Lappeenranta
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Kirsi Kokkonen

# FROM EMERGING OPPORTUNITIES TO SUCCESSFUL BUSINESS NETWORKS – EVIDENCE FROM BIOENERGY

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**ABSTRACT**

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Increasing renewable energy utilization is a challenge that is tried to be solved in different ways. One of the most promising options for renewable energy is different biomasses, and the bioenergy field offers numerous emerging business opportunities. The actors in the field have rarely all the needed know-how and resources for exploiting these opportunities, and thus it is reasonable to seize them in cooperation. Networking is not an easy task to carry out, however, and in addition to its advantages for the firms engaged, it sets numerous challenges as well.

The development of a network is a result of several steps firms need to take. In order to gain optimal advantage of their networks, firms need to weigh out with whom, why and how they should cooperate. In addition, everything does not depend on the firms themselves, as several factors in the external environment set their own enablers and barriers for cooperation. The formation of a network around a business opportunity is thus a multiphase process. The objective of this thesis is to depict this process via a step-by-step analysis and thus increase understanding on the whole development path from an entrepreneurial opportunity to a successful business network. The empirical evidence has been gathered by discussing the opportunities of animal manure refinement to biogas and forest biomass utilization for heating in Finland.

The thesis comprises two parts. The first part provides an overview of the study, and the second part includes five research publications. The results reveal that it is essential to identify and analyze all the steps in the development process of a network, and several frameworks are used in the thesis to analyze these steps. The frameworks combine the views of theory and practical experiences of empirical study, and thus give new multifaceted views for the discussion on SME networking.

The results indicate that the ground for cooperation should be investigated adequately by taking account of the preconditions in all the three contexts in which the actors operate: the social context, the region and the institutional environment. In case the project advances to exploitation, the assets and objectives of the actors should be paired off, which sets a need for relationships and sub-networks differing in breadth and depth.

Different relationships and networks require different kinds of maintenance and management. Moreover, the actors should have the capability to change the formality or strategy of the relationships if needed. The drivers for these changes come along with the changing environment, which causes changes in the objectives of the actors and this way in the whole network. Bioenergy as the empirical field of the study represents well an industrial field with many emerging opportunities, a motley group of actors, and sensitivity for fast changes.

Keywords: entrepreneurial opportunity, networking, inter-firm cooperation, small and medium-sized enterprises, SMEs, embeddedness, firm resources, breadth and depth of relationship, bioenergy, biogas, biomass heating

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This dissertation is dedicated to my dad, the great pillar in my life, who suddenly passed away two years ago, right at the same time I was coming back to work from parental leave. At that time, I was totally lost and not really sure about this project, or myself. But I decided to try my best – and I know Dad, that you would be extremely proud of me right now.

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Lappeenranta, December, 2014

Kirsi Kokkonen

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**Publication 1:**

Kokkonen, K. and Kässi, T.
**Enablers and barriers of cooperative bioenergy production in the countryside: a case study**
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# PART I: OVERVIEW OF THE THESIS

# 1 INTRODUCTION

No firm is autarchic, but all firms need to interact with other organizations in their environment. Networking is a phenomenon which we meet every day – all actors and firms should increasingly cooperate and be active in networking. What does networking really mean, however, and what does it require of the actors involved? Even though inter-firm cooperation and networking have increased exponentially in recent decades, they are not easy tasks to carry out. No network just emerges from "somewhere", but the development is a result of several different steps firms need to take. In order to gain optimal advantage of their networks, firms need to weigh out with whom, why and how they should cooperate. In addition, many factors in the external environment of the firms set their own enablers and barriers for cooperation. The thesis discusses these phenomena in the bioenergy sector, which offers a fertile ground for studying emerging business opportunities and the networked activities around them. The primary interest is on small and medium-sized enterprises (SMEs) which are in a key position in achieving growth of renewable energy options.

## 1.1 Background and motives for the study

The energy sector is inevitably in a key position in limiting climate change – it accounted for more than two thirds of the world's total greenhouse-gas emissions in 2010 (IEA, 2013). So far, the world is not on track to meet the targets of decreasing greenhouse-gas emissions and thus restraining the rise of the global temperature (IEA, 2013; Weijermars et al., 2012). Global energy consumption increases continually, and according to IEA (2013), the world's energy mix has not remarkably changed in the 21st century, as fossil fuels still account for over 80 % of global energy consumption. The vastly acknowledged fact is that something in the world's energy production and consumption still needs to change.

Thus, more environment-friendly and economical alternative solutions via renewable energy sources are gradually coming into view (Long et al., 2013). Renewable energy plays already a major role in many countries around the world, even though its share in global energy consumption is only about 19 %. The prices of renewable energy technologies continue to fall, making renewables increasingly competitive with conventional energy sources. However, the development is still partly hindered, mainly by the absence of a robust policy environment (REN21, 2013).

The European Union (EU) has defined a binding objective for its member states to increase the production of renewable energy production to 20 % by the year 2020. The country under the scope in this thesis, Finland, is one of the forerunners in renewable energy, and it is engaged in a

national objective for producing 38 % of its energy with renewables by the year 2020 (Ruska and Kiviluoma, 2011). Finland is already in a good way in achieving this target, as renewables accounted for 35.1 % of the total energy consumption already in 2012 (TEM, 2014). However, the downtrend in the economy (e.g. Statistics Finland, 2014) has, for one, restrained the growth of energy consumption during recent years. Upward tendencies in economy will presumably reflect in energy consumption as well.

Whatever the state of the economy, there remains a lot of unused potential in renewable energy sources at the global level as well as nationally. One of the most promising options for renewable energy is the use of different biomasses. Bioenergy already accounts for over 10 % of the global primary energy supply, and its use in building, industry and transport end-use sectors increases evenly (REN21). Biomass is biological material from living organisms, and bioenergy is thus renewable energy made from materials from biological sources (Long et al., 2013). The most common sources of bioenergy are forest biomass, agro-biomass, and organic wastes from communities, industry and agriculture (Finnish Bioenergy Association, 2014). Biomass is used directly or converted into another type of energy product, such as biofuel (Long et al., 2013).

Bioenergy is recognized as a field with remarkable growth opportunities for the Finnish forestry and agriculture, as well as energy and environment technology industries. As bioenergy solutions are manifold and they can be located all over the country, they offer new ways for livelihood and job opportunities also for the countryside and sparsely populated areas (Alm, 2011; Jokinen et al., 2008). Because Finland has vast forest biomass reserves, the bioenergy field has been traditionally experienced as a solid part of forestry and forest industry. However, waste materials from food industry, sewages and animal manure have a lot of untapped growth potential (Alm, 2008). This study discusses small-scale bioenergy production in Finland, concentrating mainly on two bioenergy production concepts: opportunities of animal manure refinement to biogas, and forest biomass utilization in heating plants. Although these two concepts have several differences in the ways the energy is produced and utilized, they both need to weigh out the same questions related to cooperation and networking.

Biogas is formed when microbes dismantle organic material in anaerobic circumstances. This happens constantly in wetlands, water systems and animal bowels. As a result, digested biomass and biogas are produced (Holm-Nielsen et al., 2009; Huttunen and Kuittinen, 2013). Biogas includes a lot of methane, which is a greenhouse gas. When released freely to the atmosphere, its impacts are even 20 times worse than those of carbon dioxide. Thus, the recovery of biogas entails remarkable environmental advantages (Huttunen and Kuittinen, 2013). Technical solutions for biogas production in plants are numerous, and they are developing fast (e.g. Holm-Nielsen et al., 2009).

The interest towards biogas production technologies has intensified lately in Finland due to tightened environmental norms and waste regulation, as well as the promotion of biofuels in transportation (Alm, 2011). In 2012, 1 % of renewable energy was produced by biogas. The

minimum target for biogas utilization has been reached, but there remain a lot of untapped opportunities (Alm, 2011; Huttunen and Kuittinen, 2013). In comparison to many other European countries, especially rural biogas plants have still not become common in Finland. At the moment, there exist only around ten farm-scale biogas plants, digesting mainly slurries and agro-biomass as feed material. The energy production of these plants was 3589 MWh in 2012 (Alm, 2012; Huttunen and Kuittinen, 2013). Thus, the share in the total energy palette is so far marginal, but the potential is worthy – it is estimated that 2-10 TWh of energy could be produced techno-economically in agricultural biogas plants (Finnish Biogas Association, 2014).

The use of animal manure, mainly slurries, and other organic waste for energy purposes interests rural actors increasingly, mainly because of their hygienic and economic advantages. Additionally, energy self-sufficiency, improved opportunities for transportation uses of biogas, and environmental aspects have accelerated the interest towards farm-integrated biogas solutions in recent years, and several new rural biogas plants are under consideration (Alm, 2012; Huttunen and Kuittinen, 2013). In the empirical study, rural actors' motives and readiness, as well as the affecting factors in their environment for these kinds of emerging business opportunities are in scope.

Another group of interest in the study is the existing SMEs in the bioenergy field. In the empirical part of the study, this group is represented by Finnish biomass heating firms. Heat energy production by biomass is already an established activity in the Finnish bioenergy sector, and it is mainly considered as a local activity. According to Alm (2011), over 90 % of the solid fuel used in biomass heating plants is wood chips. In addition, residues from forestry and sawmills, peat, and small amounts of agrobiomass are used (Alm, 2011; Motiva, 2014). The fuel is typically procured from the surrounding area. A heating firm can be conducted by a single entrepreneur, an entrepreneur consortium, a company, or a cooperative (Alm, 2011; Okkonen and Suhonen, 2010). The total number of heating plants operated by heating entrepreneurs in Finland was 527 in 2012 (Motiva, 2014). The number of heating firms was slightly lower, as some firms operated several heating plants. The total capacity of the plants was 290 MW, which means that the average size of the plants was about 550 kW. A third of the plants produced energy for district heating systems. The rest were integrated to real estates (Alm, 2011; Motiva, 2014).

The utilization of bioenergy is still restricted by many factors in the society. One of the main challenges is the legislation, which still is not experienced to support the growth of bioenergy solutions adequately, even though supporting mechanisms for smaller-scale production have been under remarkable upgrading lately (e.g. Marja-aho, 2011). Especially small actors find it difficult to engage in the bioenergy business without unreasonable investment costs. Thus, cooperation and networking are indisputably needed, because via networking these actors have an opportunity to seize tempting new business opportunities. Rural areas should be of special interest, because traditional ways for livelihood have become inadequate for many rural actors. Many of them may be interested in starting new business and also a lot of potential biomass in

use. The problem is, however, that a minority of these actors can launch new business by themselves.

In addition, there already exist a lot of actors, such as biomass heating firms, which may already have quite long experience in bioenergy production. In the course of time, they have built different relationships with different actors, and some of them have been successful in network formation. However, they have rarely complete understanding of how these networks are formed, how they could gain the most advantage of their relationships, or how, with whom and to what direction they could develop their business. The business field is changing rapidly, and the existing actors face new circumstances and increasing competition continually. In order to prepare the actors to these changes, the factors behind the formation and development of networks should be understood better.

### 1.2 The focus and positioning of the study

The perspectives and theories for inter-firm cooperation are numerous. Already in 1998, Oliver and Ebers found 17 different theories describing inter-organizational relations and networks. Since then, the research of inter-firm cooperation by different backgrounds and methods, at different levels and with different results and conclusions has constantly accelerated. The theories differ mainly in terms of how they interpret the meaning of human factors in the relationships. For example, rational economic theories consider inter-firm relationships mainly as economical activities, whereas e.g. socio-psychological theories raise the human as the central factor in the activities (Varamäki and Vesalainen, 2003). Between these views are a bunch of theories which see the rationale for networking to be e.g. exerting power, filling a resource need, aligning the interests of stakeholders, absorbing knowledge, and obtaining legitimacy (Barringer and Harrison, 2000).

As the viewpoint of the study for networking is mainly SME-driven, the theoretical views introduced in the thesis are related with the commonly-used theories on SME networking (Varamäki and Vesalainen, 2003). The study leans much on the *resource-dependency theory* (e.g. Pfeffer & Salancik, 1978; Oliver 1990), as the starting point for the study is that no firm can act in a vacuum but they always need some outer resources in their business. These outer resources cause dependence on the partners and the external environment, and on the other hand, a strong resource portfolio entails power over others. However, the study does not follow the theory precisely, as it does not concentrate much on the firms' aims to acquire control over others (Pfeffer & Salancik, 1978), but discusses more the balance of embeddedness and independency in relationships. In addition, the study is influenced by the *network theory* of the *Uppsala school of thought* (e.g. Håkansson and Johanson, 1992), as it considers relationships as an interaction of actors, activities and resources, and discusses the differences in the breadth and

depth of relationships. The study also considers changes in the network structure possible and even probable.

In addition to the above, the study takes into account the views of the *social network theory* (e.g. Johannisson, 1984), as it goes further in single relationships by considering the meaning of personal ties between the actors, especially in building trust in the relationships. The *strategic management literature* (e.g. Ansoff et al., 1976; Vesalainen, 1996) is not forgotten either, as it discusses the different levels of resource utilization, namely the operational, tactical and strategic levels. Thus, the study has several viewpoints to networking, which strengthens the former impression that each one of the single theories is insufficient as such to capture the complexities involved in networking (e.g. Barringer and Harrison, 2000). The selection of theories used in the study is by no means all-inclusive, but it offers a multifaceted framework for examining SME networking.

The other theoretical context in the study is entrepreneurship. The phenomenon of entrepreneurship is not discussed as such, although it refers to the sociological (e.g. Gibb, 1987; Roberts, 1977) and cognitive (e.g. Delmar, 2000) approaches to entrepreneurship by discussing the impact of embeddedness in social contexts and former experiences in cooperative entrepreneurial activities. Instead, the study concentrates more on entrepreneurial opportunities, and takes mainly the opportunity-based perspective (Eckhardt and Shane, 2003) in analyzing the entrepreneurial process.

Entrepreneurial opportunities are not a new phenomenon, as the first definitions of opportunities date back to the 1930s (Schumpeter, 1934). The study introduces different definitions for entrepreneurial opportunities but does not adopt any single definition, because the empirical study does not concentrate much on the recognition phase of opportunities but rather on the stages of their exploitation. The main interest in the thesis is in the environmental contexts for opportunity exploitation (e.g. Shane, 2000) such as the industry, region, and institutional environment.

Bioenergy has recently been the scope of several academic studies. However, the majority of the research has concentrated on the institutional context of bioenergy, such as technological development, legislative restrictions and political support mechanisms. Because these themes are in a central role in the bioenergy field, they are naturally discussed in this thesis as well. However, because of its nature of business and management research, the thesis does not take a stand on e.g. the most applicable bioenergy technologies, or the details of acts or political statements, but rather takes them “as such” and discusses their impact on the actors’ activities and networking. As several actors are always involved in bioenergy projects, it is of utmost importance to increase understanding on the multifaceted actor networks and their management.

Networking around entrepreneurial opportunities is often seen as a prerequisite, and the advantages of networking in opportunity exploitation have been discussed in the literature (e.g.

Arenius and de Clerq, 2005). However, common understanding on the whole development path from entrepreneurial opportunities to networked business is partly missing. The thesis aims to fill this gap by a thorough step-by-step analysis. Bioenergy as the empirical field of the study represents well an industrial field with many emerging business opportunities, a motley group of actors, and sensitivity for fast changes. Figure 1 illustrates the research focus of the thesis.

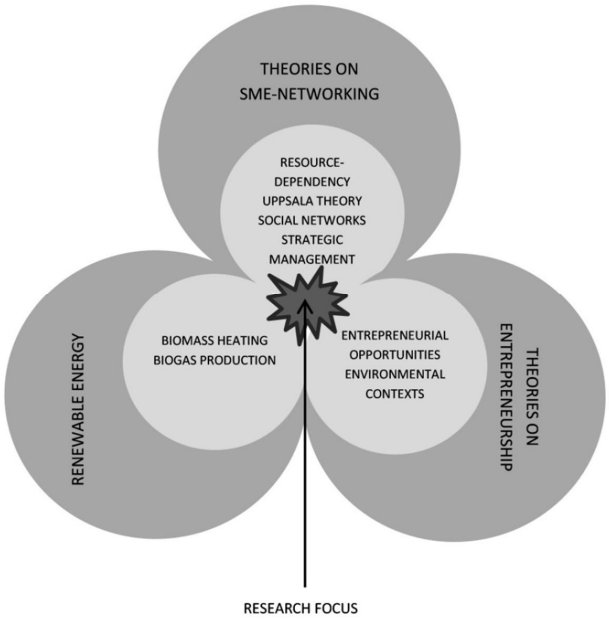



Figure 1: Research focus of the study

### 1.3 Research objectives and questions

The aim of the thesis is to clarify the development path from emerging entrepreneurial opportunities to successful business networks. This is done by examining the development path step by step: which drivers, motives and preconditions steer the actors to seize entrepreneurial opportunities and to build cooperative activities around them, and what kind of factors steer partnerships and networks to be formed as a certain type. The thesis discusses the internal and

external factors which have an impact on the emergence, development, differences and life-cycles of partnerships and networks. The main research question of the study is:

*How can a path from emerging entrepreneurial opportunity to a successful bioenergy business network be built, and what kind of factorshave an influence on this path?*

Firstly, the interest is directed to actors seeking for a foothold in the bioenergy business. Their opportunities to engage in bioenergy business in cooperation with others are contemplated on by clarifying the enabling and hindering factors in their environment. Moreover, the critical preconditions at different environmental levels are discussed. By this reasoning, the following sub-questions are answered:

*Q1: What kind of factors may work as enablers or barriers for cooperative exploitation of entrepreneurial opportunities?*

*Q2: Which preconditions are experienced to be critical for a network around an emerging business opportunity, and how can these preconditions be fulfilled?*

Secondly, the existing bioenergy actors and their networks are looked at more thoroughly. The reasons behind the formation of relationships of a certain type are discussed, and the following sub-question is answered:

*Q3: How do the differences in the actors' assets and objectives influence the relationships and networks they form?*

Moreover, notice is taken of the complex entity of relationships and networks. How firms can manage these complex entities is clarified by answering to the last two sub-questions:

*Q4: What kind of relationships and networks can the actors have simultaneously?*

*Q5: How should firms manage their different relationships and networks?*

Via the above research questions, the study sheds light on the multiple phases which the actors need to consider in network formation. In addition, the study increases the transparency of the multifaceted nature of inter-firm cooperation and offers tools for analyzing and developing it.

### 1.4 Outline of the thesis

The thesis consists of an overview and five research publications. The first part of the overview is an introduction of the background, focus and research objectives of the thesis. The theoretical part comprises two sections. In the first theory section (section 2), cooperation around entrepreneurial opportunities is discussed via the triangle of drivers, motives and preconditions for cooperation. The second theory section (section 3) discusses the diversity of relationships and networks by contemplating the interconnection of actors, activities and resources, as well as issues concerning the diversity and changing nature of networks. The research approach and methods are introduced in the research approach -section (section 4).

The main objectives and findings of the publications, their interconnection with the theoretical context, and a summary of the main results are presented in section 5. Section 6 gathers the main findings of the thesis and discusses their implications and usability. The concluding section 7 discusses the central notes made in the study and further research options. The outline of the thesis is introduced in Figure 2.

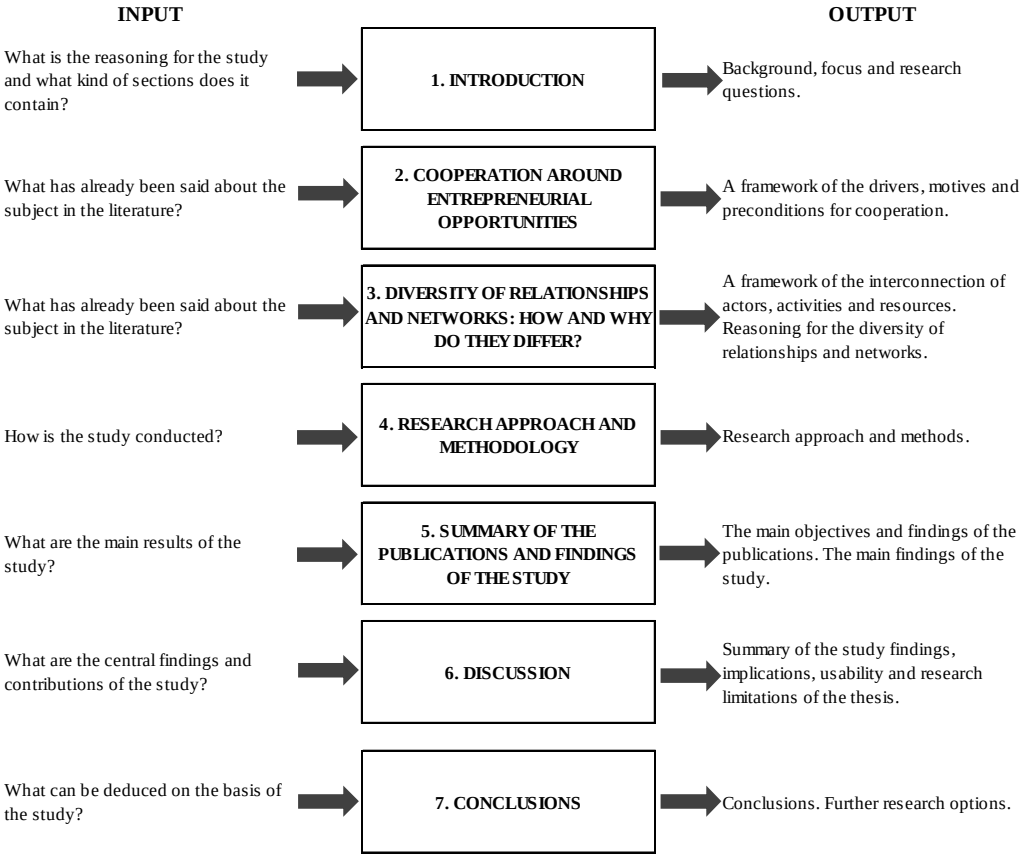



Figure 2: Outline of the thesis

## 2 COOPERATION AROUND ENTREPRENEURIAL OPPORTUNITIES

This part of the thesis concerns the factors which guide actors to cooperation. First, it introduces the existence of entrepreneurial opportunities and their recognition and exploitation. After that, the motives and preconditions for opportunity exploitation in cooperation are discussed.

### 2.1 Entrepreneurial opportunities as drivers for new business

Entrepreneurial opportunities have been examined through many viewpoints, such as microeconomics, psychology, cognitive science, and strategic management, as well as the resource-based and contingency theories (Hunter, 2013). In short, an entrepreneurial opportunity is a favorable set of circumstances that creates a need for a new product, service or business (Barringer and Ireland, 2008). Eckhardt and Shane (2003) describe entrepreneurial opportunities as situations in which new goods, services, raw materials, markets and organizing methods can be introduced by forming new means, ends or means-ends relationships.

Earlier research on entrepreneurship has made a difference between Kirznerian and Schumpeterian opportunities - in a nutshell, these views disagree over whether the existence of entrepreneurial opportunities involves the introduction of totally new information (Schumpeter, 1934) or just differential access to existing information (Kirzner, 1973). Later, researchers have begun to argue that these two perspectives represent different types of opportunities which can exist at the same time. This has opened several interesting implications for understanding entrepreneurship (Shane, 2003).

Several sources for entrepreneurial opportunities have been discussed in recent literature. According to Barringer and Ireland (2008), entrepreneurial opportunities can be perceived in three main ways: *observing* trends, *solving* a problem, or *finding* gaps in the markets. Basically, opportunities can be internally or externally stimulated – they can be generated either from the person himself or the external environment (Barringer and Ireland, 2008; Mariotti and Glackin, 2012). Opportunities are situational, i.e. they are dependent on different circumstances (Mariotti and Glackin, 2012).

There is a long way from an opportunity to successful business, however. There are many factors which affect the recognition and exploitation of entrepreneurial opportunities. Although an opportunity for entrepreneurial profit may exist, an individual can earn this profit only if he recognizes that the opportunity exists and has value (Shane and Venkataraman, 2000). Moreover, even when perceived as a promising opportunity, not all entrepreneurial opportunities prove to be profitable businesses (Shane, 2003).

Following Kirzner's (1997) arguments, it is widely acknowledged that individuals differ in terms of opportunity recognition – some people just discover opportunities that others do not. This is seen to be caused by the different beliefs and information individuals possess (Arentz et al., 2013; Barringer and Ireland, 2008; Shane, 2003). These beliefs and information are developed through an individual's prior experiences, cognitive factors, and personal characteristics (e.g. Barringer and Ireland, 2008; Hunter, 2013). Moreover, this information is gathered through the networks and environments individuals are *embedded* in (Arenius and DeClercq, 2005; Chen et al., 2009; Hung, 2005).

Partnerships and networks can provide access to knowledge that an individual does not currently possess. When knowledge is shared among individuals, they are affected by and learn from the experience of others (Arenius and DeClerq, 2005; Ma et al., 2011). Knowledge transfer can thus lead to potential for different kinds of opportunities than a single actor could recognize on one's own. In addition, it is not unimportant in which kind of networks the actors are embedded – for example regional and cultural differences may form determining factors in opportunity recognition (Ma et al., 2011).

When being embedded in relationships and networks, actors are embedded in their external environment as well. Decisions to exploit entrepreneurial opportunities are thus never made in a vacuum, but they are influenced by different outer contexts in which the actors operate (Hung, 2005; Shane, 2003). The general environment develops and closes off opportunities while opening new ones (Hunter, 2013). Different economical, political and socio-cultural factors form the institutional environment, which sets the 'rules of the game' and thus generates incentives for certain types of action, as well as determines the legitimate and acceptable behavior for its actors (Hung, 2005; Shane, 2003).

It can thus be stated that individual aspects, as well as the social and environmental context provide impulses for entrepreneurial opportunity recognition and exploitation. However, as the following sections will demonstrate, they can set numerous challenges for entrepreneurial processes as well.

### 2.2 Motives for cooperation

In the 1990s, the move from the analysis of individual firms towards the analysis of interaction between firms formed a basis for numerous academic and managerial publications (Ritter and Gemünden, 2003). Since then, the literature around interorganizational relationships and networks has exploded, and these phenomena have been studied via several approaches and rather diverse theoretical backgrounds, varying from economical viewpoints to behavioral ones (Barringer and Harrison, 2000, Möller and Rajala, 2007; Ritter and Gemünden, 2003).

When looked at through different theoretical lenses, the general motives for cooperation and networking include for example minimizing costs, reducing risks, achieving economies of scale, exerting power and control, filling a perceived resource need, increasing financial benefits, reducing environmental uncertainty, obtaining legitimacy and absorbing knowledge in order to increase organizational competence (Barringer and Harrison, 2000; Bititci et al., 2004). De Wit and Meyer (2010) have encapsulated these motives in three main categories of relational objectives, namely leveraging resources, integrating activities and aligning positions.

The fact is that firms rarely cooperate because they want to, but because they expect some value added through cooperation (Bititci et al., 2004; De Wit and Meyer, 2010). However, as no single form of cooperation is optimal in any generic sense, cooperation is represented in various forms of inter-firm relationships. These forms vary by their tightness, including tightly coupled ties, such as joint ventures and networks, and rather loosely coupled ones, such as subcontracting and licensing (Barringer and Harrison, 2000; Tidd et al., 2005). In addition, relationships have different durations, varying from short-term contracts to long-term collaboration (Tidd et al., 2005). This variation of breadth and depth of cooperation is discussed more thoroughly in section 3.2.

Small and medium-sized enterprises (SMEs) are the main focus of the empirical part of the study, and it is thus worth highlighting some special characteristics of SME networking. Naturally, a smaller size may set restrictions, and that is why smaller firms are not likely to possess all the relevant competences internally (Malmström and Wincent, 2012). Cooperation and networking thus provide a valuable source of support and information, as well as a means of sharing resources for SMEs (Fuller-Love and Thomas, 2004).

However, small firms also utilize sources of competence from outside less frequently, which partly reflects their limited capacity to absorb knowledge (Malmström and Wincent, 2012; Tidd et al., 2005). On the other hand, SMEs with knowledge-based products and technologies may be consciously cautious in cooperating, because by entering a partnership they also open themselves to opportunistic behavior of their partners (Mukherjee et al., 2013).

As some relationships are arguably more important and valuable than others, SMEs with limited resources should build fewer relationships with greater outcomes (Westerlund and Svahn, 2008). In addition, because competence is embedded in people, there is a stronger link between the entrepreneur and the firm's competence base than in larger firms (Malmström and Wincent, 2012). Moreover, the entrepreneur's personal ties play a crucial role in developing business networks for an SME (Westerlund and Svahn, 2008).

In addition to inner motives for cooperation, there are many environment-specific and individual-specific factors which have an influence on the development of cooperative activities (Mukherjee et al., 2013).These factors may work as enablers for inter-firm relationships, but

equally, they may set up barriers to cooperation. Thus, in addition to the actors' willingness to cooperate, favorable *preconditions* are needed.

### 2.3 Preconditions for cooperation

The preconditions for entrepreneurship and cooperation around entrepreneurial activities are formed as a joint effect of factors in different environmental levels around the actors. Hagedoorn (2006) calls this phenomenon three-levelled embeddedness. This means that the actors are simultaneously embedded dyadically, interorganizationally and environmentally.

In general, embeddedness exists when the social relationships in a partnership influence the economic actions of the partners involved. Thus, the interaction within partnerships is not primarily economically motivated, but rather grounded more on personal relationships, social capital, history or dyadic interactions (Hite and Hesterly, 2001; Uzzi, 1997).

As discussed above, being embedded in a network structure usually improves performance, because the individuals in the network benefit from the social capital and tangible assets of that particular context (Li and Chen, 2009; Rutten and Boekema, 2007). Moreover, embeddedness in former relationships has an impact on forming relationships in the future – when an actor gains experience in collaborating in one relationship, his capability to collaborate with others is developed (Hagedoorn, 2006).

However, social ties may also force individuals to conform to current understandings and practices (Staber, 2005). All actors are embedded in some social context which has developed its own norms, values and rules. Thus, the intangibles that influence the actors' behavior in networks are for the most part derived from the social contexts of these actors. This pertains to regions as well, which means that the actors are also embedded in regional social contexts (Granovetter, 1985; Rutten and Boekema, 2007).

Regions may differ remarkably in the preconditions for innovation and enterprise development. In addition, they also differ in terms of network cohesion (Arenius and DeClerq, 2005; Tödtling and Kaufmann, 2002). Regions have certain preconditions which may act as enablers or barriers for entrepreneurial activities. Research indicates that small firms are most likely to interact with, and learn from, others within the same region (e.g. North and Smallbone, 2000).

As rural regions are one of the main targets of interest in the empirical part of the study, it is worth discussing their special characteristics more deeply. Rural regions are on one hand experienced as unique environments for innovations and opportune grounds for interaction (Arenius and DeClerq, 2005; North and Smallbone, 2000). On the other hand, they are confronted with many barriers from outside, such as conflicting regulation and lack of

infrastructure, institutions and adequate technical support. One challenge is the long distances, which may hinder the formation of constant interaction. Moreover, groups of rural actors are often faced with barriers of their own, such as inadequate skills in management and organization of collective learning. Thus, network creation in sparsely populated regions may need more support from local authorities (Oerlemans and Assouline,2004; Schallenkamp and Smith, 2009).

The networks and regional social contexts are still embedded within broader institutional contexts. As a result, the same network position can yield different outcomes, depending on the surrounding institutional environments. Without considering the institutional settings within which different networks and actors are situated, full understanding of the influence of network structures on firm-level outcomes cannot be obtained (Vasudeva et al., 2013).

The institutional environment controls, for its part, which activities are needed and which are possible. E.g. Hagedoorn (2006) argues that environmental embeddedness is the highest level of embeddedness affecting the likelihood of new partnership formation. Changes in economic and social factors, technological advances, political actions, or regulation provide impulses for new business, but may on the other hand even set barriers for entrepreneurial activities and cooperation (Barringer and Ireland, 2008).

Bioenergy offers a fertile ground for the discussion on the influence of the levels of embeddedness discussed above. At the institutional level, there are economic factors, such as investment costs, relatively long payback times and price expectations for the energy produced. In addition, the market infrastructure may not yet be well-built, access to technology may be restricted, and the energy sector is undoubtedly highly regulated. Moreover, different legislative and political factors determine which kind of production in general is favored or excluded (e.g. Aro, 2009; Demirbas, 2009; Jokinen et al., 2008). At the actor and regional levels, lack of human resources, practices or cultural modes may make the development of bioenergy business difficult. In practice, this is illustrated by a lack of mechanisms to distribute information, lack of professional institutions, and lack of involvement (Jokinen et al., 2008; Rutten and Boekema, 2007).

Uncertainty of the environment may deter enterprises from engaging in partnerships (Mukherjee et al., 2013), and because the future of bioenergy solutions still includes many unanswered questions, this will unavoidably restrict the development of new business activities in the field. However, as the bioenergy field also offers numerous opportunities for value-creation, it increasingly gathers together individuals and firms who are eager and committed to seize emerging business opportunities. Thus, the emerging and established actors in the field are forced to balance in the *triangle of drivers, motives and preconditions* for bioenergy business.

## 2.4 The triangle of drivers, motives and preconditions

To summarize the theoretical views discussed in this chapter, the triangle of drivers, motives and preconditions for cooperation around entrepreneurial opportunities is illustrated in Figure 3 below.

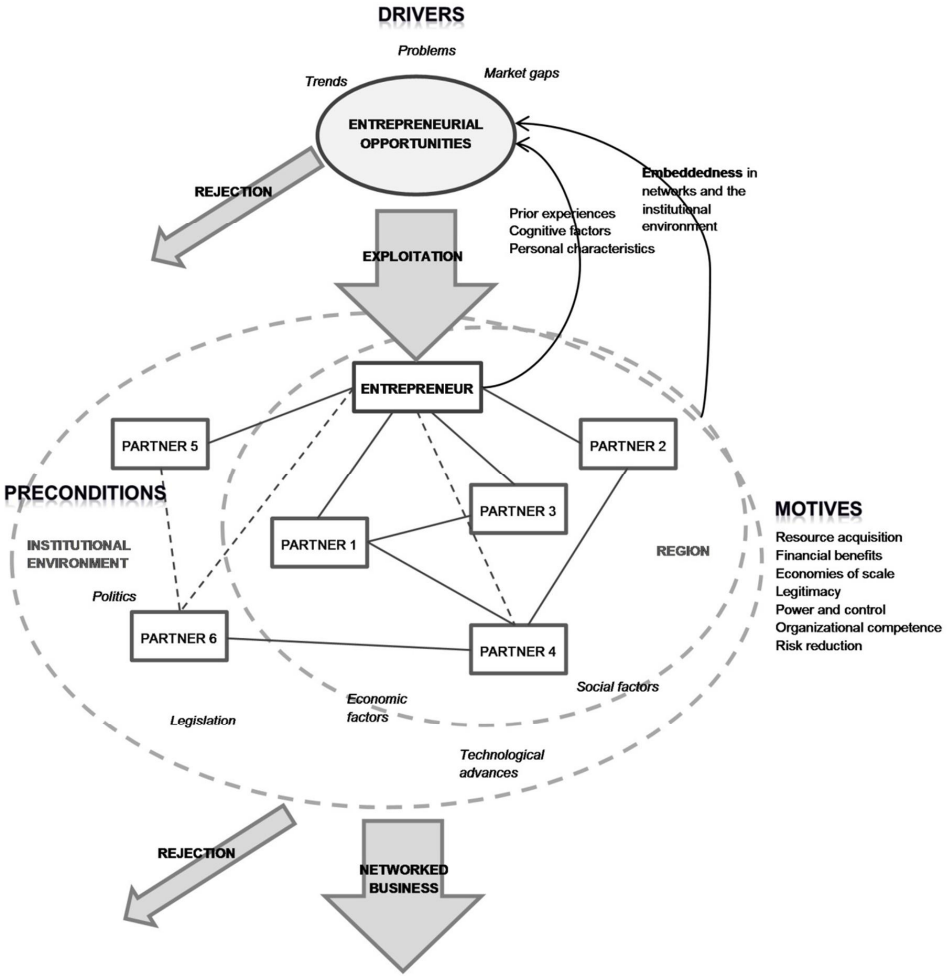



Figure 3: The triangle of drivers, motives and preconditions

In short, entrepreneurial opportunities drive entrepreneurs and firms to emerge, develop and cooperate. These opportunities are recognized in three main ways, namely trend observation, problem solving and market gap finding. In addition, the entrepreneur himself and his embeddedness in networks and the external environment have an influence on the recognition of opportunities. Those opportunities which are seen to be worth exploiting may be exploited by the entrepreneur himself or in cooperation with partners. The entrepreneur may have several motives to seize the opportunity in cooperation which can be technology-, market- or organization-based. Some opportunities, however, do not proceed to the exploitation level at all. The rejection of an opportunity may happen right in the beginning, if the opportunity is not perceived as profitable enough to be commercialized. An opportunity can also be prevented by barriers set by the external environment.

## 3 DIVERSITY OF RELATIONSHIPS AND NETWORKS: HOW AND WHY DO THEY DIFFER?

Based on the previous section, it can be deduced that the motives for cooperation are in a central role in defining who the most desired partners for a firm are. How inter-firm relationships arise is thus strongly influenced by the objectives of the parties involved, such as leveraging resources, integrating activities or aligning positions. However, as firms never act in a vacuum, the surrounding preconditions may dictate who can become possible partners and what kind of cooperation can be created as a whole.

No single form of cooperation is optimal in any generic sense, and that is why inter-firm relationships can take various forms. In this section, the reasons for the diversity of relationships and networks are discussed more thoroughly.

### 3.1 Balance of embeddedness and independency

As stated, interdependencies between the actors enable firms to develop and exploit their own resources and those of others effectively (e.g. Donaldson and O'Toole, 2007). On the other hand, interdependencies also constrain the abilities of firms to develop and implement their own independent strategies (Ford and Håkansson, 2013). Thus, firms should not be too entangled in restrictive relationships, but to maintain a certain level of freedom to maneuver, bargain and even attack in order to secure their own interests. In other words, firms should be at the same time *embedded* in cooperative interactions but *independent* enough to wield their power to their own advantage (De Wit and Meyer, 2010; Staber, 2005). The factors that cause interdependencies between actors are discussed in the next subsections.

#### 3.1.1 Resource-dependency

The *resources* an actor uses and has access to, as well as influences and controls, constitute the resource portfolio, or resource profile (e.g. Chetty and Wilson, 2003) of the actor. Basically, resources can be characterized as *tangible* or *intangible*, i.e. physical and non-physical resources (De Wit and Meyer, 2010; Johnson et al., 2006). Johnson et al. (2006) consider resources under four broad categories: physical resources, financial resources, human resources and intellectual capital. Moreover, resources can be divided into threshold resources, which are essential to a firm to be able to compete in a given market in general, and unique resources that critically underpin competitive advantage. As we have moved into a knowledge-based economy,

knowledge in its many forms has replaced traditional tangible assets as the primary source of competitive advantage (Birchall and Tovstiga, 2005).

The efficiency and effectiveness of resources depends on not just their existence, but on how they are managed. Thus, in order to use their resources effectively, firms need competences or capabilities, i.e. activities and processes through which they deploy their resources (e.g. Johnson et al., 2006; Grant, 2010). For long-term success, firms need to upgrade their resource and capability bases continuously (Grant, 2010).

As firms are rarely able to perform all their activities in-house, they rely increasingly on external knowledge to foster innovation and enhance their performance (Lichtenthaler, 2009). In any relationship, resource ties and interfaces will create interdependencies between the actors, as well as between relationships (Munksgaard, 2010). As stated above, networks are a means for overcoming resource constraints, and an essential component in benefiting from external relationships is how well the participants can utilize each other's resources and capabilities (Chetty and Wilson, 2003; Rajala and Westerlund, 2008). According to resource-dependence theorists, firms must acquire control over critical resources in order to decrease their dependence on other firms and, on the other hand, acquire control over resources that increase the dependence of other firms on them (Barringer and Harrison, 2000). Thus, inter-firm relationships can also be considered as strategic resources in themselves (Ivens et al., 2009).

However, even if networking is often seen to increase the competitive advantage of firms (e.g. Doz, 1996; Fuller-Love and Thomas, 2004), this does not mean that the actors should share everything with each other –firms have certain unique resources and core competences which should be protected from others (Johnson et al., 2006). What then is the "suitable" level of resource-exchange? This is discussed next in connection with the actors' associability, as well as the power relations and trust between the actors.

### 3.1.2 Associability

Social exchange is a necessity for valuable relationships (Westerlund and Svahn, 2008). Several studies suggest that social relationships and personal ties play a crucial role in developing business networks (see e.g. Hite and Hesterly, 2001; Vanhaverbeke, 2001; Pikka, 2007), and thus building social relationships with surrounding parties is a vital networking capability for firms. However, a social network cannot be built by itself, it requires that the actors in the network enhance the network's *social capital* collectively (Leana and Van Buren, 1999).

Social capital is the resource which reflects the character of the social relationships of a firm (Leana and Van Buren, 1999), i.e. the sum of actual and potential resources that are embedded in, available through, and derived from the network by its actors (Nahapiet & Ghoshal, 1998;

Leana & Pil, 2006). No network can exist without some flow of social capital between its actors. However, the level and nature of this flow may vary remarkably, because the actors may balance the aims for private and public goods (see e.g. Leana and Van Buren, 1999; Burt, 1997) differently and thus have different levels of *associability* (Van Buren, 2008; Wagner, 1995).

Associability has two components: the affective component, which means *willingness* to subordinate individual goals to collective goals, and the skill-based component, which refers to the *ability* to coordinate activities according to set goals (Van Buren, 2008). It thus requires more than just interdependence between the actors, because it demands the ability to interact socially with each other and also willingness to subordinate individual desires to group objectives (Leana and Van Buren 1999; Wagner, 1995). According to Leana and Van Buren (1999) and Pearse (2009), the outcome of any opportunity to engage in social ties is mediated by associability and trust. Every partnership and network is thus always to some degree dependent on the social assets of its participants.

### 3.1.3 The impact of power and trust

Not all firms have the same ability to appropriate value from partnerships, as the appropriation capacity depends on the firm's relative bargaining *power*, which is again a result of their resource basis (Lavie 2007). Since the conditions of the actors are rarely equal, the outcome of any particular exchange depends upon the relative power of the partners involved - the partner who has less power is more dependent on the more powerful one. Studied from various theoretical viewpoints, power can have its source in tangible or intangible assets as well as different positions in networks, groups or markets (Belaya and Hanf, 2009; De Wit and Meyer, 2010; Meehan and Wright, 2012). It is agreed upon that the partner who has more power has access to more resources (Davern, 1997; Belaya and Hanf, 2009).

For some authors, power is one of the greatest deterrents to *trust* (Mukherjee et al., 2013). Trust is often seen as a prerequisite for successful cooperation (e.g. Elmuti and Kathawala, 2001). According to Elmuti and Kathawala (ibid.), building trust is the most important and also the most difficult aspect of a successful partnership. Partnerships between actors should be formed to enhance trust between individuals, because only people can trust each other, not firms. Moreover, trust generates social capital between the partners and enables them to solve mutual problems and conflicts that arise during the partnership (Mukherjee et al., 2013). However, e.g. Staber (2011) argues that some partnerships may be intense but short-term, based on complementarity rather than redundancy, and oriented more to ”knowing-whom” than to building trust. Thus, not all partnerships require a complete level of trust between the partners, but the actors should find a balance between protecting their assets and establishing trust with their partners (Hagedoorn, 2002).

### 3.2 Breadth and depth of cooperation

Actors' aims for independency and embeddedness will lead to differences in the breadth and depth of cooperation. In general, the actors need to recognize the specific *activities* upon which an actor will collaborate, because all the activities do not require the same amount of commitment and close relationship (Sahay, 2003).

In addition to the selection of activities, i.e. the *breadth* of cooperation, the actors need to think about the *depth* of cooperation with their different partners. Generally, firms should focus their attention on a small number of close relationships which demand strategic investing, and find those relationships which would be optimal as more superficial (Barratt, 2004; Matopoulos et al., 2007). As a consequence, the depth of cooperation in a firm's networks may vary from operational tasks to tactical activities and strategic development (Barratt, 2004; Ståhle and Laento, 2000).

Operational relationships refer to weak links and usually short-term contracts between the partners. The aim of these relationships is mainly to reduce costs. In tactical relationships the aim is to achieve synergy e.g. by learning, combining the processes of the partners, removing overlapping activities, or combining working models. In strategic collaboration, knowledge and know-how are combined in order to achieve fundamental advantage for both partners (Ståhle and Laento, 2000; Valkokari et al., 2006). The more breadth and depth in the relationship, the more intense it will be (Matopoulos et al., 2007), which means that tightness in the relationship also increases the interdependency of the actors.

### 3.3 Interconnection of actors, activities and resources

Following the definitions of e.g. Håkansson and Johanson (1992) and Möller and Rajala (2007), a network can be described in terms of *actors, activities and resources*. As networks consist of several relationships, the description can be applied to single relationships as well. Actors refer to individuals or organizations, and their relationships to each other, and activities refer to the flow of information, goods or services performed in these relationships. Resources in this context include knowledge, social capital as well as tangible assets (Håkansson and Johanson, 1992; Möller and Rajala, 2007). The three elements have an influence on each other: actors perform activities and control resources, activities transform resources and are used by the actors to achieve goals, and resources give the actors power, thus enabling activities (Håkansson and Johanson, 1992; Ritter and Gemünden, 2003). In order to understand the variation in the relationships the actors have in a network, it is of utmost importance to look at these three elements more thoroughly. Figure 4 illustrates this interconnection and captures the aspects discussed above.

Resource ties and interfaces always create interdependency between actors. Every actor has unique needs and aims for embeddedness and independency in their cooperative activities. These aims are caused by certain needs for completing the resource portfolios from external sources, and on the other hand, protecting the unique resources and core competences from outsiders. In addition, every actor has a certain level of associability, which means its willingness and ability to share social capital in the relationships. Associability and trust go hand in hand, and trust generates social capital between the partners. However, not all relationships require a complete level of trust, they can work as more superficial ones.

Since the resources of actors are never consistent, the actors may differ in their power positions. The one who has a stronger resource profile has also more power over the other. Thus, the relationship between the actors is not necessarily balanced, but the one with less power is more dependent on the more powerful actor.

The more breadth and depth in cooperation, the more intense the relationship is. Intensity requires complete trust between the partners, and involves a greater number of resources. As all relationships do not require the same amount of investment, the actors should recognize the strategically important ones, and on the other hand, those relationships which are more productive as operational tasks.

In Figure 4, *resources* are symbolized by the letter "R". The thin arrows from the resources point to the relationships in which they are utilized. A notable fact is that in addition to the resources of the actors themselves, also resources from the external environment can be utilized in cooperation. The grey arrows between the actors describe *activities*. The thickness of the arrow indicates the *breadth* of cooperation, and the type of the outer line of the arrow (between actors 1 and 2 solid, and between actors 1 and 3 dashed) is related to the *depth* of cooperation. Thus, the thicker and more solid the arrow, the more intense the cooperation between the actors is. Moreover, the actors share *social capital* with each other. Because their aims for associability may be different in different relationships, the arrows which lead from social capital to activity - arrows are also different in thickness. In addition, the actors are situated in different *power positions* based on their resource portfolios. Actor 3 has fewer resources than Actor 1 and Actor 2. Thus, Actor 1 has power over Actor 3 in cooperation.

On the basis of Figure 4, it can be deduced that Actors 1 and 2 are in an intense strategic collaboration with each other. They collaborate in a wide range of activities, share a remarkable amount of resources in them, and also utilize some from the external environment. The level of associability is high and there prevails mutual *trust* between the partners. The actors are mutually dependent on each other. Actors 1 and 3 have a more superficial relationship with less resource and social capital exchange. Actor 1 has more power over Actor 3, which means that it is more independent in the relationship. Cooperation does not require complete level of trust between the partners.

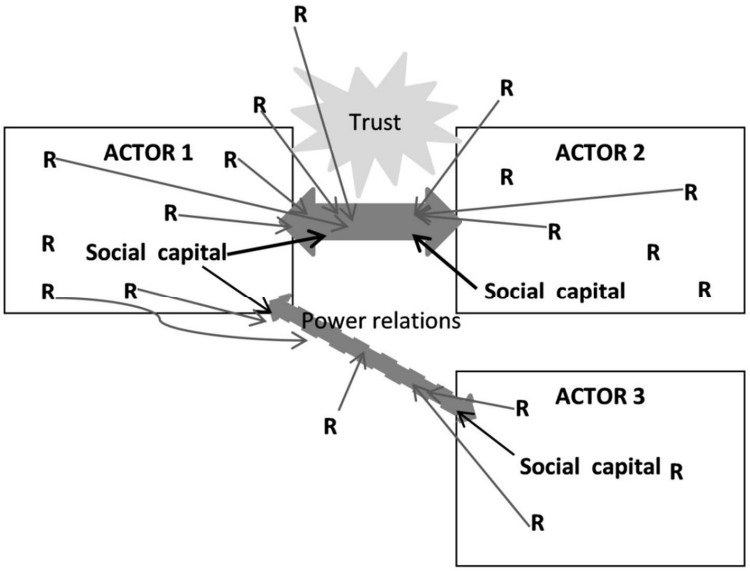



Figure 4: Interconnection of actors, activities and resources

### 3.4 Diversity of networks

A firm is not tied to a certain single network, and usually firms act as partners in several networks simultaneously. In these networks, there is a variety of forms of potential cooperation. Thus, just as firms need to manage and develop their resource portfolios, they should manage and develop their relationship portfolios as well (e.g. Wassmer, 2008).

Barratt (2004) divides cooperation into vertical, i.e. cooperation with customers and suppliers, and horizontal, i.e. cooperation with competitors and non-competitors. Valkokari et al. (2006) widen this categorization. In their viewpoint, networks can be divided into vertical, horizontal, innovation and collaboration networks. For example, a firm can act simultaneously in a vertical production network and in horizontal sales, marketing and R&D networks (Barratt, 2004; Valkokari et al., 2006). Moreover, it may exchange experiences in collaborative learning networks between firms or with its customers or find new innovative solutions through networked cooperation even across industrial boundaries. In these different networks, a firm may have rather different roles (Valkokari et al., 2006).

One prevailing viewpoint for examining the nature of business networks is by concentrating on knowledge creation and exploitation in networks (e.g. Möller and Rajala, 2007; Romero and

Molina, 2001; Valkokari and Helander, 2007). Möller and Rajala (2007) define networks as value-creation systems based on the above interconnection of actors, activities and resources. Their classification into three network types is based on the level of determination of the system: how well known are the value activities of the net and the resources of the actors to carry them out, and to what extent these value activities can be explicitly specified. By these criteria, Möller and Rajala (ibid.) categorize networks as current business nets, business renewal nets and emerging business nets.

In current business nets, value systems are clearly specified and relatively stable. The actors and their activities are known to a reasonable extent. In the opposite position are emerging value systems. They can also be called future-oriented networks, because they require radical changes in existing value systems and in the creation of new value activities. In the middle, there are business renewal nets, i.e. value systems that are relatively well determined but yet modified through incremental and local improvements (Möller et al., 2005; Möller and Rajala, 2007). Valkokari and Helander (2007) have refined this classification and named the network types as traditional supply networks, enhancing networks and innovation networks.

Firms cannot expect inter-firm cooperation to be a stable state, but it changes and develops continuously. A changing environment may require reshaping of relationships and networks. Customer expectations, industry, product life-cycles or the objectives of partners may change over time, and consequently, the dynamics and forms of cooperative activities should change as well (Valkokari et al., 2009; Varamäki and Vesalainen, 2003). In an innovation network, for instance, the roles of actors may change according to the innovation phase. This may also influence their ability or willingness to collaborate (Valkokari et al., 2012). Networks may also require a temporary structure, in which the actors learn by switching some of their partners while retaining others. Furthermore, not all partnerships need to be active all the time, some can be maintained as a latent reservoir to be drawn on when needed (Staber, 2011).

In today's global economy, firms are cooperating more and more. This means that firms engage in new forms of highly cooperative mechanisms and network structures which are expected to be capable of providing competitive advantage by combining the best skills, core competences and resources (Romero and Molina, 2011). This requires that the firms involved in these mechanisms should be capable to change and develop fast as well. In other words, firms need *dynamic capabilities*, which by Leonard-Barton (1992) and Teece et al. (1997) can be defined as a firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Thus, the resources of firms and networks, including capabilities, should not be defined only by the current value activities that can be carried out, but they need capacity to renew the current capabilities and develop new ones (Möller and Rajala, 2007).

# 4 RESEARCH APPROACH AND METHODOLOGY

Every researcher needs to make certain choices on the basic principles of the study. This section introduces the overall research strategy and methodological choices made in the thesis. It discusses two opposite philosophical traditions of research and introduces more thoroughly the chosen research approaches and methodology in the study.

## 4.1 Background for research approaches

The research philosophy forms a basis for the research strategy, data collection methods and data analysis of the research. Philosophical aspects and questions exist behind every research method and methodological approach and thus define the ways it is possible to provide new knowledge through research (Eriksson and Kovalainen, 2008; Hirsjärvi et al., 2009). The research tradition in the field of industrial management is partly contradictory and is seen to locate somewhere in the middle ground of two opposite research philosophies: positivism and hermeneutic science (Olkkonen, 1993).

Positivism, inherited from the theories of Auguste Comte (1798-1857) and originated from realism, refers to the assumption that the only legitimate knowledge can be found from experience. Positivists believe in empiricism – the knowledge is seen to be restricted in the observation and measurement of existing facts. The aim of research should be in finding causal explanations and regularities (Eriksson and Kovalainen, 2008; Olkkonen, 1993).

At the opposite end is hermeneutics, also called ‘interpretivism’, a philosophy which originates from idealism and was launched by Friedrich Schleiermacher (1768-1834). Hermeneutics refers to interpretation and understanding as part of the research process. It is seen that human intentions mould and change the reality crucially, and that is why understanding human intentions is needed (Eriksson and Kovalainen, 2008; Olkkonen, 1993).

Based on the basic philosophical traditions, certain prevailing ways of thinking on the used data, methodologies and the gathered results exist in every field of science. This has given birth to certain bunches of value choices and working methods which are called paradigms or research approaches (e.g. Modell, 2009; Olkkonen, 1993). I use the term “research approach” which I consider to include decisions e.g. about the following aspects:

- Research logic: deduction, abduction or induction
- Research data: large vs. concise
- Research design: quantitative, mixed or qualitative

- Research results: descriptive, normative or explorative

(compiled from Creswell, 2003; Eriksson and Kovalainen, 2008: Kasanen et al., 1993: Olkkonen, 1993).

*Deduction* rests on the idea that theory is the first source of knowledge, and on the basis of what is known about a phenomenon theoretically, a researcher can deduce one or more hypotheses. *Induction*, on the other hand, follows the logic of proceeding from empirical research to theoretical results. These two research logics or traditions are not, however, clear-cut alternatives, but many researchers use both induction and deduction in different phases of their study. This is often called *abduction* (Eriksson and Kovalainen, 2008, Modell, 2009). In practice, it may be difficult to dissect abduction from the iterative work taking place in all empirical research. That is why some researchers talk about a hermeneutic circle in much the same meaning (Eriksson and Kovalainen, 2008). However, in this thesis abduction is seen as a research logic between the two opposites, which offers an opportunity to modify the original framework successively, partly as a result of unanticipated empirical findings, but also of theoretical insights gained during the process (Dubois and Gadde, 2002).

Most research methods are based on either qualitative or quantitative methodologies. Qualitative methods involve collecting data that is mainly in the form of words, and quantitative methods involve data which is either in the form, or can be expressed as, numbers. However, it is sometimes difficult to distinguish quantitative and qualitative research from each other accurately, and they should thus be seen as complementary approaches (Hirsjärvi et al., 2009). This has raised interest in the mixed methods approach, which involves both quantitative and qualitative information (Creswell, 2003; Silverman, 2005).

There are many ways to categorize the research results. In this thesis, I use the categorization of e.g. Olkkonen (1993) into descriptive, normative and explorative research results. Descriptive research aims at describing the characteristics of the studied phenomenon and quantitative dependencies. Explorative research aims at increasing the understanding on the phenomenon, and normative research at recommending a way of acting.

Positivism is typically related to quantitative research, facts and large research data. In positivist research deductions from large congruent data sets are made, and descriptive results are often produced. Hermeneutics is involved in research on new fields without a vast material or opportunities for statistical analyses, in which it is difficult to form a single structured research problem. Its interpretive nature accepts certain subjectivity, and the results gathered are often explorative or qualitatively descriptive or normative (Hirsjärvi et al., 2008; Kasanen et al., 1991; Olkkonen 1993).

For example, natural sciences lean strongly on positivism, whereas humanities use a lot of hermeneutics-based research methodologies. The reality is not, however, so black and white, as positivism and hermeneutics rarely totally rule out each other in research. For example in business economics, these approaches alternate even within a same study (Olkkonen, 1993). The abductive reasoning and mixed method approaches in management research have gained attention among management scholars recently because of their potential to provide more credible results through interpretive logic, and at the same time an opportunity for more multifaceted theoretical reasoning leaning on the positivist logic (e.g. Creswell, 2003; Modell, 2010). A suggestive representation on the research philosophies and the research approaches related to them is presented in Figure 5.

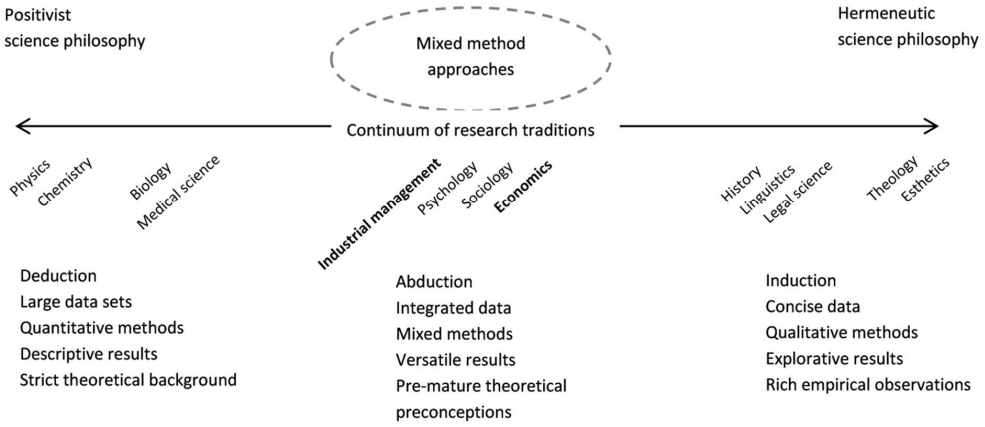



Figure 5: Research approaches in the continuum of research traditions (adapted from Hirsjärvi et al., 2008; Kasanen et al., 1991; Olkkonen, 1993; Modell, 2010)

Business and management research is applied research, which aims at both a theoretical and a managerial contribution (Vafidis, 2002). There are some research approaches which have been typically used in business and management research. Neilimo and Näsi (1980) have developed a framework for business research categorization with two dimensions: theoretical-empirical and descriptive-normative. The original framework included four categories of research: conceptual, nomothetical, decision-orientated and action-orientated research. Kasanen et al. (1993) have added a fifth category to the framework: constructive research. The extended framework is presented in Figure 6.

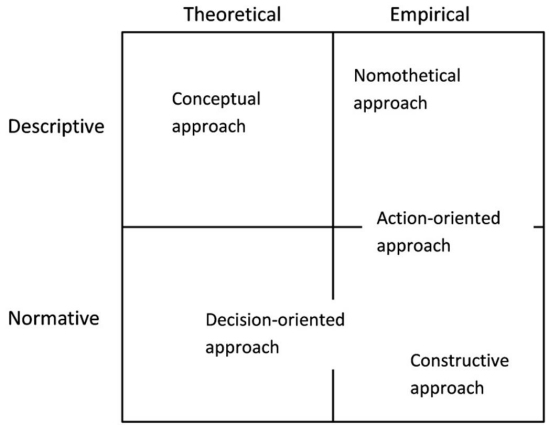



Figure 6: Framework for business research categorization (Neilimo and Näsi, 1980; Kasanen et al., 1993)

In the framework, theoretical research means reasoning. Theoretical knowledge is prior knowledge that is observable without experiment. Empirical research means that the data is collected in the field or in a laboratory. As already discussed above, in descriptive research the emphasis is on describing, explaining and forecasting "what is" and "how is". Normative research, on the other hand, is target-oriented, aiming at recommending a way of acting in practical situations (Lukka, 1991; Olkkonen, 1993).

*1)* The *conceptual approach* is mainly based on existing concepts and their analysis, and analysis and synthesis are used to create new concepts and frameworks. The research findings may be mere statements or recommendations by nature. There are no clear rules on how the research must be performed (Neilimo and Näsi, 1980; Vafidis, 2002).

*2)* The *nomothetical approach* can be characterized as a causal and analytical approach in generating ideas and assuming relationships. Usually, a hypothesis is put forward and tested with empirical evidence, using e.g. different scales and methods for measuring. The explanation of the findings is central but understanding is not a major concern. The approach highlights the objectivity of the researcher (Neilimo and Näsi, 1980; Vafidis, 2002).

*3)* In *decision-oriented research*, the emphasis is on building a model that solves a certain type of problem under certain conditions. Mathematics and logic are used for making

selections in the model. Observations from the environment are ignored, and empirical evidence is not important (Neilimo and Näsi, 1980; Vafidis, 2002).

*4)* The *action-oriented approach* leans strongly on hermeneutics. The role of empirical data is central, and empirical evidence is examined by informal but versatile methods. The approach assumes the human to be intentional, and thus accepts subjectivity. The results are often multi-level conceptual frameworks that are used to analyze or plan the surrounding world (Neilimo and Näsi, 1980; Vafidis, 2002).

*5)* The fifth approach, *constructive research* aims at building a solution construct, based on theoretical knowledge and the research process itself. The researcher and his research project affect the setting and the development of the research material – thus, results from the previous stages as well as the researcher himself become part of the data of the research. The role of the researcher is thus highly subjective (Kasanen et al., 1993; Vafidis, 2002). To be accurate, the solution to the problem should be linked with earlier knowledge, its novelty and functionality should be demonstrated, and moreover, the construction should be validated in a real-life context, i.e. the marketplace, by using weak and strong market tests (Kasanen et al., 1991).

As stated above, combining quantitative and qualitative methods is typical in the business and management research field. Both quantitative and qualitative research have some typically used research methods, which are listed in Table 1.

Table 1: Examples of quantitative and qualitative research (adapted from Eriksson and Kovalainen, 2008; Myers, 2013)

| **Quantitative research: focus on numbers** | **Qualitative research: focus on text** |
|---|---|
| Surveys | Action research |
| Laboratory experiments | Case study research |
| Simulation | Ethnography |
| Mathematical modelling | Grounded theory |
| Statistical analysis | Discourse analysis |
| Econometrics | Narrative |

In addition to combining quantitative and qualitative methods, a researcher can mix several other elements in a study, also within quantitative and qualitative researches. This basic idea that more than one thing can be done in a single study, is called triangulation (e.g. Denzin, 1978; Myers,

2013). It may feature throughout the research or only at the analysis phase (e.g Jonsen and Jehn, 2009).

The initial objective of triangulation was the confirmation of findings in order to increase validity and objectivity. More recently, triangulation has been used to increase the completeness of the data and comprehensiveness of the study (Jonsen and Jehn, 2009). According to Myers (2013), it offers a way to look at the same topic from different angles and provides a fuller understanding of the phenomenon.

Denzin (1978) has categorized triangulation into four types:

- *Data triangulation*, in which the same problem is tried to be solved by analyzing various data sources
- *Theoretical triangulation*, which involves the use of more than one theoretical perspective in interpreting the data
- *Investigator triangulation*, which means that the data is collected and analyzed by several researchers
- *Method triangulation*, which involves the use of several different research methods.

Method triangulation and mixed method research are sometimes considered as synonyms in the literature. However, this thesis follows the definitions of e.g. Creswell (2003) and Creswell and Plano Clark (2007) for mixed methods, and considers it more widely as a research approach which includes different strategies for collecting and analyzing quantitative and qualitative data, interpreting the combined data and reporting the research results as a single unity or as a multi-method research.

### 4.2 Case study research

As case study research is the main research strategy used in the thesis, it is reasonable to have a closer look at it.

A central feature of case study research is the construction of a case or several cases. The main purpose is to investigate the case in relation to its historical, economic, technological, social and cultural context (Eriksson and Kovalainen, 2008). Eisenhardt (1989, p. 534) describes case study as "a research strategy which focuses on understanding the dynamics present within single settings". Yin (2003) describes case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident.

Case study is probably the most popular research strategy used in business disciplines. Myers (2013) sees two basic reasons for this. First, a well-written case, even of a well-known firm, represents a real story that many researchers and other firms can identify with and increase their understanding on dealing with issues of current importance. Second, it allows researchers to explore or test theories within the context of complicated real-life situations.

Halinen and Törnroos (2005) see case study research as most suitable for the study of business networks for several reasons. First, it can provide a many-sided view of a situation in its context. It thus gives an opportunity to put objects (e.g. firms) in relation to the environment where they operate and use their abilities. It also offers an opportunity to study one or a small number of business networks, where multiple sources of evidence are used to develop a holistic description of the network. Moreover, it is a strong strategy for studying change processes, as it allows the study of contextual factors and process elements in the same real-life situation. In general, case study is a good strategy when the researcher has clearly identifiable cases with boundaries and when he seeks to provide in-depth understanding of the cases or a comparison of several cases (Creswell, 2007).

Stoecker (1991) suggests that there is a key difference between intensive and extensive case studies. Intensive case research focuses on finding out as much as possible on one or a few cases. It aims at understanding a unique case or cases from the inside by providing a thick, holistic and contextualized description. Extensive case study, on the other hand, aims at mapping common patterns and properties across cases (Eriksson and Kovalainen, 2008). A more detailed categorization of case studies has been presented by e.g. Creswell (2007) and Silverman (2005). In their viewpoint, the nature of a case study can be:

- Instrumental: the researcher focuses on an issue and then selects a bounded case to illustrate it
- Collective: one issue is selected to be researched, but multiple cases are selected to illustrate it
- Intrinsic: the focus is on the case itself, because the case presents an unusual or unique situation.

When comparing the two categorizations, it can be seen that the intensive case research in Stoecker's (1991) views is near to the intrinsic case research defined by Creswell (2007) and Silverman (2005). Moreover, extensive case study has the same traits as instrumental and especially collective case research. In this thesis, the latter categorization is used, because by it the special characteristics of the single publications can be brought out better.

Naturally, case study research has disadvantages as well. First of all, it can be difficult to gain access to a particular firm or group of firms one would like to study, because firms may be skeptical of the value they would gain from the research. Another disadvantage is that the researcher has no control over the situation – if the firm under research closes down or becomes

sold to another firm, there is quite little the researcher can do. Moreover, it may be difficult to focus on the most important issues, and the researcher might end up with a huge amount of data with little use for the final analysis – or on the other hand, concentrate too much on a single viewpoint. Last, case study is time-consuming, as it takes a long time to gain access to the target, to do the empirical research, and especially to do the write-up (Eriksson and Kovalainen, 2008; Myers, 2013).

Although case study is often considered to be a common method for a qualitative inquiry (see Table 1), it does not have to be exclusively qualitative, it can include quantitative elements as well (e.g. Creswell, 2007; Stake, 2000). This means that case study research should be understood more as a *research strategy* rather than a single method. There is hardly any limit on the empirical data used in case study research. Thus, also the methods of analysis vary considerably depending on the purpose and aims of the study and the more specific research questions (Eriksson and Kovalainen, 2008). This comes up in this thesis as well, as numerical and verbal data are combined and analyzed by quantitative and qualitative methods.

## 4.3 Empirical data collection and analysis

Case study research leaves a lot of freedom to the researcher. As stated, there are hardly any limits for which kind of data can be used or how it is analyzed. The thesis capitalizes on this characteristic, and uses different sources of data by different analyzing methods. Although the study uses mainly qualitative methods, the empirical study utilizes quantitative data and analysis as well, and can thus be characterized partly as a mixed method study. The empirical data collection and analysis is introduced in detail below.

### 4.3.1 Data gathering by structured and semi-structured interviews

All the data used in the thesis has been collected by interviews. The majority of the data is qualitative, including the interviewees' views and opinions. However, quantitative data on e.g. farm and cattle sizes as well as biomass heating plant sizes and capacities has been collected in order to be able to assess the bioenergy opportunities better related to the actors' characteristics. According to Creswell (2003), collecting qualitative and quantitative data in one phase of the study can be called *concurrent triangulation strategy*, which is probably the most popular one of the six mixed method strategies.

Many qualitative interviews in business research fall into the category of guided or semi-structured interviews. It means that the researcher has a prepared an outline of the topics, issues

or themes, but he still has the possibility to vary the wording and order of questions in each interview. The materials are thus rather systematic, but the tone of the interview is conversational and informal (Eriksson and Kovalainen, 2008). In this thesis, this type of interview has been used in the first two publications.

Publications 3 to 5 are based on more structured interviews. When performing structured or standardized interviews, the researcher has a preplanned script and there is little flexibility in the wording or order of the questions (Eriksson and Kovalainen, 2008). This was experienced to be useful with publications 3 to 5, as it was important to be able to compare the biomass heating firms in a systematic manner.

### 4.3.2 Data analysis by qualitative and mixed methods

Most of the data is qualitative and also analyzed qualitatively. According to Puusa (2011), standardized analysis methods in qualitative research are difficult to identify, and usually the ways to deal with the data vary remarkably within qualitative studies. The qualitative analysis used in the empirical studies conducted in the thesis is maybe nearest to *content analysis*, as the data has been first rearranged into pre-determined, detailed categories before their interpretation (Myers, 2013; Puusa, 2011).

In publications 3 and 4, also integration of qualitative and quantitative methods in data analysis phase is utilized. There are numerous ways for doing this, as the type of the research has a great impact on the chosen design (Creswell, 2003). In the empirical study of publications 3 and 4, *data transformation* (e.g. Caracelli and Greene, 1993; Creswell, 2003) is used as the mixed method strategy. In these publications, qualitative data is quantified by giving them quantitative measures. These measures are then used in forming a typology of networking tendencies, and in publication 4, additive analysis of resources, which are again analyzed qualitatively.

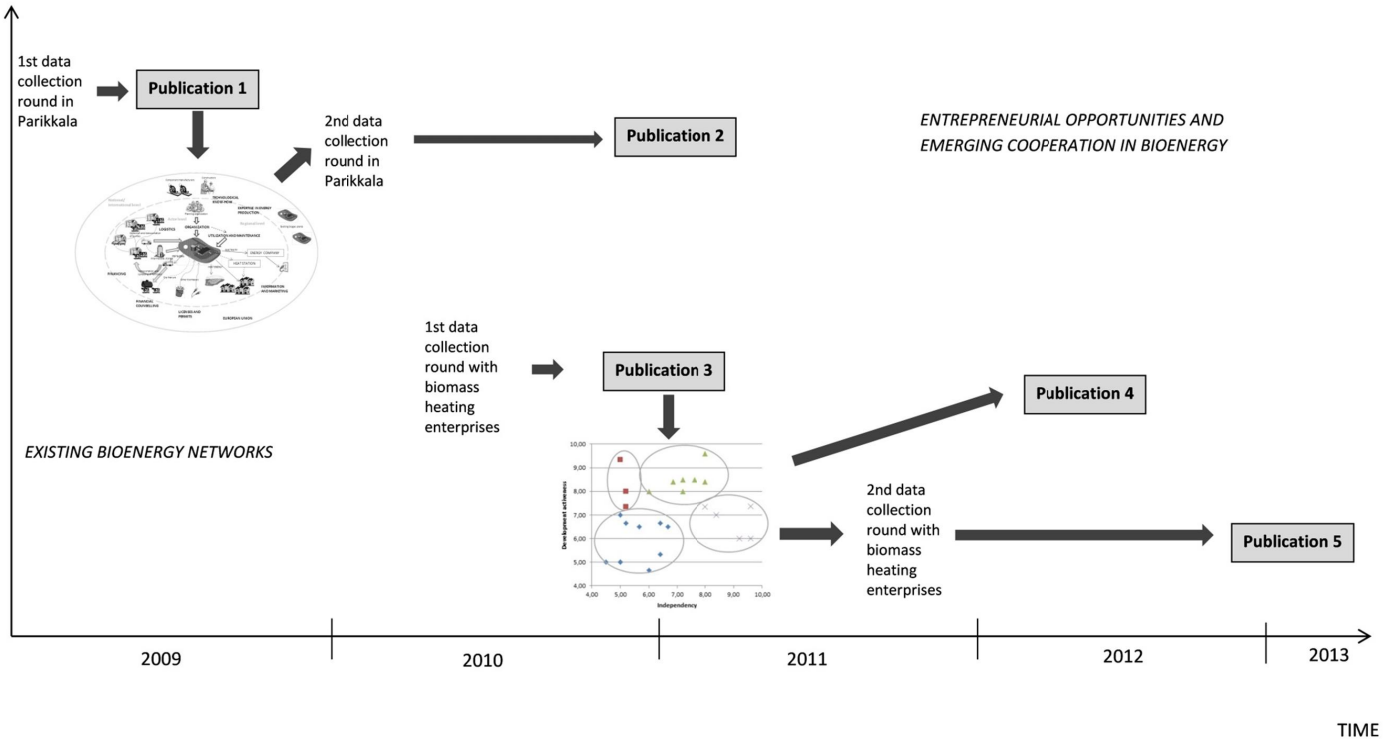
### 4.3.3 Data collection and publications in a timeline

The empirical research material used in the thesis consists of two separate research data. The first data, utilized in the two first publications, was gathered in two rounds during the year 2009. In the first round, the data was collected by semi-structured theme interviews with 13 cattle breeders in Parikkala, a rural municipality in Eastern Finland. The sampling of the interviewed breeders was made in order to include dairy cattle, beef cattle and pig breeders evenly, with different livestock and farm sizes and with locations covering the municipality area as well as

possible. In the second round, three additive interviews were conducted, targeted at persons and parties surrounding the primary producers interviewed in the first round. All the data was gathered by the author herself. The author also planned the interview themes and questions and drew a summary picture of the first research results, based on which the interviews in the second round were conducted.

The second data, utilized in publications 3 to 5, consists of two data collection rounds as well. Investigator triangulation was used, as the data was gathered by researchers who did not take part in the write-up phase. The author took part in the planning phase of the interviews but not in the interview phase. In the first round, 26 biomass heating entrepreneurs were interviewed during the year 2010. The sample included biomass heating firms from all over the country and with different plant capacities. The second interview round was conducted in 2011, again by a new researcher. It concentrated on investigating 7 of the 26 biomass heating firms more thoroughly. Figure 7 introduces the timeline of the data collection rounds and the interconnection of the publications.

Figure 7: Data collection and publications in a timeline



### 4.4 Summary of the research approach and methodological choices of the thesis

Based on the viewpoints discussed above, the research approach and the methodological choices made in the thesis are introduced next.

When looking at the continuum of research traditions (see Figure 5), the thesis, as the majority of business and management research, can be seen to locate somewhere in the middle of the continuum. As the first two publications are strongly empirically-driven and give a more subjective role to the researcher, they lean a bit more on hermeneutics than positivism. In general, it can be seen that the thesis is abductive by its research logic. The first two publications are more inductive by their logic, as the frameworks formed in the studies are driven by the empirical research. Especially the latter three publications use abduction as they aim to form tools and frameworks based both on empirical research and a theoretical background.

The research data of the thesis is for most part qualitative, but also quantitative data (e.g. basic data of farm and cattle sizes, and sizes and output of biomass heating plants) is used in order to strengthen the qualitative material. The research design is mainly qualitative, and *case study research* is used as the research strategy. However, publications 3 and 4 combine qualitative and quantitative research, and in these publications, numerical assessment is used for gathering the characteristics of biomass heating firms. In general, different frameworks and tools have been formed in order to give proposals to analyze and outline the complex field of bioenergy, and thus the thesis offers normative results, but also a lot of explorative results. A general view of the research approach of the thesis is presented in Figure 8.

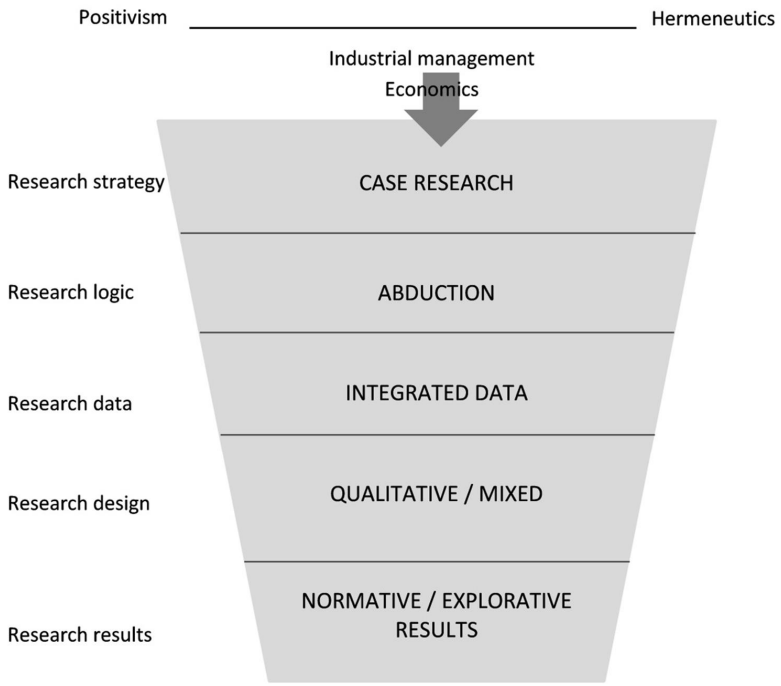



Figure 8: The research approach of the thesis in general

As the publications have some gradation in their research approaches, it is reasonable to look at the single publications more thoroughly as well. Thus, a more detailed view of the research approaches and their location in the framework of business research categorization put forward by Neilimo and Näsi (see Figure 6) is presented next. Moreover, the triangulation used in each publication is also discussed. In Table 2, the research approaches of the publications are gathered together, and then they are discussed in detail.

Table 2: Research approaches of the publications

| Publication | P1 | P2 | P3 | P4 | P5 |
|---|---|---|---|---|---|
| **Research logic** | Induction | Abduction | Abduction | Abduction | Abduction |
| **Research data** | Concise | Concise | Integrated | Integrated | Concise |
| **Research design** | Qualitative | Qualitative | Mixed | Mixed | Qualitative |
| **Data collection method** | Theme interviews | Theme interviews | Theme interviews | Theme interviews | Theme interviews |
| **Data analysis method** | Content analysis | Content analysis | Content analysis, data transformation | Content analysis, data transformation | Content analysis |
| **Research strategy** | Instrumental case study | Intrinsic case study | Collective case study | Collective case study | Collective case study |
| **Research results** | Explorative | Normative, Explorative | Explorative | Explorative | Normative, explorative |
| **Research approach in detail** | Action-oriented | Constructive | Constructive | Constructive | Constructive |
| **Triangulation** | | Data | Data, theoretical, investigator, method | Data, theoretical, investigator, method | Theoretical, investigator |

Publication 1, “Enablers and barriers of cooperative bioenergy production in the countryside: a case study” uses induction as the research logic as it is mainly empirically-driven: on the basis of the empirical study, a more detailed division in actor-related, regional and national/international enablers and barriers could be made. The data is rather concise, as it consists of 13 semi-structured theme interviews of a selected group of interviewees. The study is qualitative, using theme interviews in data gathering and content analysis in interpreting the results. The study can be characterized as an instrumental case study: it focuses on cooperation around bioenergy and selects a bounded case, cattle breeders in Parikkala, to illustrate it. The results are explorative as they aim to increase understanding on the enabling and hindering factors for bioenergy cooperation. When looking at the framework of Neilimo and Näsi (see Figure 6) closely, it can be seen that there is some inconsistency with the results and the research approach, which I see mostly as action-oriented. Despite the explorative results, the publication has many traits typical for action-oriented research: the role of empirical data is central, and a conceptual framework, division in three environmental levels, is formed in order to analyze the phenomenon.

Publication 2, “Preconditions for regional networked bioenergy production” is more abductive by nature: the conceptual framework formed in the first publication is strengthened by a theoretical background in order to increase understanding on the chosen phenomenon: networking around biogas production. The data is concise, as it consists of the results of the 13 interviews conducted for the first publication and three additional interviews. The research design is qualitative by nature, using theme interviews in data gathering and content analysis in interpreting the results. The study can be seen as an intrinsic case study: the focus is on a single case - a biogas production project and the surrounding network, and better understanding is sought through it. The results are normative in the sense that a detailed framework for analyzing the preconditions related to a networked bioenergy project is constructed. However, the study also offers explorative information on the studied phenomenon. The research approach is constructive in general, as the results of the previous step (first publication) have had a great impact on the setting of the research. The construct, a framework of the preconditions, is based on theoretical knowledge as well as the research process itself. The study uses data triangulation, as it combines the results of the first publications with new data gathered in the second interview round.

Publication 3, “Networking of biomass heating enterprises – a two-dimensional approach” also follows the abductive research logic: it uses deduction and induction side by side. The analysis framework formed, i.e. the categorization of networking tendencies, is a construction of views from theoretical discussion and empirical observations. The data consists of numerical data of the firms under scope as well as 26 theme interviews. The research design is mixed for two reasons: it uses both qualitative and quantitative data, and qualitative and quantitative methods for analyzing the data. In general, the research strategy can be characterized as a collective case study, as multiple cases, 26 biomass heating networks, have been chosen to illustrate a case of networking tendencies. The role of the researcher is rather subjective, as the quantitative assessment, which forms the basis for the verbal analysis, has been made by the researcher herself. The results are mainly explorative by nature, as they aim to increase understanding on the different actor-driven factors which have an impact on networking. In addition to data and method triangulation, the study uses theoretical triangulation, as it combines several theoretical frameworks, as well as investigator triangulation, as the data has been gathered and analyzed by several researchers.

Publication 4, “An impact of resource portfolio on networking tendencies – evidence from bioenergy business” continues the work of the third publication by taking an additive element to the examination: the actors’ resources. It uses integrated data and mixed design as well, as it adds numerical and verbal assessment of resources to the construction made in the third publication. The research strategy is a collective case study, as the same 26 case networks are utilized for illustrating the interconnection of networking tendencies and resource portfolios. The results are explorative by nature. The research approach is considered as constructive, as the former steps of

the research play a central role in the formation of the following steps. Moreover, the researcher has a central role in the quantitative assessment, based on which the final results are formed. Triangulation is used in the data sources, theoretical frameworks, investigators and methods.

Publication 5, “Networks within networks – interaction in bioenergy business” is the most deductive one of the publications. However, I wouldn’t characterize it as merely deductive, but an abductive one which first uses deduction from the theoretical background and then induction from empirical observations. However, theoretical frameworks play a central role, and based on them, an empirical study is conducted in order to form mainly normative results on how to analyze actor networks and single relationships in them. The research data is concise, as it consists of 7 theme interviews with a chosen group of biomass heating entrepreneurs. The research design is qualitative, and the research strategy can be considered as a collective case study: it introduces 7 cases via which the studied phenomenon: characteristics of relationships and networks, is illustrated. The results are partly normative, as the study offers a two-level framework for network analysis. Moreover, it produces explorative results. The research approach is again constructive, as a construction of the theoretical background and empirical observations is formed. The study uses theoretical triangulation, as it combines two theoretical frameworks, and investigator triangulation, as the data has been gathered and analyzed by different persons.

## 5 SUMMARY OF THE PUBLICATIONS AND FINDINGS OF THE STUDY

This part of the thesis presents the main objectives and central results and contributions of the five publications. After that, the five research sub-questions are answered and the main findings of the empirical research are summarized.

### 5.1. Presentation of the publications

To clarify the interconnection of the theoretical views and the publications of the thesis, the linkages between the discussed theories and the publications are presented in Table 3. The columns are not named directly according to the headlines of the theoretical parts, but the three main themes in the theoretical discussion have been chosen to form the names for the columns. The sizes of the symbols in the table cells illustrate the strength of the linkage between the publication and the theoretical theme: for example, publication 1 is more closely linked to the Drivers, motives and preconditions than the Interconnection of actors, activities and resources.

Table 3: Linkages between the theoretical context and the publications

| | **Drivers, motives and preconditions for cooperation** | **Interconnection of actors, activities and resources** | **Diversity of relationships and networks** |
|---|---|---|---|
| **Publication 1:** *Enablers and barriers of cooperative bioenergy production in the countryside: a case study* | √ | √ | |
| **Publication 2:** *Preconditions for regional networked bioenergy production* | √ | √ | |
| **Publication 3:** *Networking of biomass heating enterprises: a two-dimensional approach* | | √ | √ |
| **Publication 4:** *An impact of resource portfolio on networking tendencies - evidence from bioenergy business* | | √ | √ |
| **Publication 5:** *Networks within networks - interaction in bioenergy business* | | √ | √ |

Next, the main objectives and findings of the five publications are introduced briefly.

**Publication 1: Enablers and barriers of cooperative bioenergy production in the countryside: a case study**

*Objective*

The objective of the first publication was to increase understanding on the factors affecting the seizing on bioenergy production opportunities, and especially cooperative activities around these opportunities. The paper clarifies the possibilities and challenges of cooperation and networking in bioenergy, especially from the viewpoint of small actors in the countryside. The paper examines these aspects with a case of livestock breeders in a traditional Finnish rural municipality.

The paper has three primary research problems which are linked to each other: "What areas of biomass utilization are seen as the most potential?", "What kind of cooperative activities can be related to these areas?" and "What are the major enablers and barriers of the environment for these cooperative activities?"

*Results and main contribution*

On the basis of the empirical study, the biggest potential for cooperation in rural areas was seen in animal manure, forest biomass and agrobiomass utilization. It was noted that there are many factors among the actors as well as in the surrounding environment that have either a positive or negative effect on the formation and nature of cooperation. These 'enablers' and 'barriers' were seen to exist at three different levels in which the actors are embedded: actor level, regional level, and national and international levels.

Because of its novelty and fast-developing character, the bioenergy sector is seen to be strongly affected by institutional factors at the national and international levels, such as economic and social questions, environmental policy, legislation and ecological questions. However, in addition to the institutional environment, the paper examines the actor and regional levels in order to increase understanding on the multifaceted environment which affects the decisions of the actors. The paper highlights the viewpoint of small actors and proves that business opportunities are not restricted solely to large-scale projects, but the opportunities of smaller-scale bioenergy cooperation should also be taken seriously.

**Publication 2: Preconditions for regional networked bioenergy production**

*Objective*

The second publication continues the analysis made in the first publication. As the case, a possible biogas plant concept in a rural municipality was chosen for more thorough examination. The objective was to examine more deeply the factors which need to be taken into account when an entrepreneurial network is built around a new technological concept - in this case, bioenergy. In addition to the views of primary producers, views of some regional and institutional actors were also gathered by a few additional interviews. The paper clarifies the preconditions in three environmental contexts: social context, regional context and institutional environment.

The central research questions of the paper are: "What are the main preconditions for a regional biogas production network?", "Which of these preconditions seem to be the most challenging ones?" and "How can the preconditions be fulfilled?"

*Results and main contribution*

The empirical analysis revealed the most essential preconditions for the development of bioenergy production networks, and also ones which seemed to be the most challenging to fulfill. The results mainly reflected the previous views on the main institutional inhibitors for bioenergy production development, such as profitability, financial support, market infrastructure and legislation. Interesting observations on regional and social factors were made, and the actors' embeddedness in social and regional contexts approved to be a remarkable issue in the development of regional business networks. The analysis revealed the most challenging preconditions, but also offered solutions on how they can be fulfilled. In all, the paper gives a positive signal for the actors to seize the business opportunities offered by bioenergy. Especially, despite of the noted limitations of the actors' embeddedness in social and regional contexts, a vast potential was seen on regional networks capitalizing on their unique resources, competences and know-how.

In general, the paper forms a basis to the analysis which should be done when planning to build new regional networks around certain businesses. The paper offers a useful ground for similar bioenergy projects, which can be expected to increase in the near future.

**Publication 3: Networking of biomass heating enterprises – a two-dimensional approach**

*Objective*

The third publication aims at widening the knowledge on how the actors balance between embeddedness and independency, and furthermore, between private and public goods in their relationships. Moreover, the paper examines how the actors' balancing between embeddedness and independency, and on the other hand, their willingness and ability to share social capital (i.e. associability), reflect on the networks they tend to form. As the case, a group of Finnish biomass heating enterprises was studied. The research question of the paper is: "What kind of networks do the biomass heating entrepreneurs tend to form, and how do these networks differ in terms of independency and associability?"

*Results and main contribution*

The paper provides evidence for the fact that depending on the set objectives for the levels of independency and associability in their relationships, firms tend to form different networks. On the basis of the empirical analysis, four certain tendencies of networking could be found. According to these four tendencies, the biomass heating enterprises were categorized in four groups: 1) Actors in local networks of equal partners, 2) Actors with strong relationships with heating system manufacturers, 3) Network developers/lead firms and 4) Independent actors. These groups differed from each other by the power relations of the actors, the openness of sharing social capital, and the willingness for network development.

On the basis of the study, it could be noted that forming business networks depends on the aims of the actors, e.g. in terms of their willingness to stay independent and to maintain a certain level of power and freedom, as well as their willingness to form common goals with their counterparts. Although these aims are not the only ones the firms have, they were seen as highly remarkable ones based on the literature, as well as the empirical analysis. It is concluded in the paper that different networking tendencies should be taken into consideration when planning networked businesses - even though some firms may seem as optimal partners because of their business field or technical prospects, they may have totally different aims for networking than expected. These aims reflect their networking tendencies, and may even form barriers for cooperation.

**Publication 4: An impact of resource portfolio on networking tendencies – evidence from bioenergy business**

*Objective*

The fourth publication deepens the analysis of the third publication. In addition to an analysis of networking tendencies, the resource portfolios of the actors are looked at, and linkages between the actors' resources and their networking tendencies are searched. The four enterprise groups with different networking tendencies presented in the third publication were used as the basis for the study. The enterprises in these groups were further analyzed by their resource portfolios in order to increase understanding on their networking motives and strategies. The research question of the paper is: "How the resource portfolio of an actor correlates with its tendency to form networks?"

*Results and main contribution*

The study confirms that actors' different networking tendencies will lead to formation of different network types. Among the studied enterprises in the Finnish biomass heating field, four groups with different networking tendencies are recognized and assessed. It is illustrated that the actors differ remarkably in their bases of resources, and also that they highlight different aspects in their resource portfolios. This creates different motives for cooperation. On the basis of the empirical analysis, correlations between the actors' resources and their tendencies to form certain kinds of networks could be found. For instance, firms with basically small resource bases have primarily two diverging networking strategies – to lean on a more powerful firm or to ally with other small actors in order to gain negotiation power together. Correspondingly, firms with stronger negotiation position may lean on their own resources, or aim at strengthening their position further by active network development.

The paper provides evidence that success in any business field demands a certain level of cooperation. However, firms in the same industry may follow rather different networking strategies, which may all lead to success. The main contribution of the paper is a two-step analysis which offers knowledge on the actors' motives and tendencies to form relationships and networks. It is seen to help the actors, especially in fast-evolving business fields, to find suitable partners and that way develop their businesses better according to their objectives.

**Publication 5: Networks within networks – interaction in bioenergy business**

*Objective*

The aim of the fifth publication was to open up the complex entity of relationships and networks, especially from the viewpoint of SMEs. In the paper, two frameworks are combined into a practical two-level tool. Firstly, an actor's networks are categorized by their type. Secondly, a deeper look at the networks is taken, and single relationships in the networks are identified. Further analysis is then conducted on the design and governance, as well as establishment and maintenance of relationships. The paper answers questions about the types of networks in which a firm can act simultaneously, what kinds of relationships form these networks, and how the relationships with the partners differ within the same network.

In the study, seven of the Finnish biomass heating firms already interviewed for the third and fourth publication were chosen for more thorough examination. These firms formed the group called "Networking developers/lead firms" (see the results of the third publication), referring to their high activeness in network development and investment in cooperation. These firms were re-interviewed, and the two-level tool was utilized for analyzing their existing relationships and networks.

*Results and main contribution*

Based on the study, the firms were identified to have four kinds of networks: vertical, horizontal, collaboration and innovation networks. It was also noted that a firm can have operational, tactical and strategic cooperation at the same time in the same network. In addition, it was noted that the breadth and depth of relationships do not necessarily go side by side - a firm may cooperate in many activities with a certain partner but the depth of cooperation may stay at the operational level. Correspondingly, a firm may have strategic collaboration concentrated on a single small-scale activity.

The study confirms that SMEs can, and often need to, act simultaneously in different types of networks. In these networks, the firms may act with various partners, forming relationships that are different in breadth and depth. As all the activities do not require the same amount of involvement and close contacts, it is reasonable for firms to determine the specific activities upon which to build deep collaborative relationship, and which ones would be more effective as operational tasks. The main contribution of the paper is the specific framework for analyzing the complex entity of relationships and networks.

Table 4 gathers together the main content of each publication.

Table 4: The publications in brief

| | Publication 1 | Publication 2 | Publication 3 | Publication 4 | Publication 5 |
|---|---|---|---|---|---|
| **Title** | Enablers and barriers of cooperative bioenergy production in the countryside: a case study | Preconditions for regional networked bioenergy production | Networking of biomass heating enterprises – a two-dimensional approach | An impact of resource portfolio on networking tendencies – evidence from bioenergy business | Networks within networks – interaction in bioenergy business |
| **Objective** | To increase understanding on the enablers and barriers affecting the seizing of bioenergy production opportunities in cooperation. | To clarify the preconditions of a regional bioenergy network in three environmental contexts: social context, regional context and institutional environment. | To examine how the actors' balancing between embeddedness and independency and their associability reflect on the networks they tend to form. | To search linkages between the actors' resources and their networking tendencies. | To open up the complex entity of relationships and networks by using a practical two-level analysis tool. |
| **Theoretical perspective** | Entrepreneurial opportunities and their exploitation, actors' embeddedness, influence of institutional environment | Actors' embeddedness in social,regional and institutional contexts | Motives for networking, power and dependence in networks, actors' associability | Power and dependence in networks, actors' associability, resource-based view on networking | Network type analysis, relationship analysis, forms of cooperation |
| **Data and research strategy** | 13 interviews with livestock breeders, instrumental case study | 13 interviews with livestock breeders and 3 additional interviews with surrounding actors, intrinsic case study | 26 interviews with biomass heating entrepreneurs, collective case study | 26 interviews with biomass heating entrepreneurs, collective case study | 7 interviews with a chosen group of biomass heating entrepreneurs, collective case study |
| **Results** | It was noted that there are many factors among the actors as well as in the surrounding environment that affect the formation and nature of cooperation positively or negatively. These 'enablers' and 'barriers' were seen to exist on three different levels in which the actors are embedded. | The most challenging preconditions, and solutions on how they can be fulfilled, were found. Actors' embeddedness in social and regional contexts approved to be a remarkable issue. | Four certain tendencies of networking were found. According to these four tendencies, the biomass heating enterprises were categorized in four groups. | It was confirmed that actors' different networking tendencies lead to formation of different network types. It was illustrated that the actors differ remarkably in their resource portfolios. Correlations between these resource portfolios and actors' tendencies to form networks were found. | Firms were identified to have four kinds of networks. In these networks, the firms may act with various partners, forming relationships that are different in breadth and depth. |

### 5.2. Study findings

Each publication builds a path from an emerging entrepreneurial opportunity to a successful business network, and thus gives its contribution to the set research questions of the thesis. The interconnection of the research questions and the publications is presented in Table 5.

Table 5: The research questions and their links with the publications

| **Research sub-questions** | **Publications** |
|---|---|
| **Q1:** *What kind of factors may work as enablers or barriers for the cooperative exploitation of entrepreneurial bioenergy opportunities?* | 1, 2 |
| **Q2:** *Which preconditions are experienced to be critical for a network around an emerging bioenergy business opportunity, and how can these preconditions be fulfilled?* | 2 |
| **Q3:** *How do the differences in the actors' assets and objectives influence the relationships and networks they form?* | 3, 4 |
| **Q4:** *What kind of relationships and networks can the actors have simultaneously?* | 3, 4, 5 |
| **Q5:** *How should firms manage their different relationships and networks?* | 5 |

Next, the main results of the publications are discussed in order to answer the research questions one by one. Differing from the theoretical context, the results do not really take a stand on the recognition phase of the process, but they concentrate more on the process from an opportunity to a multifaceted bioenergy network. However, when looking at the central ways of opportunity recognition (see section 2.1), it can be deduced that bioenergy is related to all of them: emerging bioenergy opportunities can be found e.g. by observing greener energy trends, by solving technological problems related to energy production, and by finding gaps for renewable energy in the market. What should be kept in mind is that the actors' embeddedness in social, regional and institutional contexts has undoubtedly an impact on the opportunities which can be recognized in general, and on the decisions about which of the opportunities will end up in more profound consideration. For example, the opportunities opened for rural actors with few partners

are probably different than those opened for people in large cities with multifaceted partner networks.

**Q1:** ***What kind of factors may work as enablers or barriers for the cooperative exploitation of entrepreneurial bioenergy opportunities?***

Usually, bioenergy production is seen to be restricted by the institutional environment. There are many legislative and political factors which for one part enable the controlled development of new energy production technologies. However, for the most part, they are seen to slow down the development. The empirical study strengthened these views by finding numerous challenges for bioenergy projects at the national and even international level. However, differing from most research approaches to bioenergy, the issue was also examined through the actors' embeddedness in certain social and regional contexts and their impact on the exploitation of emerging bioenergy opportunities. These results revealed that in addition to institutional restrictions, the projects are affected by several actor-related and regional factors. It was noted that it should not be ignored at all among whom and in what kind of region the project is meant to be launched.

The results confirmed the former discussion on actors' motives for cooperation (see section 2.2). Several enabling motives for cooperation at the actor level, such as possibilities for employment and better income, risk and knowledge sharing, time saving and effectiveness, and attractiveness of teamwork were identified. The versatile know-how and prevailing entrepreneurial attitude of the actors involved were seen to encourage the development of cooperative projects.

However, the study also revealed several actor-related barriers for cooperative initiatives. It was noted that experiences from former and existing relationships and the characteristics of potential partners can have a remarkable influence on the eagerness for cooperation, positively as well as negatively. Prejudices and jealousy between the actors, which may be originally descended even from former generations, may still hinder the emergence of an open atmosphere and that way the emergence of cooperative projects as well. "I'll do fine by myself" is still heard to be said, and based on the opinions of the interviewees, rural actors can be divided roughly into two groups: those who seek for development opportunities actively and those who actively oppose them. A positive thing is, however, that the former group seems to be growing.

Regarding the characteristics of a rural region, the results confirm the claims made in the theoretical discussion (see section 2.3). Lack of know-how in planning and organizing the projects, low availability of workforce, as well as the long distances between the actors were observed as remarkable barriers for bioenergy cooperation. Thus, an active and supporting role of the municipality and authorities was widely demanded. However, the studied municipality and, more widely, rural areas were seen to have many positive enablers for cooperative bioenergy projects. The studied region was seen as strong in economic and geographical aspects,

and typically for a rural area, it was seen to be possible to gather the scattered biomass together in a way which would benefit every actor involved.

Especially in the case of a biogas plant, the impact of the national and international environment was highlighted. However, it should be noted that in the time the interviews were conducted, the feed-in tariff for biogas was still in preparation in Finland. For that reason, the ongoing high-spirited discussion in those days on the feed-in tariffs before their implementation was probably reflected also in the answers of the interviewees, and thus emphasized the importance of political decisions as barriers for the bioenergy business. However, the national and even the international environment undoubtedly have a meaningful role in the development of bioenergy business. It is said that the entrepreneurial opportunities related to biomass can be seen to be built up largely by the interaction of certain technological, social and political changes. This was confirmed in the empirical study, as political support, directions from the European Union, changes in energy prices, and definitions of energy policy were seen to have, depending on the project, both enabling and hindering aspects. Moreover, changes in the composition of society were seen as spurring factors towards cooperative activities and networking – networking has become an everyday phenomenon. The central enablers and barriers found in the empirical research are introduced in Table 6.

Table 6: Enablers and barriers for cooperative bioenergy initiatives

| | **ENABLERS** | **BARRIERS** |
|---|---|---|
| **ACTOR LEVEL** | Employment and better income | Prejudices |
| | Risk sharing | Jealousy |
| | Know-how and knowledge sharing | Bad experiences from former relationships |
| | Time saving, effectiveness | Unpleasant characteristics of the partners |
| | Attractiveness of teamwork | |
| | Entrepreneurial attitude | |
| | Good experiences from former relationships | |
| | Pleasant characteristics of the partners | |
| **REGIONAL LEVEL** | Active role of the municipality | Lack of know-how in planning and organizing |
| | Vast biomass potential | Long distances |
| | Economic and geographical conditions | |
| **NATIONAL/ INTERNATIONAL LEVEL** | Changes in the society | Lack of political support |
| | Political support | Restricting directions from the EU to biomasses |
| | Supporting directions from the EU to bioenergy | Changes in energy prices |
| | Changes in energy prices | Restricting definitions of energy policy |
| | Supporting definitions of energy policy | |

In sum, the enablers and barriers at all the three levels, the actor level, regional level and national/international levels should be taken into account when planning cooperative business projects. Even though a project would seem perfect from e.g. economical or technical aspects, the views on the success of the project in the region or among the actors may be rather different. Although the study concentrates on this issue in bioenergy, the results can be generalized to reflect the enablers and barriers of other cooperative business projects as well. The emphasis and contents of the levels may certainly be different, as for example the regions can differ remarkably by their characteristics. However, with every emerging business opportunity, these levels exist.

**Q2:** ***Which preconditions are experienced to be critical for a network around an emerging bioenergy business opportunity, and how can these preconditions be fulfilled?***

Based on the observed three levels with different enablers and barriers for cooperation, several preconditions for networked bioenergy production in social, regional and institutional contexts were identified. As the studied case was a biogas plant concept in a rural region, some aspects essential for biogas production, such as political decisions and legislation on waste treatment, were highlighted in the results. However, the formed framework fits any bioenergy project well, because all projects have certain preconditions in all the three contexts.

The preconditions in the institutional context are tightly connected to political and legislative factors. The study confirmed the prevailing opinions about problems with legislation and permits. The needed permits are numerous, and the legislation concerning energy production and the utilization and handling of feed material, as well as the construction and security of the plant is rather complicated, especially from the viewpoint of primary producers. For example, regulations at the EU level related to animal manure utilization made the interviewees pensive:

*"Everybody is talking about renewable energy in national and European institutions, but the deeds don't always support the words. For example, manure is categorized as toxic waste, and burning and using it seems quite difficult". [free translation of an interview in Finnish]*

However, it was believed that the difficulties related to regulations and permits could be solved in cooperation.

The main institutional inhibitor seemed to be the supposed unprofitability of electricity production – although the feed-in tariff system for biogas was put in operation in Finland in 2010 (Finlex 2010), it still does not support the smallest plants, as the required nominal output for the plants is 100 kVA. However, the smaller plants, which are not entitled to the feed-in tariff system, can be supported by investment funding. Practically, biogas projects thus have two options to ensure profitability: either build a plant adequate in size for the feed-in tariff system and sell the produced electricity to the power-distribution network, or build a smaller plant, apply

for investment funding and use the produced electricity for their own purposes. Although biogas production would not be a single source of income for any farm, the actors are not willing to take excessive financial risks – thus, cooperative projects seem reasonable also from the financial viewpoint.

Somewhat surprisingly, the procurement of the needed production technology and construction was not seen as a problem. The results indicated that bioenergy technologies are rather easily accessible, although their procurement demands remarkable investments, and a minority of the actors would be able to conduct the project by themselves. Thus, the cooperative approach is a prerequisite for an economically reasonable project. In addition, financial counseling was experienced to be easy to get.

The regional context is not without problems either. The study indicated that even though there existed a lot of unused biomass potential in a certain region, its effective utilization would not be straightforward. The examination of the biogas plant concept raised many challenges related to the location and organization of the plant, use of the produced energy, as well as the transportation of feed materials and residues.

As stated above, rural regions are characterized by long distances and rather scattered location of actors. The challenge is to develop a centralized transportation system with reasonable costs. Along with the increasing prices of energy, the opportunity for electricity production raises everybody's interest. Especially among livestock breeders, the need for heat energy for their own purposes is however limited. Ideas about farm-specific plants or plants integrated to district heating network were expressed, and several options for the organization of the plant were seen to be possible. However, even though these questions were solved successfully, there may still remain an obstructive element: resistance from the environment.

*"In many regions, there would exist potential for this kind of projects, but the location of the plant may become a problem. If I announced that I will build a small plant on my farm, I don't think it would interest anybody very much. But if I announced that I will start a company and build a plant near to the center of the municipality, I'm sure it would raise numerous negative thoughts." [free translation of an interview in Finnish]*

This is how one of the interviewees described the prevailing attitude. The persuasion of local people via information and marketing was seen as a key factor for the success of the project. The juxtaposition of traditional agriculture and new ways of living is still strong in rural regions, and the local people may not become easily convinced with the positive impacts of the project. The key factor in the social context, however, is the executors starting and conducting the project. The actors need to be encouraged to get involved – many of them are interested in new business opportunities, but a step into an unfamiliar area may seem hard to take. A summary picture of the main preconditions is presented in Figure 9.

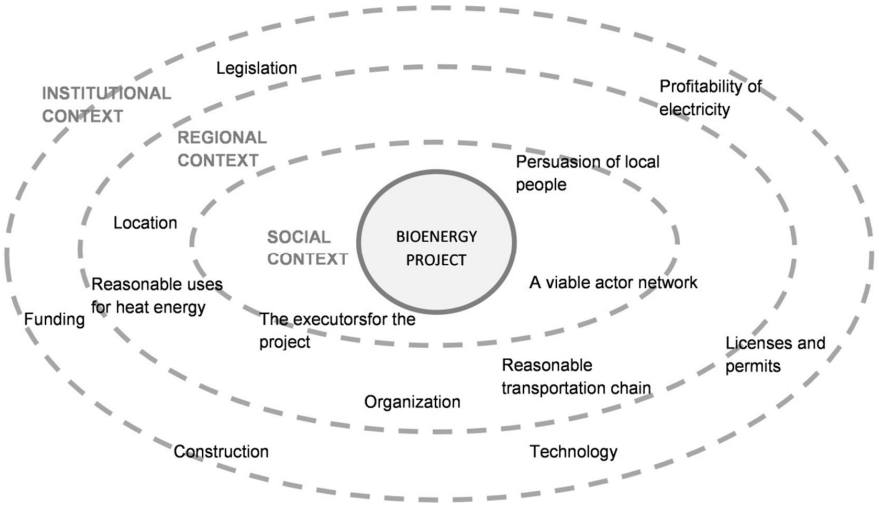



Figure 9: Critical preconditions for a bioenergy project

In sum, it can be stated that in any of the three contexts, there are preconditions which may turn out to be either favorable or unfavorable for a cooperative bioenergy project. At worst, they may even lead to rejection of the project. Institutional or regional factors may prove the project to be unprofitable or too difficult to be executed. Moreover, however carefully the project is planned, it will not succeed without a viable actor network around it. In all, the future of bioenergy projects seems however positive – there are several options for execution, and also several biomass options to use. The key is to find a concept which suits the set preconditions. For this, the study offers a profound approach.

**Q3:** ***How do the differences in the actors' assets and objectives influence the relationships and networks they form?***

The findings of the first research data indicated clearly that cooperation is seen as a necessity in bioenergy projects. The bioenergy actors are often small in size, and it is expected that none of them will be able to engage in business on their own. However, the network should be formed in a way that benefits all the parties involved in the best possible way – thus, all the relationships cannot be identical.

How the relationships are formed as a certain type is not a game of chance, but they are strongly influenced by the actors themselves. This was studied by the actors' balancing of the opposite objectives for independency and embeddedness. As the theoretical study concentrated on

examining inter-firm cooperation mainly via resource-dependency theories, the resources were foregrounded as the most meaningful motive for cooperation. Via cooperation, the actors aim at resources they do not possess on their own, and that way persuasion and negotiation power in the business. At the same time they try to avoid excessive loss of power and freedom to act according to their own objectives. This causes a need to balance between embeddedness with the partners and on the other hand, independency from the partners. The actors balance these aims differently, which causes the birth of different business relationships.

Moreover, any business relation is a social contact which requires for social capital to be shared between the partners to some degree. However, this degree varies as the actors have differing aims for balancing their private goods and the public goods of the network. This was discovered to produce different levels of willingness and ability to form collective goals, i.e. different levels of associability among the actors.

The general view of the actors' independency was formed by examining the firms' ownership bases, business activities, fuel procurement chain, network structure and their roles in the networks, independence from the HSMs, and distribution of work in maintenance and repair. This examination revealed rather different levels of independency among the biomass heating entrepreneurs. The scope of associability was formed by the number of developmental activities, willingness to cooperate, experienced opportunities and challenges of cooperative networks, and future plans.

By examining the actors' independency and associability, a two-dimensional framework for categorizing the firms by their networking tendencies could be formed. With the framework, four different groups with different networking tendencies could be easily identified. In addition, the examination of the actors' resource palettes revealed certain resource-driven motives for networking which correlated well with the networking tendencies.

In sum, actors with smaller physical resource bases are naturally more dependent on the other actors. It was noted that the first type of actors (1), named *Actors in local networks of equal partners*, ally themselves with other small actors in order to form a network of partners with mutual dependence. The second type (2), *Actors with strong relationships with HSMs*, have, despite of the small size, strong experience and know-how, which they utilize in order to ally with partners with strong physical resources, in this case heating system manufacturers. Because of the uneven relation of physical resource bases, the relationships they form are characterized by unbalanced dependence.

Actors with wider resource palettes also seem to have two diverging strategies to network, and they thus form the two latter groups. The third group (3), *Network developers/lead firms*, invest in network development, and especially aim to gather and share social capital in the networks. They thus have a high level of associability and mutual dependence between the partners in their relationships. In addition, high level of trust is expected. At the opposite side are the (4) *Independent actors* who aim to be as independent as possible. They possess strong inner resources, and form short-term partnerships in operational tasks if needed. The partnerships they tend to form are characterized with mutual independence, and they do not demand high level of trust between the partners. Figure 10 depicts the formation of networking tendencies and categorization of the studied firms by the different networking tendencies.

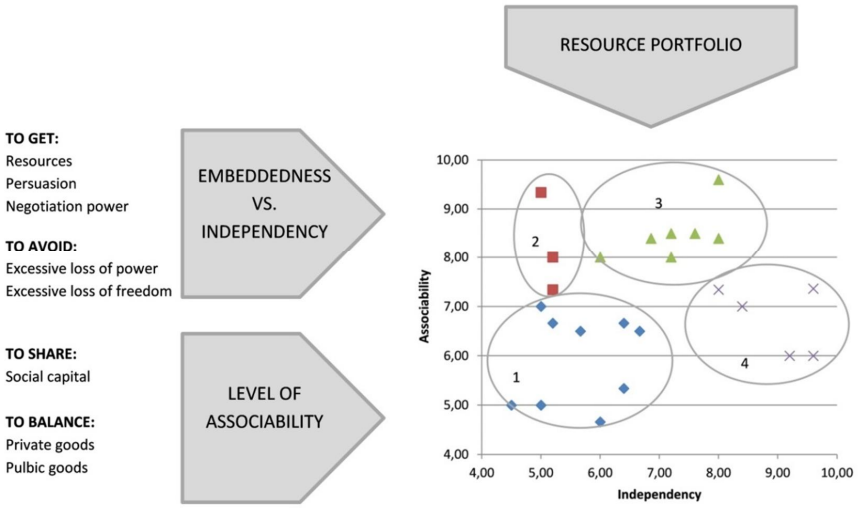



Figure 10: Influence of actors' assets and objectives on networking tendencies

On the basis of the results it can be said that the actors' assets and objectives strongly characterize the formation of business relationships. Although the study was conducted in the field of biomass heating, the same kind of groups can be identified in any business field. The resource palettes of the actors in different fields are different, and all the actors cannot, and should not have the same objectives for independency and associability. The framework is by no means without gaps, but it works as a suggestive tool for relationship analysis.

**Q4:** ***What kind of relationships and networks can the actors have simultaneously?***

As stated above, different levels of independency and embeddedness cause different relationships in depth. A high level of embeddedness causes deeper relationships which are characterized with a high level of associability. On the other hand, a high level of independency usually leads the actors to more superficial contacts with each other. This is natural and also rational for the actors, as all business relationships do not need the same amount of commitment.

The depth of relationships can vary from operational tasks to tactical partnerships and strategic collaboration. The results of the study indicated that an actor can have all these types of cooperation simultaneously, even within the same network. In addition, the breadth, i.e. the specific activities upon which the actors cooperate, varies with different partners. Moreover, the depth and breadth do not go side by side – the partners can have a deep, strategic bond around a single small activity, and on the other hand, several activities conducted as operational cooperation.

The empirical study revealed that a bioenergy production network consists of several different sub-networks. All the networks seem to consist of rather similar sub-networks, but their emphasis for the different actors may vary. In addition, the number of partners in these sub-networks varies remarkably. The sub-networks were categorized in four types, according to the classification of Valkokari et al. (2006); namely vertical, horizontal, collaboration and innovation networks. For example, fuel procurement and heat deliveries were identified as vertical cooperation, whereas R&D and cooperation in maintenance were seen as horizontal. Moreover, collaboration networks were formed in customer services and around collective learning. Industry boundary -breaking innovation networks were not identified in the studied group of biomass heating entrepreneurs. However, they seemed to be desirable in the future, especially with the development of combined heat and power production (CHP), which would demand vast know-how from different industrial sectors. Figure 11 gives a suggestive illustration on the different network types of a biomass heating firm, and the different relationships these networks may include. The strength of the actors' resource portfolios is illustrated by different sizes of actor nodes. Moreover, the intensity of relationships is illustrated with different thicknesses of the lines between the actors: the more breadth and depth in the relationship, the thicker the line.

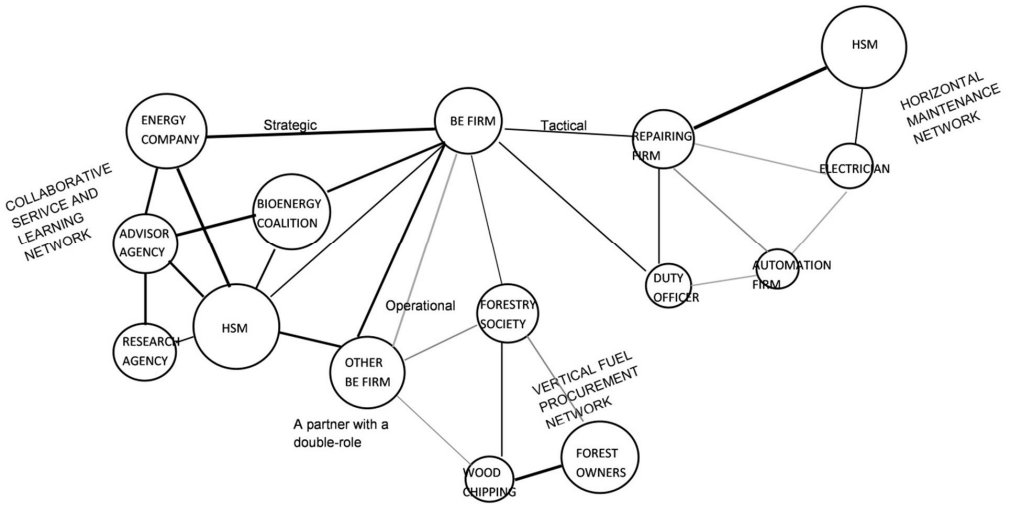



Figure 11: Simultaneous existence of different relationships and networks

The results of the study indicated that even a rather simple network may include a rich palette of different relationships and sub-networks. The actors under scope were identified as *network developers/lead firms* in the previous examination (see Q3), which probably explains a rather large proportion of tactical and strategic relationships and a vast amount of shared experiences and know-how in their networks. However, they also have operational tasks with some partners, which strengthens the previous findings on the importance of all types of cooperation – although these firms are eager to develop their networks and possess a high level of associability, they also have cooperational tasks which are more efficient as superficial. In some cases, the intensity of the relationship seems also to be dependent mainly on the counterpart – all the partners may not be eager to widen or deepen the cooperation and invest in the development. However, this raises the following questions: if the objectives of the partners are not consistent, is the partnership optimal? What could be done to streamline the differing objectives in the actor network? In order to find answers to these questions, let us have a look at the last research question.

**Q5:** ***How should firms manage their different relationships and networks?***

Different relationships and networks should naturally be managed differently. It is not sensible to invest a vast amount of resources in everyday operational tasks. On the other hand, strategic collaboration with valuable partners should be sustained carefully. As the resource palette always limits the amount of resources an actor can invest in its relationships, the actor should find those partnerships in which to invest the most. This is set by the actors' own objectives and also partly guided by the external environment.

As regards small bioenergy actors, the possible partners with the required expertise are not necessarily numerous – the locality and narrowness of the business area set certain restrictions for partner selection. This has caused the phenomenon of using the same partners in different roles in the same network. For example, a heating system manufacturer may act as a part of a maintenance network as well as an important R&D partner. Moreover, other bioenergy actors may be active deliverers of fuel and meanwhile remarkable partners in R&D activities. It can be deduced on the basis of the examples that different cooperation activities even with the same partner may vary in breadth and depth and should thus be managed differently.

Although the locality and low availability of expertise set restrictions to partner selection, these factors also make the formation of personal contacts easy. The studied actors seem to rely heavily on personal contacts in their relationships and appreciate mutual trust between the partners. Especially, strategic collaboration seems to be difficult to create without personal contacts, mainly because the adequate level of trust is hard to attain. Moreover, it seems that the relationships built via personal contacts are more durable than those which are created via e.g. competitive bidding. Partly caused by the circumstances, but also because of the increased interest in strategic collaboration, the majority of the partners are experienced to be difficult to replace or even irreplaceable. It can be deduced that the tighter the cooperation becomes, the more irreplaceable the partner will become. However, it should be remembered that the more the actor is bonded to its partners, the more it also needs to compromise with power and independency in business. The question is, again, about a balance.

Everything is not, however, dependent on the actors themselves. The fast-evolving business environment may cause radical changes in relationships even though they were not desirable. The environment changes constantly. As regards fast-evolving business fields, such as bioenergy, the actors cannot assume that they will not need to make any changes in their relationships. As the firms should be agile for changes according to changed customer expectations, technology or product-life-cycles, so should the partnerships and networks they form. Moreover, because of the changing environment, the objectives of other actors may change as well. These changes will lead firms to situations in which they need to change the formality or strategy of some relationships, or even terminate cooperation with some partners

completely. Thus, the dynamic capability of firms should also include the capability for agile network management.

However, it should be noted that many of the activities related to bioenergy production are basic tasks which do not change very quickly. These tasks do not require a high amount of investment of intellectual capital and active sharing of know-how, but they need to be done. The importance of active network developers and innovators is undeniable, but it is equally important to find the actors who will conduct these basic tasks in the networks. Thus, different roles in the network are needed. These roles should be shared in a way that gives the best advantage to everyone involved.

As the results of Q3 and Q4 indicated, all networks do not need to grow and develop constantly. For example, a current business network of small local actors can be effective as such. However, the future cannot be totally ignored by anyone: as the former results indicated, the bioenergy environment is filled with unanswered questions e.g. related to legislation and technology. Thus, even the firms with moderate willingness for growth need to keep their eyes open. Moreover, firms are expected to keep forming future-oriented networks with readiness for changes.

Figure 12 introduces the factors which, according to the results presented above, seem to have an effect on network management. The figure introduces the differences in the management of two opposite relationship types: strategic and operational ones. Moreover, it presents the outer factors which may lead to changes in the network structure.

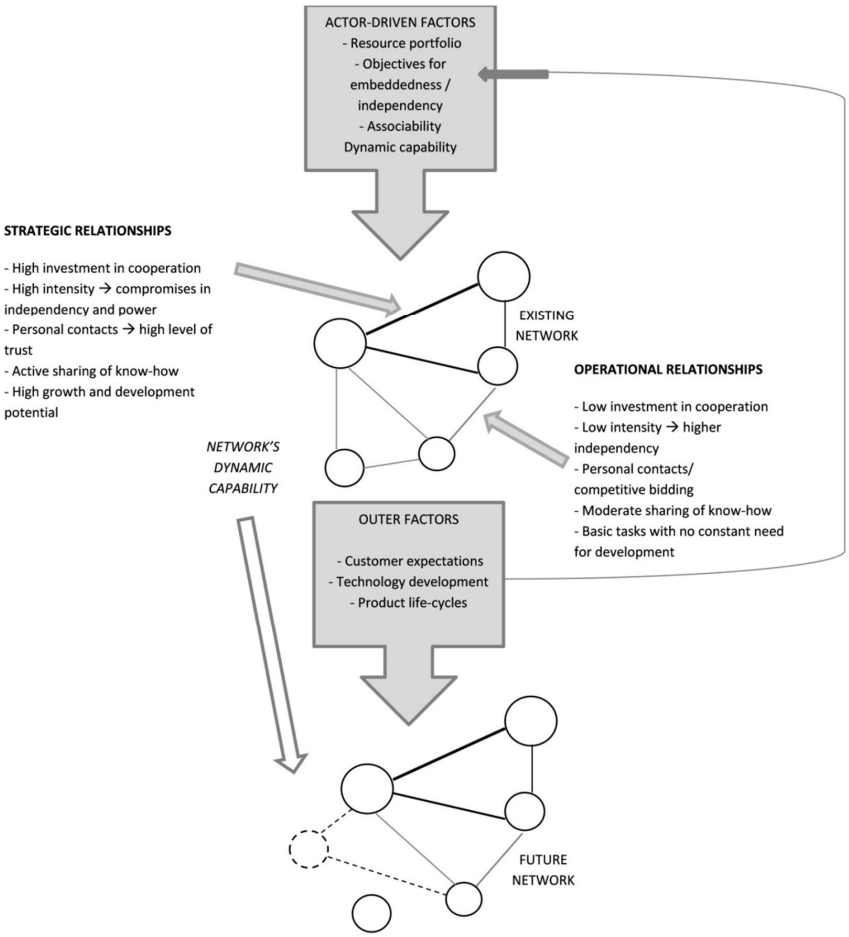



Figure 12: Management of different relationships and network development

# 6 DISCUSSION

In this section, the summary of the study findings is first introduced. After that, the main theoretical and practical implications of the thesis are discussed, the reliability and validity of the results are assessed, and the limitations of the thesis are described.

## 6.1 Summary of the findings – the "big picture"

Figure 13 gathers together the main findings of the study. The big picture illustrates that the development path from an opportunity to a multifaceted bioenergy network, and moreover, possible future changes in the network, consists of several different factors.

First of all, the enablers and barriers at three levels make the ground either favorable or unfavorable for a new project (Q1). They also set certain preconditions, which need to be fulfilled in order to be able to launch the project (Q2). In both these phases, the project may prove to be unsuccessful and will thus be rejected.

In the cases when the project advances to the exploitation phase, networking becomes a prerequisite for the actors involved. However, there are numerous opportunities for networking, and thus the networks formed around bioenergy projects are seldom identical. The resource portfolios, as well as the objectives related to the interdependency and associability of the actors have a great influence on network formation (Q3).

A network consists of different sub-networks, which all have their special meaning, such as a vertical chain-formed fuel procurement network, or a collaborative learning network. The sub-networks vary by their type, and inside these sub-networks, there exist different relationships in breadth and depth (Q4).

It seems obvious that different relationships and networks require different kind of maintenance and management (Q5a). As the relationships are formed as a certain type because of actor-driven factors, the actors should also have agility and capability to change the formality or strategy of the relationships if needed. The drivers for these changes come along the changing environment, which causes changes in the objectives of the actors and this way in the whole network (Q5b).

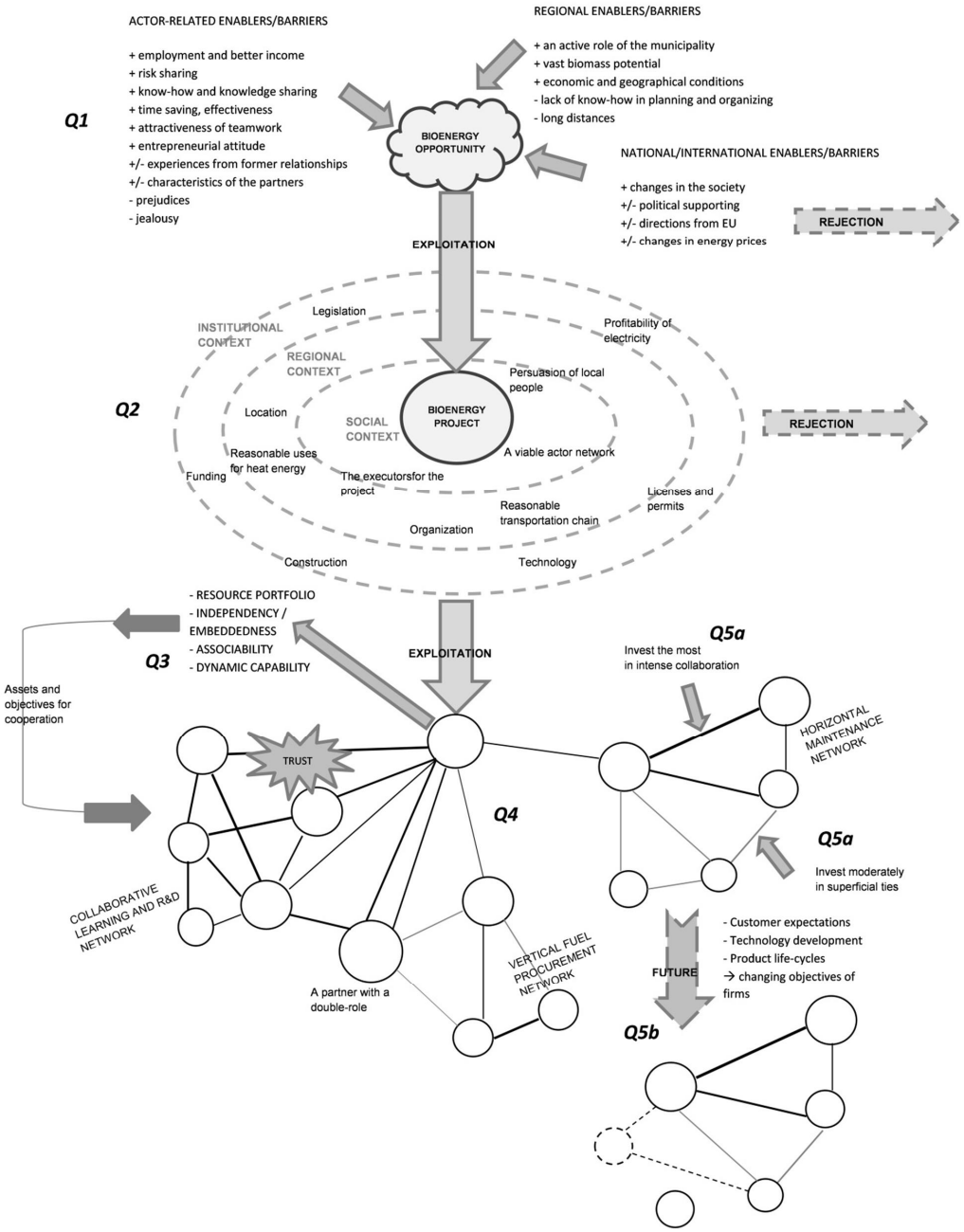



Figure 13: The big picture of the study findings

The previous sub-section answered the research sub-questions one by one. Based on the results, it is now time to answer the main research question set in the beginning:

***How can a path from emerging entrepreneurial opportunity to a successful bioenergy business network be built, and what kind of factors have an influence on this path?***

First of all, the ground for a bioenergy project should be adequately investigated. This should be done by taking account of all the three contexts in which the actors operate: the social context, the region, and the national and international environment. By acknowledging the central enablers and barriers from the different levels, it is possible to recognize the central preconditions for the project.

Even if the preconditions can be fulfilled, the success of the project is not guaranteed. A network should be formed in a way which benefits all the parties involved as well as possible. This means that all the relationships and networks cannot be identical, but different relationships in breadth and depth, as well as sub-networks with different objectives are needed. The actors have a central role in this palette, as their assets and objectives generate certain tendencies to networking.

By analyzing their relationships and networks, the actors should find the ones (strategic) which need to be invested the most, and on the other hand, the ones (operational) which do not need a lot of investment. By examining partnerships and networks as interconnections of actors, activities and resources, it is rather easy to analyze the relationships more thoroughly. In general, the question is about the balance of assets and objectives, which cannot be reached without knowing the structure and critical elements of the network at an adequate level. Moreover, the network needs a certain level of agility to be able to find the balance in changing circumstances.

## 6.2 Theoretical contribution

The theoretical part of the thesis combined the theoretical discussion on entrepreneurship, more precisely, entrepreneurial opportunities, and the widely-discussed phenomenon of networking. Within these themes, the thesis focused on two theoretical frameworks: the triangle of drivers, motives and preconditions (see section 2.4), and the interconnection of actors, activities and resources (see section 3.3). By interpreting these frameworks and discussing the management of the diversity of networks, the thesis formed a step-by-step approach for the development from an entrepreneurial opportunity to a successful business network.

The context of bioenergy was experienced to offer an interesting ground for this approach. As a multifaceted field with no established ways of operating and a number of actors with different objectives and sizes, the bioenergy sector gives numerous business opportunities for several

different networks. The thesis used several analysis frameworks for examining the different steps from emerging opportunities to successful networks. These frameworks combined the views of theory and the practical experiences of empirical study, and thus gave new multifaceted views for the discussion on SME networking.

Even though the thesis raised resources as one of the major factors in inter-firm cooperation, it also took other theories of networking into consideration. This approach strengthened the prevailing impression (e.g. Barringer and Harrison, 2000; Varamäki and Vesalainen, 2003), that none of the networking theories are sufficient as such, but the phenomenon should be examined through several theoretical lenses simultaneously.

The empirical study was conducted in the bioenergy sector, which has been investigated rather widely in recent years. However, most of the research has concentrated on the institutional environment, which has undoubtedly a prompting role in the decisions made by the bioenergy actors. Especially, political decisions have constantly been under interest, and one the prevailing issues has been the profitability of electricity production with bioenergy (e.g. Finlex, 2010; Marja-aho, 2011). However, politics does not dictate everything: the thesis considered the actor and regional levels of operation and demonstrated that these levels have a remarkable impact on the success of bioenergy projects as well. The results of the study proved that it should not be ignored at all where and with whom an actor operates.

The triangle of drivers, motives and preconditions gave an opportunity to examine the first steps of network formation thoroughly by taking account of the differences of actors as well as the multifaceted nature of the surrounding environment of these actors. The results of the study confirmed that this approach is applicable in investigating the developing phase of a business network, because it gives a good overview on the enablers and barriers for the project. The three-level model used in the study could be useful in other industrial fields as well, because the same levels are expected to exist in any field. Moreover, taking a deeper look at the networks by examining business relationships as interconnections of actors, activities and resources gave an opportunity to tackle the differences between single relationships which are integrated into different entities – in this particular study, bioenergy networks.

### 6.3 Managerial contribution

The managerial contribution of the thesis can be seen as twofold. The thesis offered a bunch of analysis frameworks which are considered useful for firms and practical managers. In addition, the results have raised some thoughts related especially to the studied field of bioenergy.

### 6.3.1 Analysis frameworks

Networking is undoubtedly more and more a prerequisite for firms to succeed in business. The trend towards networking is by no means descending, as the business environments become more and more turbulent. The studied cases proved well that especially for SMEs, networking creates opportunities they would not be able to seize by themselves (e.g. Fuller-Love and Thomas, 2004). However, SMEs in particular must be confident that the results of cooperation will be allocated fairly between the partners involved, because they have rarely excessive resources to be utilized inefficiently (e.g. De Wit and Meyer, 2010; Mukherjee et al., 2013). In order to be able to allocate the resources soundly, it is of utmost importance to understand the mechanisms behind the formation and management of networks. For this, the thesis offered a profound analysis.

The thesis provided several valuable implications for actors aiming at the bioenergy business and firms already operating in the bioenergy field. It offered several analysis frameworks which are expected to help the managers in the different phases of their projects to picture and divide in parts the multifaceted phenomenon they are engaged in.

First, enablers and barriers for cooperation around an entrepreneurial opportunity were discovered through a three-level examination of actor-related, regional and institutional factors (Table 6). This examination was then refined into a detailed analysis of preconditions for an emerging project (Figure 9). This two-step approach offers a profound approach for examining the hospitability of the business environment. The same kind of analysis could be applicable in any industrial field and in this way offer a practical tool for managers launching new businesses.

The next analysis framework focused on the assets and objectives of firms (Figure 10). The framework combined theoretical discussion on the actors' embeddedness and independency and their associability, and reflected these themes with the empirical results. By data transformation, the firms could be clustered in groups with different networking tendencies. The framework would be applicable in other industry fields as well, although it should be kept in mind that the resource palettes of the actors in different fields are different, and all the actors cannot and should not have the same objectives for independency and associability. The framework works thus more as a suggestive tool for relationship analysis.

After the examination of the basis for the formation of networks, the thesis concentrated on the prevailing structures and mechanisms of networks. A construction for relationship and network analysis was created on the basis of two theoretical frameworks: analysis of relationships and multi-level analysis of networks (see Publication 5). Via the analysis, valuable information on the different types of relationships and sub-networks could be gathered (Figure 11). Moreover, by identifying the different types of relationships, some guidelines for firms to managing their relationships properly could be formed – for example, investing in the most strategic

relationships and identifying the parts of the networks which may need to get updated. Once again, the analysis tool could be applicable in other business fields as well.

The final framework, "the big picture" (Figure 13) gathered together the separate analysis tools and gave an overview of the study findings.

### 6.3.2 Practical implications

The role of rural areas in Finnish biomass development is central – the biomass reserves of rural actors are invaluable. However, the strongest driver for bioenergy utilization seems to be the need for new sources of income, because for many farmers, traditional farming or cattle breeding solely may not make the living anymore. In addition, as in every group of actors, there exist those who actively seek for ways to develop – these network developers or lead firms of rural actors may take bioenergy opportunities just because of willingness for growth. On the other hand, not all rural actors are ready for large changes and investments, even though the responsibility were shared, and the results proved that cooperation in bioenergy can be conducted in projects rather different in scale and scope. Whatever the scale and scope of the project, it is still worthwhile to have an idea on the essential factors of a successful project. The aim of this thesis was to facilitate the actors in noting these essential factors.

The role of forest biomass is even more central. Biomass heating is established business in Finland, but it still has a lot of growth potential. The challenge of these existing networks is their effectiveness – are the resources allocated so that they give the most advantage in the network? Do the partners in the network have aligning objectives for cooperation? It is obvious that that the majority of the actors are not certain about these aspects. Moreover, as stated, the business environment may change rapidly, and in order to be able to adjust to these changes, the firms increasingly need to weigh out which activities and partnerships are the most valuable, and which ones need to be updated. For this, the thesis offers a practical framework to be utilized.

Even though there are growth and development demands for firms, the basic tasks should not be ignored either. As the results of the study indicated, the networks need actors with different roles, and moreover, the firms need networks with different roles. A network operating around a basic task can be highly efficient as such, and development should never be a prerequisite for networks. However, as the future is always unpredictable, all networks need a certain level of capability to react to changes. Roughly, it can be deduced that the more growth-oriented the network, the more dynamic capability it should have, because the increasing number and complexity of actors, activities and resources bring about needs for changes as well.

## 6.4 Evaluation of the research

Due to its nature and philosophical basis, qualitative research is experienced to be hard to evaluate with the traditional validity, reliability and generalizability concepts. Thus, such criteria as credibility, transferability, dependability and confirmability are often used for the evaluation of qualitative research (e.g. Denzin and Lincoln, 2005; Eriksson and Kovalainen, 2008; Lincoln and Guba, 1985). Because of the overall qualitative nature of the empirical research, and moreover, the subjectivity of the researcher, these criteria are also used in the evaluation of this thesis.

### 6.4.1 Credibility

Credibility of the research refers to the researcher's familiarity with the topic and the sufficiency of the research data to merit the claims (Eriksson and Kovalainen, 2008; Silverman, 2005). The sufficiency of the research material was ensured by using two research data sets for the empirical research. Overall, the data consisted of 49 interviews. The author was more familiar with the first research data gathered in Parikkala, because all the interviews were conducted by the author herself. However, the author also planned the research questions for the last three publications in cooperation with the researchers who conducted the interviews, and thus investigator triangulation was used in the data gathering. In addition, two interview rounds were conducted in order to strengthen and widen the gathered results. Method triangulation was used in publications 3 and 4 in order to provide versatile results. The author herself chose the theoretical frameworks and fitted the empirical observations with them. However, constant cross-checking of the work by the co-writers and the supervisor were used to ensure the credibility of the results.

### 6.4.2 Transferability

Transferability of the research is concerned with the researcher's responsibility to connect the research with previous results - whether some kind of similarity can be found in other research contexts (Eriksson and Kovalainen, 2008). The chosen research strategy, case study research, sets some limitations to the transferability of the results. As the cases are always bounded, they naturally have some specific traits which cannot be totally generalized. Bioenergy as an industrial field also has its special characteristics, and thus watertight deductions cannot be made. However, as the study leans on several theoretical backgrounds and combines them with rather large empirical evidence, the frameworks constructed in the study can be experienced as applicable in other industrial fields as well.

### 6.4.3 Dependability

Dependability is concerned with the researcher's responsibility for offering information on the fact that the process of the research has been logical, traceable and documented (Eriksson and Kovalainen, 2008). All the interviews were recorded and transcribed. The central results were first gathered in figures and tables with different categories, by which the research data was then logically interpreted. All these documents used in the process were cross-checked by the co-authors and the supervisor and saved for later purposes.

### 6.4.4 Confirmability

Conformability refers to the idea that the data and interpretations made from it are not just imagination. Thus, the findings and interpretations should be linked with the data in ways that can easily be understood by others (Eriksson and Kovalainen, 2008). Several analysis frameworks were used in order to form a profound description of the study findings. The step-by-step approach of the analysis was experienced to make it easy for the reader to find the linkages between the theoretical discussion, the research data, and interpretations made from them.

### 6.4.5. Limitations

As stated above, the character of the research sets some limitations which should be taken into account. These limitations are related to the typical limitations of qualitative case studies and constructive research approach. Even though two different research data with multiple cases were used, cases are always bounded and thus cannot be totally generalized. The research data was collected mainly by theme interviews, and thus the data was rather concise. However, it was considered to be adequate for the purposes of qualitative studies.

Although the interviewees were chosen with well-planned sampling, there always exists a possibility of bias in the results. Moreover, the subjectivity of the author, especially in the first two publications, may have caused some distortion in the results, although they were cross-checked by other investigators.

The thesis took several theoretical approaches into account. However, because of the multifaceted nature of the phenomenon of networking, some theories which are generally used for examining SME networking were utilized. The thesis raised resource-driven objectives as major factors boosting the actors towards cooperation. However, it should be kept in mind that

there exist other factors as well which may have an impact on the emergence and development of inter-firm cooperation. The thesis did not take account of the coopetitive viewpoint of networks either - thus, competition between the actors in a certain network or competition between networks was not discussed in the study.

The study examined the development path of networks quite thoroughly. However, certain viewpoints were chosen, and thus it cannot be expected to be an all-inclusive description. For example, the study highlighted the meaning of right partners and effectiveness of the networks, but it did not take much stand on how to gather the right actors together in practice.

As discussed, the empirical study followed much the principles of constructive research approach. However, the frameworks formed in the study did no precisely fill the requirements presented by Kasanen et al. (1991) for constructive solutions, as the time-limit of the thesis did not make market tests possible. As discussed above (see 6.3.1.), these frameworks should be seen more as suggestive tools which would be applicable in different business contexts.

The viewpoint of the thesis was mainly SME-driven. The chosen groups of potential or existing bioenergy actors – cattle breeders and biomass heating entrepreneurs - are rather small in size and their resource portfolios are not enormous. This has undoubtedly an impact on the business opportunities as well as technological and logistical solutions the actors can seize, and that way to the development opportunities of the networks. The thesis did not take account of all the opportunities offered by bioenergy. The thesis did not offer a lot of bioenergy visions for the future either, but concentrated rather on understanding the prevailing opportunities and development in the field. For example, it can be expected that combined heat and power production will become one of the future possibilities for growth for bioenergy SMEs.

## 7 CONCLUSIONS

The thesis has discussed the phenomenon of networking in a context which has been recently discussed widely in the media and academic discussion – bioenergy and its promotion. The target groups, rural actors as emerging bioenergy entrepreneurs, and biomass heating firms as existing businesses in the field, offered an interesting opportunity to study the phenomenon mainly from the SME viewpoint. Although these two target groups are rather different in the ways energy is produced and utilized, they both need to weigh out similar questions related to cooperation and networking.

Small size sets naturally restrictions in resources, and thus networking is often the most profitable way for conducting new business projects for SMEs. However, engaging in cooperation is not straightforward, as it always involves the risk of losing too much power and control to others. Small firms own invaluable, often strongly person-related competence which is difficult to acquire from anywhere outside. These competences should be protected, but at the same time the firms should be open for sharing resources with others. In general, the question is about the profitability of the business – what is the most invaluable way to do things from each partner's viewpoint. This is not an easy task to solve, but it can be facilitated. For this, the thesis has offered several applicable tools and viewpoints to think over.

In addition to several similarities, the two target groups of the study need also to be examined as different kinds of entities, especially by the three contexts the thesis has introduced: the social context, the region and the institutional environment. Especially, embeddedness in rather different social and regional contexts naturally raises different enablers and barriers for cooperation as well.

By conducting the interviews in Parikkala, I was privileged to get to know the preconditions for bioenergy right at the grassroot level. During those few weeks, I learned a lot and realized how differently the persons in different positions of a network can look at the same phenomenon. A project which would seem perfect from regional or institutional viewpoints may seem way too high-flown from the viewpoint of a primary producer. On the other hand, a bioenergy project which would seem as a perfect additive to the sources of income for a livestock breeder, may become rejected because of institutional barriers.

In rural areas, the acceptance and organization of new business concepts may take time. The actors do not necessarily have former experience on cooperation, nor do they want to engage themselves in an unstable future. However, rural strategies in general seem promising, as the interest towards networking has been prompted. Rural communities are no more seen as groups of individual actors or entrepreneurs, but rather as collective actors creating new tools for ensuring a sustainable livelihood. The results of the study also proved that the new business

opportunities offered by bioenergy are seen as tempting, but several support mechanisms are demanded to get the things done.

As regards bioenergy, especially the questions about location and logistics are central. Procurement of feed material as well as transportation of fuels and residues play remarkable roles in the profitability of bioenergy projects. These questions are highlighted especially in rural areas with long distances, scattered location of actors and still rather undeveloped practices for handling the logistic chains. However, the challenges also offer several additional sources of income for different actors around the primary producers, e.g. in forestry and transportation.

The locality of SMEs and narrowness of the business area set certain restrictions for the available partners as well. The possible partners with the required resources and competences may not be numerous. Thus, the opportunities opened e.g. for a rural actor or a heating entrepreneur in a small municipality are probably different than those opened for people in large cities with multifaceted partner networks. However, a small network in a restricted area has also several advantages. In this kind of a network, the personal characteristics are often highlighted. At their best, the relationships are based on mutual trust, and the network offers a secure business environment for the entrepreneurs themselves. Small actors do not necessarily need to be ready for complicated network structures. The essential thing is that the network is suitable by its scale and scope for the purposes of its participants.

The results of the study indicated that the networks can be organized in various ways. The essential thing is to form networks that benefit all the parties involved and in which the responsibilities are clearly divided and obeyed. Every entrepreneur or firm will not need to, and even cannot, be the “network leader”, although these actors are undoubtedly needed in any networked project. However, as important in a network are the actors who take care of the single basic tasks. For example, a regional network can offer an invaluable business context which utilizes the resources and competences of the involved actors effectively. This way it offers an important additional source of income to the region. The examination of networking tendencies indicated that these kinds of *current business nets* with equal partners can be efficient as such. However, in all networks, the actors should keep their eyes open for possible future changes.

Thus, all networks need a certain level of dynamic capability to be able to change and develop. The interconnection of actors, activities and resources is not stable, but it can change because of inner or outer influencers. The future of the bioenergy field is somewhat unclear, and the opportunities to engage in the business may be opened but also shut in a short period of time. Thus, the demand towards *business renewal networks* and *future-oriented networks* with the capacity to change the existing value systems and create totally new ones is evident.

### 7.1 Further research

Based on the results of the study, I would like to suggest some interesting issues for further research. First, a closer look at the partner selection in practice could be taken. As the results indicated, there may not be several possible partners for SMEs in a certain region. However, the study provided an impression that the way the partnership is formed (e.g. via personal contacts or competitive bidding) may have a remarkable impact on its functionality.

Another interesting issue of research could be a more thorough analysis of relationships, and more precisely, resource exchange between partners in detail. This could be done by using a network analysis tool. As an addition to case study research, the utilization of more quantitative methods would provide new invaluable information on the functionality of networks. In addition, a deeper resource analysis would provide interesting information on the dynamic capabilities of networks.

The thesis has discussed networks only from the viewpoint of cooperation and shared benefits. The truth is, however, that networks often include actors who compete with each other. Moreover, networks need to consider their competitive positions in relation to other networks. The networks under study did not seem to have a lot of competitive nature. However, the results indicated that e.g. the biomass heating networks often include several heating entrepreneurs in different roles. Although they have certain roles in the network, they still need to act in ways which do not risk their own businesses. Thus, the coopetitive-side of bioenergy networks would be an interesting area to investigate.

Last, I would still emphasize the importance of primary producers in bioenergy development and give more foothold for their opinions in bioenergy projects. They have great potential, but their objectives should be taken into account and respected. These people are curious for future, and they want to be involved in bioenergy development. However, they still want to preserve and follow the traditional ways of living. This thought was captured well by one of the interviewees:

*"Most people say that they HAVE to go to work. I have never had that feeling – I CAN go to work. I'm very happy for that… because this is a lifestyle". [free translation of an interview in Finnish]*

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**PART II: PUBLICATIONS**

**Publication 1:**

Kokkonen, K. and Kässi, T.:

**ENABLERS AND BARRIERS OF COOPERATIVE BIOENERGY PRODUCTION IN THE COUNTRYSIDE: A CASE STUDY**

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# Enablers and barriers of cooperative bioenergy production in the countryside: a case study

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**Abstract:** The paper clarifies the possibilities of cooperation and networking for small actors in the field of bioenergy production. The paper focuses on factors at three different environmental levels which may act either as enablers or barriers for the seizing of energy production opportunities and through the formation of partnerships and networks around them. The paper examines these aspects with a case of livestock breeders in Parikkala, a traditional rural municipality in Eastern Finland.

**Keywords:** cooperation; networking; opportunity exploitation; environmental levels; entrepreneurship; enabler; barrier; bioenergy production; livestock breeding; countryside; biomass; case study; Finland.

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## 1 Introduction

The bioenergy field offers numerous opportunities for value-creation and cooperative activities for the countryside. Several new biomass options provide renewable energy competitively, which has increased the opportunities for rural areas to improve their

income distribution and employment generation (Demirbas, 2009; Heinimö and Alakangas, 2006; Rikkonen and Tapio, 2009).

Biomass has been an integrated part of the Finnish national energy system in the past 20 years. Lately, biomass production in the countryside has become a widely discussed issue in the national policy (Ericsson et al., 2004; Rikkonen and Tapio, 2009). Local bioenergy can be profitable for farms, but as the farm sizes in Finland are rather small, the most cost-effective way to produce local energy is usually via cooperation (Rikkonen and Tapio, 2009; Åkerman et al., 2005).

However, there is a large number of factors which can act either as enablers or barriers for the seizing of energy production opportunities (e.g., Helynen, 2004; Niskanen et al., 2007; Åkerman et al., 2005) and through that the formation of partnerships and networks around them. These factors can appear at different levels in the actors' environment, and they can influence partnership forming and networking among different actors, as well as the effectiveness of the formed networks (e.g., Fuller-Love and Thomas, 2004; Hagedoorn, 2006). The impacts of these different-level factors need to be recognised and considered carefully. The aim of this paper is to increase the understanding of these factors, and offer some insight into what these factors mean for actors aiming at bioenergy options.

The paper clarifies the possibilities of cooperative activities and networking for small actors in bioenergy production in the countryside. The scope is the opportunities offered by biomass utilisation for livestock breeders and their interest groups in Parikkala, a traditional rural municipality in Eastern Finland. The study examines the livestock breeders' interests and aims in cooperative biomass utilisation for energy purposes, by examining three different types of potential biomass: livestock manure, forest biomass and agrobiomass.

The paper has three primary research problems. Firstly, 'what areas of biomass utilisation are seen as the most possible and potential in the studied rural area?', secondly, 'what kind of cooperative activities can be related to these areas?', and thirdly, 'what are the major enablers and barriers of the environment for these cooperative activities?' Case study (see e.g., Creswell, 2007; Eriksson and Kovalainen, 2008) is used as the research strategy of the study, and the research data has been collected by theme interviews.

## 2 Bioenergy production in the Finnish countryside

In theory, the biomass resources in Finland compared to the size of the population are so extensive that they would cover a large proportion of the energy consumption. Thus, the most important factor defining the scope and scale of future utilisation of bioenergy is its competitiveness compared to fossil fuels (Helynen, 2004). The majority of Finland's biomass potential is in forests, and forest biomass is already an integral part of modern energy systems, although, primarily in the industry and heating sectors (Ericsson et al., 2004). However, because of the experience with modern biomass technologies has been gained over several decades, production costs have been reduced and several new biomass options already provide renewable energy competitively (Junginger et al., 2006; Lehtilä et al., 2005). In addition, several reasons, such as climate change, energy security, environmental effectiveness, rural development, economic efficiency and market innovations explain the interest of many OECD member countries towards new bioenergy options (Junginger et al., 2006; Lund, 2007; Rikkonen and Tapio, 2009).

With the rising oil prices, biomass production from agriculture has become a relevant and widely discussed issue in the Finnish national policy. Agriculture can have at least two roles in the development of bioenergy solutions – it can be a self-sufficient utiliser of its own energy production, or a supplier of biomass to the refining industry (Rikkonen and Tapio, 2009). The emerging biofuel market is a new significant source of demand for some agricultural commodities, and for many farmers, producing raw material can be seen as a new opportunity to compete in the markets. Thus, bioenergy can improve the income distribution and generate new job opportunities in rural areas and thus have many balancing effects in agriculture (e.g., Demirbas, 2009; Heinimö and Alakangas, 2006; Rikkonen and Tapio, 2009).

In Europe, one of the common tendencies of livestock production is to intensify it and to increase the size of the units. High cattle density is always accompanied by an increasing amount of animal manure, and this manure needs to be managed in ways which do not harm the environment in terms of pollution and over-fertilisation of soil. Thus, along with the development in bioenergy technologies and economic sustainability, the number of biogas plants in Europe increases continually (Holm-Nielsen et al., 2009; Junginger et al., 2006).

The technologies for producing biogas from farm slurries in anaerobic digestion are already well developed. The biogas plants digesting manure are categorised as agricultural biogas plants, and they usually co-digest manure and other suitable organic residues. The size of these plants varies from large scale, joint co-digestion plants to smaller-scale farm plants (Holm-Nielsen et al., 2009; Junginger et al., 2006).

### *2.1 Potential and preconditions for bioenergy production in Parikkala*

Parikkala is situated in South-Eastern Finland, near the Russian border. There are around 6,000 habitants in the municipality. Livestock farming has traditionally been a remarkable source of livelihood in Parikkala. Although, the number of livestock breeders has steadily decreased in the past few years, there are still around 140 livestock farms in the municipality. In 2005, Parikkala was consolidated with two smaller municipalities, which increased the number of livestock farms remarkably. Because of the large number of livestock farms in the Parikkala area, the manure from these farms forms a remarkable proportion of the potential biomasses.

At the moment, a majority of the manure is used as fertiliser in the fields. Most of the livestock manure is handled as slurry, a liquid mixture of urine, feces, water and bedding material. Some livestock farms in Parikkala, however, handle the manure as dry manure**.** Although, the current biogas plants in Finland exploit mainly slurries in energy production, dry manure is successfully exploited in energy production processes, usually as a binder for slurry, in many projects worldwide. Thus, anaerobic digestion is not limited solely to slurries.

Nature and the countryside are the pride of Parikkala, and the municipality has wide forest reserves. Also many of the livestock breeders have remarkable forest reserves, and the breeders who do not necessarily see energy production potential in manure, consider the possibilities of forest-based biomass.

At the moment, a majority of the fields are used for animal maintenance. However, many farmers in Parikkala, as well as in other rural municipalities in Finland, follow the common European tendency of intensifying livestock production and concentrate on

larger units (e.g., Holm-Nielsen et al., 2009), which is naturally related to the ongoing nation-wide change of generation in the agriculture and livestock breeding. Thus, it seems likely that the number of fields needed for animal maintenance will decrease in the future, and these fields could possibly be partly transformed e.g., for energy crop cultivation.

The potential livestock farms in the municipality as regards bioenergy comprise dairy and beef cattle farms and pig farms. Because of their small number in the Parikkala area, poultry farms have been excluded from the consideration in this study.

### *2.2 Meeting the challenges*

Parikkala, among many other rural municipalities, is in a situation where new options for livelihood need to be considered. Bioenergy production offers a lot of opportunities for rural municipalities with vast biomass reserves, and there are already many examples of productive bioenergy production with different raw materials in the countryside. However, when planning new sources of livelihood from bioenergy business, the farmers face a number of unanswered questions; e.g., how can the raw materials be used effectively, without causing drawbacks or slowdowns for agricultural or forestry tasks? How should the raw material transportation chains and production be organised? How to guarantee profitability for the farmers?

One way to find answers to these questions is to approach them through the issue of cooperation. In cooperation, the farmers can learn from each other, with each other, act as a negotiating partner, invest collectively, and involve relevant partners. However, farmers' networks are often confronted with barriers, such as lack of institutional support, or organisational aspects of the network (Oerlemans and Assouline, 2004). On the other hand, there are also a lot of factors which enable the exploitation of emerging opportunities and networking activities around them.

## 3 Theoretical context

An *entrepreneurial opportunity* is a situation in which new goods, services, raw materials, markets and organising methods can be introduced through the formation of new means, ends or means-ends relationships (Eckhardt and Shane, 2005). Shane (2003) argues that the main sources for these opportunities are changes in technology, changes in politics and regulation, and changes in social and demographic factors. Three major components are widely recognised in the literature as common and important for the opportunity recognition process; the entrepreneur himself, the knowledge and experience of the firm, and technology (e.g., Park, 2005; Shane, 2000).

For the purposes of this paper, views in prior literature on the exploitation of entrepreneurial opportunities through partnerships and networking are drawn upon. Particularly, the influences of actors' embeddedness in partnerships, networks, and the external environment on opportunity exploitation are discussed.

### *3.1 The influence of partnerships and networking on opportunity exploitation*

Individuals or organisations may differ in terms of their perception of opportunities due to the differences between the *partnerships* or *networks* they are embedded in. That is, an

individual's networks can provide access to knowledge that he does not currently possess. When knowledge is transferred among individuals or organisations, they are affected by and learn from the experience of others (Arenius and De Clerq, 2005; Salmi and Torkkeli, 2009). Thus, knowledge transfer among individuals or across organisational boundaries can lead to potential for different kind of opportunities than one could recognise on one's own (Arenius and De Clerq, 2005).

In addition to the opportunity recognition phase of an entrepreneurial process (e.g., Park, 2005), actors' embeddedness in partnerships and networks is vital for the foundation process of a new business, because a network offers access to the assets and capabilities of other actors (see e.g., Chetty and Wilson, 2003; Rajala and Westerlund, 2009). Given the lack of resources, capabilities or legitimacy, which they would need for successful survival, the emerging actors usually need to gain access to external resources and know-how that cannot be produced internally. Thus, they are often dependent upon their external network to provide avenues for negotiation and persuasion and a variety of resources (e.g., market information, ideas, problem solving, social support and financial resources) (Hite and Hesterly, 2001; Mei and Nie, 2008). Especially for small actors, cooperation and networking can thus provide a valuable source of support and information, as well as a means of sharing resources (Fuller-Love and Thomas, 2004).

Being embedded in a network structure usually creates opportunities and improves performance. As organisation-level embeddedness is often determined during the start-up process of a business, it affects the endogenous resource accumulation and the openings of exogenous opportunity (Li and Chen, 2009). For long-term success, the networking must be done in a way which increases the overall value of the networks for all the participants in them (Wickham, 2001).

An essential component of benefiting from networks is how well the participants can utilise each other's resources, i.e., what are their *inter-organisational and networking capabilities* (Rajala and Westerlund, 2009; Wickham, 2001). Thus, an actor's experience of prior partnerships has an influence on the forming of new partnerships and networks. When an actor gains experience in collaborating in one relationship, his capability to collaborate with others is developed (Chetty and Wilson, 2003; Hagedoorn, 2006). *Interorganisational embeddedness* reflects the general experience of an actor in establishing partnership and networks (Hagedoorn, 2006). It refers to what Venkatraman et al. (1994) label 'the channels of communication' within the environment. *Dyadic embeddedness* is related to repeated ties within partners, i.e., previous experiences with partners have an impact on the forming of new cooperative relationships (Hagedoorn, 2006). Information asymmetry, familiarity and trust are remarkable factors in this level of embeddedness (e.g., Chung et al., 2000; Nooteboom et al., 1997). Fuller-Love and Thomas (2004) have examined the meaning of the environment from the viewpoint of *network effectiveness*. They state that the most important factor in the environment are the other actors and their existing relationships with different partners.

Overall, the cooperative ambitions, priorities and capabilities of different actors need to be recognised, because they may enhance or compromise the strategic compatibility between intended partners over time. For acquiring knowledge through their networks, the actors need to become committed to these relationships and really exchange information with each other (Chetty and Wilson, 2003; Doz and Hamel, 1998).

### *3.2 The influence of the environment on opportunity exploitation and partnership forming*

In addition to being dependent on each other, the actors are dependent on the surrounding external environment as well. Thus, decisions to exploit entrepreneurial opportunities or to create networks are not made in a vacuum, but they are influenced by the different contexts in which one operates (Hung, 2005; Shane, 2003). *Trends* create opportunities for entrepreneurs to pursue. Economic factors, social factors, technological advances, political actions and regulatory statutes are the most important trends to follow. Changes in these areas often provide impulses for new business opportunities (Barringer and Ireland, 2008).

A central dimension of the context that strongly influences opportunity exploitation is the *institutional environment*, which consists of different economical, political and socio-cultural aspects (see Table 1). The institutional environment sets the 'rules of the game' that generate incentives for certain types of action, and the social setting that determines legitimate and acceptable behaviour (Hung, 2005; Shane, 2003). Correspondingly, different degrees of relationship may define the extent to which actors are embedded in their institutional environment (Hung, 2005).

**Table 1** The effect of the institutional environment on opportunity exploitation

| | |
|---|---|
| Economic environment | Income, capital gains and property taxes reduce |
| | Economic growth and societal wealth increase |
| | Low rates of inflation and stable economic conditions increase |
| Political environment | Freedom increases |
| | Strong rule of law and property rights increase |
| | Decentralisation of power increases |
| Socio-cultural | Social desirability of entrepreneurship increases |
| | Presence of entrepreneurial role models increases |
| | Specific cultural beliefs increases |

*Source:* adapted from Shane (2003)

Institutional environments have also been studied at national level. It has been argued that countries' institutional profiles play distinct roles in promoting entrepreneurial activities (e.g., Kostova and Roth, 2002).

According to Arenius and De Clerq (2005), residential areas differ also by their network cohesion. By that definition, countries, such as Finland, where there are big differences between agglomerate versus rural areas may show high within-border differences in terms of how easily individuals can gain access to new information and that way to entrepreneurial opportunities. However, rural regions can also be seen as unique environments in which innovations take place. Research indicates that small enterprises are most likely to interact with, and learn from, others within their own region (Arenius and De Clerq, 2005; North and Smallbone, 2000).

Hagedoorn (2006) highlights the influence of *environmental embeddedness*, which he argues to be the highest level of embeddedness affecting the likelihood of new partnership formation. The *macro level* of environmental embeddedness is related to specific country differences that influence the likelihood of partnership formation in the

international context. The *meso level*, on the other hand, refers to the industry level, sectoral propensity or strategic groups in building partnerships.

### *3.3 A framework for actors' embeddedness and opportunity exploitation*

Based on the views from prior literature presented above, a simplified framework (see Figure 1) on an actor's embeddedness in relationships with other actors and the surrounding environment is introduced. In the framework, the factors influencing an actor in the decisions to exploit entrepreneurial opportunities and form partnerships and networks around them are divided into three environmental levels. These are:

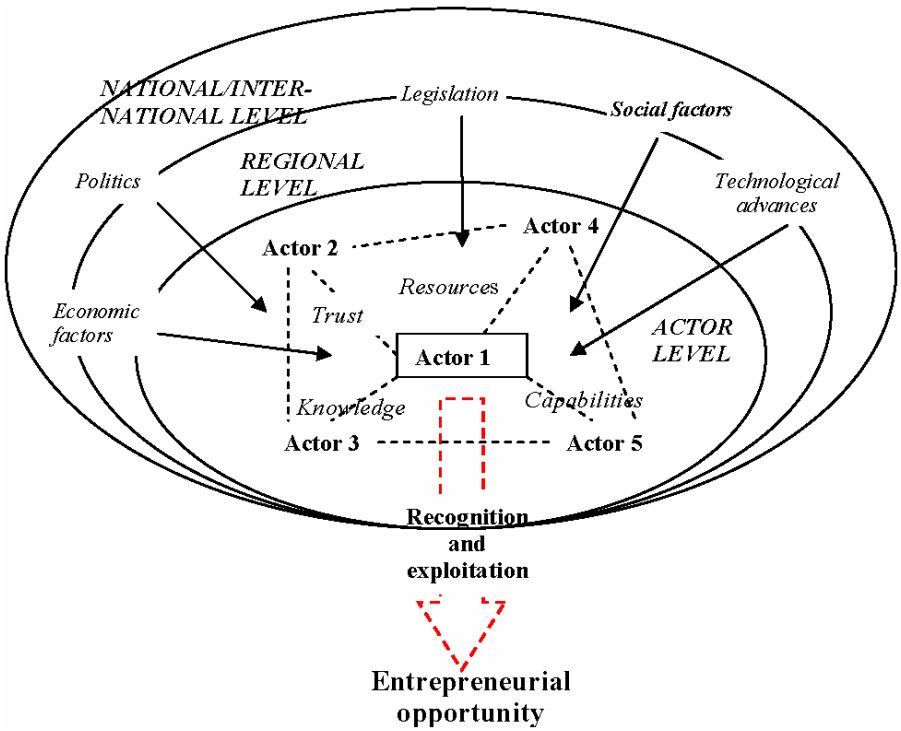
1 the *actor level*, which refers to the actor himself and the other actors who may turn out as potential partners

2 the *regional level*, which in this empirical case study refers to Parikkala municipality

3 the national and international level.

For clarity, it is presumed that the next level automatically includes the former one. However, e.g., the actor level can, and usually does, reach outside the regional level boundaries.

**Figure 1** Framework for actors' embeddedness and opportunity exploitation (see online version for colours)



## 4 Research design

The empirical study was conducted as a case study. Case study has a long history across academic disciplines. A central feature of case study research is the construction of 'the case' or 'cases'; the research questions are always related to the understanding and solving of the case: what is the case about and what can be learned by studying it (Eriksson and Kovalainen, 2008).

According to Yin (2003, p.13), case study is 'an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident'. Creswell (2007) defines a case study as an exploration of a bounded system which can be defined in terms of time and place, over time and through detailed, in-depth data collection, involving multiple sources of information which are rich in context.

Case research is particularly welcome in new situations where only little is known about the phenomenon and in situations where current theories seem inadequate (Eisenhardt, 1989; Yin, 2003). In their study of business networks, Halinen and Törnroos (2005) emphasise the advantages of case studies over other research strategies; case research allows the study of a contemporary phenomenon, which is difficult to separate from its context, but which is necessary to study within it to understand the dynamics involved in the setting. Creswell (2007) states that "a case study is a good approach when the inquirer has clearly identifiable cases with boundaries and seeks to provide in-depth understanding of the cases or a comparison of several cases".

Stoecker (1991) suggests that there is a key difference between *intensive* and *extensive* case study research. Intensive case studies aim at understanding a unique case from the inside by providing a thick, holistic and contextualised description. Extensive case studies, on the other hand, aim at elaboration, testing, or generation of generalisable theoretical constructs by comparing a number of cases. Yin (2003) has criticised the intent of some research fields to distinguish sharply between single- and multiple-case research (e.g., Agranoff and Radin, 1991); from his viewpoint, they are only two variants of case study designs.

For example, Creswell (2007) and Silverman (2005) state that case studies can be distinguished by their *intent*, i.e., the starting point of the study – the nature of a case study can thus be instrumental (the researcher focuses on an issue and then selects a bounded case to illustrate it), collective (one issue is selected but multiple case studies are selected to illustrate it), or intrinsic (the focus is on the case itself, because the case presents an unusual or unique situation).

Following the above-presented definitions from the literature, the nature of this study can be defined as an instrumental single-case study: the cooperative activities and networking in distributed bioenergy production form an issue. This issue is then illustrated by a bounded case, the views of the livestock breeders.

### *4.1 Data collection*

In this study, the data was collected by themed interviews in a limited time period. Overall, the empirical data consists of 13 semi-structured theme interviews, which means that the outline of the themes was prepared, but the wording and order of questions varied a little in each interview (Eriksson and Kovalainen, 2008), depending on the background

information, which was collected in the beginning of the interviews. The questionnaire is presented in Appendix 1.

The interviews were carried out at the livestock breeders' farms in Parikkala in March 2009. The interview themes were based on the research questions and literature and refined in cooperation with the representatives of Parikkala municipality to ensure that the questions were in line with the municipality's common definitions of energy policy. The results reported in this paper concentrate especially on the possibilities of cooperation in defined areas of biomass utilisation, and especially the enablers and barriers related to them (theme four in the questionnaire).

## 5 Results

The results of the study are presented below. First, some background information of the interviewees is given to form a clear picture of the current situation and the basis of the study. Next, the most potential options of cooperation and networking in bioenergy areas are introduced, and after that, the experienced enablers and barriers at different environmental levels related to each of the options are discussed.

### *5.1 Background information of the interviewees*

The group of interviewees comprised of dairy cattle, beef cattle and pig breeders, from different parts of the municipality and with different sizes of livestock (see Table 2). A majority of interviewees had some kind of small-scale cooperative activities related to agriculture or forestry, and that way also related to biomasses, although, not much for energy purposes. Some farms also did small-scale business, such as selling of wood or grain. At present, larger-scale cooperative or networking activities between livestock farms are rather rare in the Parikkala area. However, without exception, the breeders saw cooperation in energy issues as a very positive phenomenon and some characterised it also as a necessary future way of action.

**Table 2** Farm types and sizes

| *Type of livestock* | *Dairy cattle, beef cattle, sows and pigs* |
|---|---|
| Number of animals | 30–850 |
| Forest area (ha.) | 19–300 |
| Arable area (ha.) | 14–250 |

The interviewees saw the utilisation of their biomasses for energy purposes as a possible development path and even as an intended development action. However, the farms are mainly self-supporting in heat, as almost all the farms use wood or wood chips for heating, and the raw material is produced in their own forests. Alternatively, electrical heating systems are used, especially for service water heating, in many farms. For these reasons, the interviewees were mainly interested in the electricity-production potential of their biomass reserves or in selling heat energy outside. A majority of the interviewees were able to name the most potential category of biomass of their own reserves to be utilised cooperatively. However, some of them saw potential in a wider scale of their

biomass reserves. Detailed background information of the interviewees is presented in Table 3.

**Table 3** Background information of the interviewees

| *Farm* | *Type of livestock* | *Use of electricity* | *Source and use of heat* | *Existing cooperation* | *The most potential biomass* |
|---|---|---|---|---|---|
| A | Beef cattle | Lighting and appliances in the house and cowshed | Firewood, house, cowshed and service water | Borrowing farm machines from neighbours, helping each other in tasks | Agro- and forest biomasses in the future |
| B | Dairy cattle | Lighting and appliances in the house and two cowsheds | Wood chips, house and two cowsheds, service water (cowsheds) | Harvesting with neighbours, chipping from a contractor | Manure |
| C | Sows and pigs | Lighting and appliances in the pig shed | Wood chips/pellets, pig house and service water | | Manure |
| D | Beef cattle | Lighting and appliances in the house and cowshed | Firewood, house and cowshed | | Manure |
| E | Beef cattle | Lighting and appliances in the house and cowshed | Wood chips, house | Occasionally receives manure from other farms to use as fertiliser | Forest biomass, (manure) |
| F | Dairy and beef cattle | Lighting and appliances in the house and cowshed | Firewood, house and cowsheds | Helping each other in agricultural and forestry tasks, loaning of machinery, selling of hay | Forest biomass |
| G | Dairy cattle | Lighting and appliances in the house and cowshed, service water heating | Firewood, house and cowshed | Selling and buying of animal feed and grain | Manure |
| H | Beef cattle | Lighting and appliances in the house and cowshed, service water heating | Firewood, house and cowshed | Harvesting, joint ownership of farm machines | Forest biomass |
| I | Dairy cattle | Heating, lighting and appliances in the house and cowshed | Electricity, house and cowshed | | Manure, forest biomass |

**Table 3** Background information of the interviewees (continued)

| *Farm* | *Type of livestock* | *Use of electricity* | *Source and use of heat* | *Existing cooperation* | *The most potential biomass* |
|---|---|---|---|---|---|
| J | Dairy cattle | Lighting and appliances in the house and cowshed, service water heating | Firewood, house and cowshed | Contractors helping in agricultural and forestry work, joint ownership of farm machines, selling wood (occasionally) | Manure, forest biomass in the future |
| K | Dairy cattle | Lighting and appliances in the house, cowshed and sauna, service water heating (cowshed) | Firewood, house and cowshed | Contract on manure delivery with a neighbour, loaning of farm machines | Manure, forest biomass, agrobiomass in the future |
| L | Beef cattle | Lighting and appliances in two houses | Firewood, houses and cowshed | Occasional selling of manure and wood, helping each other in forestry tasks, occasionally contractors helping in forestry work | Forest biomass |
| M | Dairy cattle | Lighting and appliances in the house and three apartments, service water heating | Firewood, house, apartments and cowsheds | External workers hired | Manure |

## *5.2 Potential biomasses and forms of cooperation*

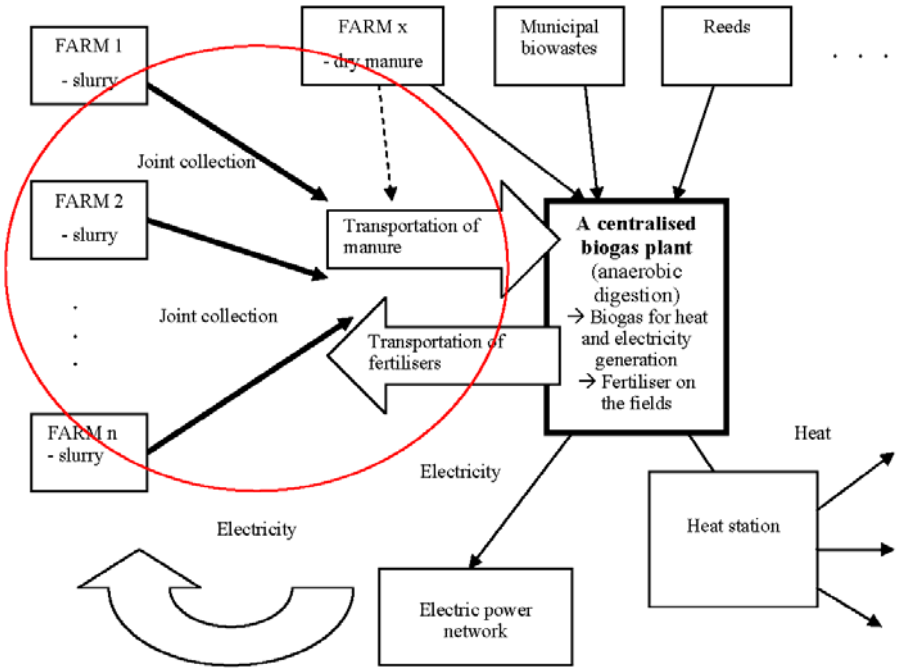
A majority of the interviewees saw animal manure as the most potential biomass for energy uses. The potential of forest biomass was also seen as important. As the opportunities of animal manure utilisation are rather parallel, the area of forest biomass utilisation was seen to have versatile opportunities for cooperative activities. At the moment, the potentials of agrobiomass were seen as rather small-scale, but because of the common development in the sources of livelihood in the countryside, it may rise as a field to be reckoned with energy purposes in the future.

As stated above, the farms are mainly self-supporting in heat, and thus, the livestock breeders' interests in biomass utilisation are headed mainly towards electricity production options or larger-scale business activities related to collecting, harvesting and transportation of different raw materials. The livestock breeders' views about the most potential forms of cooperative activities considering the three categories of biomass are introduced next.

### *5.3 Cooperation in the field of animal manure*

The opportunities of cooperative utilisation of manure are related to its biogas production potential. Thus, the interviewees saw the foundation of biogas plants with combined electricity and heat production as the most potential option for animal manure exploitation. In this model of cooperation, the collection and transportation of manure would be handled by a centralised system. Because a majority of the farms produce slurry, it was seen as a good base material for the plant. In addition, e.g., the municipal biowastes, reeds from territorial waters or dry manure could be used as solid ingredients in the process. Because of the all-increasing prices of fertilisers, the manure will be vastly needed as a fertiliser in the arable land also in the future. That is why the usability of manure for fertilising after the energy production process was seen as essential among the interviewees. The principle of the system is presented in Figure 2.

**Figure 2** Cooperative opportunities in the field of manure (see online version for colours)




Some of the interviewees considered that the bigger plant could be established, the better. Some, however, saw that because of the easiness and costs of raw material transportation, there could be e.g., two plants: one located in the north side and one in the south side of the municipality. Centralised models were seen to have many advantages over plants owned e.g., by a few livestock farms in a certain smaller area. At the moment, the investments in this kind of plants are so high, that none of the breeders would be ready to take the financial risk on their own or even with a couple of neighbouring farms. In a centralised model, the investments would not be wasted if someone stayed out of the project. In addition, because the majority of farms can not exploit all the heat energy

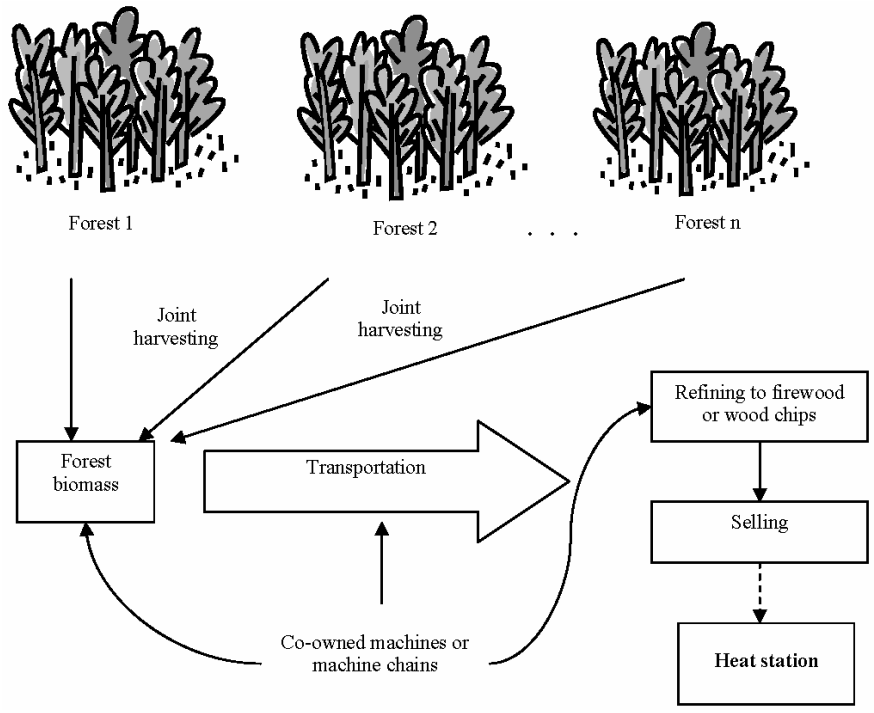
produced in the plant, there must be reasonable uses for this energy; it could be directed e.g., to the heat energy stations in the municipality or greenhouses in the area.

The views about the suitable number of partners, the other partners needed in addition to the livestock farms, the ownership base, organising and common practices in the model varied among the interviewees and need a more profound analysis. However, it was commonly admitted that in addition to the cooperation and networking between the livestock breeders, the implementation of this kind of projects would need many other parties in the aspects concerning e.g., technological, organisational and financial know-how and support. In addition, the role of the municipality in the project was seen as essential.

### *5.4 Cooperation in the field of forest biomass*

In the field of forest biomass, the cooperative activities were seen as opportunities at different levels. Harvesting activities and transportation of wooden raw material were seen as the basis for cooperative activities in the field – the wooden raw material could be harvested in a larger scale and transported collectively to the roadsides. After that, it could be sold directly onwards or refined cooperatively to firewood or wood chips. Because chipping of wood is normally contracted out, the co-ownership of a chopper raised some questions of its profitability. Additionally, some interviewees saw that the harvested forest biomass could also be used as a solid material or even as an optional fuel in centralised biogas plants.

**Figure 3** Cooperative opportunities in the field of forest biomass utilisation



On a common level, regardless of the end use of forest biomass, many of the interviewees saw co-ownership of forestry machinery as a possible and reasonable way to expand the current cooperation. As Table 3 indicates, this kind of cooperation already exists to some extent. However, there exist many options to widen this cooperation, especially between farms. Some interviewees saw that the machines could also be owned in chains where certain partners would be responsible for certain steps of the wood-processing chain. The opportunities related to forest biomass are summed in Figure 3.

Depending on the scale and scope, the cooperation related to forest biomass utilisation would also need support from different parties. As in the case of a biogas plant, the interviewees' opinions about the most suitable organisation and the needed partners varied. In addition to a municipality-led organisation, cooperative societies and project-type models were seen as possible ways to manage the cooperation. Additionally, if forest biomass were produced in a larger scale, connections with the local energy firms were seen as essential; it does not make sense to compete in markets which are already well satisfied.

### *5.5 Cooperation in the field of agrobiomass*

In the field of agrobiomass, the opportunities of cooperation were not seen as straightforward, and the potential of agrobiomass was mainly seen to become concrete in the future. Currently, almost all the arable land is needed for animal maintenance. In addition, the profitability of energy production from agrobiomass was experienced as questionable. Thus, a majority of the interviewees considered the energy utilisation possibilities of arable land with suspicion.

However, it seems probable that the number of livestock farms will continue to decrease in Parikkala, and all the arable land might not be needed for animal maintenance purposes in the future. Even among the interviewees there were a couple of breeders who had considered giving up their cattle in the next few years. After that, the cultivation of energy crops or even growing energy wood in arable fields will be potential activities. A couple of interviewees already had arable land which could be used for energy purposes if profitability could be raised above the returns from grain selling. This agrobiomass could then be used and sold as such or used as solid material in centralised energy production plants. In these cases, the cooperation with other farms or other related partners would comprise e.g., cultivation, harvesting and transportation of agrobiomass. As in the case of forest biomass, co-ownership of the machinery needed in the process was seen as a reasonable area of cooperation.

### *5.6 Enablers and barriers for cooperation*

In the examination of enablers and barriers related to the three forms of cooperation, the introduced views in the theoretical context were combined to a simplified framework with three different environmental levels (see Section 3.3). The influencing factors can thus, be divided into three levels: factors related to the *actor level*, factors related to the *regional level*, and thirdly, factors related to the *national level*.

The factors of the actor level can be seen to influence all the above-presented ways of cooperation in all the three fields of biomass utilisation. For that reason, the factors of that level were not divided to the different biomasses. At the regional and national levels, however, the factors could quite easily be identified to concern cooperation in a certain

category of biomass utilisation. Additionally, there were factors that were seen to affect cooperative activities in general.

The central enablers and barriers on the actor level are summed in Table 4. As the results indicate, the interviewees saw personal characteristics and attitudes as remarkable factors in partnership formation. On the other side, motivated, entrepreneurial actors with dissimilar know-how were seen as a certain resource. However, some interviewees saw that e.g., prejudices, independency and lack of enthusiasm can build up as barriers for the emergence of cooperation. In addition, working in teams and networks could bring along certain advantages economically, as well as from the viewpoint of effectiveness and convenience. However, some doubts about the robustness of the relationships were expressed.

**Table 4** Enablers and barriers at the actor level

| | *Enablers* | *Barriers* |
|---|---|---|
| Cooperation in the field of all three biomasses | Strong traditions of helping each other | The more people are involved, the worse the end result will be |
| | The breeders do not have time to do all the tasks by themselves - by cooperation the stress of the breeders can be diminished | Jealousy between neighbours |
| | Actors with same kinds of ideas | Prejudices |
| | Personal motives for cooperation | Independency of actors |
| | Convenience and attractiveness of team work | Lack of enthusiasm |
| | Problem solving is much more easier and effective in teams | Stubbornness: 'I'm doing fine by myself' |
| | Possibilities for better income | Fears about the end of activities if cooperation does not succeed |
| | Possibilities for risk minimising | |
| | Dissimilarities of actors can be a remarkable resource | |
| | The breeders have know-how in versatile fields | |
| | Entrepreneurial and active actors | |
| | Employment opportunities | |

The spectrum of factors that the interviewees saw as influencing on the regional level was wide. In the field of manure utilisation, the cooperation was seen to be enhanced by the great number of livestock farms. However, on the other side, some interviewees expressed doubts about the adequacy of raw material in the future. At the moment, the number of farms is great, but how about ten years forward? Cooperative utilisation of manure would have many intensifying influences on manure treatment. However, it was seen that lack of technological know-how can be a drag on the development of larger-scale projects.

As with manure, with forest biomass a certain challenge is to find reasonable uses for heat energy. The size of the municipality's energy stations is rather small, and the

costs may build up to be too remarkable, if the raw material is transported for long distances. Although, the wood reserves are wide, a central problem has been the poor availability of workforce. In cooperation, however, this lack could possibly be compensated for, and the possibilities related to co-ownership of machinery and 'machine chains' are supported by the fact that the harvesting of forest raw material is not as time critical as the harvesting of field crops. Thus, the same machinery can be used in wider geographical areas.

As stated above, the utilisation of agrobiomass evoked dissenting opinions. Some saw that the fields were not suitable for energy crop cultivation. Some interviewees, however, saw that there existed a lot of field blocks which would suit for the uses of energy production. In addition, there are some plans for increasing the cultivation of vegetable oil, possibly also for energy purposes.

**Table 5** Enablers and barriers at the regional level

| | *Enablers* | *Barriers* |
|---|---|---|
| Cooperation in the field of manure | A strong rural area | Long distances |
| | A great number of livestock farms | Difficulties in finding practical uses for heat energy |
| | As a result of consolidation with two other municipalities, the number of livestock farms has increased significantly | Adequacy of raw material in the future |
| | Environmental values: tendency to practical uses of manure | Lack of know-how in planning and organising projects |
| | Relieves for large farms that have manure over their own needs | |
| | Intensified fertilising, if the affluent ingredients of manure can be recovered | |
| Cooperation in the field of forest biomass | A great number of entrepreneurs in the woodworking field | Low availability of workforce |
| | A lot of services at hand | Difficulties in finding practical uses for heat energy |
| | A lot of forests with underused biomass potential | The small size of the municipality's heat energy stations sets questions about profitability |
| | Unlike farm machines, all the breeders do not need the forestry machinery at the same time --> possibilities of utilisation in larger geographical areas | In the countryside, people are a bit suspicious towards project-based activities |
| Cooperation in the field of agrobiomass | A great number of fields | Small size of field blocks |
| | Many uncultivated field blocks | |
| | Plans for larger-scale cultivation of vegetable oil (a compression plant) | |

**Table 5** Enablers and barriers at the regional level (continued)

| | *Enablers* | *Barriers* |
|---|---|---|
| Cooperation in the field of all three biomasses | There already exist some cooperation and networks | Lack of 'energy rings' |
| | A relatively narrow area geographically | Lack of big population centres |
| | An active and supporting role of the municipality | Long distances |
| | The economy of the municipality is well-managed | The sufficiency of markets is questionable |
| | Parikkala is in the crossroads to three towns | The farms are in different phases in their life cycles |
| | Good road and railway connections | |
| | The way of thinking has changed along the new generation; everything does not need to be done alone | |
| | Parikkala is not a 'dying locality' | |
| | Many expanding farms in the region | |

**Table 6** Enablers and barriers at the national level

| | *Enablers* | *Barriers* |
|---|---|---|
| Cooperation in the field of manure | Implementation of feed-in tariffs | Costs |
| | Possibilities to acquire knowledge and examples from the existing plants (as well in the home country as abroad) | Limitations from the EU about the amount of manure that can be delivered |
| | Large units make the implementation possible | Large-scale projects |
| Cooperation in the field of forest biomass | | Utilisation of foreign raw material, such as wood from Russia |
| Cooperation in the field of agrobiomass | The harvesting of energy crops is not scheduled at the same time with other field crops | Profitability is questionable |
| Cooperation in the field of all three biomasses | Changes in the composition of modern society --> all the breeders can not be 'big masters' | Definitions of energy policy |
| | | Changes in energy prices |
| | | Excessive visibility of energy issues in media |

Generally, Parikkala was seen as a positive region for the development of bioenergy production and that way for cooperation in different fields, by geographical and economical aspects as well. However, some interviewees saw the lack of population centres and the distances as hindering factors. In addition, the sufficiency of markets for greater amounts of bioenergy was seen as questionable. The factors on the regional level are summed in Table 5.

Decisions at the national level were seen as essential for the success of centralised biogas plants. Feed-in tariffs of electricity are already widely used in many European countries, and the interviewees saw that their implementation in Finland would speed up the biogas plant projects remarkably. The interviewees also referred to some international issues, such as the regulations set by the EU, which have a strong effect on the decisions of energy policy made at the national level. Possibilities to use the existing knowledge, from Finland and from abroad were seen as important.

In the field of agrobiomass, the different harvesting times of energy crops in relation to other crops was seen as a positive phenomenon. However, the biggest doubts were related to the profitability of agrobiomass. In general, changes in the composition of society were seen as spurring factors towards cooperative activities and networking. Excessive visibility in media, e.g., was seen as a factor which can hinder the actors' enthusiasm towards bioenergy issues. The factors on the national level are summed in Table 6.

## 6 Conclusions and discussions

The bioenergy field offers new ways of value-creation for the countryside. The approach of the study combined some theoretical views about the entrepreneurial opportunities and their exploitation in cooperation in certain environments. The entrepreneurial opportunities related to biomass utilisation can be seen to be built up by an interaction of certain technological, social and political changes. For example, the development of bioenergy technologies has made the exploitation of a wider palette of raw materials possible. The political decisions at the national level, as well as at the municipality level, spur the actors to develop and utilise new energy options. Additionally, many social and demographical aspects, such as the change of generation in agriculture support the development in the sources of livelihood. However, because the actors in the countryside usually lack tangible and intangible assets, the most reasonable way to exploit the entrepreneurial opportunities is via cooperation. In cooperation the actors can e.g., learn from each other, with each other, act as a negotiating partner, invest collectively, and involve relevant partners.

Cooperation, however, is not dependent solely on the breeders themselves, but there are many factors among the actors and the surrounding environment that influence either positively or negatively on the formation and nature of partnerships. According to the study, the actors are embedded in three different kinds of environmental levels which are related to the decisions to exploit entrepreneurial opportunities and to form partnerships and networks around these opportunities. These levels are the actor level, the regional level and the national level. On these levels, the enablers and barriers for engagement into cooperative bioenergy activities need to be recognised and considered carefully.

Experiences of former and existing relationships and the characteristics of potential partners can be expected to have a remarkable influence on partnership formation; they may either enhance or hinder the actors' enthusiasm for cooperative activities. So was the case with the actors in this particular study; the advantages of cooperation were considered as undeniable, but there were doubts about the functionality of networks with different actors. As the distances in the countryside are rather long, the farmers are used to certain independency and autonomy, and it may not be easy to share the decision-making with other parties. However, as Oerlemans and Assouline (2004) aptly argue, it

should be remembered that autonomy does not mean isolation; it means an ability to build internal and external relations without 'losing the track'.

In addition, the examined municipality has its own special characteristics as an environment for cooperative activities, and beyond the regional level, there are many nationwide or even international factors that may have their influence on the decisions made by the actors. Because of its novelty and fast-developing character, the bioenergy sector is strongly affected by different institutional factors, such as economical and social questions, climate and environmental policies, legislation and ecological questions. Thus, the decisions made by the reference group of the study are highly influenced by different forces from regional and national, even international levels; the institutional environment sets its own rules for the game.

The study proved that in addition to research on suitable technologies or on the viewpoints of energy firms or markets, it is also important to approach the possibilities of distributed bioenergy from the viewpoint of smaller actors. The case chosen for the study was experienced to reflect these viewpoints relatively widely. The livestock breeders saw the development of bioenergy options as a very positive phenomenon, and the great number of livestock farms and the strong traditions in breeding were seen to enhance the development remarkably. However, the development of larger-scale bioenergy production, such as biogas plants would set many challenges for the livestock breeders and for the municipality as a whole. Thus, it is worth noting that the opportunities are not restricted solely to large projects, but smaller-scale cooperation can also be realised, especially related to forest- and agrobiomass reserves. In general, rural areas are often considered as opportune grounds for interaction of small actors.

As the results indicate, Parikkala has many special characteristics as a region. For that reason, the results can not be completely generalised, although, they reflect the common tendencies in bioenergy utilisation in Finnish rural areas. Extension of the study to a greater number of municipalities would thus be an interesting path. In addition, at the regional level, the development of the biogas plant concept and the views about the studied themes of the interest groups of livestock breeders are considered as potential future fields of study.

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## Appendix 1

*The interview questionnaire*

*Parikkala, Spring 2009*

*'The preconditions, opportunities and challenges of livestock breeders for cooperative bioenergy production'*

*Interview themes and supporting questions*

1 Background

- The size of the farm
- The biomass reserves of the farm
  - animal manure
  - forest biomass
  - agrobiomass

  How are these reserves currently used?
- The use and sources of electricity and heat
  - the capacity of electrical connection
  - total sum of the electricity bills/year
  - the type of the heat kettle (if there exists one)
- Current cooperation with other farmers or other parties:

  How has this cooperation been born?

  How important is this cooperation to you?

  How is this cooperation maintained?

2 Objectives for bioenergy utilisation

- Do you think there are possibilities to increase bioenergy production in the Parikkala area? How?
- Are there chances to increase energy production from your farm's own biomass reserves?
- What are your objectives related to bioenergy production (expanding of own utilisation, wider utilisation alone/in cooperation, business activities, bioenergy entrepreneurship etc.)

  What kind of know-how and resources would be needed (in addition to your own know-how and resources) to attain this objective/these objectives?

  Are there actors in the Parikkala area who you see as particularly potential partners?

  Can you define certain criterias for the selection of partners?

3 The form and organisation of cooperative activities

In what areas related to bioenergy utilisation are you interested in cooperation?
Examples:

- Co-transportation of animal manure to a centralised plant
- Co-owned biogas plant with neighbouring livestock farms
- Co-owned bioenergy plant, which would utilise other biomasses than manure
- Cooperation related to forest biomass
  - harvesting and transportation
  - co-owned machines
  - chipping
  - etc.
- Cooperation related to agrobiomass
  - Cultivation and transportation
  - co-owned machines
  - etc.
- Collecting and sharing of information
- Book-keeping and other paperwork
- etc.

What kind of concrete actions would this cooperation include?

Is it possible to build a wider actor network around this cooperative activity? Who would then be potential partners in the network?

How should this cooperation be organised and managed?

How do you see your own role in the cooperation?

What kind of support would be needed from outside? (from the municipality, public sector, services etc.)

4 Enablers and barriers of cooperation

- What kind of factors may turn up as enablers for the above-discussed cooperation?
  - social factors
  - technological factors
  - legislation
  - economical factors
  - political factors
  - environmental aspects
  - geographical factors
  - etc.
- What kind of factors may turn up as barriers for the above-discussed cooperation?

  - social factors
  - technological factors
  - legislation
  - economical factors
  - political factors
  - environmental aspects
  - geographical factors
  - etc.
- What kind of advantages (on a common level) may be related to the cooperation?
- What kind of risks (on a common level) may be related to the cooperation?

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**PRECONDITIONS FOR REGIONAL NETWORKED BIOENERGY PRODUCTION**

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# Preconditions for regional networked bioenergy production

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**Abstract:** Bioenergy offers a lot of new opportunities for rural regions considering new options for livelihood. The possibilities opened by bioenergy also create needs for building new kinds of regional networks. Although rural areas are commonly considered as opportune grounds for networking, regional development faces many challenges as well. In addition, exploitation of a new technology is controlled by many parties. The paper clarifies the preconditions for a new regional entrepreneurial network around bioenergy production. A possible biogas plant concept in a rural municipality in Eastern Finland is examined, and the preconditions set by social, regional and institutional contexts are brought up and discussed. The research reveals the preconditions which seem the most challenging to fulfil. It is shown that the success of the concept depends on numerous actor-related, regional and institutional factors. The study also highlights the importance of networking in developing new entrepreneurship for rural regions.

**Keywords:** regional development; networking; rural region; preconditions; embeddedness; institutional environment; bioenergy; biogas; animal manure.

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## 1 Introduction

Many rural municipalities are confronted with a situation where new options for livelihood need to be considered. The development of rural areas is diverse; the actors in the countryside no longer lean on single sources of living, but rural development consists of a variety of new entrepreneurial activities and services. This development demands, e.g., re-configuration of the way rural resources are used in farms and between agriculture and other rural activities (Jokinen et al., 2008; Murdoch, 2000).

One of the new options is bioenergy production, which offers entrepreneurial opportunities for rural municipalities with vast biomass reserves. The interest in bioenergy has risen at the same time as the price of fossil fuels has increased and climate protection has been raised in the policy agenda (Hillring, 2002; Rikkonen and Tapio, 2009). Along this interest, biomass production from agriculture has become a relevant and widely discussed issue in national policies, and many countries have established policy goals and targets to develop bioenergy production from agriculture (Rikkonen and Tapio, 2009). The purpose of this paper is to clarify the questions related to bioenergy production in the countryside and to examine the demanded preconditions.

The emerging biofuel market is a new significant source of demand for some agricultural commodities. For many farmers, producing raw material can be seen as a new opportunity for income. In addition, local energy production based on local resources provides jobs and enterprise opportunities. Thus, bioenergy can increase energy self-sufficiency, improve the income distribution, generate new entrepreneurship and job opportunities in rural areas, and have thus many balancing effects on agriculture (e.g., Demirbas, 2009; Domac et al., 2005; Heinimö and Alakangas, 2006; Rikkonen and Tapio, 2009).

However, new sources of livelihood usually create needs for building new kinds of regional structures. This has led to some rethinking of rural development strategies and prompted an interest in networks; a rural community is not a group of individual actors or entrepreneurs, but rather collective actors performing and creating tools for ensuring sustainable livelihood (Jokinen et al., 2008; Murdoch, 2000). Although rural areas are commonly considered as opportune grounds for interaction and networking of different actors, the development of regional networks is also faced with challenges (Oerlemans and Assouline, 2004). There are actor-related, regional, and also national and international factors which either enable or hinder the exploitation of emerging entrepreneurial opportunities and the networking activities around them (Arenius and De Clerq, 2005; Barringer and Ireland, 2008; Rutten and Boekema, 2007).

Entrepreneurial decision making involves the recognition and assessment of *opportunities*, and it is often a bridge between two questions – what is needed and what is possible. The responses to these questions can be shaped, e.g., by the increased knowledge of the external environment, which can be gathered by social and business networks (Parsons and Rose, 2010). Thus, individuals or organisations differ in terms of their perception of entrepreneurial opportunities, due to differences between the partnerships or networks they are *embedded* in (Arenius and De Clerq, 2005; Cantner et al., 2010).

The actors' embeddedness in partnerships and networks is vital for the foundation process of a new business, because a network offers access to the assets and capabilities of other actors (see, e.g., Chetty and Wilson, 2003; Chen et al., 2009). Usually the actors lack some resources, capabilities or legitimacy which they need for successful survival,

and thus need to gain access to external resources and know-how that cannot be produced internally. This means that they often become more or less dependent on their external network (Hite and Hesterly, 2001; Mei and Nie, 2008). Being embedded in a network structure usually creates opportunities and improves performance, because the individuals benefit from the social capital and tangible assets of that particular context (Li and Chen, 2009; Rutten and Boekema, 2007).

However, social ties may also force the individual to conform to current understandings and practices (Staber, 2005). All actors are embedded in some social context which has developed its own norms, values, rules etc. The intangibles that influence the behaviour of actors in networks are, for most part, derived from the social context of these actors. This social context may pertain to regions as well, which means that the networks in a region may all be characterised by the same or similar norms, values and rules. In that case, it can be said that the actors are embedded in a regional social context (Granovetter, 1985; Rutten and Boekema, 2007).

Regions may differ remarkably in the preconditions for innovation and enterprise development. In addition, they also differ in terms of network cohesion (Tödtling and Kaufmann, 2002; Arenius and De Clerq, 2005). In his research on the determinants of regional innovation, Radosevic (2002) states, however, that the initial advantages of a region do not necessarily guarantee growth and success for it. Some regions with initially unfavourable conditions have been able to recover and grow faster than those with seemingly more favourable preconditions. In addition, regions with similar preconditions are likely to diverge in their growth and innovation. In general, regional development policies are more and more based on network-like modes of action where several interest groups take part, and where there are many kinds of networks crossing organisational, regional and institutional boundaries (Sotarauta, 2009).

In addition to being dependent on social and regional contexts, the actors are dependent on the surrounding external environment as well. Decisions to start a new business or to create networks are never made in a vacuum, but they are influenced by various outer contexts as well (Hung, 2005; Shane, 2003). Responses to the questions of what is needed and what is possible are thus shaped also by *the institutional environment*.

The institutional environment consists of different economical, political and socio-cultural aspects (Hung, 2005). The institutional environment thus sets the 'rules of the game' that generate incentives for certain types of action, and provides the social setting that determines legitimate and acceptable behaviour (Hung, 2005; Shane, 2003). *Trends* create new entrepreneurial opportunities. Changes in economic factors, social factors, technological advances, political actions, and regulatory statutes often provide impulses for new business opportunities (Barringer and Ireland, 2008), but these factors may also inhibit opportunity exploitation (e.g., Roos et al., 1999).

Bioenergy represents new technology, and thus many technical and non-technical factors may inhibit its application. Firstly, there are economic factors, such as investment costs, relatively long payback times, and price expectations for the energy produced. In addition, the market infrastructure may not yet be well-built. Access to technology may be restricted, and the energy sector is undoubtably rather highly regulated. In addition, different institutional and political factors may determine which kind of production in general is favoured or excluded. On the actor level, lack of human resources, practices and cultural modes of action may make the development of bioenergy business difficult. In practice, this is illustrated by a lack of mechanisms to distribute information, lack of professional institutions and lack of involvement (Jokinen et al., 2008; Painuly, 2001;

Rutten and Boekema, 2007). As discussed above, these actor-related factors may even stand out in rural regions.

Rural regions are on one hand commonly experienced as unique environments for innovations and opportune grounds for interaction and networking (Arenius and De Clerq, 2005; North and Smallbone, 2000). On the other hand, rural networks are confronted with many barriers from outside; e.g., conflicting regulation, lack of institutional support, little room to experiment, lack of infrastructure, lack of adequate technical support etc. In addition, groups of rural actors are usually faced with barriers of their own, such as management of the group and the organisation of collective learning (Oerlemans and Assouline, 2004). One challenge for rural areas are long distances between the actors, which may hinder the formation of constant interaction. Although entrepreneurs have been noted to be more satisfied with networks that they had a part in creating than with those created by governmental or other institutions, network creation in sparsely populated areas may need some support from local authorities (Schallenkamp and Smith, 2009).

When planning regional development, rural regions are thus faced with a number of unanswered questions: e.g., how a fragmented group of actors, resources, competences, ideas and visions can be pulled together, how people can be mobilised, how a new perception concerning the region and its future can be created for the needed change, and who are capable and respected enough to do it (Sotarauta, 2009). If also the requirements set by the exploitation of a new technology (such as bioenergy) are examined, the interesting question is: what kind of factors need to be taken into account when an entrepreneurial network is built around a new technological concept?

This paper addresses the above question by clarifying the preconditions of a new regional entrepreneurial network around bioenergy production. As the case, a possible biogas plant concept in the rural municipality of Parikkala in Eastern Finland has been chosen for more thorough examination. The social context of the study consists of a group of farmers and surrounding partners interested in bioenergy development. As a traditional rural community, Parikkala forms an interesting regional context for examination. In addition, as bioenergy production is determined by many institutional factors, the meaning of the institutional context stands out clearly in the study. The preconditions for networked bioenergy production are demonstrated to be formed as a joint effect of all the above three layers. The central research questions are: “What are the main preconditions for a regional biogas production network?”, “Which of these preconditions seem to be the most challenging ones?”, and “How can the preconditions be fulfilled?”

## 2 Research design

The empirical study was conducted as a case study. A central feature of case study research is the construction of ‘the case’ or ‘cases’; the research questions are always related to the understanding and solving of the case: what the case is about and what can be learned by studying it (Eriksson and Kovalainen, 2008). Creswell (2007) defines a case study as an exploration of a bounded system which can be defined in terms of time and place, over time and through detailed, in-depth data collection, involving multiple sources of information which are rich in context.

Case study is not a methodological choice, but a choice of what is to be studied. Case studies typically combine data collection methods, such as archives, interviews, questionnaires and observations. Case study research does not need to be essentially qualitative, although it is a common way to do qualitative inquiry (Creswell, 2007; Stake, 2000). Case research is particularly welcome in new situations where only little is known about the phenomenon and in situations where current theories seem inadequate (Eisenhardt, 1989; Yin, 2003). Halinen and Törnroos (2005) emphasise the advantages of case studies over other research strategies; case research allows the study of a contemporary phenomenon which is difficult to separate from its context, but is necessary to study within it to understand the dynamics involved in the setting.

Stoecker (1991) suggests that there is a key difference between *intensive* and *extensive* case study research. Intensive case studies aim at understanding a unique case from the inside by providing a thick, holistic and contextualised description. Extensive case studies, on the other hand, aim at elaboration, testing, or generation of generalisable theoretical constructs by comparing a number of cases. Yin (2003), for his part, sees that single- and multiple-case studies are only two variants of case study designs.

According to some authors, case studies can be distinguished by their *intent*, i.e., the starting point of the study (see e.g., Creswell, 2007; Silverman, 2005; Stake, 2000). *Intrinsic* case study is undertaken when better understanding of a particular case is searched for. The focus is thus on the case itself, because the case presents an unusual or unique situation. *Instrumental* case study is used if a particular case is examined mainly to provide insight into an issue or to redraw a generalisation. The researcher focuses on an issue and then selects a bounded case to illustrate it. The role of the case is rather supportive, and it facilitates understanding something else. *Collective* case study is an instrumental study extended to several cases – one issue is chosen for examination but multiple case studies are selected to illustrate it (Creswell, 2007; Silverman, 2005; Stake, 2000).

## *2.1 Empirical data collection*

The initial data for the study was collected for an earlier study in Parikkala municipality (see Kokkonen and Kässi, 2010), where local livestock breeders were interviewed about their views on the potential of biomass. In addition, three interviews tailored for the present study were conducted.

In the first data collection phase, the empirical data consisted of 13 semi-structured theme interviews, which means that the outline of the themes was prepared, but the wording and order of questions varied a little (Eriksson and Kovalainen, 2008), depending on the background information that was collected in the beginning of the interviews. The interviews were carried out in Parikkala in March 2009. The interview themes were based on the research questions and literature, and refined in cooperation with the representatives of Parikkala municipality. The results reported by Kokkonen and Kässi (2010) concentrated on the possibilities of cooperation in defined areas of biomass utilisation, and especially the enablers and barriers related to them. As a result of the first phase, central preconditions for a regional biogas production network were recognised.

The second data collection phase was conducted in December 2009. The data was collected through themed interviews with persons and parties surrounding the primary producers of the first interview phase, who were conversant with bioenergy issues and regional development. The second data collection phase can also be described as

semi-structured, but it was organised differently from the first phase; an actual questionnaire was not used, but a list of themes to be covered and a summary picture (see Appendix) of the results of the first data collection round were used as the basis for the interviews. With the picture, the interviewees were asked to assess the central preconditions related to a possible biogas plant concept; how challenging these preconditions, set by the surrounding social, regional and institutional contexts, seemed to be, and what kind of cooperative activities they would demand?

Following the above-presented definitions from the literature, the nature of the first round of the study can be defined as an instrumental single-case study: the cooperative activities around bioenergy production formed an issue which was then illustrated by a bounded case, the livestock breeders' views on the bioenergy production opportunities in Parikkala. The second round of the study, however, was rather intrinsic by nature – a particular case, the biogas plant concept and the surrounding network, was constructed and better understanding was sought through it.

## 3 Results

### *3.1 Initial conditions*

One of the common tendencies in livestock production in Europe is intensifying it and increasing the size of the units. High cattle density means an increasing amount of animal manure. This manure needs to be managed in ways that do not harm the environment in terms of, e.g., pollution and over-fertilisation of soil. Thus, along with the development in bioenergy technologies and economical sustainability, the number of biogas plants in Europe increases continually (Holm-Nielsen et al., 2009; Junginger et al., 2006).

Finland is one of the pioneers in biogas production. However, the production of biogas from manure is still rather a new phenomenon in the country. Finnish farms have strongly leaned on forest biomass, which, in all, is the most remarkable source of renewable energy in the country (e.g., Alm, 2008). Besides traditional agriculture, many farmers have acquired income from forestry, as well as from machine contracting.

In 2010, there were ten operating on-farm biogas plants in Finland, and nine plants were under start-up (Huttunen and Kuittinen, 2011). The interviewees believed that so far mainly three issues have restricted the spreading of biogas plants in the Finnish countryside. Firstly, feed-in tariffs for electricity, which are used widely in European countries, have not existed in Finland. The lack of this supporting mechanism has kept the production of electricity in smaller units unprofitable. At the time of the empirical research phase of the paper, the Finnish Ministry of Employment and the Economy (2009) was preparing a presentation of feed-in tariffs for energy from wind and biogas. In 2011, the feed-in tariff system for biogas was put into operation, setting a guarantee price for electricity of 83.5 Euros/MWh for new biogas plants with the generator power of at least 100kVA. In addition, if a remarkable share of the produced heat can also be utilised and 50% total efficiency is obtained, the guarantee price will be 133.5 Euros/MWh (Ministry of Employment and the Economy, 2011; Marja-aho, 2011).

The second reason for the rather low number of Finnish biogas plants is that the farm sizes in Finland have been fairly small, and also the distances between farms are rather long in international comparison. However, as Finland has followed the common

European tendency of intensifying livestock production and concentrating on larger units (e.g., Holm-Nielsen et al., 2009), the number of larger livestock farms which would produce an adequate amount of feed material has increased. Thirdly, it has also been a question of technology. However, the development of bioenergy production technologies has been fast recently, and the prices of biogas plant constructions have decreased. In addition, the support systems for bioenergy investments are under constant development (e.g., Marja-aho, 2011; Taavitsainen, 2011).

Improvement in the factors listed above will naturally diminish the risk of investment and make the opportunities for bioenergy production more tempting. Among these aspects, improved energy self-sufficiency, widened possibilities of biogas utilisation and environmental targets have boosted Finnish farmers' interest towards biogas production in the past few years (Huttunen and Kuittinen, 2011). The calculations for different biogas plant concepts (e.g., Taavitsainen, 2011; Mykkänen, 2009; Vilkkilä, 2007) indicate that with reasonable feed material choices, well-organised infrastructure and sufficient governmental support, the investments in manure-using biogas plants will be profitable.

Parikkala is situated in South-Eastern Finland, near the Russian border. There are around 6000 habitants in the municipality. Livestock farming has traditionally been a remarkable source of livelihood in Parikkala. Although the number of livestock breeders has steadily decreased in the past few years, there are still around 140 livestock farms in the municipality. An increase of unit sizes and intensity in livestock breeding is also evident. The interest towards producing energy from the farms' own biomass reserves has increased significantly among the farmers. Because of the large number of livestock farms in the region, the manure from these farms forms a remarkable proportion of the potential biomass. Thus, the concept of a biogas plant that would use manure as the main feed material has risen as an option to be considered.

Based on the results of the first interview round, the biogas plant concept was chosen for more thorough examination. The interviewees saw the foundation of biogas plants with combined electricity and heat production (CHP) as the most potential option for the utilisation of the biomass reserves of Parikkala. Due to livestock breeding, manure is available constantly, and could be thus used continually in energy production. A majority of the farms produce slurry, a liquid mixture of urine, faeces, water and bedding material (Holm-Nielsen et al., 2009). In relation to other areas, the region also has many farms that handle their animal manure as dry manure, which can also be exploited in energy production processes, usually as a binder for slurry. Slurries and dry manure together could thus form the basic feed material of the plant. In addition, other biomasses, such as municipal biowaste and agrobiomass could be used, because modern technologies enable the utilisation of a rather diverse supply of feed material.

Profitability was strongly emphasised in the opinions of the interviewees. Although biogas production would not be a single source of income for any farm, no-one was willing to take excessive financial risks. However, in addition to economical aspects, the concept would have many other advantages as well. One way to benefit from the plant would be the production of fertilisers; the manure is reformed in the process, and it can be easily and effectively re-used for fertilising the fields. In addition, the environmental harms of manure would be diminished. For the municipality, the plant would create new job opportunities and a possibility to improve its energy self-sufficiency, and thus offer an opportunity for regional development.

### 3.2 Preconditions for the biogas plant concept

The preconditions for the development of a regional biogas plant and the supporting network around it are presented in the figure in Appendix. The actor level mentioned in the figure illustrates the social context related to the plant, the regional level in the inner circle accords with the regional context, and the national/international level in the outer circle illustrates the institutional context. It can be seen that also in the studied case, the preconditions apply in all these contexts. The decisions and plans related to the construction and development of a plant are thus made by many different actors in different parties and societies, and on different environmental levels. The central preconditions discussed in the interviews and the views related to these preconditions are introduced below. In order to avoid overlapping and to form clear entities, some aspects presented in the figure in Appendix are grouped together.

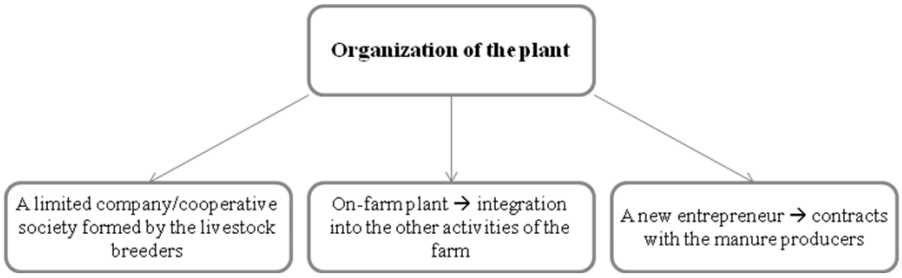
#### 3.2.1 Organisation

The first precondition, 'organisation' of the plant, comprises the planning, utilisation and maintenance of the plant, the form of the enterprise, and the role of the municipality in the project.

Of these factors, the interviewees considered the planning phase as the most challenging one. The greatest challenge seemed to be triggering the project off – how to find the persons who would take the incentive and start the project? One possibility to develop a plant would be along the ongoing 'Carbon Neutral Municipalities' –project, which the municipality is engaged in. In the project, plans have been made for improving the energy self-sufficiency of the farms, and the aspects related to biogas production could possibly be taken into consideration in these plans.

The interviewees referred to three optional ways of organising the plant, shown in Figure 1. Firstly, if the plant were established by several farms or other parties, a suitable form of the enterprise would be a limited company or a cooperative society with clear models of operation. If the plant were established on a single farm, it would be integrated as a part of the activities of the farm and would thus not require a separate organisation around it. However, a separate organisation would still be possible, and for clarity, some interviewees also preferred it. One possibility would be for the plant to be established by a totally new entrepreneur who would build and utilise the plant, and the farmers would thus act mainly as deliverers of the manure and receivers of the fertilisers.

**Figure 1** Possible organisational forms of the biogas plant




The utilisation and maintenance of the plant was seen as rather easy; the plants are usually designed as highly automated, so regardless of the form of enterprise, it could be

maintained mainly by one person. The plant itself would thus not work the breeders or other parties involved very much. However, the surrounding activities, such as the delivery of manure and other feed materials would employ several persons and also create new job opportunities. For the breeders, giving out the manure would form an additional source of income. In all, tight cooperation is required between the parties involved.

The role of the municipality in the project was seen as a customer for the produced energy, or also as a part-owner of the plant. In addition, the municipality could help in finding a suitable location for the plant and uses for the produced heat energy. If new heating lines were needed, the municipality could also support the project by building these lines.

### *3.2.2 Location and logistics*

In the interviewees' opinion, the questions related to the location and logistics were probably the most important and also rather challenging to solve. The location should be central but at the same time distant enough: long distances cause excessive transportation costs of manure, and additionally, heat can not be transferred long distances because of high leakages and costs. One option would be a location near the existing district heating network. However, the interviewees thought that a plant located near residential areas would probably raise a lot of resistance because of the possible problems with noise, smell and increased traffic. As a good option, the interviewees saw a plant which would utilise feed material from several farms, but which would be located on a single farm. This way, resistance from surrounding parties could probably be avoided.

Regardless the location of the plant, the collection and transportation of manure from the farms and back to the farms in the form of fertiliser, as well as transportation of other used feed materials should be handled by a centralised system. Although the transportation would be planned carefully, managing the transportation costs may turn out to be challenging because of long distances between the parties involved. However, it should be noted that manure is already transported widely between farms and spread to fields which may be located rather far away from the farms. Some of these existing costs would be diminished by a well-organised transportation system.

### *3.2.3 Uses of heat and electricity*

As stated above, the location of the plant should be near the utiliser(s) of the heat. In addition to real estates or animal houses, e.g., greenhouses would be optimal partners for the plant. However, the possibilities of building the plant next to a greenhouse seemed rather weak. From the business point of view, an actual heat enterprise would not be needed if the plant could be located next to the utiliser, or integrated to the municipal district heating network. An on-farm plant would raise a problem with the heat energy, because the farm itself would probably not need all the heat produced. However, if the heat energy could be used for house warming by an efficient heat recovery system, this problem could be solved. Many breeders warm their houses by woodchips, and one interviewee also brought up the possibility of using the heat energy for drying woodchips.

In the opinion of the interviewees, the profitability of electricity production seemed highly challenging. They argued that as long as the feed-in tariff system does not support the smallest plants, it is difficult to gain profit from electricity production for farms.

Some interviewees, however, thought that even though the feed-in tariff system came into operation in Finland, it would still not support small-scale farm-specific production, because the requirements for produced energy seemed rather high. Thus, in order to gain a sufficient amount of feed material, cooperative activities around feed material procurement would be needed.

One option for improving profitability could be net measuring of electricity: depending on the location of the plant, the nearest actors would use the amount of electricity they need for their own purposes, and the rest could be sold to the distribution network. However, it is expected that the amount of electricity for distribution would be rather small compared to the required investments.

### *3.2.4 Technology and construction*

The needed technology and the construction of the plant were not seen as problems. As stated above, the technologies in the field are developing fast, and at the time of interviews, there were already two turnkey biogas plant constructions available in the market. If these solutions were not used, constructional know-how could be found, possibly even in the region. One interviewee described the situation as follows:

> "I don't see it as a problem at all. Technical know-how is easy to buy. Basically, the whole concept is commercialised, so the plant can be ordered as a turnkey-system if desired. But the problem is the launching-phase of the project: to find the persons who would actually initiate it."[1]

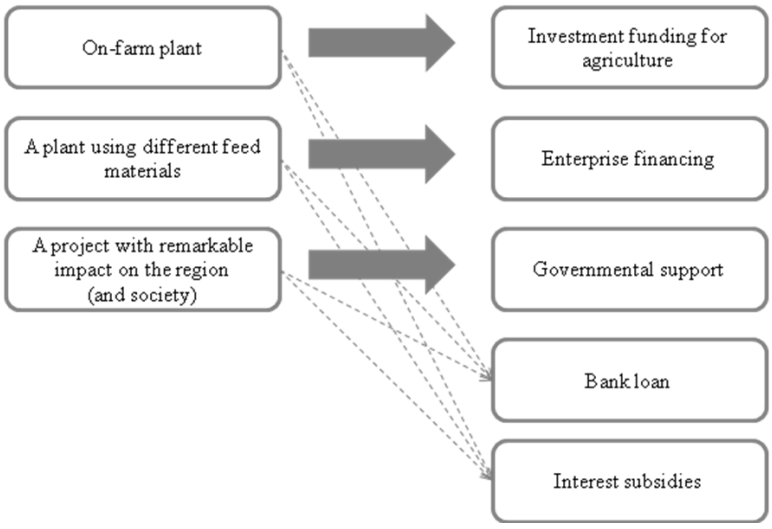
In addition to the construction of the plant, every farm involved in the delivery of manure and/or fertilisers would need new containers for the manure, or they would have to renew the existing ones.The needed components and machines could be ordered from abroad, e.g., Denmark or Germany, where the biogas technologies are already well developed. Components are also produced in Finland, but at the time of the interviews, they were mainly sold to foreign markets because of the low demand in the domestic market. Guidance for energy production could be gained from the existing plants in Finland and abroad. In addition, cooperation in energy production issues could be done with universities and research institutes.

### *3.2.5 Financial support*

In the interviewees' opinion, financing was one of the most challenging aspects in developing a plant. However, they also mentioned several options for applying financial support, depending on the plant size and organisation. As bioenergy issues are widely recognised as remarkable in national and international politics, investments related to the bioenergy business are also relatively well supported.

If the plant were established on a single farm and integrated into its activities, investment funding for agriculture could be applied for. For a bigger plant with a remarkable portion of other than farm-produced feed materials, the way to apply for funding would be via normal enterprise financing. Projects with a remarkable impact on the region or society, e.g., via employment of local people, would also have a possibility to receive funding from the government. The options for funding, dependent on the size and location of the plant are presented in Figure 2.

**Figure 2** Alternative ways for financial support




Because of the topicality of renewable energy issues, the interviewees saw that financial counseling was rather easy to get. The advisor organisations offer well-planned counseling for farms. However, some of the interviewees would also need more courageous views on the future with bioenergy issues.

### *3.2.6 Legislation and permits*

The interviewees supposed that regardless of the size or the location of the plant, at least environmental and building permits for the plant would be needed. Depending on the size of the plant, an environmental audit may also be needed. In addition, the production of electricity, especially to the distribution network may require some permits. Also, the restrictions related to the amount of manure the breeders can give out to other parties would need to be taken into account. The permits could be applied in cooperation with the parties involved; for example, it does not seem reasonable to apply a permit for manure containers separately for every farm.

The legislation varies in different countries, and from the viewpoint of bioenergy production, the Finnish national legislation seems quite challenging at the moment. In addition, there are many regulations at the European Union (EU) level, for example related to the utilisation of manure, which may also hinder the opportunity exploitation. One interviewee described the attitude towards animal manure as follows:

> "Everybody is talking about renewable energy in national and European institutions, but the deeds don't always support the words. For example, manure is categorized as toxic waste, and burning and using it seems quite difficult."*

There are also legal provisions of energy production. For example, by the energy directive of EU, the energy balances of the farms will be examined more thoroughly than before. In addition, the interviewees supposed that general provisions of construction and security may set certain boundaries for the development. The main legislation for bioenergy production from agricultural feed-material and biowastes is depicted in Figure 4.

**Figure 3** Needed permits

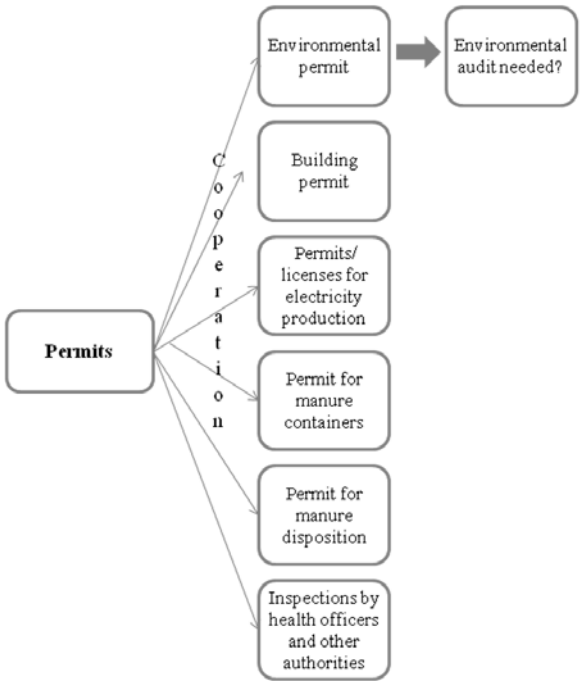
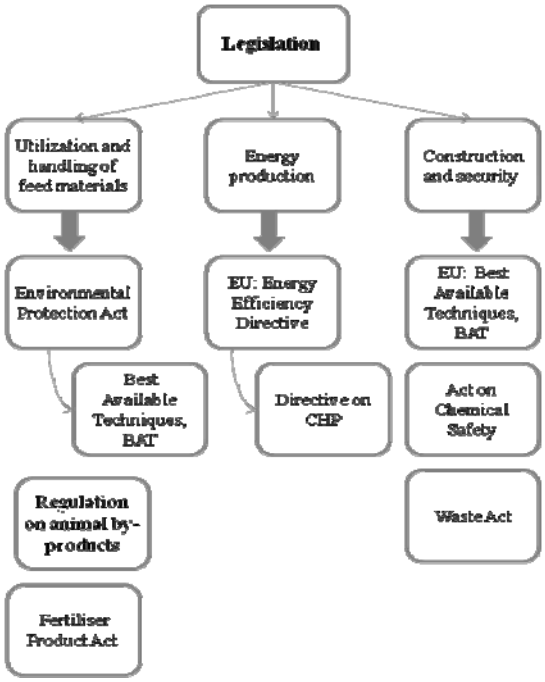



**Figure 4** Main acts regulating biogas production from manure




*Source:* Latvala (2009) and Villa and Saukkonen (2010)

### *3.2.7 Information and marketing*

Information and marketing have an essential role in gaining social acceptance and visibility to the project. In general, information on the project should not be difficult to get: during the last few years, the media has been extremely interested in bioenergy issues. One of the interviewees reminded, however, that although bioenergy is gaining a more and more positive image all over, the ways to inform and persuade the people in the region need to be planned carefully; the impacts for the region should be brought out realistically and convincingly. A biogas plant should be seen as an option which does not destroy the traditional agricultural sources of livelihood, but offers a new opportunity for income beside them, and that way vitality to the whole region.

In addition to the utilisation of different media, the interviewees saw that information should be given in person in discussions. Information about the project should also be distributed at national level to increase the awareness of the decision makers on how things are really done in the countryside. One interviewee argued that "…when setting new statutes, the authorities should listen to the primary producers more carefully… their opinions should also have a certain weight in the decisions."*

**Table 1** The most challenging preconditions

| | *Precondition* | *How it can be fulfilled* |
|---|---|---|
| Institutional context | Profitability of electricity production | Feed-in tariffs (in preparation), net measuring |
| | Financial support | Investment funding, enterprise financing, governmental funding |
| | | Financial counselling |
| | Legislation (Finland and EU) | Cannot be affected but should be observed, cooperation with permits |
| Regional context | Location: should be central but distant enough | Farm-specific plants using feed material from several farms |
| | | Near to the heat utiliser(s) or the district heating network |
| | Transportation of feed materials and fertilisers | A centralised system should be developed |
| Social context | Executors for starting the project | Active farmers and other actors in the region should be encouraged to take the first step |
| | | Possibility to support farms through the Carbon Neutral Municipalities-project |
| | Persuasion of local people | Information needs to be planned carefully: the positive impacts on the region should be highlighted |

## *3.3 Summary*

The results of the study revealed a set of preconditions which are essential for the development of a biogas plant and the supporting network around it. A number of them seemed quite easily attainable, but there were some preconditions which the interviewees considered more challenging. These preconditions were related to the institutional environment, as well as to the actors and their embeddedness in the region (see

Section 1). On the basis of the interviewees' opinions, the most challenging preconditions at different environmental levels and the possible ways for fulfilling them are summarised in Table 1.

## 4 Discussion and conclusions

The studied municipality is a good example of a rural region which may reach for new options for livelihood with the bioenergy business. With vast biomass reserves, especially in the form of animal manure, this rural region holds an opportune ground for bioenergy production. But, as the results of the first study already indicated, the success of a biogas plant project depends on numerous factors.

In this study, preconditions for a biogas plant concept were further identified and discussed. The study revealed the most essential preconditions, and also ones which appeared to be the most challenging. As bioenergy represents new technology, and the establishment of a biogas plant requires new regional structures, it is expected to be inhibited by, e.g., different technical, economical, political, institutional and actor-related factors. These factors were also found in this particular research.

The results of the empirical study confirmed the aspects discussed in the first section of the paper concerning the possible inhibitors of bioenergy production in networks. Investment costs were seen as a challenge, and the national and European concessions may not correspond to the breeders' price expectations for the energy produced. In addition, the market infrastructure in the region should in practice be built practically from the beginning. However, differing from the views presented in the literature, access to technology was not seen as a challenge by the interviewees. On the other hand, it is widely admitted that energy production, especially when using manure as feed material, is rather highly regulated by national and European Acts. The institutional and political environment, however, supports the utilisation of biomasses increasingly.

It was also admitted by the interviewees that the studied region and its actors by themselves form a challenge for the biogas plant concept. The distances are long, and the infrastructure should be planned carefully. In addition, the mechanisms to distribute information are rather unconstructed and experience from similar projects is missing thus far. As highlighted by the majority of the interviewees, one of the greatest challenges is to find the persons who would be in charge of the project.

However, it seems that the studied region has many optional paths for the development. Although the interviewees were highly worried about the economical aspects of the project, there already exist some examples of productive manure-using biogas plants even in Finland (see, e.g., Huttunen and Kuittinen, 2011; Latvala, 2009), as well as in many European countries (see, e.g., AEBIOM, 2009). In addition, the supporting mechanisms for bioenergy are developed constantly (e.g., Marja-aho, 2011; Taavitsainen, 2011). The results also indicated that most of the structures and technologies are rather easily accessible. The first and foremost challenge is to find the executors for the project.

It is obvious that the above-mentioned preconditions cannot be met without a viable actor network around the plant; as noted, rural municipalities are increasingly coalitions of different actors, not collections of individual actors. This was already

acknowledged in the studied area, and none of the interviewees questioned the importance of networking in developing new entrepreneurship in the region. The regions always have their own social contexts in which the region and its actors are always to some degree embedded in. This embeddedness should not be seen merely as a constraint, but an opportunity to build something unique – regional entrepreneurship and networks which capitalise on the resources, competences and know-how of the actors in this particular region.

One notable fact is that regional development is not merely an issue of local authorities, but their role is first and foremost to multiply the opportunities and alternatives for other actors and thus boost the regional development overall (see Sotarauta, 2009). This fact also came up in the views of the interviewees; a municipality of a rather small size cannot be responsible for everything, but activeness is needed from all the actors involved. As Schallenkamp and Smith (2009) propose, entrepreneurs usually find more satisfaction in networks that they had a part in creating as opposed to those created solely by governmental or other entities. However, as the studied municipality is a typical rural area with relatively long distances and rather short history of cooperation between farms, the authorities have an important role in gathering the actors together and supporting their entrepreneurial and networking activities.

The decision made to approach the issue first from the producers' (breeders') viewpoint and then to widen the view with regional and institutional actors proved to be fruitful. Too often, regional development seems to be conducted by authorities without decent contacts with the most important side: individual actors and entrepreneurs. This also came up in the interviews; it was criticised that, e.g., the political decisions related to agriculture are often far removed from primary production.

Because of concentrating on a single case, the study had some limitations which need to be noted. For example, it should be remembered that a biogas plant is just one option for producing bioenergy in the region. As indicated in the paper by Kokkonen and Kässi (2010), there is also an interest towards other biomasses in the region, and especially the opportunities of forest biomass should be considered carefully. An interesting research topic would thus be clarifying the preconditions for enterprise development around forest biomass utilisation.

In addition, clarification of the preconditions for a regional entrepreneurial network in another geographical area with a different profile would be an interesting subject for further study. As with all regions, the interviewed persons are also embedded in certain social ties and the studied region. Thus, the opportunities and preconditions in some other areas may be rather different. And, as Radosevic (2002) reminds, even though the preconditions were perfect, it still would not guarantee the success of the project. What was not discussed in the paper, but which should be taken into account, is the fact that the contexts in which the actors operate may also change rather fast.

In general, the study forms a basis on the issues related to building new regional networks around certain businesses. For the municipality, the study offers a good snapshot on the issues the people in the region consider as the most challenging in exploiting new entrepreneurial opportunities. As on-farm plants producing biogas are so far rather sparse in Finland, the study also offers useful grounding for other similar projects.

## Acknowledgements

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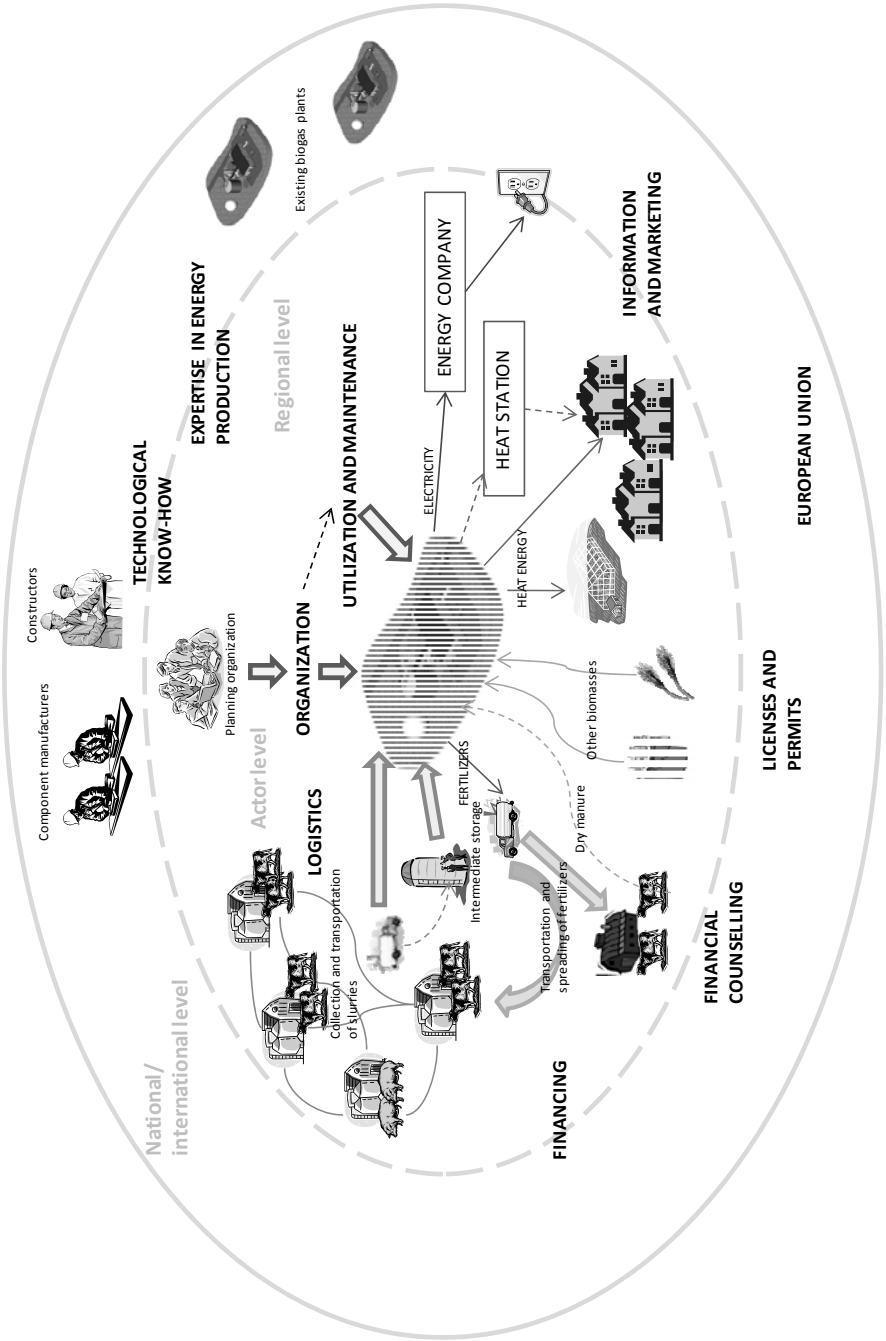
## Notes

1 The citations are translations of the original interviews in Finnish.

## Appendix

*Preconditions for the development of a regional biogas plant and a supporting network*



**Publication 3:**

Kokkonen, K., Lehtovaara, M., Rousku, P. and Kässi, T.

**NETWORKING OF BIOMASS HEATING ENTERPRISES – A TWO-DIMENSIONAL APPROACH**

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# Networking of biomass heating enterprises – a two-dimensional approach


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**Abstract:** In fast-evolving business areas, firms usually need networks to provide resources, respect and negotiation power they do not yet possess themselves. However, the actors should avoid becoming too entangled in restrictive relationships. The paper examines how actors balance between embeddedness and independency in their relationships, and how this balancing and their willingness and ability to share social capital reflect on the networks they tend to form. As a case, we study a group of biomass heating enterprises and discuss their tendencies to form business networks with the surrounding partners. Four groups of enterprises with different networking tendencies are recognized and further assessed. The results provide evidence that depending on the set objectives by actors related to their independency and associability, they tend to form different networks which differ from each other by the power relations of the actors, the openness of sharing social capital, and the willingness for network development.

**Keywords:** Networking, bioenergy business, biomass heating enterprises, independency, associability, network development, power relations, social capital

## 1 Introduction

Increasing greenhouse gas emissions have raised a global concern, and have caused significant changes in the prices and exhaustion of traditional fossil fuels. As a consequence, renewable energy options are increasingly favoured, and improved overall energy efficiency plays an important role in the future energy politics (Cowie & Gardner, 2007; Tekes, 2008). In many countries, one of the most promising options of renewable energy is the utilization of different biomasses.

Different forms of bioenergy business are increasingly taken into utilization. In addition, as in many fields of business, also the significance of networking is becoming more evident in the bioenergy production solutions. Especially in the fast-evolving business areas, in which bionergy also can be counted, firms usually need external networks to provide channels for negotiation and persuasion and a variety of resources (e.g. Hite and Hesterly, 2001; Mei and Nie, 2008) However, at the same time, the actors should avoid becoming too entangled in their relationships (e.g. Staber, 2005).

The existing literature covers well the pros and cons of networking and also discusses how the actors often need to struggle with the question of balancing between embeddedness (e.g. Granovetter, 1985) and independency (e.g. De Wit and Meyer, 2005). It is also widely acknowledged that the actors in any field of business differ in terms of sharing social capital, which impacts on their willingness and easiness to form partnerships and networks in general. To wit, every actor has a certain level of associability (see Leana and Van Buren, 1999).

Our aim is to widen the existing knowledge by examining how the aspects mentioned above; the actors' independency and associability, affect on the formation of networks in a growing business field. We analyze these aspects and concentrate on finding linkages between them and the types of networks created by actors.

As the case, we study a group of biomass heating enterprises. Heat energy production is mainly considered as a local activity. The main fuel in the plants, wood chips, are typically procured in the surrounding area. The plants may also use supplementary fuels, such as peat, agrobiomass and oil. The heating enterprise may take care of all the steps from fuel procurement to the delivery of heat to real estates or the heating network, as well as the maintenance of the plant, or it may concentrate on the actual business activities of the plant, or something between these (Okkonen and Suhonen, 2010). Typically, a heating entrepreneur or enterprise is a single entrepreneur, an entrepreneur consortium, a company or a cooperative (Okkonen and Suhonen, 2010; TTS, 2010). In this study, the terms 'heating entrepreneur' and 'heating enterprise' are used interchangeably, referring to all these possible forms of ownership.

The research question of the paper is: "What kind of networks do the biomass heating enterprises tend to form, and how these networks differ in terms of independency and associability?" Based on the two dimensions, different networking tendencies of biomass heating enterprises are analyzed, and four groups of biomass heating enterprises with different networking tendencies are recognized and further assessed.

The networking types found in the study are confirmed to differ remarkably. The results provide evidence that in building relationships and networks, the actors need to balance between the two differentiating aspects: embeddedness and independency. In addition, the actors' associability and their need for self-determination have a remarkable impact on the tightness or looseness of the relationships, and that way also to the cooperative development of the networks. Thus, each actor has a certain level of independency and associability, and on the basis of them, a certain tendency to form networks that leads to a certain network type.

## 2 Literature review

How inter-organizational relationships develop is strongly influenced by the objectives of the parties involved. Firms need to be able to engage in competition and cooperation simultaneously, even though these demands are often seen as each other's opposites (Ford et al., 1998; De Wit and Meyer, 2005). On the one hand, firms need external networks to provide channels for negotiation and persuasion and a variety of resources (e.g. market information, ideas, problem solving, social support and financial resources) (Hite and Hesterly, 2001; Mei and Nie, 2008). But, on the other hand, they must not to become too entangled in restrictive relationships (see e.g. Staber, 2005), but maintain their freedom to maneuver, bargain and even attack in order to secure their own interest. In other words, firms should be *embedded* (see Granovetter, 1985) and *independent* at the same time (De Wit and Meyer, 2005).

Within business network research, a network can be described in terms of actors, activities and resources. Actors refer to individuals or organizations, and how they are related to each other. Activities, for one, refer to the flow of information, goods or services performed in these relations. Finally, resources refer to knowledge, social capital or financial resources through activities (Håkansson and Johanson, 1992; Slotte-Kock 2009). The elements influence each other: actors perform activities and control resources, activities transform resources and are used by actors to achieve goals, and resources give actors power and enable activities. (Håkansson and Johanson, 1992; Ritter and Gemünden, 2003)

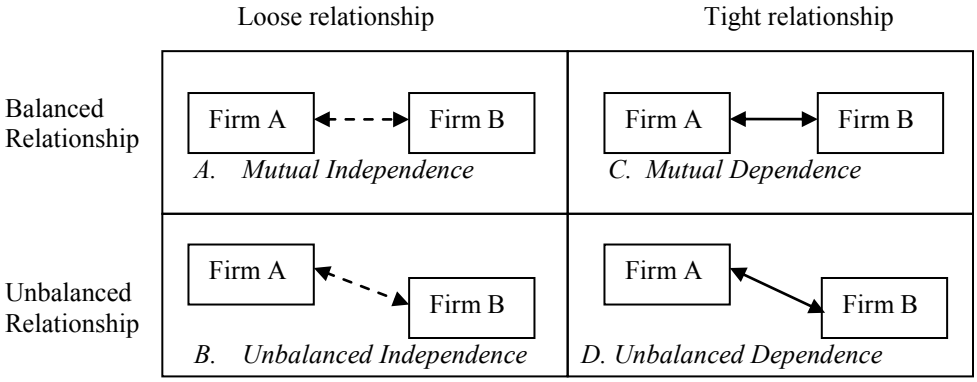
In this study, we first concentrate on the actor-dimension of networks by examining relations between different actors. To wit, we discuss the above-mentioned problem of balancing between embeddedness and independency via power positions and mutual dependence of firms. Secondly, we discuss how individual goals and activities may turn to collective goals and activities, and thus form social capital of a network.

## *2.1. Power and dependence in networks*

Kay (1993) argues that to understand the interaction between firms, it is highly important to gain insight into their relative power positions. Power is the ability to influence the other's behaviour. Power in relationships has been researched from many viewpoints, e.g. with sociological, psychological and managerial theories. However, Belaya and Hanf (2009) argue that regardless the origin, it is agreed upon that the one who has more power has access to more resources, such as higher esteem, praise and positive attention. Since the resources of actors are rarely equal, the outcome of any particular exchange depends upon the relative power of the participants (Davern, 1997; Belaya and Hanf, 2009).

Relationships can be examined in terms of mutual dependence between the parties, and power can be located at the interdependencies among the actors embedded in these relationships (Pfeffer and Salancik, 1978; Belaya and Hanf, 2009). De Wit and Meyer (2005) state that one way of measuring power in a relationship is to make a distinction between the closeness of the relationship (loose vs. tight) and the distribution of power between the two parties involved (balanced vs. unbalanced). This leads to a categorization of four specific types of inter-firm relationships depicted in Figure 1.

**Figure 1** Relative power positions in inter-organizational relationships (De Wit and Meyer, 2005 (adapted from Ruigrok and van Tulder, 1995))




a) Mutual independence: both organizations have full freedom to act according to their own objectives. Neither organization has significant influence over the other.
b) Unbalanced independence: a loose relationship, where Firm A has more power than Firm B, i.e. Firm A is more independent. Firm A's power gives it more freedom to act, while Firm B can be influenced by the powerful Firm A.
c) Mutual dependence = interdependence: the organizations have a tight relationship, in which they are mutually dependent on each other, having an equal amount of impact on their counterpart.
d) Unbalanced dependence: asymmetrical dependence, where one party will be able to dominate the other. The organization with the lower level of dependence will have more freedom to maneuver and impose its conditions than its counterpart. (De Wit and Meyer, 2005)

## *2.2. Associability in social networks*

The networking capabilities of a firm presume building social relationships with the surrounding parties. Several studies suggest that social relationships and personal ties play a crucial role in developing business networks, especially those of small and medium-sized enterprises (see e.g. Hite and Hesterly, 2001; Vanhaverbeke, 2001). It is seen that with the right contacts e.g. the level of uncertainty can be diminished, the risks reduced and critical market information provided. Personal relationships also provide security and trust (Pikka, 2007).

Furthermore, a social network can offer the company business growth and new business opportunities (Pikka, 2007). Social networks help managers to recognize the knowledge possessed by different actors in the network and to understand the relevance of applying that information (Westerlund and Svahn, 2008). Through the actors' social networks, firms have opportunities to update their knowledge in dynamically changing markets and to detect future developments in the industry (Vanhaverbeke, 2001).

According to Nahapiet and Ghoshal (1998), social capital is the sum of actual and potential resources that are embedded in, available through and derived from the network by an individual or social unit. The nature of social capital thus both structures and facilitates the operation of networks and their actors (Anderson and Jack, 2002). Two main approaches emerge in the various definitions of social capital: the public goods and private goods approaches. In the *public goods* approach, the phenomenon is mainly studied at the macro and meso level, and individual benefits are secondary. Social capital is seen as an attribute of a social unit, and an individual actor either benefits from its presence or suffers from its absence (Leana and Van Buren, 1999). In the *private goods* approach, the social capital focuses on the individual (a person, a group, an organization or an industry) and his or her accrued social assets. The focus in terms of outcomes is always on the individual person or unit, and the types of social arrangements and strategies that can work to his, her or its private benefit (e.g. Leana and Van Buren, 1999; Burt, 1997).

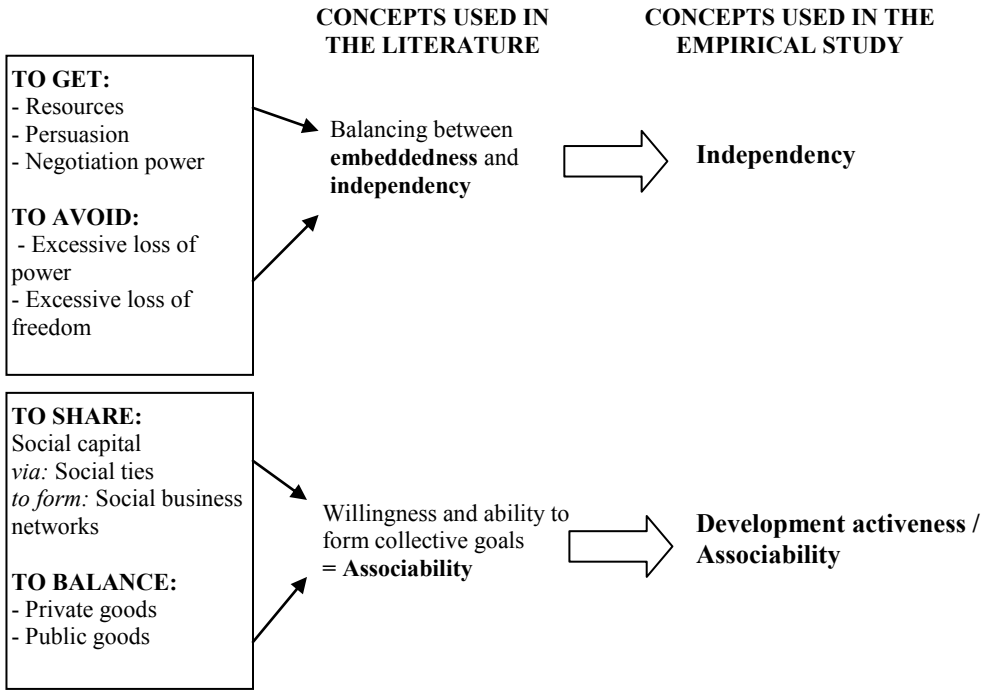
In this study, we follow Leana and Van Buren's (1999) view that the above-mentioned approaches need not be in conflict if properly managed. If individuals act in ways that enhance organizational social capital, or as applied in this study, a network's social capital, secondary benefits will accrue to them as well. This requires *associability*, which by Leana and Van Buren (1999) is the willingness and ability of an actor to subordinate individual goals and associated actions to collective goals and actions. This means that individuals will subordinate their personal goals to collective goals which will then be reached for through collective action. Thus, associability is both task-centered and goal-driven. Associability requires more than simply interdependence between participants; it combines elements of sociability (i.e. the ability to interact socially with each other) with willingness to subordinate individual desires to group objectives (Leana and Van Buren 1999; Wagner, 1995).

It thus can be seen that a network's social capital will not appear from "somewhere" but it requires that the actors in the network will use their associability to form collective goals and plan actions to gather them. However, individuals differ in terms of associability (Wagner, 1995) which means that every social tie and every network is always to some degree dependent on the social assets of its participants.

## *2.3 Conceptual framework of the study*

In Figure 2, a summarizing framework of the central concepts used in the study is introduced.

**Figure 2** Conceptual framework of the study




Via forming relationships and networking, the firms aim to get e.g. resources, respect and negotiation power they don't sufficiently possess themselves. However, at the same time, they need to avoid excessive loss of their power or freedom. This leads to the balancing between embeddedness and independency, which in the empirical part of the study is considered as the level of independency of the actors.

In addition, individuals differ in terms of their social assets, and thus every individual has a unique variety of social capital to share. Social capital can be shared via social ties, and social ties are needed in order to form social business networks between firms. However, each individual also has its' own goals, and these need to be weighed with the public goals. For that, each individual has a certain level of willingness and ability, i.e. they differ in their levels of associability. In the empirical part, the issue of associability is examined via the actors' network development activeness. Within this study, the development activeness, however, can be seen to describe well the associability of the examined actors.

## 3 Research design

The empirical study was conducted as a case study. Case study is not a methodological choice, but a choice of what is to be studied - e.g. Eisenhardt (1989, p. 534) depicts case study as "a research strategy which focuses on understanding the dynamics present with single settings". In case study research, the central feature is the construction of 'the case' or 'cases'; the research questions are always related to the understanding and solving of the case: what the case is about and what can be learned by studying it (Eriksson and Kovalainen, 2008).

Creswell (2007) sees a case study as an exploration of a bounded system which can be defined in terms of time and place, over time and through detailed, in-depth data collection, involving multiple sources of information which are rich in context. Case studies thus typically combine several data collection methods, such as archives, interviews, questionnaires and observations (Barton Cunningham, 1997; Eisenhardt, 1989). Although case study research is a common way to do qualitative inquiry, it doesn't need to be essentially qualitative (Creswell, 2007; Stake, 2000).

Case research is particularly welcome in new situations where only little is known about the studied phenomenon, and in situations where current theories seem inadequate (Eisenhardt, 1989; Yin, 2003). According to Halinen and Törnroos (2005) the advantage of case studies over other research strategies is that case research allows the study of a contemporary phenomenon which is difficult to separate from its context, but which is necessary to study within the context to understand the dynamics involved in the setting.

The data for the study was collected in the summer 2010. The research data consists of 52 semi-structured theme interviews: 26 of them with biomass heating entrepreneurs and 26 with biomass heating system manufacturers. Mainly the data concerning heating entrepreneurs is utilized in this study, but the main ideas of the interviews with the system manufacturers are taken into account. The group of the chosen 26 heating enterprises consists of heating plants in different parts of Finland, with different plant sizes and ownership bases. It can thus be expected that the chosen group represents rather well the group of Finnish biomass heating enterprises. In all, the number of Finnish heating plants operated by heating entrepreneurs was 455 in 2009. The number of heating enterprises was a bit lower, because some enterprises operated in several heating plants. The average size of the plants was 550kW. 90 percent of the solid fuel used in the plants was wood chips (TTS, 2010).

## 4 Results

The aspects discussed in the literature review (see Section 2) are next examined in the light of the conducted interviews. On the basis of the theoretical background, two dimensions; independency and associability, were chosen for more profound examination, and based on those, different networking tendencies of the biomass heating enterprises are next recognized and assessed.

Firstly, the question of power relations and dependency in the networks was examined by

the *"independency"* dimension, which depicts the heating enterprises' tendency to lean on the other actors. Simply put, the more independent the heating enterprise is, the less its partners have power over it and are involved in its activities. Secondly, the questions concerning the actors' associability were combined to a dimension called *"development activeness"*. This dimension depicts the enterprises' tendency to develop their business and network, i.e. their tendency to share social capital with others. The more active the enterprise is, the more it spends time for planning and developing activities, and the more willing it is to have cooperative goals and activities with its partners, and is also willing to find new partners. Suitable questions in the interviews (see the questionnaire in Appendix I) depicting these dimensions were chosen for more thorough examination. In order to form clear entities and specify the assessment, some questions were combined.

*Independency* was examined through the following interview questions:

- ownership base: the plant and the heating network
- business activities of the enterprise (if independency was brought out)
- fuel procurement: procurement, delivery and the enterprise's own forest property and its impact on procurement
- structure of the network and the enterprise's role in the network
- independence from the heating system manufacturer
- distribution of work in maintenance and repair
- (other questions where independency was brought out)

There are clear differences in the ownership base of the plants and distribution networks. Some heating enterprises own the plant as well as the network, but in many cases, the network is owned e.g. by the municipality. Differences can also be found between the plants of a certain enterprise – some plants and networks can be completely owned, whereas in others the enterprise only maintains the plant.

Clear differences were found in the ways the fuel is procured. In some cases, the enterprise seems to take care of the whole procurement chain, whereas in some other cases, the procurement is far outsourced. As regards the maintenance of the plants, some enterprises maintain their plants nearly completely on their own, whereas some have outsourced the maintaining activities.

The business activities and some other questions were also taken into account if aspects related to independency were mentioned by the interviewee. In addition, the network structure and the heating enterprises' roles in their networks, as well as their relationships with the heating system manufacturers (later HSMs) were analyzed regarding their dependency on the partners.

*Development activeness* was examined through the following interview questions:

- business activities of the enterprise (if developmental activities were brought out)
- willingness to cooperate with the HSMs
- opportunities and challenges of the development of cooperative networks
- planning of new heating plants or other activities
- future views
- (other questions where activeness was brought out)

The enterprises seem to differ in their willingness to cooperate with the system manufacturers and also in the amount of support they are willing from them. In the question of opportunities and challenges of the development of cooperative activities, attention was paid to the interviewees' emphasis on opportunities/challenges and their views on the importance of cooperation. Clear differences were found in the amount of time the entrepreneurs spend on planning their future – some seem to be satisfied with the current situation, whereas others are constantly finding new business and cooperation opportunities, for example in combined heat and power production (CHP). The business activities and some other questions were also taken into account if aspects related to development activeness were mentioned by the interviewee.

In the tables in Appendices II and III, the heating enterprises are assessed by the above-mentioned dimensions. The sub-questions of both dimensions are assessed with the scale 1-5. The higher the number in the questions related to independency, the more independent the enterprise is. Correspondingly, the higher the number in the questions related to development activeness, the more actively the enterprise develops its network(s) and thus the higher its level of associability. The scores for the dimensions are averages of the scores of the used sub-questions, and in order to clarify the differences between the groups better (see e.g. Figure 3), the averages have been weighted by 2. As can be seen, the level of independency varies from 5.13 to 8.96. Thus, the differences in this dimension are notable between the groups. Similarly, there are clear differences between the levels of development activeness, as the highest number is 8.49 and the lowest 5.83. The meaning of these differences is further discussed below.

Four groups of enterprises with different networking tendencies can be recognized on the basis of the assessment. For clarity, the enterprises have been already sorted by the below-presented categorization and indicated with group numbers in the Appendices II and III. The four recognized groups are:

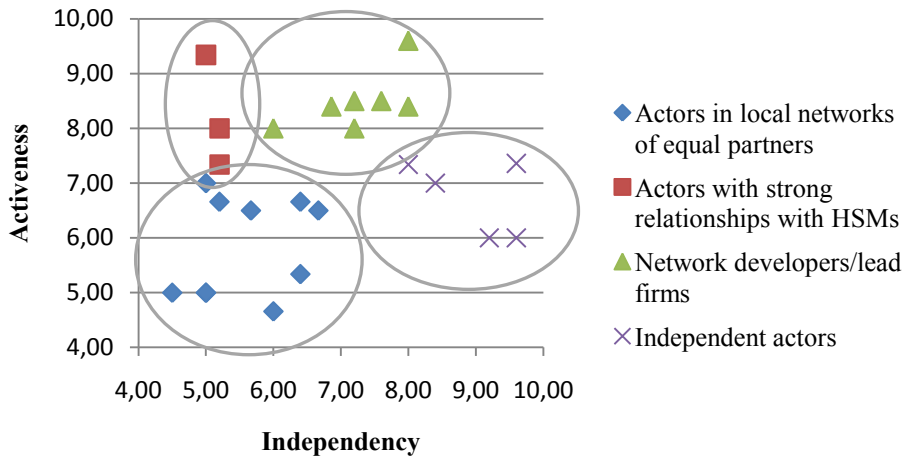
1) *Actors in local networks of equal partners*
   These actors tend to build networks locally, and form tight relationships with other local actors with a certain role in the network. The meaning of locality in the networks is emphasized, and all actors are rather equal in the power relations. In addition, the employment of local people and supporting of small actors are seen as important. This group also includes heating enterprises which are subordinate to a municipality – in these contracts the municipality owns the plant and the heating network, but the enterprise takes care of the business activities and the maintenance of the plant.
2) *Actors with strong relationships with HSMs*
   These actors tend to build strong relationships with the heating system manufacturers. The plants, with relatively small resource-bases on their own, actively exploit the manufacturers' networks in the maintenance activities of the plants. In addition, these enterprises have common research and development interests with the manufacturers and they may operate as lead users for them.
3) *Network developers/lead firms*
   These actors are willing to extend the existing networks and build new ones. The networking activities also reach beyond the everyday business and maintenance, as these actors invest in research and development in cooperation with different

instances, such as other entrepreneurs, different organizations and educational institutes.

4) *Independent actors*
These actors tend to be quite cautious in building relationships with external actors. That is mainly because these actors are usually co-operatives or family firms which already have all the needed know-how and expertise on their own. The spheres of responsibilities are clearly divided between the partners. The meaning of personal ties in the formation phase is highly important.

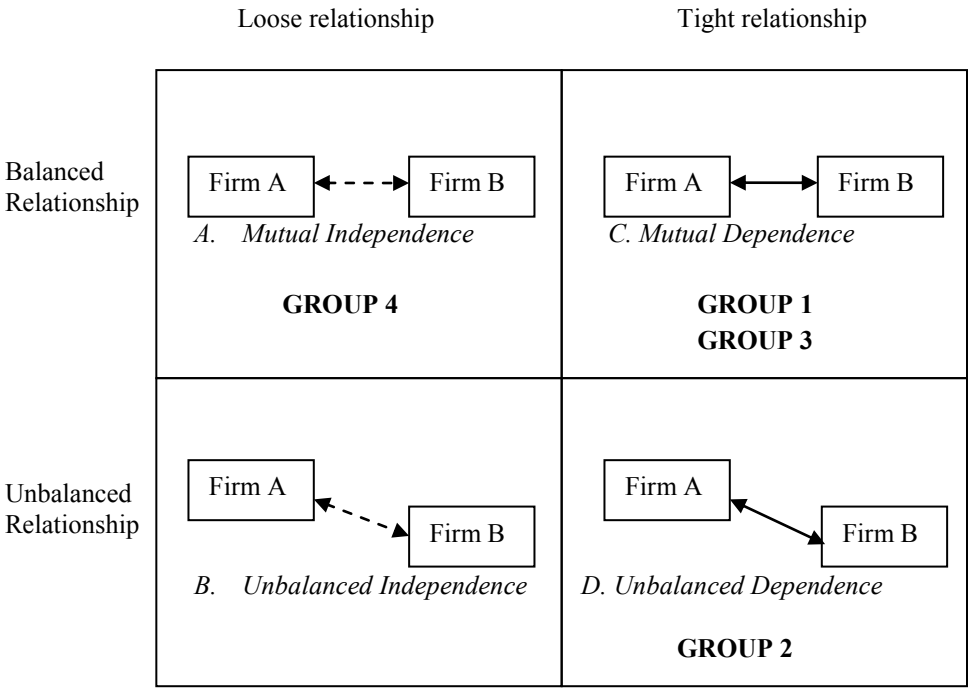
In Figure 3, the enterprises are located in coordinates where x-axis depicts the independency -dimension and the y-axis the development activeness -dimension. The scores for the dimensions are averages from the scores of the used sub-questions (see Appendices II and III), and the averages are weighted by 2. As can be seen, the four above-discussed groups can be easily separated as clusters in the coordinates. Thus, it can be confirmed that each of the researched biomass heating enterprises mainly follows one of the above-discussed networking tendencies.

**Figure 3** Grouping of biomass heating enterprises according to their networking tendencies




Next, we look at these four groups more thoroughly on the basis of their relative power positions with their partners by using the framework of De Wit and Meyer, 2005 (see Section 2.1.). In Figure 4, the four groups with different networking tendencies are located in the framework according to the assessments of the groups' characters discussed above.

**Figure 4** Relative power positions of biomass heating enterprises




Group 1 (*Actors in local networks of equal partners)* and Group 3 *(Network developers/lead firms*) can be located in the "Mutual Dependence" box. As mentioned above, the actors in local networks tend to form tight and equal relationships with the surrounding actors. Thus, none of the actors in these networks has remarkable power over the others. However, each actor in the network is highly important, because each of them has certain, and probably unique, know-how or resources to share in the network. Group 3 is composed of firms with lively networks which are actively developing business for common good. Although the networks may include partners rather big in size (such as educational institutes), these actors do not have power over the others but they are considered as equal research and development partners. The actors are, however, somewhat dependent on each other, because none of them is able to develop the business and the network on their own.

Group 2 (*Actors with strong relationships with HSMs)* can be located to the "Unbalanced Dependence" box. The networking activities of these actors are mainly targeted at the utilization of the existing relationships of the HSMs. Thus, these firms are not eager to build networks of their own but are willing to develop the business in cooperation with the manufacturer and its partners and thus are dependent on the HSMs.

The relationships of the firms in Group 4 (*Independent actors)* can be characterized as "Mutual Independence", as these firms do not generally form tight relationships, but their cooperation with the surrounding actors is rather free-form; they occasionally use

partners when they need to procure some additional know-how or resources. No partner in these loose networks has power over the others.

Finally, we discuss the groups based on their degree of associability. The actors in Group 1 (*Actors in local networks of equal partners)* share some of their social capital in their networks, and the operability of the networks is highly based on the unique know-how and assets of different actors. However, as can be noted in the discussion above, these actors are moderate with developing the business or the network from its present scale and scope, or setting cooperative goals for the future. Thus, the total level of associability in these networks is rather low.

At the first glance, the sharing of social capital in Group 2 (*Actors with strong relationships with HSMs)* may appear as open but rather one-way, as the heating enterprises utilize the know-how and social ties of the system manufacturers. However, it has to be remembered that the manufacturers have their own objectives in the cooperation: they can gain valuable information straight from their customers (heating enteprises), which the heating entrepreneurs share openly. In addition, both the parties have interests in common development activities. Thus, the level of associability in these networks is rather high.

In Group 3 *(Network developers/lead firms*), associability can be seen as a prerequisite for the networks. The actors in Group 4 *(Independent actors)* do not tend to share their social capital with others constantly. However, they plan the future actively and interact with suitable partners (e.g. system manufacturers) if needed. Thus, their associability can be characterized as moderate.

Table 1 sums up the results. The summary indicates that each of the four networking tendencies found among the heating entrepreneurs has its special characteristics, and each of the network types has its own level of dependence and associability between the participants.

**Table 1** Summary of the results

| Group | Type | Power relations | Level of associability |
|---|---|---|---|
| **1** | Actors in local networks of equal partners | Mutual dependence | Rather low |
| **2** | Actors with strong relationships with heating system manufacturers | Unbalanced dependence | Rather high |
| **3** | Network developers/lead firms | Mutual dependence | High |
| **4** | Independent actors | Mutual independence | Moderate |

## 5 Discussion and conclusions

Networking is a many-sided phenomenon. Even in businesses, which can be categorized as rather small in size, the actors form partnerships and networks with several different motives and objectives. The case of Finnish biomass heating enterprises reflects this phenomenon rather well, and based on the chosen dimension; the actors' independency and development activeness, four certain tendencies of networking could be found among the researched group of enterprises.

The results indicate that the actors need to balance between two differentiating aspects – embeddedness in formed relationships, and independency. I.e. the actors need each other in sharing resources and for providing channels for negotiation and persuasion. But, at the same time they need to weigh up the pros and cons of being dependent on the other actors. In every network, there are certain power relations between its participants, which are highly related to the resource-bases of the actors as well as the actors' need for self-determination in general. In addition, the actors differ from each other in their degree of associability, which means that their willingness and ability to subordinate individual goals and actions to collective goals and actions varies.

As discussed above, every social tie and network is always to some degree dependent on the social assets of its participants, and after all, their ability and willingness to share it with others. Thus, depending on the set objectives by actors related to these above-presented aspects, they tend to form different networks. Simply put, each actor has a certain tendency to form networks which leads to a certain network type. These types differ from each other by the power relations of the actors, the openness of sharing social capital, and the willingness for network development.

The paper opens up the current situation and future directions of the actors' networking in bioenergy business. Bioenergy field offers numerous business opportunities for many emerging actors, which usually are rather small in size. Thus, networking may be a prerequisite for these actors in order to gain a sufficient volume for their business. For example, new technologies for combined heat and power production (CHP) provide many new opportunities for value creation, but also demand gathering new know-how by networking with different actors.

On the basis of this study, it can however be noted that forming business networks depends on the aims of the actors e.g. in terms of their willingness to stay independent and to maintain a certain level of power and freedom, as well as their willingness to form common goals with their counterparts. These issues need to be taken into account when planning networked businesses – even though some firms might seem as perfect partners because of their business fields or technical prospects, they may have totally different aims which reflect to their networking tendencies.

It must be remembered that the study has concentrated only on certain dimensions related to networking, and there might be many other factors impacting the actors' decisions. However, these dimensions were formed on the basis of a widely-discussed theoretical background and a relatively large set of interview questions. Thus, it can be expected that these issues, independency and associability, are seen as important and highlighted in the actors' aims of building business relations and networks.

Although the focus of the study was on biomass heating entrepreneurs, the results can be expected to reflect the situation in many fields alike and that way to offer fresh and wider knowledge on the issues under scope. For the actors themselves, the study offers a clear view on their tendencies to form relations and networks and thus helps them to develop their business better according to their objectives.

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## Appendix I: Interview questionnaire

**CONFIDENTIAL**

**Biomass heating enterprises and their networks, spring-summer 2010**

*Every answer will be handled with total confidentiality and anonymity. The results of the research will be generated in a way that the interviewees are not recognizable in any way.*

### A. BACKGROUND INFORMATION

1. Company
2. Place of business/department/unit
3. Profession (employee, CEO, manager, etc.)

### B. CURRENT STATE OF THE ENTERPRISE

1. Plant capacity
2. Fuels used in the plant
3. Fuel suppliers
4. Human resources
    i. *Managers/executives (number of persons, level of know-how etc.)*
    ii. *Personnel (number of persons, skills etc.)*
5. Customers
6. Business activities, strategy
7. Ownership base: plant and heating network
    i. *If the network is owned by another party, e.g. the municipality, what are the consequences if the business activities are extended?*
8. Forest property of the entrepreneur, and does it have impact on the fuel procurement
9. Duration of heat delivery contracts *(if the entrepreneur is not the owner of the plant)*
10. Price fixing of the heat energy
    i. *How the price is checked during the contract period*
11. External factors affecting the business
12. Former experience on heating plants/heating entrepreneurship
    i. *Has the experience helped in launching the business, or would it have been useful to have former experience?*

### C. COOPERATION AND NETWORKS

1. How and why are the existing networks born?
2. Network participants, and their inputs and motives for networking
3. The distribution of work of the network participants, and the enterprise's own role in the network

4. The strengths and possible black spots in the network
5. Willingness to co-operate with a planning/consulting company
    i. *Is there cooperation at the moment?*
    ii. *If not, is there any interest?*
    iii. *If not, why?*
6. Willingness to co-operate with heating system manufacturers
    i. *Is there cooperation at the moment?*
    ii. *If not, is there any interest?*
    iii. *If not, why?*
7. Opportunities and challenges of network development/building new networks (along with CHP or otherwise)
    i. *At the actor level (e.g. resources and know-how of the partners, interesting new partners)*
    ii. *Enablers and barriers at actor/local/national/international level*

## D. DISTRIBUTION OF WORK

1. The duration and number of on-call duty periods per year (hours)
2. The amount of routine heating work and maintenance (hours)
3. How is bookkeeping organized?
4. Unscheduled maintenance tasks per year (hours)
5. Alerts: number, duration and the most common reasons for alerts
6. Planning of new heating plants or other business activities
    i. *How much time is spent for planning?*

## E. FUTURE PROSPECTS

1. Development of markets
    i. *Are there plans for expanding the business to new heating plants?*
    ii. *What would be an optimal number of plants or amount of delivered heat energy?*
    iii. *How many of the plants would be suitable for CHP production?*
2. What sources of renewable energy will be the most significant in the future?
    i. *Forest and wood*
    ii. *Agrobiomass*
    iii. *Biogas*
    iv. *Wind/solar power*
    v. *The future of bio-CHP?*
3. Future expectations from networks

**Thank you for your invaluable answers and cooperation!**

**Appendix II: Independency of the biomass heating enterprises**

| BIOENERGY HEATING FIRM | GROUP | Ownership base: plant and heating network | Business activities (related to independency) | Fuel procurement | The structure of the network and the firms' role in it | Independence from the heating system manufacturer | Distribution of work in maintenance and repair | Other questions | AVERAGE | INDEPENDENCY (Weighted by 2) |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Group 1 | 5 | | 1 | 3 | | 1 | | 2,50 | 5,00 |
| **2** | Group 1 | 2 | | 3 | 3 | | | 1 | 2,25 | 4,50 |
| **6** | Group 1 | 3 | 4 | 4 | 3 | 4 | 2 | | 3,33 | 6,67 |
| **13** | Group 1 | 3 | 2 | 1 | 2 | 2 | 5 | | 2,50 | 5,00 |
| **14** | Group 1 | 1 | 2 | 1 | 3 | 5 | 3 | | 2,50 | 5,00 |
| **15** | Group 1 | 3 | 3 | 1 | 4 | 2 | 4 | | 2,83 | 5,67 |
| **21** | Group 1 | 4 | | 3 | | 2 | 3 | | 3,00 | 6,00 |
| **22** | Group 1 | 1 | | 2 | 3 | 3 | 4 | | 2,60 | 5,20 |
| **24** | Group 1 | 5 | | 1 | 3 | 3 | 4 | | 3,20 | 6,40 |
| **26** | Group 1 | 4 | | 3 | 3 | 2 | 4 | | 3,20 | 6,40 |
| | | | | | | | | | 2,79 | 5,58 |
| **10** | Group 2 | 5 | | 2 | 2 | 1 | 3 | | 2,60 | 5,20 |
| **12** | Group 2 | 3 | | 3 | 2 | 1 | 4 | | 2,60 | 5,20 |
| **19** | Group 2 | | | 5 | 1 | 1 | 3 | | 2,50 | 5,00 |
| | | | | | | | | | 2,57 | 5,13 |
| **3** | Group 3 | 4 | 4 | 2 | 5 | 4 | 5 | | 4,00 | 8,00 |
| **5** | Group 3 | 3 | 3 | 2 | 4 | 4 | 2 | | 3,00 | 6,00 |
| **7** | Group 3 | 3 | | 5 | 4 | 3 | 4 | | 3,80 | 7,60 |
| **11** | Group 3 | 5 | | 2 | 5 | 3 | 3 | | 3,60 | 7,20 |
| **18** | Group 3 | 4 | | 2 | 5 | 3 | 4 | | 3,60 | 7,20 |
| **20** | Group 3 | 3 | 4 | 1 | 4 | 5 | 3 | 4 | 3,43 | 6,86 |
| **23** | Group 3 | 5 | 4 | 2 | 5 | | 4 | | 4,00 | 8,00 |
| | | | | | | | | | 3,63 | 7,27 |
| **4** | Group 4 | 3 | | 4 | 5 | 5 | 4 | | 4,20 | 8,40 |
| **8** | Group 4 | 5 | | 5 | 5 | 4 | 5 | | 4,80 | 9,60 |
| **9** | Group 4 | 3 | 5 | 4 | 4 | 4 | 4 | | 4,00 | 8,00 |
| **16** | Group 4 | 4 | | 5 | 5 | 4 | 5 | | 4,60 | 9,20 |
| **25** | Group 4 | 4 | | 5 | 5 | 5 | 5 | | 4,80 | 9,60 |
| | | | | | | | | | 4,48 | 8,96 |

**Appendix III: Development activeness of the biomass heating enterprises**

| BIOENERGY HEATING FIRM | GROUP | Business activities (related to development activeness) | Willingness to cooperate with heating system manufacturers | Opportunities and challenges of the development of cooperative networks | Planning of new heating plants or other activities | The future views | Other questions | AVERAGE | DEVELOPMENT ACTIVENESS (Weighted by 2) |
|---|---|---|---|---|---|---|---|---|---|
| **1** | Group 1 | | 3 | | 2 | | | 2,50 | 5,00 |
| **2** | Group 1 | | 3 | 2 | 3 | 2 | | 2,50 | 5,00 |
| **6** | Group 1 | 4 | 2 | 4 | 3 | | | 3,25 | 6,50 |
| **13** | Group 1 | | 4 | 4 | 3 | 3 | | 3,50 | 7,00 |
| **14** | Group 1 | | 1 | 2 | 3 | 4 | | 2,50 | 5,00 |
| **15** | Group 1 | | 4 | 2 | 4 | 3 | | 3,25 | 6,50 |
| **21** | Group 1 | | 3 | 2 | 2 | | | 2,33 | 4,66 |
| **22** | Group 1 | | 4 | 2 | 4 | | | 3,33 | 6,66 |
| **24** | Group 1 | | 3 | 4 | 3 | | | 3,33 | 6,66 |
| **26** | Group 1 | | 3 | | 2 | 3 | | 2,67 | 5,34 |
| | | | | | | | | 2,92 | 5,83 |
| **10** | Group 2 | | 5 | 2 | 4 | | | 3,67 | 7,34 |
| **12** | Group 2 | | 5 | 3 | 4 | | | 4,00 | 8,00 |
| **19** | Group 2 | | 5 | 5 | | | 4 | 4,67 | 9,34 |
| | | | | | | | | 4,11 | 8,23 |
| **3** | Group 3 | 5 | 5 | 5 | 5 | 4 | | 4,80 | 9,60 |
| **5** | Group 3 | | 4 | 5 | 3 | 4 | | 4,00 | 8,00 |
| **7** | Group 3 | | 4 | 4 | 4 | 5 | | 4,25 | 8,50 |
| **11** | Group 3 | | 4 | 5 | 3 | | | 4,00 | 8,00 |
| **18** | Group 3 | | 4 | 4 | 4 | 5 | | 4,25 | 8,50 |
| **20** | Group 3 | 4 | 5 | 4 | 4 | 4 | | 4,20 | 8,40 |
| **23** | Group 3 | 4 | 5 | 3 | 4 | 5 | | 4,20 | 8,40 |
| | | | | | | | | 4,24 | 8,49 |
| **4** | Group 4 | | 4 | 4 | 3 | 3 | | 3,50 | 7,00 |
| **8** | Group 4 | | 4 | 2 | 2 | 4 | | 3,00 | 6,00 |
| **9** | Group 4 | | 4 | 4 | 3 | | | 3,67 | 7,34 |
| **16** | Group 4 | | 4 | 3 | 2 | | | 3,00 | 6,00 |
| **25** | Group 4 | | 5 | 3 | 3 | | | 3,67 | 7,36 |
| | | | | | | | | 3,37 | 6,74 |

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**AN IMPACT OF RESOURCE PORTFOLIO ON NETWORKING TENDENCIES – EVIDENCE FROM BIOENERGY BUSINESS**

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# AN IMPACT OF RESOURCE PORTFOLIO ON NETWORKING TENDENCIES – EVIDENCE FROM BIOENERGY BUSINESS

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## Abstract

*Indisputably, networking offers many benefits in business. However, at the same time, it may also restrict the freedom of its actors. The aim of the paper is to complement the knowledge on the benefits and delimitations of networking by a two-step process. Firstly, the actors' aims for independency and associability in their business relations are examined and based on these aims, different tendencies for networking are found. Furthermore, the paper discusses the resource portfolios of actors, and searches linkages between the actors' resources and their networking tendencies. The research question of the paper is: "How the resource portfolio of an actor correlates with its tendency to form networks?" Case study research is used as the research strategy. A group of Finnish biomass heating enterprises is studied as the case, and four groups with different networking tendencies are recognized and further assessed. The results provide evidence that the actors tend to form different networks which differ from each other by the power relations and the openness of sharing social capital. In addition, it is noted that the actors differ in their resource portfolios. That creates dissimilar motives for cooperation and networking which are well-reflected with the four networking types found in the study.*
**Key words**: *associability, bioenergy, independency,networking, resources.*

## Introduction

There is a global concern about increasing greenhouse gas emissions. The amount of traditional fossil fuels is exhausting, and their prices are continuously increasing. As a consequence, the use of renewable primary energy sources and improved overall energy efficiency play an important role in future energy production and consumption (Cowie & Gardner, 2007; Tekes, 2008). One of the most promising options of renewable energy is the utilization of different biomasses. The bioenergy business offers new business opportunities increasingly, to existing actors as well as to the new ones. In addition, as in several other fields of business, also the significance of networking is becoming more evident in the bioenergy production solutions.

Links with external actors may be beneficial to a firm in a variety of ways. Networks offer access to the resources and capabilities of other actors (Chetty & Wilson, 2003), and cooperative activities can thus provide a valuable source of support and information as well as means of sharing resources (Fuller-Love & Thomas, 2004). Especially, emerging actors usually need external networks to provide a variety of resources, capabilities or legitimacy which they need for successful survival, but which they cannot produce internally (Hite & Hesterly, 2001; Mei & Nie, 2008).

However, even sharing resources is often vital for firms, they should also avoid to become too entangled in restrictive relationships (Staber, 2005), but maintain their freedom to

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maneuver, bargain and even attack in order to secure their own interests. In other words, firms should be *embedded* in their relationships (Granovetter, 1985) and *independent* at the same time (De Wit & Meyer, 2005). How different firms balance between these two is an interesting field of study.

Kay (1993) argues that to understand the interaction between firms, it is highly important to gain insight into their relative power positions. Power is the ability to influence the other's behavior, and the one who has more power has also access to more resources, such as higher esteem, praise and positive attention. Since the resources of actors are rarely equal, the outcome of any particular exchange depends on the relative power of the participants (Davern, 1997; Belaya & Hanf, 2009).

Relationships can be examined in terms of mutual dependence between the parties, and power can be located at the interdependencies among the actors embedded in these relationships (Pfeffer & Salancik, 1978; Belaya & Hanf, 2009). De Wit and Meyer (2005) state that one way of measuring power in a relationship is to make a distinction between the closeness of the relationship (loose vis-à-vis tight) and the distribution of power between the two parties involved (balanced vis-à-vis unbalanced). This leads to a categorization of four specific types of inter-firm relationships which are illustrated in Figure 1.

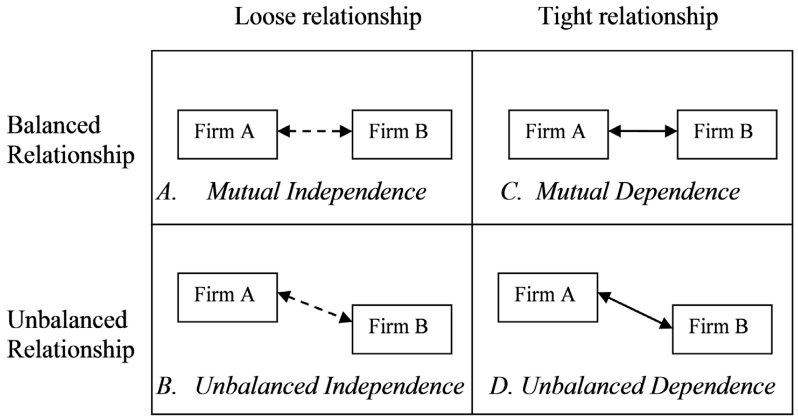


**Figure 1: Relative power positions in inter-organizational relationships. (De Wit & Meyer, 2005 (adapted from Ruigrok & van Tulder, 1995)).**

A. Mutual independence: both organizations have full freedom to act according to their own objectives. Neither organization has significant influence over the other.

B. Unbalanced independence: a loose relationship, where Firm A has more power than Firm B, i.e. Firm A is more independent. Firm A's power gives it more freedom to act, while Firm B can be influenced by the powerful Firm A.

C. Mutual dependence (interdependence): the organizations have a tight relationship, in which they are mutually dependent on each other, having an equal amount of impact on their counterpart.

D. Unbalanced dependence: asymmetrical dependence, where one party will be able to dominate the other. The organization with the lower level of dependence will have more freedom to maneuver and impose its conditions than its counterpart. (De Wit and Meyer, 2005)

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In their studies Hite and Hesterly (2001) and Vanhaverbeke (2001) suggest that social relationships and personal ties play a crucial role in developing business networks, especially those of small and medium-sized enterprises. Building social relationships with the surrounding parties is a vital networking capability for the firms. A social network can offer a firm business growth and new business opportunities. It is seen that with the right contacts for example the level of uncertainty can be diminished, the risks reduced and critical market information provided. Personal relationships also provide security and trust (Pikka, 2007). Social networks help managers to recognize the knowledge possessed by different actors in the network and to understand the relevance of applying that information (Westerlund & Svahn, 2008). Through the actors' social networks, firms have opportunities to update their knowledge in dynamically changing markets and to detect future developments in the industry (Vanhaverbeke, 2001).

A social network will not be built by its own but it requires that the actors in the network collectively enhance the network's social capital. Social capital is the sum of actual and potential resources that are embedded in, available through and derived from the network by its actors (Nahapiet & Ghoshal, 1998; Leana & Pil, 2006). The outcome of the opportunity to engage in social ties is mediated by *associability* and trust (Leana and Van Buren, 1999; Pearse, 2009). Associability is seen to have two components: an affective component, which means the *willingness* to subordinate individual goals to collective goals, and a skill-based component, which refers to the *ability* to coordinate activities according to set goals (Van Buren, 2008). It is confessed that individuals differ in terms of associability (Van Buren, 2008; Wagner, 1995) which means that every social tie and network is always to some degree dependent on the social assets of its participants.

As stated above, partners are often vital for firms, because of the need for sharing resources. However, the resources of actors are rarely equal, which set the partners in different power positions. These power positions of partners may lead to rather different levels of tightness and independency in relationships. Furthermore, it is a confessed fact that a network cannot be fully developed without an active flow of social capital between the actors. However, level of associability differs remarkably between firms. These aims related to independency and associability create certain tendencies for networking and furthermore, for different network types in an industrial field.

The aim of the paper is to provide evidence on the different solutions the firms seem to have with balancing between the objectives for independency and embeddedness in their business relations. We aim to complement this knowledge with a two-step process. First, we look at the two aspects mentioned above, the actors' independency and associability, and examine the different networking tendencies based on them. Secondly, in order to examine the motives for networking in a fast-evolving business area, we take a look at the resource-bases of the actors, and search linkages between the actors' resources and their networking tendencies. The research question of the paper is: "How the resource portfolio of an actor correlates with its tendency to form networks?" Case study research (Creswell, 2007; Eriksson & Kovalainen, 2008) is used as the research strategy. A group of Finnish biomass heating entrepreneurs is studied as the case. The case is considered to represent well a group of actors in a fast-evolving business area.

The study confirms that each actor has a certain level of independency and associability, and based on them, a certain tendency to form networks. These tendencies lead to formation of different network types. Among the studied enterprises in the Finnish biomass heating field, four groups with different networking tendencies are recognized and further assessed. These groups are: 1) actors in local networks of equal partners, 2) actors with strong relationships with heating plant manufacturers, 3) network developers/lead firms, and 4) independent actors.

In addition, we illustrate that the actors differ remarkably in their bases of resources, and also that different aspects are highlighted in their resource portfolios. This creates different motives for cooperation and networking, which are reflected well in the four networking types found in the study. On the basis of the analysis, correlations between the actors' resources and their tendencies to form certain kinds of networks can be found.

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## Methodology of Research

The empirical study was conducted as a case study. Many authors state that case study is not a methodological choice, but a choice of what is to be studied (Eisenhardt, 1989). In case study research, the central feature is the construction of 'the case' or 'cases'; the research questions are always related to the understanding and solving of the case: what the case is about and what can be learned by studying it (Eriksson & Kovalainen, 2008).

Creswell (2007) sees a case study as an exploration of a bounded system which can be defined in terms of time and place, over time and through detailed, in-depth data collection, involving multiple sources of information which are rich in context. Case studies thus typically combine several data collection methods, such as archives, interviews, questionnaires and observations (Barton Cunningham, 1997; Eisenhardt, 1989).

Case research is particularly welcome in new situations where only little is known about the studied phenomenon, and in situations where current theories seem inadequate (Eisenhardt, 1989; Yin, 2009). According to Halinen and Törnroos (2005) the advantage of case studies over other research strategies is that case research allows the study of a contemporary phenomenon which is difficult to separate from its context, but which is necessary to study within the context to understand the dynamics involved in the setting.

The research data consists of 52 semi-structured theme interviews: 26 of them with biomass heating entrepreneurs and 26 with the biomass heating system manufacturers. Mainly the data concerning the biomass heating entrepreneurs is utilized in this study, but the main ideas of the interviews with system manufacturers are taken into account. The group of the chosen 26 heating enterprises consists of heating plants in different parts of Finland, with different plant sizes and ownership bases.

Heat energy production is mainly considered as a local activity. Wood chips, which are the main fuel in the plants, are typically procured in the surrounding area. In addition, the plants may use supplementary fuels, such as peat, agrobiomass and oil. The heating enterprise may take care of all the steps from fuel procurement to the delivery of heat to real estates or the district heating network, as well as the maintenance of the plant, or it may concentrate on the actual business activities of the plant, or something between these (Okkonen & Suhonen, 2010). Typically, a heating entrepreneur or enterprise is a single entrepreneur, an entrepreneur consortium, a company or a cooperative (Okkonen & Suhonen, 2010; TTS, 2010). In this study, the terms 'heating entrepreneur' and 'heating enterprise' are used interchangeably, referring to all these possible forms of ownership. In Finland, the number of heating plants operated by heating entrepreneurs was 455 in 2009. The number of heating enterprises was a bit lower, because some enterprises operated in several heating plants. The average size of the plants was 550kW, and 90 percent of the solid fuel used in the plants was wood chips (TTS, 2010). As in many other countries, the possibilities for small-scale combined heat and power production (CHP) have been discussed widely in Finland as well, also among the heating entrepreneurs. However, many of small-scale implementations still require significant research and development investments before they are feasible for possible commercialization (Lehtovaara, 2011; Motiva, 2011).

## Results of Research

The results of the study are introduced in this section. Based on the interview data, the differences in independency and development activeness of the studied biomass heating enterprises are first analyzed, and the firms are divided in four groups with different networking tendencies. Secondly, a look at the resource portfolios of the firms is taken, and their correlations with the networking tendencies are examined.

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The question of power relations and dependency on networks was examined by the *"independency"* dimension, which depicts the heating enterprises' tendency to lean on the other actors. Simply put, the more independent the heating enterprise is, the less its partners are involved in its activities. Secondly, the questions concerning the actors' associability were combined to a dimension called *"development activeness"*. This dimension depicts the enterprises' tendency to develop their business and network - the more active the firm is, the more positively it responds to the development, plans the future and engages its partners. The dimension thus indicates the firms' tendency to share social capital with others which is considered as associability.

*Independency* was examined through the following interview questions:

- Ownership base: the plant and the heating network.
- Nature of business activities of the enterprise (was independency highlighted?).
- Fuel procurement: procurement, delivery, and the enterprise's own forest property and its impact on procurement.
- Structure of the network and the enterprise's role in the network.
- Independence from the heating system manufacturer (HSM).
- Distribution of work in maintenance and repair.
- Other questions where independency was discussed.

There are clear differences in the ownership base of the plants and district heating networks. Some heating enterprises own the plant and the heating network, but in many cases, the heating network is owned by the municipality. Differences can also be found between the plants of a certain enterprise – some plants and district heating networks can be completely owned, whereas in others the enterprise only maintains the plant.

Clear differences were also found in the ways the fuel is procured. In some cases, the enterprise seems to take care of the whole procurement chain, whereas in some other cases, the procurement is far outsourced. As regards the maintenance of the plants, some enterprises maintain their plants nearly completely on their own, whereas some have outsourced the maintaining activities.

The business activities and some other questions were also taken into account if aspects related to independency were mentioned by the interviewee. In addition, the network structure and the heating enterprises' roles in their networks, as well as their relationships with the heating system manufacturers were analyzed regarding their dependency on the partners.

*Development activeness* was examined through the following interview questions:

- Nature of business activities of the enterprise (were developmental activities highlighted?).
- Willingness to cooperate with heating system manufacturers.
- Attitude towards opportunities and challenges of the development of cooperative networks.
- Planning of new heating plants or other activities.
- Future views.
- Other questions where development activeness was discussed.

The enterprises seem to differ in their willingness to cooperate with the system manufacturers and also in the amount of support they are willing to receive from them. Attention was also paid to the interviewees' emphasis on opportunities/challenges of cooperative development and their views on the importance of cooperation. Clear differences were found in the emphasis of the future – some entrepreneurs seem to be satisfied with the current situation, whereas others are constantly finding new business and cooperation opportunities, for example in combined heat and power production (CHP). The business activities and some other questions

were also taken into account if aspects related to development activeness were mentioned by the interviewee.

In Tables 1 and 2, the heating enterprises are assessed by the above-mentioned dimensions. The sub-questions of both dimensions are assessed with the scale 1-5. The higher the number in the questions related to independency, the more independent the enterprise is. Correspondingly, the higher the number in the questions related to development activeness, the more actively the enterprise develops its network(s) and thus the higher its level of associability. The scores for the dimensions are averages of the scores of the used sub-questions, and in order to clarify the differences between the groups better (Figure 2), the averages have been weighted by 2. As can be seen, the level of independency varies from 5.13 to 8.96. Thus, the differences in this dimension are notable between the groups. Similarly, there are clear differences between the levels of development activeness, as the highest number is 8.49 and the lowest 5.83. The meaning of these differences is further discussed below.

**Table 1. Assessment of the independency of the biomass heating enterprises.**

| HEATING FIRM | GROUP | Ownership base: plant and heating network | Nature of business activities | Fuel procurement | The structure of the net-work and the enterprise's role in it | Independence from the HSM | Distribution of work in maintenance and repair | Other questions | AVERAGE | INDEPENDENCY (Weighted by 2) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Group 1 | 5 | | 1 | 3 | | 1 | | 2.50 | 5.00 |
| 2 | Group 1 | 2 | | 3 | 3 | | | 1 | 2.25 | 4.50 |
| 6 | Group 1 | 3 | 4 | 4 | 3 | 4 | 2 | | 3.33 | 6.67 |
| 13 | Group 1 | 3 | 2 | 1 | 2 | 2 | 5 | | 2.50 | 5.00 |
| 14 | Group 1 | 1 | 2 | 1 | 3 | 5 | 3 | | 2.50 | 5.00 |
| 15 | Group 1 | 3 | 3 | 1 | 4 | 2 | 4 | | 2.83 | 5.67 |
| 21 | Group 1 | 4 | | 3 | | 2 | 3 | | 3.00 | 6.00 |
| 22 | Group 1 | 1 | | 2 | 3 | 3 | 4 | | 2.60 | 5.20 |
| 24 | Group 1 | 5 | | 1 | 3 | 3 | 4 | | 3.20 | 6.40 |
| 26 | Group 1 | 4 | | 3 | 3 | 2 | 4 | | 3.20 | 6.40 |
| | | | | | | | | | 2.79 | **5.58** |
| 10 | Group 2 | 5 | | 2 | 2 | 1 | 3 | | 2.60 | 5.20 |
| 12 | Group 2 | 3 | | 3 | 2 | 1 | 4 | | 2.60 | 5.20 |
| 19 | Group 2 | | | 5 | 1 | 1 | 3 | | 2.50 | 5.00 |
| | | | | | | | | | 2.57 | **5.13** |
| 3 | Group 3 | 4 | 4 | 2 | 5 | 4 | 5 | | 4.00 | 8.00 |
| 5 | Group 3 | 3 | 3 | 2 | 4 | 4 | 2 | | 3.00 | 6.00 |
| 7 | Group 3 | 3 | | 5 | 4 | 3 | 4 | | 3.80 | 7.60 |
| 11 | Group 3 | 5 | | 2 | 5 | 3 | 3 | | 3.60 | 7.20 |
| 18 | Group 3 | 4 | | 2 | 5 | 3 | 4 | | 3.60 | 7.20 |
| 20 | Group 3 | 3 | 4 | 1 | 4 | 5 | 3 | 4 | 3.43 | 6.86 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 23 | Group 3 | 5 | 4 | 2 | 5 | | 4 | | 4.00 | 8.00 |
| | | | | | | | | | 3.63 | **7.27** |
| 4 | Group 4 | 3 | | 4 | 5 | 5 | 4 | | 4.20 | 8.40 |
| 8 | Group 4 | 5 | | 5 | 5 | 4 | 5 | | 4.80 | 9.60 |
| 9 | Group 4 | 3 | 5 | 4 | 4 | 4 | 4 | | 4.00 | 8.00 |
| 16 | Group 4 | 4 | | 5 | 5 | 4 | 5 | | 4.60 | 9.20 |
| 25 | Group 4 | 4 | | 5 | 5 | 5 | 5 | | 4.80 | 9.60 |
| | | | | | | | | | 4.48 | **8.96** |

**Table 2. Assessment of the development activeness of the biomass heating enterprises.**

| HEATING FIRM | GROUP | Nature of business activities | Willingness to cooperate with HSMs | Attitude towards opportunities and challenges | Planning of new heating plants or other activities | Future views | Other questions | AVERAGE | DEVELOPMENT ACTIVENESS (Weighted by 2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| **1** | Group 1 | | 3 | | 2 | | | 2.50 | 5.00 |
| **2** | Group 1 | | 3 | 2 | 3 | 2 | | 2.50 | 5.00 |
| **6** | Group 1 | 4 | 2 | 4 | 3 | | | 3.25 | 6.50 |
| **13** | Group 1 | | 4 | 4 | 3 | 3 | | 3.50 | 7.00 |
| **14** | Group 1 | | 1 | 2 | 3 | 4 | | 2.50 | 5.00 |
| **15** | Group 1 | | 4 | 2 | 4 | 3 | | 3.25 | 6.50 |
| **21** | Group 1 | | 3 | 2 | 2 | | | 2.33 | 4.66 |
| **22** | Group 1 | | 4 | 2 | 4 | | | 3.33 | 6.66 |
| **24** | Group 1 | | 3 | 4 | 3 | | | 3.33 | 6.66 |
| **26** | Group 1 | | 3 | | 2 | 3 | | 2.67 | 5.34 |
| | | | | | | | | 2.92 | **5.83** |
| **10** | Group 2 | | 5 | 2 | 4 | | | 3.67 | 7.34 |
| **12** | Group 2 | | 5 | 3 | 4 | | | 4.00 | 8.00 |
| **19** | Group 2 | | 5 | 5 | | | 4 | 4.67 | 9.34 |
| | | | | | | | | 4.11 | **8.23** |
| **3** | Group 3 | 5 | 5 | 5 | 5 | 4 | | 4.80 | 9.60 |
| **5** | Group 3 | | 4 | 5 | 3 | 4 | | 4.00 | 8.00 |
| **7** | Group 3 | | 4 | 4 | 4 | 5 | | 4.25 | 8.50 |
| **11** | Group 3 | | 4 | 5 | 3 | | | 4.00 | 8.00 |
| **18** | Group 3 | | 4 | 4 | 4 | 5 | | 4.25 | 8.50 |
| **20** | Group 3 | 4 | 5 | 4 | 4 | 4 | | 4.20 | 8.40 |
| **23** | Group 3 | 4 | 5 | 3 | 4 | 5 | | 4.20 | 8.40 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | 4.24 | **8.49** |
| **4** | Group 4 | 4 | 4 | 3 | 3 | 3.50 | 7.00 |
| **8** | Group 4 | 4 | 2 | 2 | 4 | 3.00 | 6.00 |
| **9** | Group 4 | 4 | 4 | 3 | | 3.67 | 7.34 |
| **16** | Group 4 | 4 | 3 | 2 | | 3.00 | 6.00 |
| **25** | Group 4 | 5 | 3 | 3 | | 3.67 | 7.36 |
| | | | | | | 3.37 | **6.74** |

Four groups of enterprises with different networking tendencies can be recognized on the basis of the analysis. For clarity, the enterprises have already been sorted by the below-presented categorization and indicated with group numbers in Tables 1 and 2. The four recognized groups are:

*Group 1: Actors in local networks of equal partners*

The actors in this group tend to build networks locally, and form tight relationships with other local actors with a certain role in the network. The meaning of locality in the networks is emphasized, and all actors are rather equal in the power relations. In addition, the employment of local people and supporting of small actors are seen as important.

If the power positions of the firms are looked at more thoroughly with the framework of De Wit and Meyer (2005), this group can be located in the "Mutual Dependence" box (Figure 3). None of the actors in these networks has remarkable power over others. However, each actor in the network is highly important, because each of them has certain, and probably unique, know-how or resources to share in the network.

Furthermore, the actors in the group share some of their social capital in their networks and the operability of the networks is highly based on the unique know-how and assets of different actors. However, the firms in group 1 are moderate with developing the business or the network from its present scale and scope, or setting cooperative goals for the future. Thus, the total level of associability is rather low.

*Group 2: Actors with strong relationships with Heating System Manufacturers (HSMs)*

These actors tend to build strong relationships with the heating system manufacturers (HSMs). The plants actively exploit the HSMs' networks in the maintenance activities of the plants. In addition, these enterprises have common research and development interests with the HSMs, and they may operate as lead users for them.

This group can be apparently located in the "Unbalanced Dependence" box in de Wit and Meyer's (2005) framework (Figure 3). The networking activities of these actors are mainly targeted at the utilization of the existing relationships of the HSMs. Thus, these firms are not eager to build networks of their own, but they are willing to develop the business in cooperation with the manufacturer and its partners.

At the first glance, the sharing of social capital by the firms of this group may appear as open but rather one-way, as the heating enterprises utilize the know-how and social ties of the heating system manufacturers. However, the HSMs have their own objectives in the cooperation as well: they can gain valuable information straight from their customers (biomass heating plants), which the heating plants share quite openly. In addition, both parties have interests in common development activities. Thus, the level of associability of firms in group 2 is rather high.

*Group 3: Network developers/lead firms*

These actors are willing to extend the existing networks and build new ones. The networking activities also reach beyond the everyday business and maintenance, as these actors invest in research and development in cooperation with different instances, such as other entrepreneurs, different organizations and educational institutes.

The actors in this group can be located in the "Mutual Dependence" box (Figure 3), because the firms build lively networks which are actively developing business for the common good. Although the networks may include partners rather big in size (such as educational institutes), these actors do not have power over the others, but they are considered as equal research and development partners. The actors are, however, clearly dependent on each other, because none of them is willing or able to develop the business and the network on their own. Furthermore, associability can be seen as a prerequisite for the networks.

*Group 4: Independent actors*

These actors tend to be quite cautious in building relationships with external actors. That is mainly because these actors are usually co-operatives or family firms which already have a lot of know-how and expertise on their own. The spheres of responsibilities are clearly divided between the partners and the meaning of personal ties in the formation phase is highly important.

The relationships of the firms in this group can be characterized as "Mutual Independence" (Figure 3), as these firms do not generally form tight relationships, but their cooperation with the surrounding actors is rather free-form; they occasionally use partners when they need to procure some additional know-how or resources. No partner in these loose networks has power over the others. The firms do not tend to share their social capital with others constantly. However, they plan the future and interact with suitable partners (for example the heating system manufacturers) if needed. Thus, their associability can be characterized as moderate.

In Figure 2, the enterprises are located in a coordinates where x-axis depicts the independency dimension and the y-axis the development activeness dimension. As can be seen, the four above-discussed groups can be easily separated as clusters in the coordinates. Thus, it can be confirmed that each of the researched biomass heating enterprises mainly follows one of the above-discussed networking tendencies. Furthermore, in Figure 3, the groups are located in the framework of De Wit and Meyer (2005) based on their relative power positions.

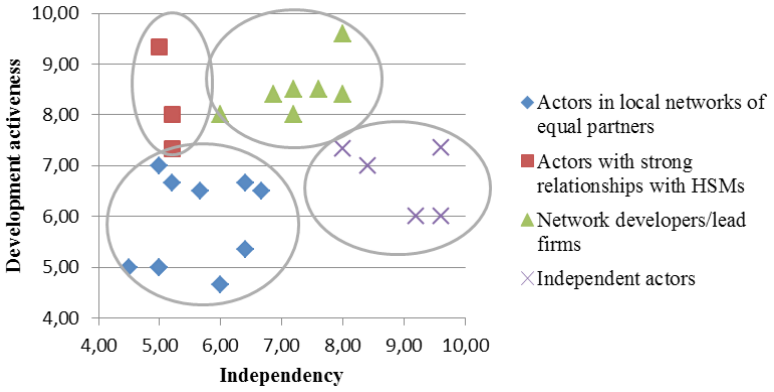


**Figure 2: Grouping of biomass heating enterprises according to their networking tendencies.**

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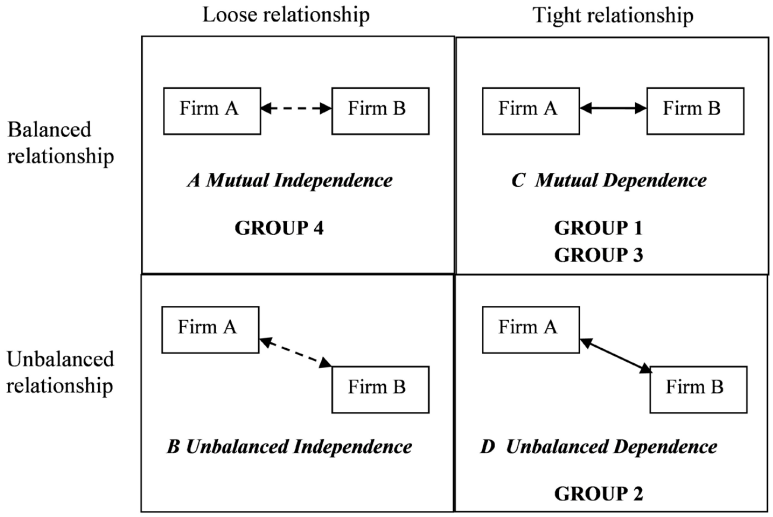


**Figure 3: Relative power positions of biomass heating enterprises.**

Next, the resource portfolios of the biomass heating enterprises are discussed. Each enterprise was assessed by the six categories of resources:

- *Human resources:* The number of associates and workforce in relation to the number of plants and their capacity. In addition, the division of active and passive associates is taken into account: how many participants are really involved with the operational activities of the enterprise.

- *Former experience and know-how:* Former experience on heating entrepreneurship, entrepreneurship on the whole, or on working in a similar field. Education and theoretical know-how of the entrepreneur/associates.

- *The functionality of the network (s):* The number and activeness of the partners, division of work in the networks. Functionality of cooperation on the whole. The strengths and weaknesses of the network(s).

- *Relationships with HSMs:* Amount and regularity of relationships and satisfaction with the cooperation with HSMs.

- *Interest and readiness for CHP:* Interest on the whole, readiness of the enterprises' plants for CHP, cooperative activities related to the development of CHP.

- *Physical resources:* Number of plants and their capacities.

The assessment of the resources of the biomass heating enterprises is presented in Table 3.

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**Table 3. Assessment of the resources of the biomass heating enterprises.**

| BIOENERGY HEATING FIRM | GROUP | Human resources | Former experience and know-how of the field | The functionality of the network(s) | Relationships with HSMs | Interest and readiness for CHP | Physical resources | AVERAGE | RESOURCES (Weighted by 2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 1 | Group 1 | 3 | 2 | 3 | 3 | | 2 | 2.60 | 5.20 |
| 2 | Group 1 | 3 | 2 | 3 | 3 | 2 | 2 | 2.50 | 5.00 |
| 6 | Group 1 | 5 | 2 | 3 | 2 | 1 | 1 | 2.33 | 4.67 |
| 13 | Group 1 | 1 | 3 | 4 | 4 | 3 | 2 | 2.83 | 5.67 |
| 14 | Group 1 | 4 | 4 | 4 | 1 | 3 | 1 | 2.83 | 5.67 |
| 15 | Group 1 | 3 | 2 | 4 | 2 | 3 | 1 | 2.50 | 5.00 |
| 21 | Group 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2.50 | 5.00 |
| 22 | Group 1 | 3 | 4 | 3 | 2 | 3 | 1 | 2.67 | 5.33 |
| 24 | Group 1 | 3 | 2 | 3 | 3 | 2 | 2 | 2.50 | 5.00 |
| 26 | Group 1 | 3 | 2 | 3 | 2 | 3 | 2 | 2.50 | 5.00 |
| | | 3.00 | 2.60 | 3.30 | 2.50 | 2.44 | **1.60** | 2.58 | **5.15** |
| 10 | Group 2 | 3 | 4 | 3 | 5 | 2 | 1 | 3.00 | 6.00 |
| 12 | Group 2 | 1 | 4 | 3 | 5 | 3 | 3 | 3.17 | 6.33 |
| 19 | Group 2 | 3 | 3 | 2 | 5 | 3 | 1 | 2.83 | 5.67 |
| | | **2.33** | **3.67** | 2.67 | **5.00** | 2.67 | **1.67** | 3.00 | **6.00** |
| 3 | Group 3 | 3 | 5 | 5 | 5 | 4 | 5 | 4.50 | 9.00 |
| 5 | Group 3 | 3 | 3 | 4 | 2 | 3 | 4 | 3.17 | 6.33 |
| 7 | Group 3 | 1 | 4 | 5 | 5 | 4 | 3 | 3.67 | 7.33 |
| 11 | Group 3 | 3 | 3 | 5 | 3 | 4 | 3 | 3.50 | 7.00 |
| 18 | Group 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3.50 | 7.00 |
| 20 | Group 3 | 1 | 4 | 3 | 3 | 3 | 4 | 3.00 | 6.00 |
| 23 | Group 3 | 3 | 4 | 4 | 4 | 3 | 2 | 3.33 | 6.67 |
| | | **2.43** | 3.86 | **4.29** | 3.71 | **3.43** | 3.43 | 3.52 | **7.05** |
| 4 | Group 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3.33 | 6.67 |
| 8 | Group 4 | 4 | 3 | 3 | 3 | | 2 | 3.00 | 6.00 |
| 9 | Group 4 | 4 | 5 | 4 | 4 | 3 | 2 | 3.67 | 7.33 |
| 16 | Group 4 | 5 | 5 | 4 | 4 | 3 | 3 | 4.00 | 8.00 |
| 25 | Group 4 | 5 | 5 | 4 | 4 | 4 | 3 | 4.17 | 8.33 |
| | | **4.40** | **4.40** | 3.60 | 3.60 | 3.25 | 2.60 | 3.63 | **7.27** |

Differences can be found in the averages, and especially, the groups seem to highlight different aspects and resource categories in their resource portfolios. For clarity, these are highlighted with darker colour in Table 3.

Group 1 (*Actors in local networks of equal partners*) has a rather moderate level of resources in all categories. A notable fact is that their physical resources are rather small, which is explained by their tendency to form rather small local networks with several other smaller actors. The meaning of these local networks is to provide energy for communities and municipalities, and thus the required capacity is rather low. In relation to physical resources, the group has a strong base of human resources. This is because each participant in the networks has its special and meaningful role in the business, and the activities are thus highly chained. In all, however, the level of resources is lowest in this group.

The levels of the human and physical resources of Group 2 (*Actors with strong relationships with HSMs)* are low. This is because these enterprises are rather small in size and they lean strongly on the bigger HSMs and their business relationships. However, the level of experience and know-how in this group is high, which is explained by the fact that these actors gain and develop their know-how together with the HSMs, for example by common research and development activities. Naturally, the relationships with the HSMs are considered as extremely valuable in the group.

Firms in Group 3 *(Network developers/lead firms)* have quite strong resource bases. However, their own human resources are not very large, because their activities are well-networked and thus they utilize a lot of external human resources in their business. The functionality of the networks is naturally experienced as high, although the actors are well-committed to further development of their relationships and building new networks. The interest and readiness for combined heat and power production (CHP) is rather high, and especially the strong physical resources support the development of new technologies – for example, many plants driven by these enterprises are rather big in size and thus have more potential to CHP production than the plants of Groups 1 and 2.

Firms in Group 4 *(Independent actors)* have a high level of human resources – a majority of the business is driven by own resources, and thus these enterprises also need a large amount of active personnel. In addition, their experience and know-how is notably high – their utilization of external forces is much lower than in the other groups. Because the enterprises in this group do not tend to form long-lasting relationships with external parties, the functionality of the networks and the relationships with HSMs could not be assessed as thoroughly as in the other groups. However, according to the answers, the actors seem to be quite satisfied with the contracts they have had with external parties. In all, the level of resources is highest in this group.

Table 4 sums up the results. As can be seen, the resource analysis supports rather well the above-discussed characteristics of the four biomass heating enterprise groups with different networking tendencies. It can thus be stated that the resource-base of an actor correlates rather strongly with its networking tendency. In Group 1, the actors lean on each other and form a tight network via which they can operate locally. The resource-bases of the actors are rather low, which makes the actors equal – none of the participants in the network has significant power over the others. Enterprises in Group 2 are rather small in size and they are thus dependent on the stronger partners, especially HSMs. However, they are also desirable partners for HSMs because of their strong experience and know-how in the field, and their willingness for cooperative R&D. Group 3 consists of enterprises with a rather strong resource portfolio, which they also eagerly share with their partners. As the partners in their networks are mutually dependent on each other, they both give and gain a lot of their relationships. Enterprises in Group 4 stand strongly on their own feet, which is also shown in their resource portfolios – they possess a sufficient amount and combination of inner resources and do not thus have a need to form tight relationships. Although both the Group 3 and Group 4 have rather strong resource bases, their philosophy to do business is rather different, and this is also reflected in the aspects they high-

light in their resource portfolios: firms in Group 3 lean much on external experts whereas firms in Group 4 trusts on inner experience and know-how.

**Table 4. Summary of the results.**

| Group | Power relations | Level of associability | Level of resources | Specialities in resource portfolios |
|---|---|---|---|---|
| **1:** *Actors in local networks of equal partners* | Mutual dependence | Low | Low | Small physical resources |
| **2:** *Actors with strong relationships with HSMs* | Unbalanced dependence | Rather high | Moderate | Small human and physical resources<br>Strong experience and know-how<br>Strong relationships with HSMs |
| **3:** *Network developers/ lead firms* | Mutual dependence | High | Rather high | Rather small human resources<br>High functionality of networks<br>High interest and readiness for CHP |
| **4:** *Independent actors* | Mutual independence | Moderate | Rather high | Strong human resources<br>Strong experience and know-how |

## Discussion

Balancing between independency and embeddedness is not an easy task for firms, and the results of the study indicate that firms can solve this problem in many different ways. Every firm has its own objectives related to its independency and associability, which means that every firm tends to maintain a certain level of independency in its relationships, and that it also has a certain willingness and ability to share its social capital with its partners. These objectives may lead to formation of different network types. In the researched group of Finnish biomass heating enterprises, four groups with different networking tendencies based on these objectives could be found. These objectives may be useful to be taken into account when planning networked businesses – even though some firms might seem as perfect partners because of their business fields or technical prospects, they may have totally different aims related to their networking tendencies.

Furthermore, the results indicate that there is certain correlation between the actors' resources and their tendencies to form networks. For example, a rather small resource-base of a firm seems to lead easily to the formation of tight relationships with other small actors - the actors lean on each other, but none of the participants in the network gains significant power over the others. In addition, because of the limited amount of resources, the networks do not have ambitions for wider development, and thus the level of associability in these networks is low. On the other hand, with a higher level of associability, a small firm can also network with

a more powerful firm (in this study with a heating system manufacturer) and concentrate on strengthening its experience, know-how and negotiation power through cooperative activities.

Actors with stronger resource portfolios seem to have two, rather diverging networking strategies, depending on their objectives of the independency-level, and their associability. In the network developers/lead firms' case, the activities are well-networked. The firms utilize a lot of external human resources in their business and do not thus have a remarkable number of human resources of their own. As the partners in the networks are mutually dependent on each other, they both give and gain a lot in their relationships, and thus the level of associability is high. In the independent actors' case, the situation is rather the opposite – these firms possess a sufficient amount and a suitable combination of inner resources. Because of their objective for a high level of independency, they do not tend to build long-lasting relationships with other actors.

## Conclusions

The business environments are becoming more and more complex entities, and the study supports the fact that networking is an increasing phenomenon in these environments. Especially fast developing business fields, such as bioenergy, offer numerous opportunities for growth, but at the same time also require cooperation from firms – no firm can possess all the needed resources and know-how on its own. It thus can be said that success in any business field demands a certain level of cooperation. However, as the study indicates, the firms in the same industry may follow rather different networking strategies which may all lead to success.

Every firm aims for certain level of power. However, this power can be provided and shared in many different ways. Based on the conducted study, a firm with basically small negotiation power has two diverging strategies – to lean on a more powerful firm or to ally oneself with other smaller actors and thus ways gain negotiation power together. Correspondingly, firms with stronger negotiation position may lean on own resources or aim to further strengthen their position by active network development.

Inter-firm collaboration has been widely discussed in the literature from different perspectives. According to Varamäki and Vesalainen (2003), these perspectives can be classified into five groups: resources and specialization, intensity of objectives and investments, formality of cooperation, uncertainty and the use of power, and socio-psychological concepts. This study can be seen to settle between the resource-based views, power relation examination and socio-psychological aspects by offering a practical view on the motives behind cooperative activities. As the study indicates, aiming for wider resources draw firms into cooperative activities, but at the same time they have certain aims for independency and associability between which they need to balance. As a consequence, the firms in the same industry seem to end up in building rather different actor networks around themselves.

Although the focus of the study was on biomass heating entrepreneurs, the results can be expected to reflect the situation in many fast-evolving business fields, and that way to offer fresh and wider knowledge on the issues under scope. For the actors themselves, the study offers a clear view on their tendencies to form relations and networks and thus helps them to develop their business better according to their objectives. The study does not, however, consider much on the actual structure of the networks nor the actual resource exchange between the actors. A more thorough examination on these aspects would thus be an interesting field for further studies.

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