bringing a transdisciplinary nuance towards the analysis of barriers related to biofuels sector.

Keywords: liquid biofuels for transport, Romania, multi-level perspective, barriers, post-communism

Word count: 13,294

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List of Abbreviations

IEA – International Energy Agency

GHG – Greenhouse Gasses

RE – Renewable Energy

IUCN – International Union for Conservation of Nature and Natural Resources

RED – Renewable Energy Directive

FQD – Fuel Quality Directive

EU – European Union

NREAP - National Renewable Energy Action Plan

RES – Renewable Energy Sources

ANRE – Agentia Nationala de Reglementare in domeniul Energiei

GT – Grounded Theory

MLP – Multi-Level Perspective

EM – Ecological Modernization

CEE – Central and Eastern Europe

RES – E – Renewable Energy Sources – Electricity

RES – T – Renewable Energy Sources – Transport

NGO – Non Governmental Organizations

R&D – Research and Development

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1 Introduction

1.1 Defining the 'wicked problem'

Considering the way and the scale at which humans have impacted the Earth, some scientists proposed that a new geological era should be acknowledged – 'the Anthropocene' (Crutzen, 2002, Steffen, Crutzen, & McNeill, 2007). Among major negative impacts of the so-called development is the climate change, one of the proposed planetary boundaries that have been transgressed, threatening the "safe operating space for humanity" (Rockström et al., 2009, p. 472). As Steffen et al. (2011) stated, "climate change is a prominent sign of human-driven changes to the global environment" (p.739). There is strong consensus among scientific community regarding both the existence of climate change and, with a high degree of certainty, its main anthropogenic driver – greenhouse gases (GHG) emitted mainly in the process of burning fossil fuels (Cook et al., 2013, Oreskes, 2004).

In its report *CO2 Emissions From Fuel Combustion - Highlights (2014 edition)*, the International Energy Agency (IEA) shows that energy generation is the main contributor to anthropogenic GHG, with 69% share, while CO2 represents the main component of GHG emitted with 90% contribution (IEA, 2014, p. 7). In terms of sources, transport represents the second contributor of CO2 emissions, globally, with a share of 23%, after electricity and heat generation (IEA, 2014, p. 10). Road transport represents the main generator of CO2 emissions within transport, followed by aviation and marine bunkers (IEA, 2014, p. 11).

Complex environmental challenges like climate change, labeled '(super) wicked problems' (Rittel & Webber, 1973, Levin, Cashore, Bernstein & Auld, 2012) require a complex and different approach for solving, as attempts to solve a wicked problem might create another one.

Renewable energy (RE) has been seen as a potential answer, among others, to reduce GHG emissions generated in transport, mainly in the form of liquid biofuels (called hereinafter biofuels), with first generation[1] biofuels being commercially available for some time, produced and utilized globally, while later generations (advanced) biofuels are mainly under research and testing phase (Naik, Goud, Rout, & Dalai, 2010, Timilsina, 2014). They are considered the main RE option in transport (IEA, 2015). However, the current production and utilization of biofuels proves controversial because of

[1] Sometimes called also conventional biofuels, they are produced mainly from foods crops (grains, sugar cane vegetable oils), while second generation biofuels are produced out of energy crops like miscanthus, residues and waste from agriculture, or woody biomass (Mohr & Raman, 2013). Liquid biofuels used in transport consist mainly of bioethanol, biodiesel and biogas (Naik, Goud, Rout, & Dalai, 2010)

their adverse social and environmental effects, mainly the competition with food, competition for resources (land), important socio-economic effects (Solomon, 2010) and in particular, the negative environmental impacts associated with the first generation biofuels (Ajanovic & Haas, 2014).

In the European Union, a consistent response to climate change and reduction of GHG by use of renewable energy came in 2003 in the form of Renewable Energy Directive 2003/28/EC (European Parliament, 2003), which was later amended by Directive 2009/28/EC (European Parliament 2009a), aiming at 20% share of renewables in the total final consumption of energy at EU level, by 2020, and established binding national targets (Klessmann et al., 2011). In the case of transport, a target of 10% share of RE in total energy consumption used in transport was established. In the domain of transport, the Renewable Energy Directive (RED) is complemented also by Fuel Quality Directive 2009/30/EC (FQD) implemented in 2009 (European Parliament, 2009b). Biofuels emerged as the main solution for RE in transport in the EU (Ecofys, 2014) mainly in the form of biodiesel[2] and bioethanol[3]. Other options for a more sustainable transport play a smaller part, with electrical vehicles representing a share around 0.5% (Ecofys, 2014) and renewable electricity and biogas playing a more important role only in a few EU countries. In order to cover some of the unsustainability aspects related to biofuels, the EU introduced in the RED a set of 'sustainability criteria' aimed at "incentivizing biofuel producers to adopt environmentally responsible production practices" (German & Schoneveld, 2012, p. 766).

As such, the EU framework and policy for RE and biofuels became the major driver at global level with regards to the increase in biofuel production and trade (German & Schoneveld, 2012).

Romania, a member state of the European Union since 2007, implemented in its national legislation the legal frameworks related to renewable energy and agreed on binding national RE targets, as submitted in the National Renewable Energy Action Plan (2010). For transport, Romania adopted a target of 10% RE share in fuel consumption used in transport, to be achieved by 2020 (NREAP, 2010). Although having implemented the EU regulations related to RE and biofuels, with success regarding the RE target for electricity[4] and the RE target[5] in overall energy consumption, Romania is not showing the same development rate when it comes to transition towards a more sustainable transport.

[2] In 2012 biodiesel represented 80% out of biofuel consumption in EU, with 11, 638 ktoe (Ecofys, 2014)
[3] In 2012 bioethanol represented 20% out of biofuel consumption in EU with 2,852 ktoe (Ecofys, 2014)
[4] Romania has adopted a 2020 target for renewable energy share in overall electricity consumption of 38%, which was achieved in 2014 (ANRE, 2015a, NREAP, 2010)
[5] Romania has adopted a 2020 target for renewable energy share in total energy consumption of 24%, which was achieved in 2014 (ANRE, 2015a, NREAP, 2010)

This study brings a contribution to the identification and analysis of barriers related to the development of biofuels sector in the specific context of Romania, with a focus on institutional and regulatory category, identified as key barriers based on respondents' statements. Based on concepts from Post-Communism, Europeanization and Ecological Modernization theories, I have analyzed the interactions among actors at different levels – macro, meso and micro, in relation to the key barriers, uncovering the underlying structures that facilitate the emergence of these barriers. Finally, I have proposed several points of intervention, which could bring change regarding the development of biofuels sector and contribute towards a more sustainable transport in Romania.

1.2 Research Outline

1.2.1 Justification

Transport is one of the major contributors to CO2 emissions, with 23% globally as of 2012 that is generated mostly in road transport and it has registered a significant increase during the last two decades, from the level of 1990 (IEA, 2014). A similar pattern regarding transport emissions exists at the EU level (see Fig. 1 below).

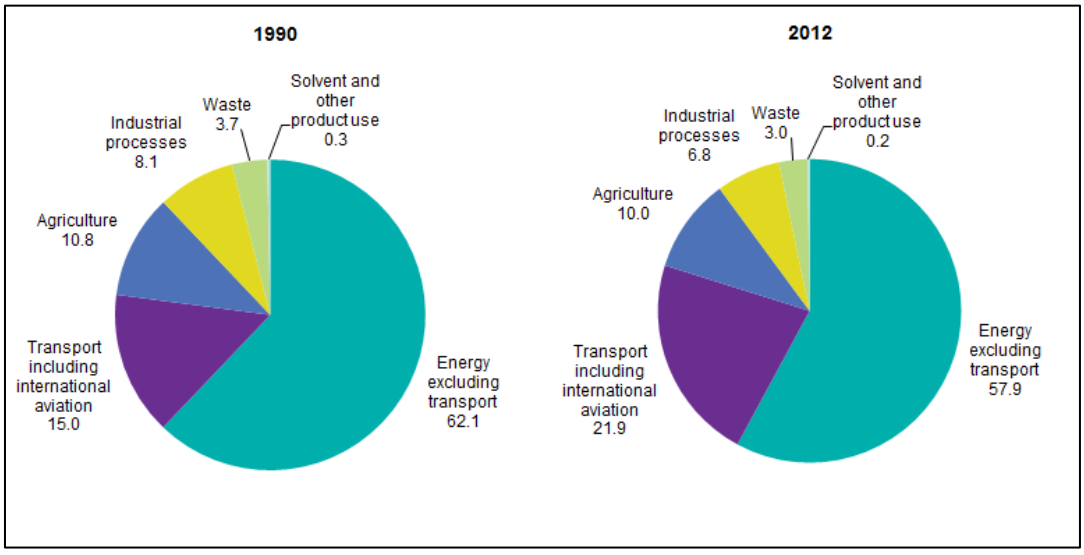

Figure 1: Greenhouse gas emissions, by source sector, EU-28, 1990 and 2012 (EUROSTAT, 2015a)

In order to mitigate these, there is recognition of biofuels as being a significant renewable energy alternative to fossil fuels in transportation sector (IEA, 2015). In the same time, there is also considerable debate around biofuels, regarding their sustainability (Solomon, 2010). Among major shortcomings discussed in the literature are: negative impact on biodiversity (Campbell & Doswald, 2009), questionable GHG emission reduction capacity (Fargione et al., 2008, Searchinger et al., 2008),

food vs. fuel debate (Runge & Senauer, 2007, Tenenbaum, 2008), direct and indirect land use change (Borjesson & Tufvesson, 2011, Rathmann, Szklo, & Schaeffer, 2010) and negative social impacts (van der Horst & Vermeylen, 2011). However, it is considered that biofuels 'done right' (Tilman et al., 2009) produced and utilized in a sustainable way, can bring a positive contribution to reducing GHG emissions and mitigate climate change, playing a major role in a transition towards a more sustainable transport (Holden & Gilpin, 2013), as "for parts of the transport sector biofuels are the only low-carbon option" (IUCN, 2014, p. 24). As such, I have found interesting and relevant as a thesis topic, to focus in this study on the RE use in transport, in particular the liquid biofuels in the form of biodiesel and bioethanol.

Furthermore, Romania can be considered an interesting case, for several reasons. In line with the global and European patterns, energy generation and transport are the biggest contributors to CO2 emissions in Romania (Cioca, Ivascu, Rada, Torretta, & Ionescu, 2015). The country is dependent mainly on fossil fuels for its energy generation (Colesca & Ciocoiu, 2013), having also important fossil fuel reserves and extraction activities[6] (Stratfor, 2014). However, in only three years (2011-2013), investments in RE sector grew at an incredible rate[7], fueled by one of the most attractive support schemes in Europe (Câmpeanu & Pencea, 2014), an interesting aspect considering that Romania is among the poorest countries in the EU (EUROSTAT, 2014). As a result, Romania managed to achieve its 2020 targets for renewable electricity and renewable energy sources in overall consumption in 2014, quite ahead of 2020 (ANRE, 2015a). But, this is not the case for the RES target of 10% in transport[8], although there are premises that would allow for considerable achievements. Another important aspect is that before becoming a member of the EU starting 2007, Romania was under communist rule until 1989. Post-communist transition shaped in a specific way the development of the country and its energy and transport sectors. Moreover, the geo-political context[9] in the region and the energy security aspects add further complexity. Final reason behind choosing to focus on Romania is related to the limited academic literature available on the transport biofuels and sustainable transportation in Romania, these sectors being under-researched[10].

[6] Romania has a long history in oil production. It is the first country in the world to start oil production officially, in 1857, with an amount of 275 tons, as registered in international statistics (Stratfor, 2014)

[7] In total, RE grew in Romania between 2011 and 2013 with 283%. Author's calculations based on ANRE, 2014, 2015a

[8] As of 2013 data, Romania is below half of that target (EUROSTAT, 2015b).

[9] The conflict in neighboring Ukraine and status of Russia as a major energy supplier in the region and for the EU industry (Stratfor, 2014)

[10] I have performed literature searches on the scientific databases SCOPUS and Web of Knowledge using various search terms, both in Romanian and English which found only limited research, situation confirmed by

1.3 Aims and Research Questions

This thesis has as main purpose to contribute with knowledge that facilitates an improved understanding of a real-world problem (Kates et al., 2001). As such, this qualitative study identifies and analyzes, from a multi-level perspective (Geels, 2002, 2012) the interactions among different actors situated at different levels – macro, meso and micro, in relation with the key barriers perceived by the stakeholders as affecting the development of biofuels in Romania, and provides an explanation for the underlying structures that facilitate the emergence of these barriers.

1.3.1 Research Questions

The main research question that driven this study is:

"What are the factors affecting the development of liquid biofuels for transport in Romania, and which are their underlying structures?"

In order to answer it, these sub-questions have guided my research:

I. Which are the key barriers that affect the development of the biofuels sector in Romania, perceived by the stakeholders?
II. What are the main interactions among actors situated at different levels related to the barriers affecting biofuels?
III. Which are the underlying structures facilitating the identified barriers?

1.4 Contribution to Sustainability Science

Sustainability science seeks to analyze 'wicked' problems connected to society-nature complex interactions, and propose solutions that would allow for transition to a sustainable society (Clark & Dickson, 2003). It has a holistic approach, analyzing issues from a systems perspective, and focusing on normative and transformative ends (Kates et al., 2001).

Sustainability challenges are defined also by uncertainty and high stakes (Jerneck et al., 2011) and the domain of biofuels is such an uncertain area, posing high stakes to a large category of stakeholders and reflecting a problematic interaction of society-nature type, highlighted in the debates around biofuels' sustainability.

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some of the respondents in the study, and in recent literature (Stan, Fîntîneru & Ion, 2014, David & Fistung, 2015). No study analyzes the barriers to the development of biofuels sector in Romania.

Identifying the barriers related to development of biofuels sector in Romania, perceived by the stakeholders, and uncovering their underlying structures allowed me through this thesis to explore a complex and challenging problem, in line with the sustainability science's areas of study. An additional contribution of this study is to cover a gap in research, as research about transport biofuels in Romania is limited, thus contributing to the advance of sustainability science literature. In the same line, involving those that affect and are affected by the biofuels development in Romania, brings a transdsiciplinary nuance and reflects "a problem-driven research in support of a sustainability transition" (Clark & Dickson, 2003, p. 8059).

2 Methodology

2.1 Research Approach and Strategy

This research relies on qualitative methods, which allows me "to represent the views and perspectives of the participants in a study" (Yin, 2011, p. 8) and follows at large the process described by Yin (2011). My research strategy is based on a single case study (Creswell, 2007), including explanatory and exploratory aspects, focusing on the barriers identified as affecting biofuels sector in the particular context of Romania, analyzing the interactions between actors at different levels and uncovering the barriers' underlying structures. The research, informed by a critical realist ontology, begun with a previously loose design, that developed continuously, and it is characterized by the use of abduction, starting from the observation of a surprising real world event – although the premises are there, biofuels sector in Romania seems underdeveloped – and further aiming at identifying the key factors that hinder its development and trying to uncover their underlying structures that facilitate their emergence.

2.2 Epistemological and Ontological Considerations

2.2.1 Critical Realism

Critical realism is based mainly on the works of Roy Bhaskar (1975, 1978, 1989) being further developed by the contribution of other important scholars (Archer, 1995, Collier, 1994, Sayer, 1992, 2000). As Oliver (2012) puts it, critical realism "marries the positivist's search for evidence of a reality external to human consciousness with the insistence that all meaning to be made of that reality is socially constructed"(p. 372).

A key feature of critical realism is to acknowledge existence of different levels or domains, parts of a stratified ontology, the empirical, the real and the actual, implying that even if there is one reality, we don't have immediate access to it and we can't comprehend its entirety (Sayer, 2000). In the domain of the empirical, events are experienced by the observers or participants, the domain of the real consists of objects and structures influenced by certain causal powers and liabilities, acting as generative mechanisms, while the domain of the actual is where the events occur, whether or not experienced, being mediated by the mechanisms in the real domain (Easton, 2010, Zachariadis, Scott & Barrett, 2013). Under this approach, the researcher has an important role to explore the relations and underlying mechanisms which are hidden and create the stratification, and can do this by using theoretical insights. Other important aspect that was relevant for my research is that observable phenomena in the form of events, facilitated through mechanisms, "derive from the structures of objects, and they take place within geo-historical contexts" (Sayer, 2000, p. 15). As such, in this study I have uncovered and explained the underlying structures that facilitate the emergence of the barriers perceived by respondents (events) by exploring the relations among different actors, at different level, considering the geo-historical context in Romania. For this, I have made use of theoretical concepts derived from more structural theories as I consider that barriers are not an aggregate outcome of individual actions, as per rational-choice theories.

2.3 Methods for Data Collection and Analysis

2.3.1 Grounded theory method in a critical realist perspective

Grounded theory (Glaser & Strauss, 1967) is credited to Barney Glaser and Anselm Strauss. Besides its original form and the different variants developed by its creators, it was further elaborated by other scholars, either based on the 'classical' version, or taking it to new directions, like Charmaz (2005, 2006) which introduced a constructivist approach towards grounded theory.

Grounded theory (GT) method is characterized by intensive analysis of data, driven by the act of constant comparison, data collection being an iterative process (Creswell, 2007). The main steps related to grounded theory, as introduced by Strauss and Corbin (1990, 1998) are open coding, with main goal to structure the data collected into categories and identify properties and subcategories, the axial coding, where relationships among categories are explored, while under selective coding, researcher aims at establishing a theory or proposition, around the core phenomenon identified, developing the relationships of categories, creating a story line.

It is considered that grounded theory can provide a sound method for critical realism. Oliver (2012) mentions that application of GT brings robustness and that under the newer GT versions, use of literature is accepted and abduction is considered an important tool. My use in this study of the GT method relates mainly to the data coding section and follows at large the data coding process described by Strauss and Corbin (1990, 1998) considered a very systematic one (Creswell, 2007) and also incorporates ideas reflected in more recent GT versions.

2.3.2 Data collection

The main method that I have used for data collection in this qualitative study was the semi-structured interview, which allows for an in-depth exploration and makes possible to "to depict a complex social world from a participant's perspective" (Yin, 2011, p. 135). In order to select the participants, I have applied purposive sampling at the beginning, complemented with snowballing, as some of the later respondents have been referred to me by previous ones (Yin, 2011). For the purposive sampling I have targeted deliberately the stakeholders close to biofuels sector as I considered that they would be the most suited to provide data for my research questions. I have defined stakeholders here in line with the definition advanced by Freeman (1984) as individuals or groups who can affect a decision or are affected by it.

As to acquire empirical evidence of the factors presumed to influence the development of biofuels sector in Romania, I have conducted 7 semi-structured interviews with key stakeholders from different categories, to obtain diverse perspectives on biofuels in Romania (see Table 1). In order to protect anonymity and confidentiality, I have assigned letters A–G to the respondents, for further reference in this study. For conducting the interviews I have followed the process proposed by Yin (2011). Except of one interview conducted via telephone, all the interviews were made in person.

Table 1: List of respondents. Compilation by author

	Respondent	**Domain**	**Gender**
A	Professor	Sustainable Development	F
B	Professor	Research on Biofuels	F
C	Representative	NGO1 - Energy, Transport and Climate Change	F
D	Representative	NGO2 - Transport and Environment	M
E	Representative	Farmers' Trade Association 1	M
F	Representative	Farmers' Trade Association 2	M
G	Manager	Local bioethanol producer	F

The semi-structured interviews followed at large an interview guide consisting of 20 open-ended questions and a ranking exercise (see in Appendix I) and were conducted in Romanian. Additional details regarding the respondents and interviews are presented in Appendix II. I have supplemented the data collected through interviewing by using other methods: collection of documents, which were analyzed in relation to the primary data gathered through interviews, secondary data from statistical databases, in order to facilitate triangulation.

Further, I have complemented the data collection with an extensive literature review. The literature review had several aims – to understand the extent at which the topics on renewable energy and biofuels are studied from a sustainable perspective in Romania, to identify some problematic potential entry points for my research, to explore theoretical frameworks and concepts that would allow to investigate at different levels the interactions of actors related to biofuels sector in Romania. A particular focus was placed in reviewing the literature that deals with barriers to development of RE technologies. Beside academic literature, the review covered also grey literature, like reports from Romanian and International organizations, the European Union and other sources.

2.3.3 Data analysis

For the data analysis, I followed the structure proposed by Yin (2011), consisting of 5 steps: compiling data, disassembling, reassembling, interpreting and concluding (p. 177), which were further adjusted to the specifics of grounded theory, here being informed for the coding process mainly by the procedure described by Strauss and Corbin (1990, 1998).

In the compiling phase, all interviews were transcribed, trying to make the transcription as accurate as possible, so that the exact words used by participants to be included. Transcription was made in Romanian, same language as the interviews, while coding was made directly in English. After transcribing all interviews, I have begun the process of disassembling the data, by performing the first step of open coding, in order to analyze the text as per grounded theory approach. Here, the use of constant comparison was in focus, described as looking for similarities and dissimilarities in data (Yin, 2011), as such to be sure that nothing relevant was missed. After reducing data to categories, and labeling them in the open coding, reassembling step started with the axial coding phase where the relationships among categories have been explored, and the positive and negative aspects were highlighted based on the perspective of the respondents (stakeholders). At this point, it emerged that the majority of the data reflected shortcomings, negative factors and barriers that influence the (under)development of biofuels sector in Romania. In the selective coding phase, the barriers were selected as the central phenomenon of interest, based on the incidence and weight

given by those interviewed to certain core categories, and the relationships identified between these core categories.

Further, data was interpreted and analyzed, as data do not "speak for themselves" (Yin, 2011, p. 207). The analysis in this study is based on interpretations and combines a descriptive and explanatory approach (Yin, 2011). As such, after I have arrived inductively at core categories and phenomena of interest, in the form of barriers, their classification and analysis was made based on reviewed literature, in general, and in particular, regarding the specific context of Romania. Quotes provided under the analysis section are in English, translated from Romanian. All translations were made by the author.

2.4 Reflexivity and ethical considerations

Reflexivity or self-reflexivity as it is sometimes called is considered at the core of qualitative research (Seale, 1999, Tracy, 2010, Yin, 2011). My position as a 'research instrument' and the interplay with the events and participants from the field is of considerable importance (Yin, 2011). Influences work both ways, as the researcher influences the participant, while it has to be acknowledged that at the same time there are influences from the participant as well. As such, the study has been affected to an extent by my personal perspective and values, which I tried to mitigate by following closely the methods employed and being sincere, reflective and transparent about the process.

Since the study is a qualitative one, involving human subjects, I have paid particular attention regarding ethical considerations (Yin, 2011). For all interviews an agreement to audio tape was requested from participants at the beginning of interviews. Information was provided regarding the rights that respondents have, to stop the recording, to ask for it to be deleted, a copy to be provided to the participant if desired, and that they can answer only the questions they are comfortable with. Further, I have provided details about the use of data collected through interviewing and discussed about anonymity.

2.5 Limitations

Several limitations have influenced this research in different ways. One drawback is related to the profile of the respondents – although I have aimed for a large variety of stakeholder categories[11], considered important from the beginning, in the end I have been able to interview only four

[11] Categories of stakeholder aimed for in this study, and contacted: biofuels producers, feedstock producers, R & D, biofuel traders and distributors, fossil fuel retailers, NGOs, trade associations for biofuels, feedstock, central public authorities with attributions related to biofuels, experts.

categories. As such, the lack of participants from fuel retailer companies which represent the main channel of distribution of biofuels and a key policy influencing actor, lack of participants from industry's professional association and lack of participation from Romanian public authorities – mainly Department for Energy, were all of significant importance.

Although I have identified several categories of barriers considered important by respondents, the focus of this study is on institutional and regulatory barriers, as they were perceived as key barriers by most of the respondents and they have been highlighted as significant also in the literature. However, the rest of the barriers have their role when it comes to biofuels sector in Romania.

In this study only first generation biofuels are considered, as they are mostly in production and use in Romania, and although I'm aware about the controversies around biofuels, I do not discuss here their sustainability in depth.

In the end, lack of research in the area, limited availability of data and high degree of non-transparency made this analysis challenging but also worthwhile.

3 Theoretical and Conceptual Framework

In this section, I present an overview of the theories, concepts and the framework used for analyzing the barriers related to biofuels in Romania. The framework I have applied is the multi-level perspective framework. I have gained an understanding of the theoretical framing behind biofuels promotion in Romania by exploring Ecological Modernization theory, while concepts related to Post-communism and Europeanization were important in providing theoretical insight into the underlying structures that facilitate emergence of the barriers identified empirically, in line with the critical realist ontology.

3.1 Multi-Level Perspective Framework

When it comes to frameworks used for analyzing the transition to sustainability, there are several approaches. For this study, the Multi-Level Perspective (MLP) was chosen, in particular the version developed by Geels (2002, 2010, 2012) as a framework that allows for the exploration of complex interactions at different levels between actors involved in the biofuels sector in Romania and barriers that hinder the development of the sector.

In the view of Withmarsh (2012), MLP is considered a valuable tool for the analysis involving stakeholders, by emphasizing differences of perspectives among actors at different levels, when it

comes to unsustainability issues. As such, it can be a useful framework when dealing with the so-called 'wicked' problems identified in relation to sustainability in transport (Brown et al., 2010).

MLP defines transitions as "complex and long-term processes comprising multiple actors" (Geels, 2011, p. 24), shifts in a regime which are influenced by interactions in and between three different levels of socio-technical systems: niche, regime and landscape (see Fig. 2).

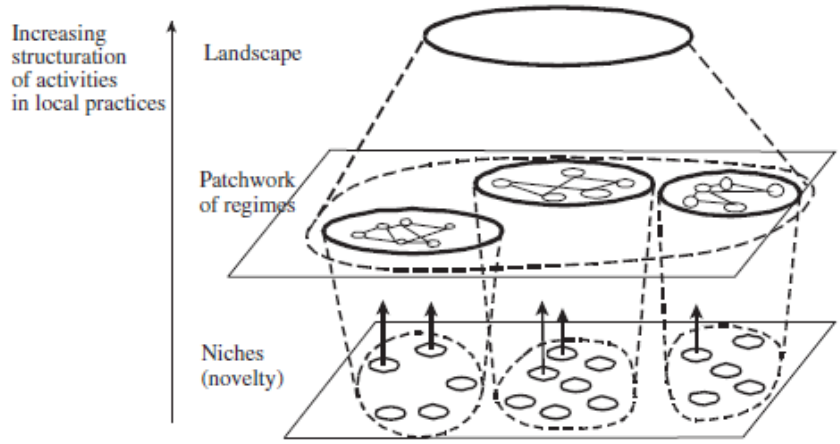

Figure 2: Multi-levels as nested hierarchy (Geels, 2002)

The niche –innovation level is described as the place for novelty and radical innovation, a protected space that provides support to build social networks favoring innovation, and "where it is possible to deviate from the rules in the existing regime" (Geels, 2004, p. 912). They are considered very important for transitions "because they provide the seeds for systemic change" (Geels, 2012, p. 472). Socio-technical regimes consist of environments shaped by established rules, norms, regulations and culture, which impacts different groups of actors that are gathered around a proven and well in use technology (Geels, 2002). There is not a singular regime, but a multitude of regimes (Geels, 2012). At this level the change is incremental (Whitmarsh, 2012). The socio-technical landscape, described as an external, wider context (Geels, 2002) encompasses regimes and niches that interact with each other and are influenced by the landscape. It contains the broad physical, ideological, cultural, economic or environmental macro-trends (Geels, 2002) and includes drivers and barriers that facilitate or hinder change (Whitmarsh, 2012). As such, this level is outside the direct influence of the actors, changes do not happen at one's desire (Geels, 2004). Development at this level is relatively slow. Transitions happen when linked developments occur at all these levels (Geels, 2002).

Regarding the utilization of the MLP framework, several criticisms[12] were pointed by scholars. In the case of utilization of MLP for transport research, Whitmarsh (2012) argues for a better reflection of spatial dimensions. Although MLP has been used extensively to analyze global, broad transition processes, spanning decades, it has been applied also to single technology studies, as biogas (Fallde & Eklund, 2015) or biofuels (van Bree, Verbong, & Kramer, 2010), that reflected more local processes. As mentioned by Whitmarsh (2012) when it comes to agency and spatial levels, identification of different levels at which agents interact (local, national, international) and the nature of interaction brings positive contribution for analysis.

3.1.1 Application of MLP in this study

The utilization of MLP "requires both substantive knowledge of the empirical domain and theoretical sensitivity (and interpretive creativity) that help the analyst 'see' interesting patterns and mechanisms" (Geels, 2012, p. 474).

The analysis in this study has been made following a flexible utilization of the MLP framework, acknowledging that there are different ways to operationalize levels (Geels & Schot, 2007). Therefore, my research focuses on a single technology – first generation biofuels, as a niche-innovation technology and seeks to analyze the interactions between actors situated at different levels, in order to understand the emergence of the barriers that hinder the development of the sector, and to uncover the underlying structures.

3.2 Ecological Modernization and Biofuels

Ecological modernization (EM), introduced by Joseph Huber (Fisher & Freudenburg, 2001) emerged as a concept in the 1980s from the German environmental debate (Andersen & Massa, 2000). Andersen and Massa (2000) point out that EM is closely linked to the precautionary principle and social market economy. EM has evolved in a variety of forms, ranging between the "weak" and the "strong" version, introduced by Christoff (1996). Regarding EM relation to sustainable development, some authors conflate this two concepts, seeing ecological modernization as "a new, and in many ways in improved, synonym for sustainable development" (Buttel, 2000, p. 63) while others see a clear distinction between the two, without the possibility of using them interchangeably (Langhelle, 2000).

[12] Among others, criticism regarding the empirical and analytical levels and claim that there is too much focus on the niche level regarding its influence on the change of regimes and transition process was brought by Berkhout et al. (2004). Another important criticism is related to the consideration of agency within MLP (Smith et al., 2005).

EM postulates that it is possible a win-win relationship among environmental protection and economic growth, and even more, that protection of the environment is seen as a pre-requisite for sustainable economic growth (Fisher & Freudenburg, 2001). According to Sezgin (2013) EM also places a great emphasis on the environmental policy integration as most environmental issues work across sectors. Environmental technological innovation is main part of the solution – clean and green technology that contributes to further economic growth.

International environmental policy is being determined by ecological modernization, which is also seen as shaping EU environmental policy (Gouldson & Murphy, 1996, Sezgin, 2013). In relation to climate change ”advances in the energy efficiency of production and the reduction of carbon emissions via technological improvements and renewable energy are embraced like a flotation ring that would save humanity from the ultimate environmental catastrophe” (Sezgin, 2013, p. 95).

Regarding the advancement of ecological modernization process in Eastern Europe, is considered that the Europeanization played a significant role. As Romania is a member of the EU since 2007, EM is being further diffused from the EU level through environmental policies and strategies that are defining the national approach.

When it comes to the biofuels and their promotion, they are seen as a materialization of the EM approach and the EU is considered among the world leaders, shaping the global biofuels regime (Holleman, 2012). Research from EM theory scholars has addressed also the issue of biofuels and the controversies around them (Huber, 2008, Mol, 2007, Mol, 2010). While acknowledging the negative effects associated with biofuels, Mol (2010) has seen biofuels as facilitating the creation of a global biofuel network, and allowing for emergence of new environmental governance based on markets and private actors. And these, in turn, can reduce the negative effects associated with biofuels, considered as being caused by ineffective state regulation.

Among major critiques, as Holleman (2012) mentioned, in the end, EM assumes that economic growth in a capitalist system can be decoupled from environmental damage and in the case of biofuels the private market actors will advance the “fair fuels.” In the same line, the compatibility of capitalism with ecological change as forwarded by EM, “led to a confrontation between the theory and a core thesis in other influential sociological theories of the environment–society nexus—that capitalist economic growth is incompatible with ecological sustainability and social justice” (Holleman 2012, p. 287). These issues have been raised also by other scholars (Fisher & Freudenburg, 2001).

3.3 Post-communism transition and Europeanization

Mungiu-Pippidi (2010) describes post-communist transition as a dual process, representing on one hand a change from a command-type, central planning economy to the market economy, and a change from authoritarian or totalitarian regimes to democracy. As such, the transition had two major components – an economic one and a political one, with various achievements among post-communist countries. Ganev (2001) points out the symbiosis of party and state as the most important feature of communism in Eastern Europe.

Post-communists states are characterized by significant state capture and considered weak states (Andreev, 2009, Buzogány, 2015, Dimitrova, 2010, Dimitrova & Buzogány, 2014), in a process of transformation, engaged in state building and reconstructing public authority (Dimitrova, 2010). On the same line, Ganev (2001) emphasizes as main causes of state weaknesses, in the case of Bulgaria, the fact that in the early stage of post-communism transition, the state building process was based on restructuring the existing institutions that were legacy of the past, redistribution of extracted resources and rearrangements of strategic positions. These are mentioned also by Innes (2014) stating that mass elite parties in Central and Eastern Europe (CEE) have "established themselves by monopolizing and asset-stripping state resources and information" (p. 93). These lay the foundations for the new democracy (Ganev, 2001).

Further in the transition process, Dimitrova and Buzogány (2014) mention that countries in CEE, mainly Bulgaria and Romania, are still weak in two major aspects: in formulating and implementing coherent policies and the high level of state capture.

Among other effects, weak post-communist states lose control on some of their functions by making room for informal networks to emerge and take over. Further, non-state actors gained significant influence on the reform and policy process. Together, these actors have weaken the state and affected its capacity for democratic governance (Dimitrova, 2010). On the other hand it is mentioned that lack of resources has hindered the collaboration of state and non-state actors, as not only states were weak in post-communist countries but non-state actors too (Buzogány, 2015).

Another important aspect related to post-communist transitions in CEE countries is the process of restructuring reforms at economic, political and administrative level, implemented in order to join EU, which has been described as Europeanization (Dimitrova, 2010) and has been defined as a "process of change in national institutional and policy practices that can be attributed to European integration" (Hix & Goetz, 2000, p. 17 in Andreev, 2009). The adoption of reforms for integration

gave EU certain powers in shaping the post-communist transformation in the candidate countries, the so called EU conditionality, which has expired once these countries joined the EU (Dimitrova, 2010). However in the case of Bulgaria and Romania, the EU still has some leverage, as it has set up a 'co-operation and verification mechanism' with the role of an oversight tool for justice, corruption and organized crime (Dimitrova & Buzogány, 2014). Besides important political and economic reforms, accession criteria included also the requirement to adopt the EU's 'acquis communautaire' (Buzogány, 2015, Dimitrova, 2010).

Among post-communist countries that joined the EU, Bulgaria and Romania are considered "the laggards of eastern enlargement" (Dimitrova & Buzogány, 2014, p. 139). Biggest challenges for countries like Bulgaria and Romania are considered their legacies of the early transition period, the "unfinished political and socio-economic transformation" (Andreev, 2009, p. 391). Romania has been classified among the most corrupted countries in Europe in a recent study (Paulus & Kristoufek, 2015) and scores poor also in Transparency International classification (2014).

Mungiu-Pippidi (2010) describes as following the present post-communist societies:

> "*Today, many postcommunist countries can be characterized as captive states—places where voters are alienated, political parties compete only for spoils, the media are used as tools of corruption, and what passes for political discourse is little more than a public-relations campaign*" (p. 126).

4 Case Study Context

4.1 General information about Romania

Romania, a member state of the European Union starting 2007, is the largest country in South Eastern Europe (Colesca & Ciocoiu, 2013) and it has a population of 20,121,641 inhabitants, as per 2011 census, out of which 54,0% live in urban area (INS, n.d.).

Until end of 1989 Romania was under a communist rule, considered particularly oppressive in the region (Stringer, Scrieciu, & Reed, 2009) which changed to a democracy after the fall of the regime. Among others, the communist regime restricted the development of the civil society and limited reforms (Dăianu & Murgescu, 2013). Although significant changes and reforms were implemented during the post-communism transition, it is considered that "in Romania, however, there has never been a clean break with the past" (Grødeland & Aasland, 2011, p. 20).

In terms of economic development, Romania is at the bottom of the list among the EU member states. Poverty is still one of the major challenges, as noted in the EU report, *Key figures on Europe* (EUROSTAT, 2014), Romania registering a high degree of poverty, with 41.7% of population being affected by poverty or social exclusion (as of 2012). Further, development is also hindered by a high level of corruption.

Agriculture in Romania contributes to around 6% of national GDP, compared with an EU average of 1.7% (MADR, 2014). When it comes to arable land, Romania has a total area of 8,002,434 ha (Calciu, Mihalache, Dumitru &Vizitiu, 2014) being an important producer of grains, especially a major producer of corn in the EU, used also as feedstock for bioethanol (Ecofys, 2014). Other type of feedstock crops are produced as well and the surfaces cultivated have increased recently (Stan, Fîntîneru, & Ion, 2014). As per MADR (2014) the following quantities of major crops, potentially biofuel feedstock, were produced in Romania:

Table 2: Domestic production of crops potentially usable as biofuel feedstock in Romania. Compilation by author based on data from MADR, 2014

Production (tsd. tonnes)	2010	2011	2012	2013
Corn	9,042	11,717.6	5,953.4	11,373
Rapeseed (for oil)	943	739	157.5	686
Soybean	149.9	142.6	104.3	151
Sunflower	1,262.9	1,789.3	1,398.2	2,135

Fluctuations in production are due mainly to changes in the surface cultivated with these crops, except the corn where also productivity differed significantly between the periods.

4.2 Particularities related to energy and transport in Romania

Romania is a country with significant energetic resources. In their brief analysis of the Romanian energy sector, Stratfor (2014) shows that although the crude oil production has declined slightly in recent years, Romania ranks 4th in the EU in terms of confirmed oil reserves. Natural gas production, declined from the peaks in the 1990s, however Romania ranks 5th in the EU in terms of natural gas reserves. Regarding the coal production, which was quite stable in the last decade, after a significant

fall after 1990, Romania covers most of its domestic consumption from the local resources, mainly lignite. It ranks 6th in the EU as a coal producer.

Within the EU, Romania has a low dependency on foreign energy (21%, versus 54%, the EU average), as per Stratfor analysis (2014). Another important aspect highlighted in the report is that, due to a diverse energy mix based on domestic resources, with coal having an important role, Romania was able to face much easier the regional geo-political situation related to the crisis in Ukraine. This is mainly due to domestic production, which supplies around 80% of the primary energy demand, generated mainly by fossil fuels and large hydropower plants. In addition, around 19% of the electricity is generated by nuclear power (Colesca & Ciocoiu, 2013). In the electricity generation sector the renewables have their strongest presence (including large hydro). Figure 3 below shows the energy sources used for producing electricity in Romania, as of June 2015 (ANRE, 2015b).

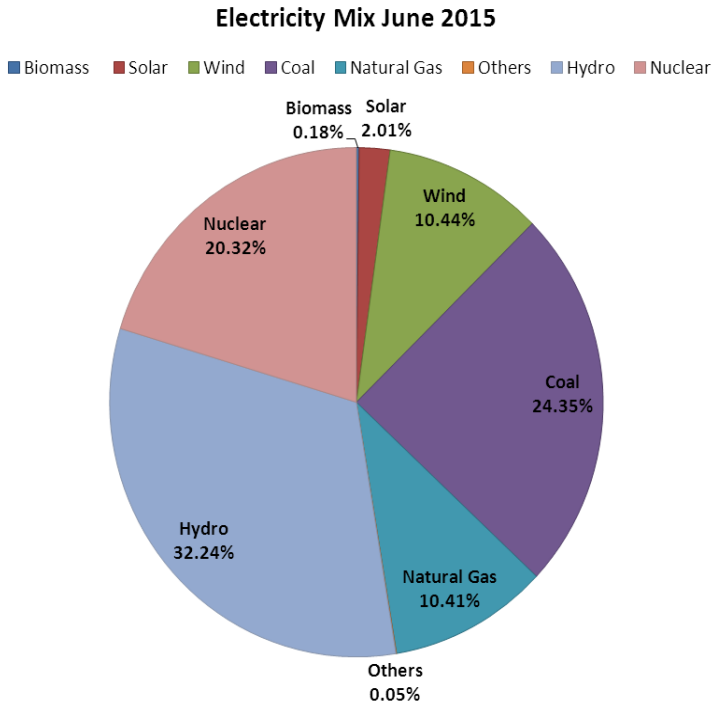

Figure 3: National electricity production sources as of June 2015 - Romania (ANRE, 2015b)

Regarding the transport sector, Romania has a national fleet of cars that are quite old, with 56% of cars being older than 11 years (see Table 3). This was also highlighted by the Romanian Government when decided to reduce the blending quotas for biofuels.

Table 3: National car fleet structure - Romania. Compilation by author based on data from DRPCIV, 2015

Car fleet structure in Romania *(in mln. units)*					
Year	Total fleet	Passenger cars	Cars > 11 yrs. Old	Cars- gasoline	Cars - diesel
2014	6.27	4.90	2.75	3.40	2.53
2013	5.9	4.69	2.68	3.3	2.35

4.2.1 Renewable Energy in Romania

As an EU member state, Romania has transposed into its national law the EU directives and the aquis. In 2008 Romania has issued the Renewable Energy Law (220/2008), which was modified several times, becoming operational only from 2011 by the introduction of a proper support scheme for investments in renewable energy (Câmpeanu & Pencea, 2014). As a result, starting 2011 there was a significant boom of investments in RE, especially wind capacities, followed later by small hydro (<10MW) and solar, but biofuels still lagging (Colesca & Ciocoiu, 2013). Regarding the target for renewable energy in transport, Romania implemented blending mandates to support the biofuel utilization. Legal instability characterizes also the biofuels sector, blending quotas being amended several times, by decreasing the set quotas (Ecofys, 2014).

Implementing EU RED in the national law, Romania assumed the following national targets for RE, to be achieved by 2020, based on the National Renewable Energy Action Plan (NREAP): renewable energy share in total energy consumption - 24%; renewable energy in electricity - 38%; renewable energy in transport - 10% NREAP (2010). An update regarding the achievement on these targets is presented below (see Table 4).

Table 4: Share of renewable energy sources Romania vs. EU-28. Compilation by author based on data from Eurostat, 2015b, NREAP, 2010

Indicator	**Romania (2013)**	**Romania (2020)**	**EU–28 (2013)**
Share of renewable energy in gross final energy Consumption	23.9%	24%	15%
Electricity generated from renewable sources (% of gross electricity consumption)	37.5%	38%	25.4%
Share of energy from renewable sources: heating and cooling	26.2%	22,05%	16.5 %
Share of renewable energy in fuel consumption of transport	4.6%	10%	5.4%

While the target for RE sources related to cooling and heating was already achieved in 2013, target for RE in overall energy consumption and for RE in electricity were achieved at the beginning of 2014 (ANRE, 2015a) due to significant investments in RE, accelerated by the most attractive support

scheme for RE investments, applicable starting 2011. Installed RE capacities for electricity that benefit from the support scheme[13] amounted to 3,935 MW as of 2014, as shown below in Table 5. However, due to changes made in 2013 to the support scheme for RES, investments will decrease significantly as they became less profitable for investors.

Table 5: Renewable energy capacities-electricity (accredited as RES-E) installed in Romania. Compilation by author based on data from ANRE, 2014, 2015a

Installed accredited RES-E capacities (MW)					
Year	**Wind**	**PV**	**SHP (<10MW)**	**Biomass**	**Total RES-E**
2014	**2,294**	**1,230**	**311**(*)	**100**	**3,935**
2013	2,594	1,158	531	66	4,349
2012	1,794	51	427	29 (**)	2,301
2011	n/a	n/a	n/a	n/a	1,134

*In 2014 RE capacities have been withdrawn from accredited RES; **) includes 2.4 MW generated by waste fermentation gas

4.2.1.1 Biofuels in Romania

Regarding its RE for transportation, Romania considered that the 10% target can be achieved mainly by use of biofuels, setting biofuel blending mandate at 10% by 2020 (NREAP, 2010) and offering a tax incentive, which was removed by the Government starting 2011 (Colesca & Ciocoiu, 2013). As such, biofuels registered less interest from investors, resulting in small developments regarding local biofuel production capacity, although Romania holds significant feedstock production potential, estimated to supply for around 550,000 tonnes of biofuels (Colesca & Ciocoiu, 2013, NREAP, 2010). Biofuels blending quotas were modified several times, first upwards, in 2008 (Covrig, 2011) and starting 2012, downwards, last at the beginning of 2014 (Ecofys, 2014). Current blending quotas considering sustainability certified biofuels are as follows:

-diesel: starting 01/01/2013 in amount of min. 5%; starting 01/01/2016 in amount of min. 6.5%

-gasoline: starting 01/01/2014 in amount of min. 4.5%; starting 01/01/2018 in amount of min. 8%

EU Sustainability criteria for biofuels were implemented into national regulations (Ecofys, 2014). Sustainability criteria, as stipulated by the EU RED, include: rich biodiversity areas, primary forests, protected areas, grasslands rich in biodiversity, lands with high carbon stocks, peat lands.

[13] Large hydropower does not benefit from the RE investment support scheme and is not included in the calculations here.

As per EUROSTAT (2015b) information, Romania reached 4.0%, as of 2012 and 4.6% as of 2013, share of renewable energy in fuel consumption for transport, mainly by using sustainability certified biofuel blending.

Concrete, detailed and reliable recent data regarding the existing production capacities of biofuels in Romania is not available. Most recent data (as of 2013) related to biofuels production, import-export and consumption in Romania is available on EUROSTAT (2015c-f) database (see Table 6 below).

Table 6: Biofuels in transport in Romania - production, use, import and export. Compilation by author based on data from EUROSTAT, 2015c-f

Liquid biofuels sector in Romania					
	Unit	Year	Biodiesel	Biogasoline	Total
Gross inland consumption	*Tsd TOE*	2012	165.9	58.9	224.8
		2013	147.4	55.9	203.3
Production capacity	*Tsd ton*	2012	206	89	295
		2013	206	89	295
Imports	*Tsd ton*	2012	106	44	150
		2013	60	67	127
Exports	*Tsd ton*	2012	29	42	71
		2013	30	26	56

Although, in 2010 Romanian authorities stated that there would be no need for feedstock imports to produce biofuels (NREAP, 2010) from the existing data results that Romania has considerable imports of already processed biofuels. Another important aspect is the level of domestic biofuels production, which did not register an increase between 2012 and 2013.

5 Analysis

In this part I present the main findings and their analysis, with each section structured around one research question, in order to provide clarity and coherence. In section 5.1 I have focused on the first question and introduce the categories of barriers identified in the literature as being common to RE technologies, showing which are the barriers identified empirically and emphasizing the institutional and regulatory category as the key barriers to the development of biofuels sector in Romania. In the next section, 5.2., I have situated the key actors influencing development of biofuel sector in Romania in a multi-level perspective, showing their interactions. The last section, 5.3., I provide an account for how underlying structures – legacies of the past regime and challenges of the unfinished transition facilitate emergence of the barriers identified, relying on concepts from Post-communism, Europeanization and Ecological Modernization theories.

5.1 Main barriers regarding the development of biofuels sector in Romania

By asking '*Which are the key barriers that affect the development of the biofuels sector in Romania, perceived by the stakeholders?*' my aim was to identify empirically, in an inductive way, the most significant barriers related to the biofuels sector in Romania, as perceived by the stakeholders. For answering this question I have employed both empirical data from respondents and reviewed literature on barriers related to RE.

Out of the analysis of empirical data emerged a large variety of barriers perceived to hinder the development of biofuels sector in Romania. In the next step, after I have processed data from the interviews, for the classification of barriers I have applied the categories identified and compiled from the literature[14] focused on studying barriers from different domains related to renewable energy: renewable energy technologies diffusion and penetration barriers (Reddy & Painuly, 2004, Painuly, 2001), barriers related to bioenergy market growth (Roos, Graham, Hektor, & Rakos, 1999) algal biofuels (Oltra, 2011), and aviation biofuels (Gegg, Budd & Ison, 2015).

In the end, seven broad categories were considered for structuring the barriers identified from respondents' statements, in order to facilitate their analysis: market related barriers, economic and financial barriers, institutional and regulatory barriers, technical barriers, social, cultural and

[14] Here are presented the studies and reports based on which the classification of categories was made. The classification follows mostly the one provided by Painuly (2001) and Reddy and Painuly (2004). In the other sources are discussed aspects related to classification and the impact of barriers from different perspectives.

behavioral barriers, environmental barriers and other barriers considered relevant (see Table 7 below).

Table 7: Barriers categories and their description. Compilation by author based on Painuly, 2001, Reddy & Painuly, 2004

Barriers categories	Description
Market	Includes market failures, imperfections, distortions, mainly affecting competition and/or acting as entry barriers
Economic and Financial	Considers mainly economic viability, costs and risks, access to financing
Institutional and regulatory	Comprise aspects related to policy, formal and informal institutions, government regulations, expertise and know-how
Technical	Refers mainly to technical aspects, risks and performance of biofuels technology
Social, cultural and behavioral	Includes aspects related to social and individual norms, values, public/consumer perception, cultural context, behavior
Environmental	Mainly describes the environmental impact of biofuels and issues related to its assessment and mitigation
Others	Other aspects considered relevant in acting as barriers

The categories from the literature, under which I have classified the barriers, are broad and fit this research as well. Painuly (2001) states that the classification of a certain barrier in a category is not very rigid, as a barrier could be part of more categories, or can be assigned in a different category. These aspects are also applicable to the classification and analysis in my study. Most of these barriers are common to all renewable energy technologies, while some are specific to a certain technology, country or region (Painuly, 2001). In this case, specific aspects are related to biofuel technology and Romania. Regarding the analysis of RE barriers, there is a considerable body of literature, but in relation to policy discussion on barriers for specific technologies like biofuels, there is less research done (Klessmann et al., 2011).

5.1.1 Institutional and regulatory barriers, as perceived by stakeholders

The general categories of barriers common to all RE technologies, introduced above, were applied in the specific context of Romania, and against empirical data gathered from stakeholders close to the biofuels sector. The results are presented in Table 8.

Table 8: Barriers related to biofuels sector development in Romania. Compilation by author based on Painuly 2001, Reddy & Painuly, 2004

Barriers category	Examples of barriers identified by respondents
1. Market	Competition with conventional fuel industry Monopoly on biofuel and energy production Distorted competition for agricultural products High investments needed No incentives/support for small farmers to produce biofuels
2. Economic and Financial	High costs to produce biofuels Lack of customers, unstable market Lack of access to financing Low subsidies for farmers Competing cheaper alternative (fossil fuel) Taxation policies promoted by Romanian Government
3. Institutional and Regulatory *[key barriers category identified by respondents]*	Lack of transparency and participatory approach Issues with legislation, lack of coherent strategy, policies, measures and political will Lack of scientific ground, studies, analysis, expertize Lack of cooperation and accountability/responsibility RES-T target not feasible, lack of support at EU level Bureaucracy Clash of interests (agriculture, fossil fuel, environment)
4. Technical	Biofuel technology is expensive 1st generation biofuels not sustainable Low production in RO/import of biofuels for RES-T Advanced biofuels costly to produce ;not commercially available Old national car fleet Low production capacities
5. Social, Cultural and Behavioral	Reactive vs. proactive attitude Lack of interest by general public and trade associations Lack of public knowledge/awareness on biofuels Resisting change Preference for imports vs. local production Farmers need to associate/cooperate EU regulations used as arguments for bad decisions Romanian Government support for global instead of local
6. Environmental	All negative environmental effects related to biofuels RE in Romania implemented with negative environmental impacts Improper environmental impact assessments Competition with food crops Improper sustainability criteria
7. Others	Lack of proper transport infrastructure Lack of capacity – stakeholders Not clear how the biofuel sector will develop Romania - mainly as a raw material supplier Romania has a servant relationship with EU Post-communism measures/privatization destroyed production capacities No real interest for sustainability and environment in Romania

I have found that **institutional and regulatory barriers** represent the main barriers category in this study. Out of the main barriers identified, this category was considered most important by almost all

respondents (6 out of 7) while answering the question related to naming the main barriers affecting the development of biofuels production in Romania (see Table 9). Furthermore, the institutional and regulatory issues were brought up most during the interviews, by all respondents in the study, stakeholders close to the industry.

Table 9: Key barriers related to the development of biofuels production in Romania, from the view of stakeholders. Compilation by author

Respondents	Main barriers stated related to biofuels production in Romania	Institutional & regulatory=I; Others=O
A	• Legislation changes needed to reduce primacy of economic interests	I
B	• Transport infrastructure • Legislation	I, O
C	• Legislation • Lack of incentives	I,O
D	• Low price for oil • Monopoly on energy production • Incompetency of authorities • Lack of support at EU level for biofuels • Inconsistency at public policy level • Lack of studies • Economic interests of a small group	I
E	• Lack of coherent strategy for farmers • Medium and long term planning and organization seen as "communist"	I,O
F	• High costs to produce biofuels • Traders control crop harvest in Romania • No agricol exchange; not a free market	I,O
G	• Lack of funding for investments • Lack of clients; lack of a stable market • Lack of infrastructure	O

5.2. The multi-levels related to biofuels in Romania

In this subsection, in order to respond to the second research question, first I'm introducing the levels related to biofuels in Romania, as a niche-technology according to MLP framework. Further, the key actors identified were structured at different levels, depending on their hierarchical relationship and dependency, which resulted from the respondents' statement, literature and other documents analyzed. Here I show which are the most important processes influencing the relationship among these key actors.

5.2.1 Biofuels in Romania as a niche technology

According to the MLP framework and based on the literature and data from respondents, I have constructed a multi-level structure with macro, meso and micro levels related to the biofuels technology in Romania (see Fig. 4 below). **Socio-technical landscape (macro)** comprises the broad social, environmental, cultural, economic and political trends, which in the case of Romania were identified as being of significant importance the following: the environment (climate change in particular), the local culture, oil supply, marketization (main ideology regarding the approach EU has to renewable energy). Other factors might play an important role as well, but were not considered here. The **socio-technical regime (meso)** includes rules and actors gathered around policy, markets, science, industry, all linked to the dominant socio-technical system, namely the fossil fuels. Due to important interactions and dependencies, other regimes were included: energy regime (as the system that incorporates the fossil fuels), transport regime and agriculture regime, due to the fact that actors and system elements within these regimes were identified as having a key role related to biofuels development in Romania. Regarding the **niche-innovations (micro)** level, here we find the actors that are united around the biofuels technology: feedstock producers, biofuel producers, biofuel traders and distributors, R&D, civil society. In this study, as shown, due to the insignificant development of other niche-innovation technologies, only conventional biofuels were considered for the multi-level perspective analysis.

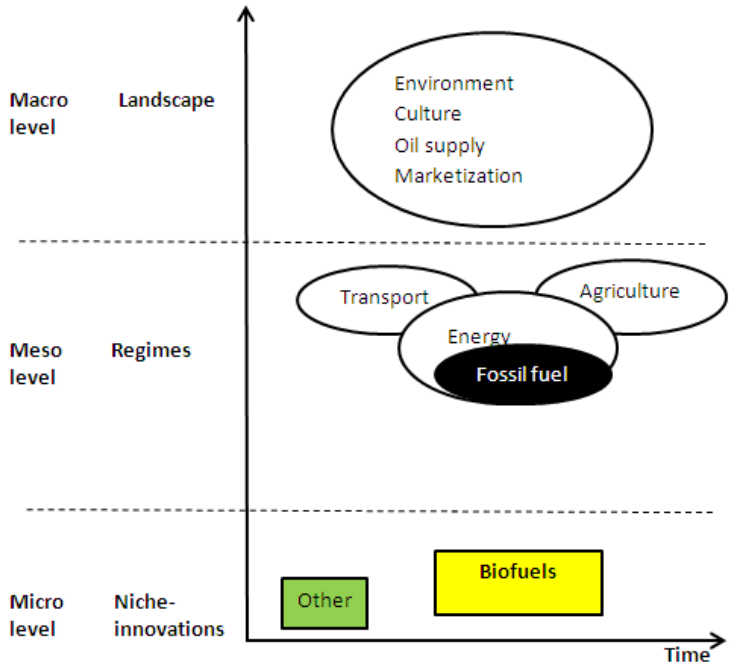

Figure 4: Multi-levels hierarchy related to biofuels technology in Romania. Illustration by author based on Geels, 2002 [The box marked *Other* represents other niche-innovation technologies that are less developed, like advanced biofuels, fuel-cell and electric vehicles, biogas]

Biofuels, as a niche-innovation technology, interacts significantly and in a complex way with several regimes. Most important, biofuels are developed in order to be embedded in the energy regime, and are influenced strongly by the fossil fuels regime. Regarding the interaction with the agriculture regime, most of the biofuels produced and used currently in Romania are based on food-related or energy crops cultivated within the agriculture sector. Dynamics within agriculture regime affect significantly the development of biofuels (i.e. food vs. fuel debate). Regarding the transport regime, biofuels are proposed as a cleaner alternative to fossil fuels used in transportation. On the other hand, in Romania there are other technologies at niche-innovation level, at very incipient phase of development, either still under research and testing, or available commercially but with insignificant market shares and limited support from actors and networks, like fuell-cell and electric vehicles, advanced biofuels, biogas. Also, transport regime has a major influence through key actors as the car producers, which influence significantly which technology develops further and how.

5.2.2 Key actors in the biofuels sector

In this next step of the multi-level analysis, I have situated the key actors at different levels – macro, meso and micro (respectively international, national and local), in order to analyze how they interact and influence the biofuels development in Romania (see Fig. 5). Interactions among them are evidenced with the blue and red arrows.

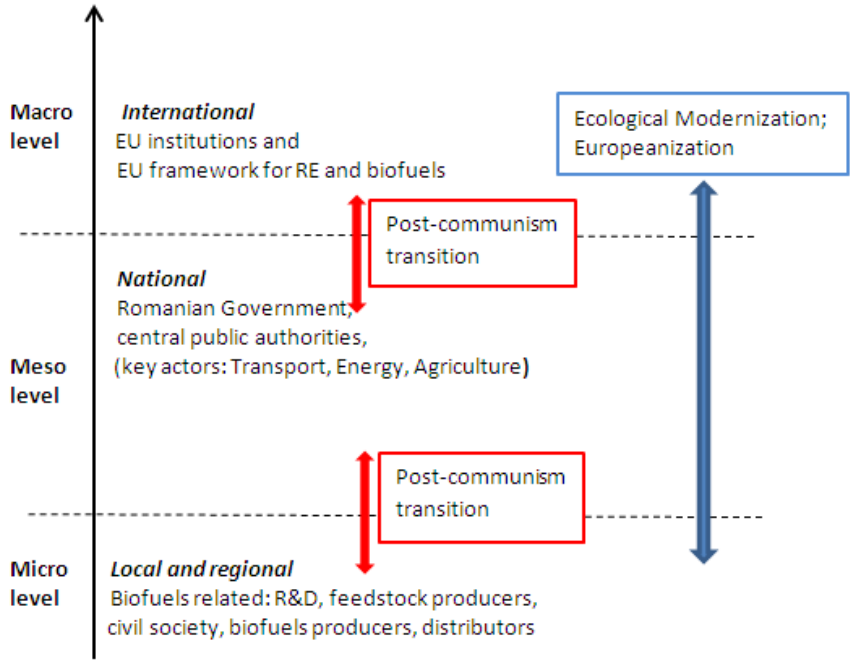

Figure 5: Key actors related to biofuels sector in Romania and the processes influencing their interactions. Illustration by author based on Geels, 2002

The **macro level** is heavily shaped by the EU framework on RE and biofuels, which has already been implemented in the national legislation, with an important role being played by the EU institutions. I considered these as the most influential external factors impacting the overall development of renewable energy and biofuels in Romania, as recognized by all respondents. According to respondent D, when discussing about development of biofuels in Romania, he stated that "we have to see what legislation will be made, and how the advanced biofuels will be promoted after 2020. Until then, nothing will move, so the pressures will come from Brussels" (personal communication, May 15, 2015). Furthermore, on the same line, "now, depends also on how it is promoted, how the trend is coming from European level, because in the end, you know that the roads lead to the capital, roads lead to Brussels now" as stated by respondent E (personal communication, May 14, 2015).

Before Romania's accession to the EU, certain reforms and transformations were imposed as requirements for joining the EU, through the so called 'EU conditionality'. This process, termed "Europeanization Eastern style" by Goetz (2001, p. 1036), has transformed the candidate countries in a top down approach. It has allowed for strengthening of "the weakened representative institutions and democratic elites" (Andreev, 2009, p. 389), but I argue that it happened with some considerable limitations, as I will show later.

Regarding the interactions between international and national levels (macro and meso), the national environmental policy, an area considered strongly Europeanized (Dimitrova & Buzogány, 2014) allowed for the advance of technical and market based solutions, as biofuels, in line with the Ecological Modernization ideology that is at the heart of the EU environmental policy (Gouldson & Murphy, 1996, Sezgin, 2013), including climate and energy area.

At the **meso level**, Romanian Government and other public central authorities were acknowledged by the respondents as key actors when it comes to the development of biofuels. Most important authorities mentioned were the Government and the Parliament, Ministry of Energy, Ministry of Environment, and Ministry of Agriculture. The strongest lobby was acknowledged as coming from fossil fuels industry and agriculture sector. In the words of respondent B "the interest for biofuels is blocked by those that produce conventional fuel" (personal communication, May 18, 2015). Regarding the lobby from agriculture, it has been described as "the tsunami from Indonesia and I'm on the beach, you know, it's like that. And you try to run, but there's nowhere to" (respondent D, personal communication, May 15, 2015).

Moreover, respondent C described the whole policy related to renewable energy in Romania as being unpredictable, aspect confirmed also by respondent B, while respondent D mentioned the legal instability and unpredictability related to biofuel blending mandates.

The lack of a coherent and unitary approach among authorities noticed by respondent C is further emphasized by respondent D, who stated that there is lack of communication not only among authorities but also within the respective authorities, between their different departments (personal communication, May 15, 2015). Respondent B explained how the biofuels related responsibilities and attributions are spread among several public authorities, each with its own approach, not collaborating among them, with a lack of a coherent policy (personal communication, May 18, 2015).

Micro level consists of local and regional actors that are related to biofuels: feedstock producers (farmers), trade associations, biofuels producers, biofuels traders and distributors, R&D institutions, local communities, NGOs, users.

I found that honest and transparent interactions here have less impact on the above levels and outcomes, as members of the civil society "have not yet acquired the organizational capacity and embededness to act as partners of the state in policy-making" (Dimitrova & Buzogány, 2014, p. 143). On the same line, Stringer, Scrieciu, & Reed (2009) see the civil society in Romania still being at a "nascent stage" (p. 87).

Regarding interactions at national – local level (meso-micro), according to respondent B it is difficult for non-political actors to initiate changes related to biofuels in the legislation, while, on the other hand legislation is not respected and changed often by authorities (personal communication, May 18, 2015). Concerning the collaboration between research and public authorities, respondent A emphasized the lack of scientific grounds for the development of biofuels sector (personal communication, May 19, 2015), which was also acknowledged as very limited by respondent B, describing how difficult is to have the legislation related to energetic crops to be changed, due to high bureaucracy (personal communication, May 18, 2015). According to respondent C there is a high level of bureaucracy regarding authorization for investments in renewable energy, complicated by ambiguous legislation and that small investors and farmers do not benefit of a simplified procedure and conditions (personal communication, May 20, 2015).

Following from the above, I argue that at national and local levels there is a considerable influence from the post-communist transition process, acting as a general underlying base against which all post-communist transformations rest upon (i.e. Europeanization/Ecological Modernization).

Following, I propose an explanation for how post-communism impacts the interactions among actors at these levels and facilitate the emergence of the institutional and regulatory barriers identified.

5.3 Barriers and actors in a multi-level perspective – the underlying structures

Although barriers in relation with the international (macro) level were perceived as barriers with broad consequences, influencing at large the development of biofuels, I have identified most of the institutional and regulatory barriers emerging at the national (meso) and local (micro) level, these being the levels at which I have focused further. This followed also from the argument I put forward that there is a stronger influence cast upon the biofuels sector by drivers related to post-communist transition, acting as an underlying dynamic that affects the politics, but also administrative and institutional capacities in Romania, compared to the Europeanization process. This 'underlying dynamic' was found also by Hlebarov (2013) who investigated the underlying structures that affect the sustainability of waste management in Bulgaria, the other post-communist country that joined EU together with Romania in 2007, these two countries having strong similarities (Dimitrova, 2010).

For gaining access to and analyzing these underlying structures and the drivers identified behind the interactions between state and non-state actors, which facilitate the emergence of the institutional and regulatory barriers affecting the biofuels sector, I relied on concepts related to Post-Communist theory introduced already above (see Figure 6 below).

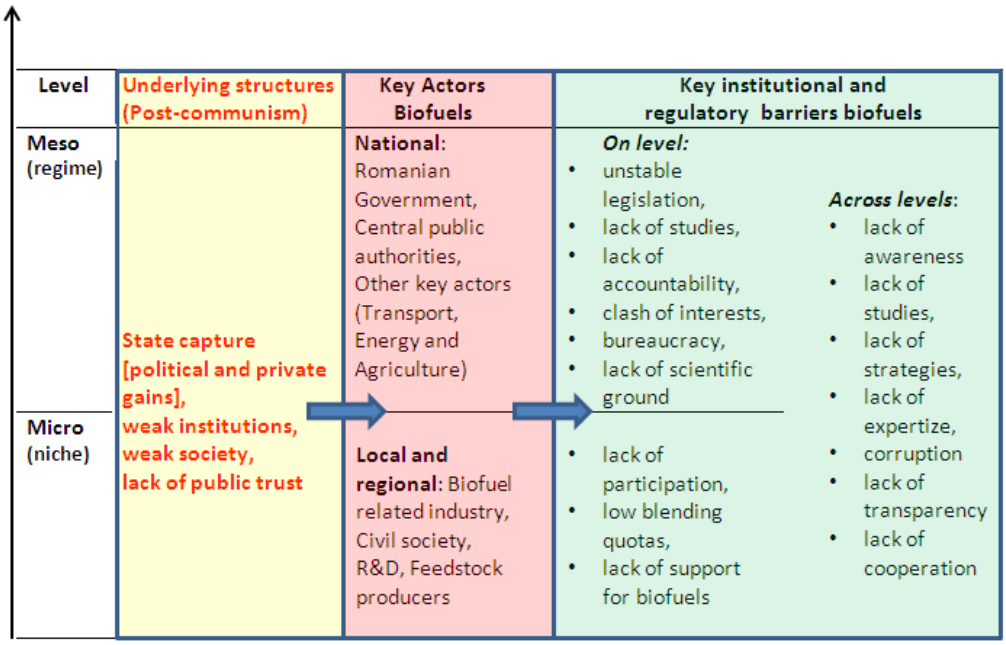

Figure 6: Underlying structures, key actors interactions and barriers related to biofuels sector at national and local levels. [Blue arrows do not show a linear causality, but layering]. Illustration by author, based on Geels, 2002

According to Post-communism studies, main characteristics of post-communism transitions, that are valuable for my investigation, are: post-communist states are still weak states, with weak institutional capacities, weak societies (Andreev, 2009, Buzogány, 2015, Dimitrova, 2010). They are also characterized by widespread corruption (Goetz, 2001).

Their weaknesses, among others, is instilled by **state capture**, a mechanism through which policy process is severely affected, being diverted to certain outcomes and limits transparency and stakeholder participation (Dimitrova & Buzogány, 2014). This was confirmed also by respondent A, who mentioned the lack of stakeholders' participation regarding the policy process, while *w*hen it comes to transparency at this level, respondent A characterized the development of the biofuels sector in Romania as not transparent. Regarding the biofuel production, she mentioned that "you can make comments regarding the forecast for respective production dynamic in the moment when the policies are transparent" (personal communication, May 19, 2015). Further, in relation to the interaction with public authorities and their transparency, respondent C stated that it is "difficult to tell how they perform, as it is very difficult to enter into relation with public authorities, they are absolutely not transparent" (personal communication, May 20, 2015).

Innes (2014) ascribes two modes of state capture to which post-communist countries are most vulnerable, namely "party state capture and corporate state capture" (p. 88). These modes were deeply institutionalized due to the ample character of state rebuilding process and clearing of institutions during transition. I have found these aspects related to the state capture to play an important role in how the development of biofuels is shaped at national level, with both **political gains** and **private gains** as major drivers behind policy-making related to biofuels. In relation to the political gain, one significant example given by respondents is related to the unstable legislation and several changes that were made with regards to the blending mandates. Respondent D described how setting lower blending quotas has brought political gain to the politicians (personal communication, May 15, 2015). On the other hand, ambigous regulation related to RE and frequent changes favor certain interests, in line with the private gain concept, whereas in a captured state policy-making is being influenced by business entrepreneurs that are close to state institutions, either acting informally or even set up as NGOs (Dimitrova & Buzogány, 2014). Preferential treatment regarding biofuel production is considered to be provided to corporations and powerful actors, while local communities, small farmers remained without voice and their interests not considered and promoted. According to respondent C, "most of the times Romanian policies are made for the use of big corporations, and against small companies or farmers" (personal communication, May 20, 2015). Strongest lobby related to biofuels is considered to come from agriculture sector, supporting mainly

the production of feedstock, as mentioned by respondent D (personal communication, May 15, 2015) while respondents B and C recognized the fossil fuel industry as the most powerful actor influencing biofuels development.

Primacy of economic aspects follows also from the statement of respondent B "businessmen don't take into account climate change, what do they care…in business there isn't this interest for the planet" (personal communication, May 18, 2015), with respondent D on the same line, who stated that "in Romania there is a lot, a lot of focus on the economic aspect, and not the environmental one" (personal communication, May 15, 2015). Low level of support from Romanian authorities regarding development of biofuels was generally acknowledged as a significant barrier. Respondent B emphasized the lack of a political will regarding biofuels development in Romania (personal communication, May 18, 2015).

Andreev (2009) mentions that it "is impossible to understand the post-accession trajectory of Bulgaria and Romania, without paying specific attention to the overarching problem of corruption"(p. 377.) This was emphasized also by Dimitrova and Buzogány (2014) in their study showing that "aspects of the policy process, such as effectiveness and inclusiveness, are particularly vulnerable to state capture and corruption" (p. 140). All these are confirmed also by my findings. Different aspects of corruption were mentioned by respondents C, D and E, F. Respondent C explained how ambiguous legislation makes room for corrupt activities (personal communication, May 20, 2015), while respondent D considered corruption a threatening phenomenon among state authorities, reflected also in the recent inquiries, indictments and convictions made by National Anticorruption Directorate (DNA) (personal communication, May 15, 2015). According to respondent F, corruption is promoted among public functionaries through contagion, older ones, more versed, teach the younger ones. He also states that corruption is one of the reasons affecting changes in legislation and taxation, as to favor certain groups of interests (personal communication, May 20, 2015). While corruption is present everywhere, when it comes to corruption among post-communist countries, it is considered as very pervasive and difficult to combat due to it having many sub-types and being institutionalized, anchored in systemic features of the previous communist regime and prevailing through transition (Karklins, 2002).

Another important aspect noted in the literature in relation to the **weak institutional capacity** of post-communist countries, acknowledged also for Romania is the availability of resources. In comparison with EU-15, regarding the state institutions in CEE, the scarcity (quantity and quality) of resources available is mentioned by Zubek and Goetz (2010). They mention also **low trust** in public institutions as a significant resource that affects negatively the institutional capacity and outcomes in

these countries. Lower level of resources and weaker state capacities are mentioned also by Buzogány (2015), as a consequence of the past legacies and challenges of transition, having as a result that "the weak capacities of both sides keep state and non-state actors stuck in a vicious circle characterized by mutual mistrust" (Buzogány, 2015, p. 913). I have found this applicable also for the state and non-state actors related to biofuels. According to respondent C, there is a low level of expertize within public authorities that is very problematic (personal communication, May 20, 2015) aspect emphasized also by respondent D. On the same line, respondent E stated that there is no biofuels trade association in Romania to support domestic biofuels at EU level and mentioned several times that there is lack of coherent and reliable data regarding agriculture (personal communication, May 14, 2015). Further, lack of enough staff and the nepotism and political influence were recognized as important causes of institutional weaknesses by respondents. Respondent E argued that "we have to encourage professionals, it doesn't matter their political color, they can even not engage into politics, or they can if they want, this is less important, important is that, hey, if there is a good one there, leave him there, no matter if you support him or not, if you like him or not, but he has to be correct and impartial" (personal communication, May 14, 2015).

According to respondent B, the lack of strategies is an effect of the avoidance of responsibility and accountability "because they are obligated, if they made, different ministers, if they made a certain strategy, they have to assume it, if they paid they have to assume it. And that is why they don't want to make strategies, in order not to assume responsibility, and then everybody escape as they can" (personal communication, May 18, 2015).

6 Discussion

6.1 Summary of the research findings

In this study, after having identified empirically the main barriers related to biofuels development in Romania, I have classified them following the literature on general barriers to RE technologies (Painuly, 2001, Reddy & Painuly, 2004) in seven broad categories: market related barriers, economic and financial barriers, institutional and regulatory barriers, technical barriers, social, cultural and behavioral barriers, environmental barriers and other barriers considered relevant. Further, I have found that the institutional and regulatory barriers category emerged as the key category based on respondents' perception. In order to uncover the underlying structures that facilitate the emergence of these barriers, I have structured the biofuels from a multi-level perspective and placed the key actors at different levels – international (macro), national (meso) and local (micro), and explored the

interactions among them and in relation with the identified barriers. In line with the critical realism approach, based on theoretical concepts from Post-communism, Ecological Modernization and Europeanization theories, I have showed that state capture, through political and private gain, weak institutional capacity and a weak society together with low levels of public trust act as underlying structures that facilitate the emergence of the identified barriers and hinder the development of biofuels in Romania, in line with the empirical findings.

Understanding the underlying structures behind these barriers and how they relate with the actors at different levels, hindering the development of biofuels in Romania, allowed me to identify several points of intervention that could bring about change.

Following, I will discuss the barriers in relation with the key literature and present the points of intervention recommended here based on the findings in my study.

6.2 What about barriers, actors and structures?

The institutional and regulatory barriers emerged as the most significant category affecting the development of biofuels in Romania. In the literature this category of barriers was acknowledged as very important and it has been discussed in several studies and reports focusing on RE in general (Ecorys, 2010, IEA, 2015, IPCC, 2011, Müller, Brown & Ölz, 2011, Painuly, 2001, Reddy & Painuly, 2004, UNDP, 2014). Roos et al. (1999) found out that non-technical barriers have more significant impact than technical ones when it comes to bioenergy implementation.

However, while some of the institutional and regulatory barriers are identified as common for all RE technologies, and discussed in the literature, others appeared to be more country-specific. For instance, while insufficient transparency when it comes to policies and regulations and problematic process for permit granting, was identified as a barrier related to the deployment of RE also by Müller, Brown & Ölz (2011), in the case of barriers like lack of scientific grounds, lack of studies and data, these appears to be barriers more specific to Romania. In the same line, in the literature (Painuly, 2001, Reddy & Painuly, 2004) were discussed among other, the following barriers: unstable legislation and lack of predictability, lack of expertise, lack of participation or lack of awareness. When it comes to barriers perceived as being more country specific, I have identified the following: clash of interests, corruption, lack of collaboration and cooperation, lack of accountability and responsibility. There are also barriers that appear to be important in the Romanian context, and are discussed only limited in the literature on general barriers: lack of strategies and measures, bureaucracy (Ecofys, 2014). Some barriers perceived by the respondents are specific in this case to

the biofuel technology, namely the unfeasibility of the 10% RES-T target, lack of support at both EU and national level and the low blending mandates in Romania.

Geo-historical structures identified as underlying factors have a great importance regarding which barriers emerge related to the Romanian biofuel sector and how they evolve and affect its development. Country's communist past is still influencing the present (Grødeland & Aasland, 2011). As Dimitrova and Buzogány (2014) shown, when it comes to implementing coherent policies, Romania is characterized by state weakness, facilitated by an inability to deal with corruption and state capture. Lack of participation and transparency, high levels of bureaucracy and corruption are linked to these aspects. Moreover, there is a significant influence from businesses regarding the procedure and outcomes of policy making, due to their close link to state institutions (Dimitrova & Buzogány, 2014). These aspects were perceived also by the repspondents as playing an important role in the current situation and future development of biofuels in Romania, and I argue that they are inherent to country's historical development and its recent post-communist transition.

Hlebarov (2013) arrived to similar findings in a case study in Bulgaria – another post-communist country, member of the EU, showing that political and private gains, together with distrust in public institutions and NGOs were the main drivers behind the unsustainable waste management in Sofia, while he also acknowledged a significant impact on the decision-making process caused by weak administrative capacity and lack of transparency.

I have found that key actors at national and local levels have in common more complex and dynamic interactions, compared with their interaction with the international level, affecting differently the way in which barriers develop and hinder biofuels, in part, due to the legacies of the past regime and the challenges related to the post-communist transition.

As I already shown through the empirical findings, main drivers behind the barriers identified and described in the literature are the political gain and private gain in the form of state capture, the overall weak state, institutional weakness and fragmentation, low levels of public trust further augmented by lack of transparency and specific forms of post-communist corruption. As such, "Europeanization without decommunization", as Mungiu-Pippidi (2015, p. 94) described the process has specific imapcts that should be considered carefully. These make the identification of measures to overcome these barriers challenging. As Painuly (2001) stated, measures to overcome barriers might be country specific, which I argue that is also the case here.

6.3 Points of intervention

As sustainability science has also a normative dimension, I propose here a few possible points of intervention with a specific consideration for the underlying structures identified, structured at different levels, in line with my findings and analysis in a multi-level perspective on biofuels in Romania.

Macro level hosts the deepest structures (Geels, 2002), and since promotion of RE and biofuels follows a top-down approach, I argue that interventions for change at macro level, targeting the potent actors identified here (the EU) can prove to be disruptive enough to facilitate significant changes at both meso (national) and micro (local) level, influencing both barriers at these levels and providing a window of opportunity for completing the unfinished transition project. The macro-trends that shape this level, like the "marketization" and technical fixes approach that is applied by the EU to RE and biofuels, are driven by Ecological Modernization strategies, as part of the EU environmental policy (Gouldson & Murphy, 1996, Sezgin, 2013).

Regarding the actors that can affect this level, these could be societal pressure groups, activists, social movements, which have been recognized in the literature related to transitions (Geels & Schot, 2007) as having important potential to contribute to initiating changes at macro level. Through their interventions they can shape the public attitude, and public policies. Interventions at this level necessitate time.

Furthermore, in relation to the interactions at international – national levels (macro – meso), I consider that continuous support from the EU regarding the strengthening of the Romanian democracy, and especially its weak civil society can bring positive contributions to further reducing the negative impacts associated with the legacy from the communist past and the challenges of the post-communism transition: state capture, weak institutions and low levels of public trust.

Meso level changes would have the most direct impact on the development of biofuels, in three major ways. Firstly, because here is where I have identified most of the barriers; secondly, because here most of the underlying structures reside and manifest, facilitating the emergence of these barriers, while thirdly, this is the level at which important policy making takes place and EU frameworks are implemented, shaping the development of biofuels sector. Important aspects that should be considered in order to reduce the state weakness, diminish the state capture and increase the institutional strenght and capacity is to further consolidate the democracy, as already mentioned,

by supporting the democratic elites, increasing transparency and participation, fighting corruption, and continuation of decommunization.

Buzogány (2015) argues that state capacity is important for development of collaboration among state and non-state actors, which need to have strong institutional capacities. The author mentions the need for "a strong and stable governmental structure with clear division of responsibilities" (p. 914). He points out excessive fragmentation and recommends increased coordination at governmental level and sufficient staffing in order to increase the administrative capacity of the state. Further, there is a need for setting up consultation structures that would facilitate participation for all stakeholders and turn the process into a more holistic, equitable, just and inclusive one. As Stringer, Scrieciu, & Reed (2009) puts it "participation needs to be institutionalised" (p. 87).

From a time perspective, interventions here take less time than those at macro level, but more time than those at micro level, while having the deepest implications.

Micro level corresponds mainly with the level at which the barriers are perceived and produce their ultimate effects, hindering the development of the sector. Here, interventions would be effective in very short time, as there is less structure at this level and barriers tend to be less complex.

I argue that an important intervention which could contribute in several ways to overcoming the underlying structures behind barriers is to consolidate and strengthen the civil society, which could play a more significant role in shaping the development of biofuels sector and balance the influence from state actors and businesses. One way for doing this is to facilitate a greater role for NGOs which could foster improved participation "ensuring that participants have the power to influence decision-making; and that they have the technical capability to engage effectively with those decisions" (Stringer, Scrieciu, & Reed, 2009, p. 87).

However, I consider that interventions be made at all levels, as they have different effects and time frames and would address different underlying structures related to the development of biofuels in Romania. At micro and meso level interventions can trigger changes in a relative short time, while interventions at macro levels take longer time. On the other hand, considering the degree of structuration of the levels, interventions at macro levels would bring the most consistent changes at meso and micro level.

6.4 A critical eye on sustainable transport in Romania

Biofuels have been adopted also in Romania as the main technology for reducing GHG in transport sector and for achieving the RES-T 2020 target (NREAP, 2010). Although not discussed here in depth, the debates about sustainability of biofuels, especially concerning first generation biofuels, are applicable also in relation to the biofuels produced and consumed in Romania. Furthermore, Stan, Fintineru and Ion (2014) mentioned that there is no research on Romania regarding the impact of biofuels on environment, GHG emissions and land use.

Other green technologies, like fuel-cell and electric vehicles, are in a very incipient phase, with limited potential in the near future due to the cost aspect, Romania being one of the poorest countries in the EU. Moreover, other strategies relevant for a more sustainable transport (alteration and reduction) are not explored enough.

This follows the main approach at the EU level, where biofuels are the most supported solution in use for road transport and efficiency strategy is the preferred option. Here, ecological modernization plays an important role, shaping the environmental policy at the EU level, and being further diffused among member countries. While it promises a win-win situation, that of decoupling economic growth from environmental damage, I consider that solutions following from Ecological Modernization are not sufficient for achieving a meaningful change towards more sustainable transport. We know that technological fixes have their limitations and without social change they will not deliver alone the expected outcome. Thus, Ecological Modernization cannot be conflated with Sustainable Development.

7 Conclusion

Romania made considerable progress in the last years regarding the implementation and utilization of renewable energy sources in its energy system, succeeding to achieve already most of the RE targets for 2020. However, this is not also true for the 2020 RES-T target, where biofuels are promoted as the main renewable sources for transport, and considered to contribute towards a more sustainable transport are at a low level of development.

The purpose of this study was to identify the underlying structures that facilitate the emergence of the key barriers hindering the development of biofuels in Romania and analyze them in relation with the key actors, using a multi-level perspective framework. I have done these by conducted semi-structured interviews with stakeholders from biofuels sector, combined with literature review and

document analysis. Out of a variety of barriers I have identified from respondents' perspective, institutional and regulatory category emerged as the main phenomenon of interest. Among these, lack of support for biofuels, at both national and EU level, legal instability, lack of cooperation, lack of studies and expertize, lack of strategies and political will, bureaucracy and clash of interests were considered the most significant. In order to gain access to underlying structures that facilitate the emergence of these barriers I have relied upon concepts from Post-communism, Ecological Modernization and Europeanization theories. Based on these, I have analyzed the key barriers hindering development in relation to the key actors, structured at different levels: macro (international), meso (national) and micro (local and regional).

I argue that I have provided a coherent explanation for what the underlying structures are and how they facilitate the emergence of the barriers. Unfinished post-communism transition in Romania and legacies from the past facilitate state capture, for political and private gains, weaken the state and its institutions, keep a weak civil society and produce low levels of public trust.

An understanding of these structures, the influences behind the interactions among the key actors at different levels allowed me to identify potential points of intervention and measures to overcome the barriers and bring change in relation to the development of the biofuels sector in Romania, contributing to a more sustainable transport.

7.1 Further research orientations

Another important outcome of this study – beside the findings presented above and their implications, is represented by the themes for further research that I have identified, as proposed below:

- Further research on the other categories of barriers identified in this study as hindering biofuels development in Romania (see Table 8 in the section 5) that were not in my focus;
- In-depth research of specific individual barriers and the implications for biofuels in Romania;
- Identification of a set of concrete measures applicable under the proposed interventions presented above, to deal with the barriers identified here and in future studies, by applying a transdisciplinary approach, involving all relevant stakeholder categories

There is a considerable need for a better understanding of both the barriers and the underlying structures that facilitate their emergence, and here sustainability science can bring a meaningful contribution with its systemic approach to solving "wicked" problems arising from a complex and dynamic nature-society relationship, having in mind its normative and transformative end goals.

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Appendices

Appendix I. Interview Guide

English version

Questions for a semi-structured interview on liquid biofuels for transport in Romania - stakeholders' perspective

Part 1: Renewable Energy and liquid biofuels in transport – Romania

General:

How would you describe the development of liquid biofuels sector in Romania and which do you think are the main factors influencing it? Why is less successful compared to other RE?

How would you describe the renewable energy policies and politics in Romania?

Do you see liquid biofuels as sustainable renewable energy contributing towards mitigation of climate change? Why?

Biofuels - Policies and targets:

What do you think about the EU 10% target for RE in transport for 2020?

What is your opinion about the Romanian policies regarding the blending quotas (currently 4.5% for gasoline and 5% for diesel), the way they are changing, and what factors do you think are influencing this?

What do you think about 7% limit for first generation biofuels in EU and how this will influence the biofuels sector in Romania?

How do you see the relationship between EU and Romania, when it comes to liquid biofuels, considering the fact that Romania is one of the poorest countries in EU?

Romania is considered to have a high potential for producing feedstock for biofuels, but local processing capacities are small. How would you explain this?

What interests are involved when it comes to biofuels development in RO? Who do you think are the most powerful actors?

Name the main 4 public authorities that you consider shaping the development of biofuels in Romania. How do you think they are acting in this sector?

Which do you think are the main barriers in developing liquid biofuels production in Romania?

Part 2. Sustainability of biofuels in Romania

How would you describe the approach towards sustainability and environment in Romania?

What do you think are the negative and positive impacts regarding development of biofuels and how should Romania deal with these?

What do you think about the controversies around biofuels? Are biofuels debated enough in Romania? Is the public involved?

What is your opinion regarding sustainability criteria for biofuels?

How do you think the sustainability criteria promoted by EU RED have influenced the development of biofuels in Romania?

Part 3. Influencers of the development of liquid biofuels in Romania

Name the factors that you think are the most important when it comes to influencing the development of liquid biofuels in Romania.

Part 4. Development perspectives

How do you think the biofuel sector will further develop in Romania?

In your opinion, what should be done regarding to biofuels in Romania?

Are liquid biofuels a sustainable solution, in your opinion? Why?

Part 5. Ranking exercise

Which sustainability aspects do you find most important to ensure that liquid biofuels produced and/or used in Romania are sustainable? Please select the 5 aspects you find most important and indicate their order of importance.

Lower GHG Emissions

Fuel Energy Balance

Air Pollutants

Biodiversity

Water Use and – Quality

Effects on Land Use and Soil Productive Capacity

Economic Efficiency

Competition with Food

Economic Equity

Labour - and Human Rights

Land – and Resource Rights

Livelihood Impacts and Rural Development

Other (comment)

Romanian version

INTREBARI INTERVIU

Partea 1: Energia regenerabila si biocarburantii pentru transport – Romania

General:

Cum ati descrie dezvoltarea sectorului de biocarburanti din Romania, si care credeti ca sunt factorii principali care il influenteaza? De ce acest sector este mai putin de success comparativ cu celelalte energii regenerabile?

Cum ati descrie politica si masurile legate de energiile regenerabile in Romania?

Vedeti biocarburantii lichizi ca fiind energie regenerabila sustenabila, ce contribuie la mitigarea schimbarii climatice? De ce?

Biocarburanti - Politici si tinte:

Ce parere aveti despre tinta UE de 10% cu privire la energia regenerabila in transport pentru 2020?

Care este opinia Dvs. cu privire la politica legata de cotele de amestec pentru biocarburanti in Romania (in acest moment 4.5% pentru benzina si 5% pentru diesel), modul in care sunt modificate, si ce factori credeti ca influenteaza asta?

Ce parere aveti despre limita de maxim 7% pentru biocarburantii de prima generatie la nivelul UE si cum va influenta aceasta sectorul de biocarburanti din Romania?

Cum vedeti relatia dintre UE si Romania, cand vine vorba de politicile in domeniul biocarburantilor, luand in considerare faptul ca Romania este una din cele mai sarace tari in UE?

Romania e considerata ca avand un potential ridicat pentru producerea de materie prima pentru biocarburanti, dar capacitatile locale de productie biocarburanti sunt mici. Cum explicati Dvs aceasta situatie?

Ce interese sunt implicate cand vine vorba despre dezvoltarea sectorului de biocarburanti in Romania? Cine credeti ca sunt actorii cei mai puternici?

Numiti principalele 4 autoritati publice care credeti ca influenteaza decisiv dezvoltarea sectorului de biocarburanti in Romania. Cum considerati ca actioneaza in acest sector?

Care credeti ca sunt principalele bariere in dezvoltarea productiei de biocarburanti in Romania?

Partea 2. Sustenabilitatea biocarburantilor in Romania

Cum ati descrie abordarea cu privire la sustenabilitate si mediu in Romania?

Care credeti ca sunt impacturile pozitive si negative cu privire la dezvoltarea biocarburantilor si cum ar trebui Romania sa le trateze?

Ce credeti despre controversele din jurul biocarburantilor? Sunt biocarburantii dezbatuti destul in Romania? Este publicul implicat?

Care este opinia dumneavoastra cu privire la criteriile de sustenabilitate ale biocarburantilor?

Cum credeti ca criteriile de sustenabilitate promovate la nivel UE RED au influentat dezvoltarea biocarburantilor in Romania?

Partea 3. Factori ce influenteaza dezvoltarea biocarburantilor in Romania

Numiti factorii care credeti ca sunt cei mai importanti cand vine vorba despre a influenta dezvoltarea biocarburantilor in Romania.

Partea 4. Perspective de dezvoltare

Cum credeti ca sectorul de biocarburanti se va dezvolta in Romania?

In opinia Dvs. , ce ar trebui facut cu privire la biocarburanti in Romania?

Sunt biocarburantii o solutie sustenabila, in opinia dvs? De ce?

Partea 5. Exercitiu clasificare

Ce aspecte de sustenabilitate considerati ca fiind cele mai importante pentru a asigura productia/utilizarea sustenabila a biocarburantilor in Romania? *Va rog sa selectati 5 aspecte considerate cele mai importante si sa indicati ordinea lor (1,2,3,4,5 iar 1 fiind cel mai important si 5 cel mai putin important).*

Reducerea emisiilor de gaze cu efect de sera

Balanta combustibil/energie

Poluanti atmosferici

Biodiversitate

Calitatea si utilizarea apei

Efecte asupra utilizarii terenului si capacitatii productive a solului

Eficienta economica

Competitia cu hrana

Echitate economica

Drepturi de munca si ale omului

Drepturi asupra terenului si resurselor

Impactul asupra traiului si dezvoltarii rurale

Altele (comentati!)

Appendix II. List of respondents and details related to interviews

	Respondent	Domain	Date	Duration (minutes)	In person	Gender
A	Professor	Sustainable Development	19/05/2015	33:46	Yes	F
B	Professor	Research on Biofuels	18/05/2015	37:40	Yes	F
C	Representative	NGO1 - Energy, Transport and Climate Change	20/05/2015	46:40	Yes	F
D	Representative	NGO2 - Transport and Environment	15/05/2015	1:30:00	Yes	M
E	Representative	Farmers' Trade Association 1	14/05/2015	55:35	Yes	M
F	Representative	Farmers' Trade Association 2	20/05/2015	52:34	Yes	M
G	Manager	Local bioethanol producer	02/07/2015	43:52	Phone	F