

How does the innovation system in the Slovak forestry service sector work?¹⁾

(With 2 Figures and 1 Table)

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(Accepted in March 2018)

DOI Number 10.23765/afjz0002018

KEY WORDS – SCHLAGWÖRTER

Innovations; innovation system; information; cooperation; financial incentives; innovation behaviour and potential; forestry services; Slovak forestry.

Innovationen; Innovationssystem; Information; Zusammenarbeit; finanzielle Förderung; Innovationsverhalten; Innovationspotenzial; forstliche Dienstleistungen; slowakische Forstwirtschaft.

1. INTRODUCTION

1.1 Innovations and innovation systems

Forestry as a sector is often considered a mature, “low-tech” industry which invests comparatively little in research and development and is mainly an innovation user (RAMETSTEINER et al., 2010; WEISS et al. 2011). However, developments in the sector have led to a widely shared perception that past practice might not necessarily bring future success. This opens up opportunities for innovations in the forest sector (RAMETSTEINER et al., 2005).

The OECD (2005) defines innovation in its Oslo Manual as “the implementation of a new or significantly improved product (good or service), or process, new marketing method, or a new organisational method in business practices, workplace organisation or external relations.” Institutional innovation as a separate category was added by WEISS et al. (2010).

Innovation is the first economic utilisation of a new product or process. New processes, marketing methods or organisational methods are implemented when they are brought into actual use in the firm’s operations. “New” may mean new to the market, new to a sector or new to a firm, so we thus speak of different degrees of novelty. So not only is the implementation of a novelty by the first innovating firm relevant to society, but so also is adoption of that innovation by others (ROGERS, 1995). As FARIAS and VISSER (2016) state, innovation is not only finding and developing something new, but also taking full advantage of what is already available. A further distinction among degrees of novelty is between radical and incremental innovations. The first would be a more profound change in a production process or product, the latter a small-scale adaptation that means an improvement of that product or process (LUNDVALL, 2010).

There is a growing consensus in the innovation system literature that innovations are the result of institutional processes (NELSON and WINTER, 1977), which means that the entrepreneur is not the only one responsible for the innovative character of the company (EDQUIST, 2001; LUNDVALL et al., 2002). The integration of innovations into the institutional systems that can support them is really important. Innovation systems represent a set of institutions and actors who influence innovation processes in a given territory and/or sector, and they may be national, regional and sectoral innovation systems. Actors are considered to be organisations, which are seen as formal structures with an explicit purpose and which are consciously created. Institutions are understood as a set of habits, routines, rules, laws or regulations that regulate the relations and interactions among individuals, groups and organisations (EDQUIST and JOHNSON, 1997).

The innovation system of the forestry service sector can be divided into four levels: the institutional, business-to-business (b2b), firm and personal levels (ŠTĚRBOVÁ et al., 2014b). The system influences competition and cooperation, which affect the implementation of innovation activities (PEHRSSON, 2016). The ability of contractor firms to generate innovations currently depends on the way they work and interact as a part of the system. Systems of innovations can be analysed to find out their functions in the context of the innovation behaviour of firms and for intentional planning of innovation policy (JOHNSON, 2001). The basic functions of

¹⁾ This study was supported by the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Sciences under Grant [number 15/0715] and under Grant [number 180678/14]; and the Cultural and Educational Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic under Grant [number 017TU Z-4/2015]. The study originated in terms of the Project ‘Centre of Excellence: Adaptive forest ecosystems’, based on the support of SOP Research and Development funded by the European Regional Development Fund under contract [number 262201200006] and [number 26220120049].

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that innovation system in the forestry service sector are (DOSI, 1988; EDQUIST and JOHNSON, 1997; RAMETSTEINER et al., 2005):

(i) to reduce uncertainties by provision and exchange of information – the institutional system and institutions shall provide knowledge and information about the behaviour of other actors to reduce uncertainties in the innovation activities of the enterprise or reduce the amount of information needed,

(ii) to manage conflict, risk, and cooperation among the various actors – the institutional system shall support and manage networks and clusters, for example the competition and cooperation between individuals and groups necessary for an innovation-friendly environment,

(iii) to provide non-pecuniary and pecuniary incentives – the institutional system shall also provide a system of non-pecuniary incentives (e.g. learning activities) and pecuniary incentives (e.g. tax rules, government subsidies) that shall channel resources to innovation activities.

There are several approaches that can be used to analyse innovation systems. For researching innovation and innovation policies in forestry, sectoral innovation systems and regional innovation systems are of particular importance, putting emphasis on the sectoral institutional system in the former or regional networks in the latter. The agents composing the sectoral system represent individuals and organisations (firms, non-firm organisations, organisations at a lower or higher level of aggregation). They are characterised by a specific learning process, competence, structures and behaviour. They interact in a market and non-market way through processes of communication, exchange, cooperation, competition and command, and their interactions are shaped by institutions (rules and regulations) (RAMETSTEINER et al., 2005).

1.2 The market for forestry services in Slovakia, innovation behaviour, and the potential of contractor firms

As BOURIAUD et al. (2011) report, traditional forestry aims are associated with the establishment and cultivation of forests to produce timber. In recent years, forest enterprises do not do the work themselves, but increasingly by outsourcing. Through this the business community of enterprises providing forestry services develops. It consists mainly of small- and medium-sized enterprises (SMEs), which provide and ensure a wide range of forestry services (HÄGGSTRÖM et al., 2013).

The market for forestry services in Slovakia is relatively new and young, having originated about 25 years ago. The restitution process of returning forest property and restructuring state-owned enterprises can be considered a main impulse for the creation of this sector. The community of forestry contractors consists of more than 21,000 business entities, 95% of which are micro-enterprises with fewer than nine employees and one or two machine units. Of these small contracting enterprises, 60.8% prefer a legal form of 'individual contractor', because of its simplicity, freedom and flexibility. They do

not own and use forest lands, but only provide and ensure the full range of forestry services. Extraction of timber is carried out by 86.3%, timber skidding by 76.5% and timber transport by 33.3%. Of all services provided and ensured, 70.1% are for the state forest enterprise, 67.4% are for private forest owners, and the rest are for communal, municipal, church and cooperative forests. However, though the forestry contractors are familiar with new, modern and environmentally friendly technologies, 69.1% of them prefer using traditional technologies. In addition, 52.9% of contractors still work with animals, especially with horses (ŠTĚRBOVÁ, 2016).

According to PALUŠ et al. (2011) outsourcing of services is more profitable for forest owners. While in other sectors it is more common that subsidiary activities are outsourced, in the market for forestry services the major forestry operations are outsourced, mainly to reduce risk and cost (AGER, 2012; AMBRUŠOVÁ and ŠULEK, 2014) and decrease investments in machinery (NORIN, 2002). Also a lot of larger Swedish forest companies prefer outsourcing of forestry services (AGER, 2012). While some companies outsourced all their operations to contractors, others procure only a few services from contractors (HÄGGSTRÖM et al., 2013). The level of quality provided by forestry service contractors plays an increasingly important role, opening up opportunities for innovation activity.

Innovation behaviour represents a set of business activities that specialise in constant implementation of innovations. It is considered a way for an entrepreneur to adapt, apply and refine new knowledge and ideas which are very important for the economic development of regions (ŠULEK, 2002). We consider innovation potential as an appropriate characteristic of the existing innovation environment of a company, where innovations are created, developed and executed. The term 'innovation potential' identifies a specific company's ability to use the knowledge and experience of employees to achieve greater competitiveness in the market and to use its own internal sources most effectively in order to improve and rationalise product or process (PITTNER and ŠVEJDA, 2014).

ŠTĚRBOVÁ (2016) states that innovation activity of contractor firms in the Slovak forestry service sector is low (40.7%) and does not even reach average value (i.e. 50%). Although a level of innovation activity that exceeds 40% can seem positive in general, this result represents only a simple percentage reflecting the number of enterprises with innovation activity to the total number of respondents. The innovation index that ranks innovation performance from a broader perspective was not computed. The results of a questionnaire survey showed that innovation behaviour of contractors is limited to incremental innovations, often only technological innovation that is new for the firm, not for the sector, and with radical innovations almost completely absent. Innovation activities of contractors are oriented toward procurement of the technology necessary for timber harvesting, skidding and transport (ŠTĚRBOVÁ, 2016). Also PALUŠ et al. (2015) confirmed that extensive innovations are very rare in the sector of forestry services; innovations often take the form of small modifications to applied technologies.

Therefore, taking into account these facts, it cannot be said that innovation activity of contractors is satisfactory. It can be assumed that if an innovation index ranking innovation performance from a broader perspective, including assumptions, business activities, outputs, and so on, were computed, the level of innovation activities would be lower.

The majority of innovation incentives originate in the internal company environment, especially incentives from the company's own management or co-workers. Most factors supporting the innovation process are associated with the possibility of financing innovation by loans and with good vertical and horizontal cooperation. An unfavourable financial situation within a firm, high costs of innovations, and financial dependence on one dominant customer slow the innovation process down. Nevertheless, contractors try to implement new solutions into forestry practice, because they are aware that traditional harvesting and transport technologies are no longer quite sufficient (ŠTĚRBOVÁ, 2016).

These findings were verified also by following research of ŠTĚRBOVÁ (2016). Through the results of 13 case studies the dominance of technological innovations in the forestry service sector was confirmed. This clear focus on the acquisition of newer machinery and technology is caused mainly by the need for renewal and modernization of the technology used previously, with respect to changing markets' and customers' demands. The forestry

service sector in Slovakia is currently influenced by changes in knowledge and overall development. This opens up opportunities for innovations and indicates a high innovation potential for the forestry service sector.

2. OBJECTIVE AND RESEARCH QUESTIONS

Based on previous empirical research, the main aim of the study was to evaluate the functioning of the sectoral innovation system in the Slovak forestry service sector, with an emphasis on the evaluation of its three basic functions for innovation support:

RQ1: How effectively does the Slovak forestry service sector provide and exchange information about innovation implementation?

RQ2: What is the level of cooperation among the various actors in the innovation system within the Slovak forestry service sector?

RQ3: Does the innovation system in the Slovak forestry service sector provide enough pecuniary incentives for innovation?

3. MATERIALS AND METHODS

This study summarises and synthesises selected results of the authors' extensive innovation research in the Slovak forestry service sector. Research results concerning the innovation behaviour and potential of contractor firms, the key regions for the cluster, the innova-

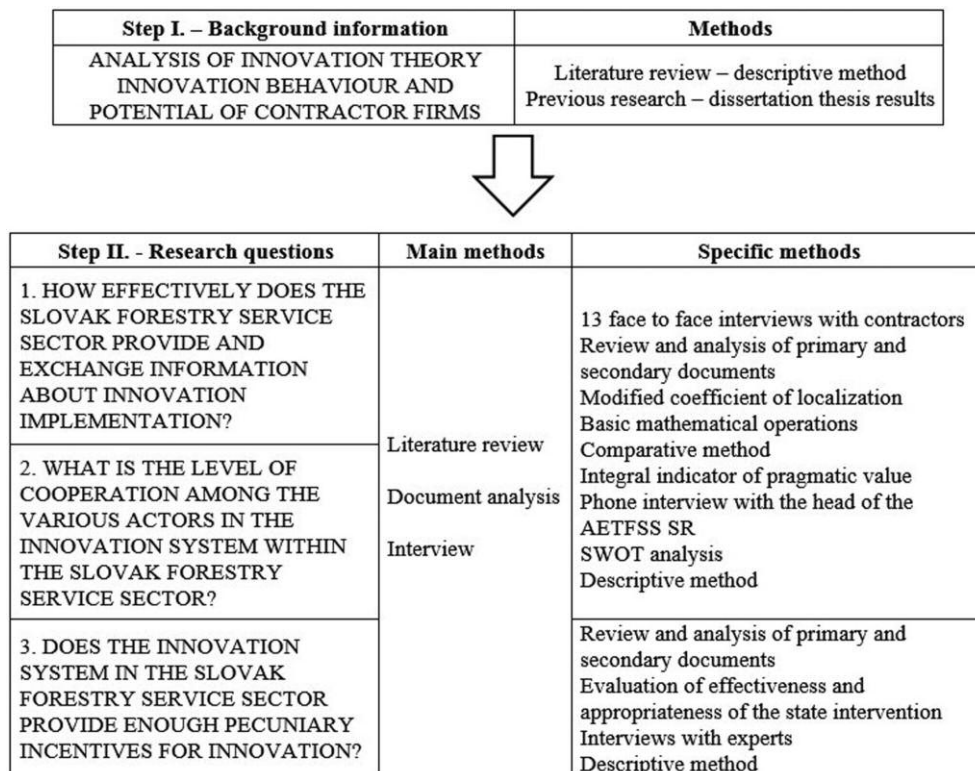


Fig. 1

Structure of materials and methods used.
Die Struktur von angewandten Datenquellen und Methoden.

tion strategies of contractors, and financial incentives to innovation in the sector have been published in papers. However, there has been no holistic view of the issue of innovation implementation in this sector from the innovation system perspective, and that represents the added value of this study.

In order to meet the aim of the research the following combination of scientific methods and approaches was used (*Figure 1*).

Background information about the theory of innovations and innovation systems was identified using a literature review. The characteristics of innovation behaviour and the potential of contractor firms were based on the dissertation thesis results of ŠTĚRBOVÁ (2016).

The study was based on the analysis of innovation system individual features – contractor firms and institutional system and support. The main methods used were literature review, document analysis and interview.

The study analysed and evaluated the functioning of the innovation system, with emphasis on the fulfilment of its three basic functions: (i) reduction of uncertainties by providing information, (ii) management of conflicts and cooperation, and (iii) the provision of pecuniary and non-pecuniary incentives. It should be noted that information exchange is closely associated with cooperation between the various actors in the innovation system. The functions of providing information and management and supporting cooperation are interdependent and it is not easy to evaluate them separately. Therefore, these two functions (i) and (ii) were evaluated jointly.

Data for assessment of the process of information exchange and cooperation in the market for forestry services were obtained during the 13 face-to-face interviews with contractors. Interviews represented the data sources for case studies of innovation implementation (ŠTĚRBOVÁ, 2016). Based on the analysis of relevant data from the Register of Financial Statements of the Ministry of Finance of the Slovak Republic (number of the contractor firms in forestry service sector in 8 individual regions in Slovakia and the total number of enterprises in the regions and in Slovakia), the calculation of coefficient of localisation LQ was used to identify the key regions suitable for the cluster (innovation networks representing an effective system for supporting innovations based on the principle of synergistic effect) in the sector of forestry services (ŠTĚRBOVÁ et al., 2014a). LQ is also known as the index of concentration, which measures the degree of concentration of contractor firms in the forestry service sector over a set of regions. It represents the sum either of the positive or negative deviations of the regional percentage of firms in the given region from the corresponding regional percentage of all enterprises in this region (PORTER, 1998).

Information regarding to factors affecting innovation behaviour of contractor firms were gained from the dissertation thesis results of ŠTĚRBOVÁ (2016). The SWOT analysis of these factors identified the most appropriate innovation strategy for these subjects. Through the questionnaire survey, fostering factors for innovation were identified by the firms with innovation experience.

Impeding factors, which restrain the implementation of innovations, were identified by firms without innovation experience. Respondents were allowed to select more than one factor from a list of possibilities. The ranking of individual fostering and impeding factors indicates their importance within the innovation process. Factors identified on the basis of the inductive and deductive methods were categorised as belonging to the internal or external environments of contractor firms. Factors in the internal environment were evaluated as strengths (S) and weaknesses (W) and those in the external environment as opportunities (O) and threats (T). Their importance is a quantitative measure of the proportion-identifying factor of all responders expressed as a percent (ŠTĚRBOVÁ et al., 2016). The assessment of management of conflicts and risks is based on the research results of PALUŠ et al. (2015).

Regarding the provision of pecuniary incentives, we focused on the assessment of ‘policy output’ of the selected key forestry measures from the project support through the Rural Development Programme (RDP) of the Slovak Republic 2007–2013 and 2014–2020. The area of ‘policy output’ begins as a result of the programme formulation and it consists of the various formal actions and policies that the government takes to pursue its goals (KROTT, 2001; ŠÁLKA, 2006, 2002). We used document analysis of the RDP SR in order to select and characterise the key measures related to the issue of institutional support for innovations in the forestry services sector. Based on a literature review of the theory of policy analysis, in regard to the condition of effectiveness and appropriateness of the state intervention (ŠÁLKA, 2006, 2004; GIESSEN et al., 2006; WEISS et al., 2005), nine evaluation criteria of this financial support were set up. According to these criteria, the financial support should not debit the applicant, and it has to be risk oriented and support pioneering innovations, new ideas and pilot projects. It also has to be focused on interactions and information exchange within the innovation system and development of human resources. It cannot be associated with a high level of bureaucracy, and contractor firms have to be included among eligible applicants (ŠTĚRBOVÁ and ŠÁLKA, 2016). A regulatory component expresses the assumptions, conditions and required behaviour under which it is possible to provide a financial contribution. The motivational component should ensure the optimal value of financial support. This means that the value of the grant is accepted by the applicant and at the same time ‘the effects of financial participation’ (financial support for such innovations, which applicants are able to implement also without this help) are eliminated (DAHME et al., 1980).

These rules were used to assess whether a financial subsidy from the selected measures is set up in order to fulfil the function of the provision of pecuniary incentives to contractor firms in the Slovak forestry sector (ŠTĚRBOVÁ and ŠÁLKA, 2016). Through the document analysis of the RDP SR Summary Reports, literature review of HRBÁL’ et al., 2010, 2013 and estimates of experts from the Agricultural Payment Agency, we also evaluated ‘policy impact’ and ‘policy outcome’ of this pro-

ject support within the programme period 2007–2013. Impacts give information about the effects such actions have on the addressees of the programme, (BÖCHER, 2006; GIESSEN et al., 2006; ŠÁLKA, 2006), so we assessed changes in target behavior caused by conditions for obtaining financial support. Outcomes describe the overall effects of the programme on problem to be solved (BÖCHER, 2006; GIESSEN et al., 2006; ŠÁLKA, 2006). Therefore, the evaluation of outcomes was based on the total number of financial supported contractors in the forestry service sector.

4. RESULTS

4.1 Information exchange, management of conflict and risk, and cooperation

Based on the results of face-to-face interviews and contractors' opinions, it can be stated that there is a lack of cross-sectoral knowledge, connection and information for the reduction of uncertainties. The existing innovation knowledge base does not provide good guidance for managers to develop and follow their innovation pathways. Moreover, state administration does not provide enough direct information and subsidies directed towards consultancy and knowledge transfer. Therefore, communication about innovations and potential innovation opportunities in the Slovak forestry service sector depends mainly on innovators themselves.

Contractors further state that there is a high level of uncertainty in the forestry services market, influenced mainly by the strong dominance of the state forest enterprise, which manages more than 50% of forest land. It represents the main customer of forestry services and determines the conditions of public tenders. In many cases, price is the single most important criterion for

getting the tender. As a result, contractors are given short-term contracts and there is no guarantee that the companies will get tender again, even if they professionally and successfully complete the tender obligations (ŠTĚRBOVÁ, 2016). Moreover, due to the strong dependency on work for the state forest enterprise, the negotiating position of contractors is weak and there is a limited space to reach terms that would effectively protect contractors from the potential opportunistic behaviour of forest owners (PALUŠ et al., 2015) in partnership that is motivated by the maximization of economic self-interest and occasioned loss of the other partners.

As PALUŠ et al. (2015) state, contractors concerned with risk management prefer long-duration contracts and complex service delivery based on long-term relationships between the parties. The length of a firm's existence in the market is also an important factor when considering risk management of the innovation process, because longevity increases a firm's reliability and credibility. The majority of contractors are willing to invest in innovations only when 50%–80% of the investment will be paid back by the contract. In this way firms try to reduce risk. So the possibility of obtaining financial support for innovations has a positive impact on risk management.

Regarding cooperation, the results of face-to-face interviews and document analysis pointed out that interactions among the various actors in the innovation system are weak and a formal cluster does not explicitly exist. Contractors collaborate and work as partners mainly on an informal level (ŠTĚRBOVÁ et al. 2014a). Moreover, the supply of services exceeds demand and there is a dearth of job offers in the forestry services market. The market is unstable and there is a high solvability risk. Therefore

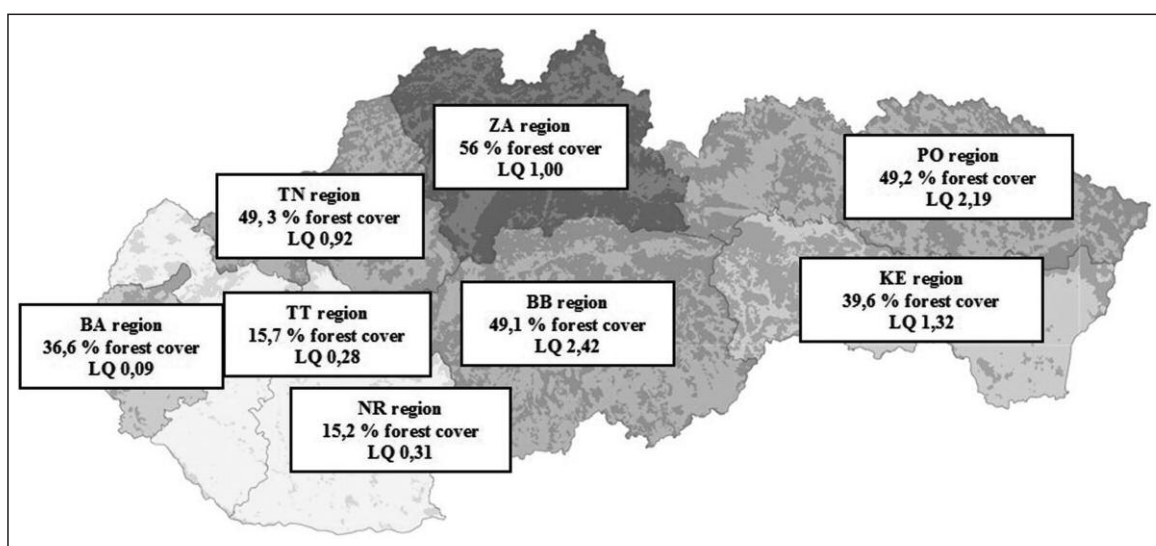


Fig. 2

LQ for each region of Slovakia in the forestry service sector (ŠTĚRBOVÁ et al., 2014a)
 LQ für slowakische Regionen im forstlichen Dienstleistungssektor (ŠTĚRBOVÁ et al., 2014a).

contractors try to strengthen their own position compared to others, so they are more competitors than partners.

At the institutional level, the Association of Entrepreneurs and Tradesmen Working in the Forestry Service Sector of the Slovak Republic (AETFSS SR) (in Slovak: Združenie podnikateľov a živnostníkov pracujúcich v lesnom hospodárstve Slovenskej republiky) has a characteristic function within the cluster and aims to create the best conditions for the development of SME enterprises in the forestry sector in each region of the Slovak Republic. The association seeks to promote the professional and economic interests of its members in the course of their profession as well as ensuring fair competition between the economic entities. However, according to the heads of the AETFSS SR, it has a small membership base and its members are not consistent.

Based on the methodology described above, the key regions suitable for the formal cluster in the sector of forestry services were identified (*Figure 2*).

Regional clusters potentially exist in the regions, where groups of related industries with an LQ higher than 1 are located. This indicates a region with a particularly large representation of selected enterprises, but there can be more than one region with an LQ higher than 1 in the same country. A value of 0 would indicate that the contractor firms are distributed very evenly over the region. Therefore, according to ŠTĚRBOVÁ et al. (2014a), based on the value of the coefficient of localisation, the regions of Banská Bystrica, Prešov and Košice appeared most appropriate for clusters within the sector. The region of Žilina also has relatively high potential with an LQ of 1. As *Figure 2* shows, the values of the LQ are connected to the forestation of Slovakia. The highest values were identified in regions with the largest forest cover and, on the other hand, lower values were identified in areas of the country with lower forest cover. It has to be noted that the LQ does not indicate the region with the highest importance for this sector. It indicates only the actual importance.

The importance of cooperation within the innovation process in the forestry service sector was also confirmed by another study of ŠTĚRBOVÁ et al. (2016). According to the SWOT analysis of fostering and impeding factors affecting innovation behaviour of contractor firms, the alliance strategy appeared as the most appropriate in this sector. The most appropriate strategy to foster innovation is cooperation, aimed at maximising the opportunities of contractors possessing complementary areas of specialisation and expertise. Innovations in the combination of the provider network and the vertical production chain improve efficiency, where the contractors prefer a cluster of suppliers-to-customers chains based on the inputs and outputs, as they represent economic partners for the contractors.

4.2 Financial incentives for innovation implementation

Innovation implementation is significantly influenced by a sufficient number of financial means. Financial support from public sources is assessed as a very significant

aid (ŠTĚRBOVÁ, 2016). There is no national financial support for contractor firms in the Slovak forestry sector, and government support takes the form of co-financing of financial support from EU funds. Therefore, to examine financial support for innovation implementation, we focused on the provision of pecuniary incentives granted by the Agricultural Paying Agency under the project support of the Rural Development Programme 2007–2013. We selected measures numbered 2.2.4 – Improving the economic value of forests – and 2.2.6 – Restoring forestry potential and introducing prevention actions – as key measures related to the issue of institutional support for innovations in the forestry service sector. According to the nine evaluation criteria of this financial support, we assessed whether a financial subsidy from the selected measures is set up in order to fulfil the function of provision of pecuniary incentives to the contractor firms in the Slovak forestry industry (*Table 1*).

As *Table 1* shows, the type of financial support – a non-repayable grant – was appropriate, because the debt of the applicant was not required. The matched funding (amount of support – 50% of eligible costs) within measure 2.2.4 ensured relatively high motivation of applicants for the grant and also eliminated ‘the effects of financial participation.’ Because of the full funding within measure 2.2.6, there was a high level of motivation for the grant and also a high risk of ‘the effects of financial participation.’ The results point out that the strict conditions set up in the Rural Development Programme in the programming period 2007–2013 caused these financial incentives not to fulfil their function within the innovation system. It can be concluded that the financial support in the period of 2007–2013 was not focused on supporting innovation in the forestry service sector (ŠTĚRBOVÁ and ŠÁLKA, 2016).

In evaluating policy impacts of the selected innovation incentives, we note that experts from the Agricultural Paying Agency estimate approximately 50% of all applicants for grants represented contractor firms. However, these subjects were not included among eligible applicants of this financial support from the RDP 2007–2013, because of the condition to own or use at least 10 hectares of forest land. Because the majority of contractors do not own and use forest land, approximately 70% of them rent forest land in order to fulfil this basic condition. That indicates a small change in their behaviour.

Regarding evaluation of policy outcomes of the selected innovation incentives, according to expert estimation, in the forestry service sector approximately 70% of the approved projects were finally completed. Others were rejected mainly because of the high level of bureaucracy, lack of guidance and help for applicants, low quality of the projects and incorrectly completed applications (HRBÁL’ et al., 2010, 2013). Moreover, the low prices for provided services in the market means that contractors do not have enough of their own financial resources for the matched funding. Finally, only 0.01% of total number of contractors in the forestry service sector obtained financial support for innovation from the RDP during the programme period 2007–2013. Based on this data, it

Tab. 1
Evaluation of policy output of the selected innovation incentives
 (ŠTĚRBOVÁ and ŠÁLKA, 2016).
Die Beurteilung von Programmzielen bei ausgewählten
Innovationsförderungen (ŠTĚRBOVÁ und ŠÁLKA, 2016).

	N.	The evaluation criteria for financial support	Measure	
			2.2.4	2.2.6
appropriateness	1	appropriate type of financial support	✓	✓
	2	risk oriented	X	X
	3	addressed to new ideas and pilot projects	X	X
	4	focused on the interactions in the innovation system	X	X
	5	focused on human resources development	X	X
	6	simple “paperwork”	X	X
	7	focused on the contractor firms	X	X
effectiveness	1	regulatory component	✓	✓
	2	motivational component	✓	X

✓ Meets the criteria X Does not meet the criteria

can be concluded that the innovation system in the Slovak forestry service sector did not provide enough pecuniary incentives for innovations (ŠTĚRBOVÁ and ŠÁLKA, 2016).

The study also evaluated the policy output of innovation incentives (the formulation of the selected key forestry measures) from the Rural Development Programme of the Slovak Republic 2014–2020. We selected measures numbered 8 – Investments in forest area development and improvement of the viability of forests– and 16 – Cooperation and information actions – as key measures related to the issue of institutional support for innovations in the forestry service sector in the programme period of 2014–2020. Based on document analysis it can be concluded that the conditions for obtaining a financial grant in the actual programme period compared to the period of 2007–2013 are significantly improved towards supporting innovations in the market of forestry services, because they meet the evaluation criteria. It can be assumed that this will ensure a higher level of motivation of contractor firms to implement innovations into practice compared to the previous programme period (ŠTĚRBOVÁ and ŠÁLKA, 2016).

The results ultimately showed that the innovation system fulfils its three basic functions at an insufficient level.

5. DISCUSSION

Up to now, there have not been a lot of studies of entrepreneurs in forestry in general (NYBAKK et al., 2015) and the innovation research in this sector was

mainly oriented toward the primary and secondary wood industry (HANSEN et al., 2011; NYBAKK, 2012; STENDAHL and ROOS, 2008). However, nowadays, it is developing into a solid research field (RAMETSTEINER et al., 2006) and more research attention is focused on innovations in the forest sector (HANSEN, 2010; WEISS et al., 2011). Especially issues related to harvesting and timber transport are studied in detail (NYBAKK et al., 2015). According to the results of our research, it can be concluded that the current situation with respect to innovation research within the forestry sector in Slovakia has similar characteristics.

5.1 Innovations in the market for forestry services

In general, forestry entrepreneurs face similar realities and react in similar ways to their counterparts in other sectors (DROLET and LEBEL, 2010). Hansen et al. (2014) state that forestry represents a conservative and isolated field, with limited knowledge transfer, which is not able to invest enough in innovations. Moreover, DOBŠINSKÁ et al. (2010) report that innovations in the forestry service sector are often incremental and not new for the sector. These statements are consistent with the results of our study. However, the level of innovation activity, which exceeds 40%, can be evaluated as positive compared with the results of innovation research of forest enterprises in central Europe, where only 9% of those entities innovated (RAMETSTEINER et al., 2005; SARVAŠOVÁ, 2004).

Technological innovations dominate within the forestry service sector in Slovakia. Also, innovation

research in forest enterprises in central European countries, as well as independent innovation research into forest enterprises in Slovakia (EFI Project Centre Innovation, project IPOLES) confirmed that technological innovations are more extended and successful than innovations of product and services (SARVAŠOVÁ, 2004; SARVAŠOVÁ et al., 2014).

In addition, current technology and equipment are both physically outdated and very often damage the environment, creating a moral issue with their use. As SARVAŠOVÁ and DOBŠINSKÁ (2016) state, the awareness of environmental issues in forest management is increasing due to changes in environmental education. Therefore, contractor firms oriented toward technological innovations. Similarly to the situation in the Czech Republic (JARSKÝ, 2014, 2015; PUDIVÍTRVÁ and JARSKÝ, 2011), the lack of financial resources for the purchase of modern technology can be identified as the biggest problem within the innovation process. A similar situation has also been reported in Finland (AMBRUŠOVÁ and MARTTILA, 2012). Moreover, in recent years, profitability of forest contractor firms has been in decline. The recruiting of qualified machine operators is a growing problem also in Sweden, mainly because of a stressful work environment and low salaries (BERGQUIST, 2009). Very similar experiences have been also identified in Finland and Romania (RUMMUKAINEN et al. 2009; PENTTINEN et al., 2011; BORRIAUD and MARZANO, 2014; MUTU and JALUBÁ, 2012).

At the same time, there is strong competition in the market for forestry services, and within the contracting process, environmental factors play an increasingly important role. Contractor firms consider innovations to their competitive advantage, helping them improve and consolidate their position in the sector (POSAVEC et al., 2011). Therefore they are looking for innovation opportunities and have to invest money in innovations (DOBŠINSKÁ et al., 2010; PALUŠ et al., 2011). These findings are supported by studies from NYBAKK et al. (2009) and POSAVEC et al. (2011), who make a case for continual renewal and innovation in helping enterprises to be competitive over time. Similarly to the situation in Norway, providers of forestry services in Slovakia are strongly aware that traditional harvesting and transport technologies are no longer quite sufficient. However, this does not mean that modernization is inconsistent with the keeping of characteristic forestry traditions (NYBAKK et al. (2009).

5.2 Innovative impulses, fostering and impeding factors to innovation

RAMETSTEINER et al. (2005) and SARVAŠOVÁ (2004) state that the most innovative impulses for forestry enterprises in Austria, the Czech Republic, Germany, Hungary, Italy and Slovenia came from external sources. This is similar to the situation in Canada (ANDERSON, 2006). Regarding forest enterprises in Slovakia, the greatest incentives for innovation come from forest owners and users. The same situation was identified in the sector of forestry services, where the most innovative ideas come also from the internal company environment

(ŠTĚRBOVÁ, 2016). This is also characteristic of the market for forestry services in Macedonia (ŠTĚRBOVÁ, 2016; STOJANOVSKI et al., 2015). These findings are supported by LACKO (2004), who states that the primary incentives for innovation in Slovak forestry coming from the internal environment are the most impressive and have to be supported. A prevalence of internal motivations toward innovation in the forestry sector is typical also in New Zealand and Italy (NOTARO et al., 2012).

The innovation process in contractor firms is mainly supported by the offer of loans for innovation funding. Also cooperation with customers and suppliers and the personal characteristics and knowledge of the innovator are very important for the success of the innovation process. These factors also play an important role in the implementation of innovations in Macedonia (ŠTĚRBOVÁ, 2016; STOJANOVSKI et al., 2015). ŠIKORA et al. (2015) confirm that forest contractors who are not afraid to take risks are more innovative and achieve better results in competition. These findings are also consistent with the studies of WIKLUND (1999); RAUCH et al. (2009); NOTARO et al. (2012) and ŠIKORA and NYBAKK (2012). The results of case studies of innovation in Oregon also prove that the fear of risk and changes, as well as insufficient levels of cooperation, are important challenges to the implementation of innovations into practice (CREPELL and HANSEN, 2008).

On the other hand, unfavourable economic conditions in the forestry services market, lack of financial resources on the part of contractor firms, and the high price of innovation make such implementation more difficult (ŠTĚRBOVÁ, 2016). These findings are also supported by the study of LEKOVIČ (2013). These kinds of fostering and impeding factors play an important role within the innovation processes of forest enterprises in the European countries mentioned above as well as in Slovakia (DOBŠINSKÁ et al., 2010; SARVAŠOVÁ, 2004;). A similar situation has also been reported in the forestry services market in Macedonia, where the most important innovation barriers are also associated with the dominance of the state forest enterprise, economic uncertainty and risk, a high level of bureaucracy and the lack among forestry services contractors of their own financial resources for innovation (ŠTĚRBOVÁ, 2016; STOJANOVSKI et al., 2015). The public forest sector also puts a burden on the business activities of contractor firms in Romania (BOURIAUD and MARZANO, 2014). In addition, contractors in Slovakia have a lack of information about financial support for innovation from EU funds. This level of knowledge among contractors in Slovakia is comparable to that of applicants for grants from the Rural Development Programme in the Czech Republic, Bulgaria, Austria and Germany, as well as in Italy (SARVAŠOVÁ et al., 2014).

ŠTĚRBOVÁ (2016) concluded that the innovation potential of companies providing forestry services in Slovakia is high. High innovation potential and orientation to technological innovations is also typical of the market for forestry services in Macedonia; (STOJANOVSKI et al., 2015).

5.3 Functioning of the innovation system in the sector

Significant weaknesses were identified within the functioning of the innovation system in the sector. Based on the results of our study, it can be concluded that the innovation system fulfils its three basic functions at an insufficient level. Interactions and cooperation within the innovation system are weak. However, PÖLLUMÄE et al. (2016) find cooperation valuable, because of information sharing and exchange. Also TRNKA (2004) confirmed that the cooperation and clustering of enterprises in the sector are very important for innovation implementation support, and ŠTĚRBOVÁ et al. (2016) recommended cooperation as an innovation strategy for this sector. These findings are supported by studies from several other countries, where researchers also highlight the importance of cooperation for the development of innovation in the forestry service sector (RAMETSTEINER and WEISS, 2006; ELLEFSON et al., 2007; RAITZER, 2010; SCARASCIA-MUGNOZZA et al., 2012; FAZEY et al., 2014). The innovation system, with innovation networks – clusters – is a very important instrument of the knowledge economy. Also, the survey of NONIC et al. (2012) shows that entrepreneurs support the idea of clustering. As PALUŠ and LOUČANOVÁ (2014) reported, forestry-wood complex enterprises are able to use all instruments of the Slovak innovation system. ŠTĚRBOVÁ et al. (2014a) identified the appropriate regions for clusters in the forestry service sector in Slovakia.

With regard to risk management, contractors prefer long-duration contracts based on long-term relationships between the parties (PALUŠ et al. 2015). Similar findings have been reported from the wood industry in Germany, where long-term timber contracts play an important role in the reduction of uncertainty. In a lot of cases they help solve problems and complications associated with the exchange of timber (BRODRECHTOVÁ, 2015). Also, the possibility of obtaining financial support for innovations has a positive impact on risk management. The results of our research are also supported by the argument of WEISS et al. (2005), who reported that the internal financial resources of SMEs are limited and, moreover, it is often quite complicated to receive loans from banks. SMEs are more likely to seek external financing, therefore government policies and programmes can play an important role for innovators without sufficient resources of their own. This is also supported by the study of HAJDÚCHOVÁ et al. (2014). However, according to the assessment of the possibilities and conditions of financial support granted by the Agricultural Paying Agency under the project support of the Rural Development Programme 2007–2013, it can be concluded that the strict conditions set up during this period within the key measures numbered 2.2.4 and 2.2.6 caused those financial incentives not to fulfil their function within the innovation system. Also within the programme period 2004–2006, the forestry measures were not focused on innovations in the forestry service sector. Financial support was oriented mainly towards promoting protection and improvement of the environment (SARVAŠOVÁ, 2007; JARSKÝ et al. 2014). On the other hand, we can assume

that the conditions of obtaining financial support in the ongoing period 2014–2020 will ensure a higher level of motivation by contractor firms to implement innovations, because the incentive programme has significantly improved its emphasis in that regard (ŠTĚRBOVÁ and ŠÁLKA, 2016). As PUDIVÍTRVÁ and JARSKÝ (2011) state, at the level of European funding, there is no direct measure for supporting innovations, and therefore measures of the RDP, which indirectly supports innovation implementation, play a crucial role.

6. CONCLUSION

It can be concluded that the innovation behaviour of contractor firms in the Slovak forestry service sector is not satisfactory. Incremental innovations new for the firms, but not for the sector in general, dominate. For the most part, successful innovations are technological, because current equipment is outdated and very often damages the environment. Since the sector is being influenced by various changes, new knowledge and overall development, opportunities for innovations are opening up. This indicates high innovation potential for the sector. Therefore, the correct functionality of the innovation system, with an emphasis on all three of its functions, is important to facilitate innovation implementation support.

However, the results of the study pointed out that the innovation system does not work very well towards supporting innovations, because it fulfils its three basic functions at insufficient levels. For successful innovation implementation, all functions of the innovation system have to be fulfilled. Innovations are done without much institutional support and there is no one innovation system supporting implementation within the forestry service sector. Thus, institutionalisation and systemic support are needed.

Interactions and cooperation among the actors are weak, so the innovation system does not provide enough information to reduce uncertainties, conflicts and risks related to innovation implementation. Moreover, a formal cluster does not explicitly exist, and contractors prefer an informal level of cooperation. Because of the dominance of the state forest enterprise, the market is unstable and economic risk is high. Therefore contractors try to strengthen their own position compared to others, so they are more competitors than partners. In addition, there is no national financial support for contractor firms in the Slovak forestry and government support comes in the form of co-financing of financial support from EU funds. However, it can be concluded that the Rural Development Programme of the Slovak Republic did not provide enough pecuniary incentives for innovations within the forestry service sector.

Finally, it can be concluded, that the innovation system in the Slovak forestry service sector can support innovation implementation, when the innovation process will be fostered by: better risk management through the long-term and clear contracts with the guarantees; cluster formation for better cooperation of actors and positive incentives from the RDP 2014–2020 focused on innovations.

7. SUMMARY

The market for forestry services in Slovakia consists of contractors' business entities that don't own and use forest lands, but only provide and ensure forestry services, such as timber harvesting, skidding and transport. The objective of the study is to evaluate the functioning of the sectoral innovation system in the Slovak forestry service sector, with an emphasis on the evaluation of its three basic functions for innovation support: (i) reduction of uncertainties by providing information, (ii) management of risk and cooperation among the various actors, and (iii) the provision of pecuniary and non-pecuniary incentives.

Previous research on innovation behaviour in the Slovak forestry service sector pointed out that innovation activity of contractor firms is low, while the innovation potential of these subjects is high. Incremental innovations – new for the firms, not for the sector in general – dominated, and the largest share of successful innovations were technological.

The added value of the study represents the holistic view of innovation support in this sector from the innovation system perspective. It is based on the analysis of innovation system individual features – contractor firms and institutional system and support. In order to meet the aim of the study, three main methods were used – literature review, document analysis and interview (*Figure 1*).

The conclusion is that the innovation system in the sector fulfils its three basic functions for innovation support at insufficient levels. There is a high level of uncertainty, mainly because of the strong dominance of the state forest enterprise, which results in disadvantageous conditions for public tenders. Moreover, contractor firms are not able to reduce such uncertainties because of a lack of sectoral knowledge, links, and information regarding innovation opportunities. The existing innovation knowledge base does not provide good guidance for managers to develop and follow their innovation pathways. From an institutional system point of view, information exchange and cooperation among the various actors is weak. A formal cluster does not explicitly exist and contractors work together only on an informal level. Most appropriate for the potential clusters within the sector appeared the regions of Banská Bystrica, Prešov and Košice (*Figure 2*). Moreover, the market is unstable because the supply of services exceeds demand and the dominant state forest enterprise pushes prices for services down. Therefore, contractors try to strengthen their own position compared to others, so they are more competitors than partners.

At the same time, the financial support from the RDP in the programming period 2007–2013 was not focused on supporting innovations in the forestry service sector. Its strict conditions caused financial incentives not to fulfil their function within the innovation system. On the other hand, the conditions for obtaining financial grants in the period of 2014–2020 are significantly improved towards supporting innovations in this market. Therefore, a higher level of motivation of con-

tractor firms to implement innovations into practice can be expected.

8. ZUSAMMENFASSUNG

Titel des Beitrages: *Wie funktioniert das Innovationssystem im slowakischen forstlichen Dienstleistungssektor?*

Der Markt mit forstlichen Dienstleistungen in der Slowakei besteht aus Dienstleistungsunternehmen, die nicht die Wälder besitzen und bewirtschaften, sondern forstliche Dienstleistungen wie Holzernte und -transport anbieten und gewährleisten. Das Ziel der Untersuchung ist, die Funktionsweise des sektoralen Innovationssystems im forstlichen Dienstleistungssektor der Slowakei zu beurteilen. Besondere Beachtung gilt dabei der Beurteilung von drei Basisfunktionen des Innovationssystems für die Förderung von Innovationsaktivitäten: (i) Unsicherheitsreduktion durch Informationsaustausch, (ii) Risikomanagement durch Zusammenarbeit zwischen verschiedenen Akteuren und (iii) Förderung durch monetäre und nicht-monetäre Anreize.

Unsere bisherige Forschung hat gezeigt, dass Innovationsaktivitäten der Dienstleistungsfirmen in der slowakischen Forstwirtschaft wenig ausgeprägt sind, deren Innovationspotential jedoch erheblich ist. Dominant sind inkrementelle Innovationen, die neu für die Firmen, nicht aber für den Sektor sind; der größte Anteil an erfolgreichen Innovationen entfiel dabei auf den technologischen Bereich.

Der Mehrwert der Untersuchung ist eine holistische Sicht auf Innovationsförderung im Sektor aus der Perspektive des Innovationssystems. Sie basiert auf der Analyse von individuellen Eigenschaften des Innovationssystems – Dienstleistungsfirmen, institutionelles System und der Förderung. Um die Ziele der Untersuchung zu erreichen, sind drei Hauptmethoden: Literaturrecherche, Dokumentenanalyse und Experteninterview angewendet worden (*Abbildung 1*).

Die Untersuchung lässt darauf schließen, dass das Innovationssystem seine drei Basisfunktionen für die Innovationsförderung nur unzureichend erfüllt. Eine beträchtliche Unsicherheit wird von der Dominanz der Staatsforsten bei der Vergabe von Kontrakten verursacht, die ungünstige Bedingungen für öffentliche Ausschreibungen bewirkt. Die forstlichen Dienstleistungsfirmen können solche Unsicherheiten nicht reduzieren, weil ihnen sektorales Wissen, Beziehungen und Informationen für Innovationsmöglichkeiten fehlen. Die vorhandene Wissensbasis im Bereich von Innovationen bietet den Betriebsleitern keine ausreichende Hilfe, um ihre Innovationspfade zu entwickeln und umzusetzen. Aus Sicht des institutionellen Systems sind der Informationsaustausch und die Kooperation zwischen verschiedenen Akteuren nur schwach ausgeprägt. Ein formalisiertes Cluster existiert nicht, und die forstlichen Dienstleistungsfirmen arbeiten nur auf informalem Niveau zusammen. Die Regionen Banská Bystrica, Prešov und Košice scheinen als geeignet für Entstehung eines potentialen Clusters im Sektor (*Abbildung 2*). Darüber hinaus erweist sich der Dienstleistungsmarkt als instabil, weil das Angebot die Nachfrage übersteigt und

die dominante Position der Staatsforste die Preise für Dienstleistungen drückt. Entsprechend versuchen die Dienstleistungsfirmen ihre eigene Position zulasten anderer stärken und sehen diese eher als Konkurrenten denn als Partner.

Gleichzeitig lässt sich feststellen, dass die finanzielle Förderung aus dem Programm zur ländlichen Entwicklung in der Periode 2007–2013 nicht auf Innovationen im forstlichen Dienstleistungssektor gerichtet war. Strenge Fördervoraussetzungen haben hier verhindert, dass die finanzielle Förderung die Anreizfunktion des Innovationssystems erfüllt hätte. Erst in der Programmierungsperiode 2014–2020 sind die Fördervoraussetzungen erheblich in Richtung einer Innovationsförderung für forstliche Dienstleistungen verbessert worden. Für die Zukunft steht daher eine stärkere Motivation der forstlichen Dienstleistungsunternehmen zur Umsetzung von Innovationen in die Praxis zu erwarten.

9. RÉSUMÉ

Titre de l'article: *Comment fonctionne le système d'innovation dans le secteur des prestations de services forestiers slovaques?*

Le marché des prestations de services forestiers en Slovaquie existe via des entrepreneurs de prestations de services qui ne possèdent ni ne gèrent les forêts mais qui offrent des prestations de services forestiers pouvant assurer la récolte de bois et son transport. L'objectif de la recherche est d'évaluer le fonctionnement du système d'innovation sectoriel dans le secteur des prestations de services forestiers de la Slovaquie. Une attention particulière s'applique lors de l'évaluation de trois fonctions de base du système d'innovation pour le soutien des activités d'innovation: (i) réduction de l'incertitude par l'échange d'informations, (ii) gestion du risque par la coopération de différents acteurs et (iii) soutien par des incitations monétaires et non monétaires.

Notre recherche réalisée jusqu'ici a montré que les activités d'innovation d'entreprises de prestations de services dans la gestion forestière slovaque dont le potentiel d'innovation est pourtant élevé, sont peu marquées. Les innovations incrémentales, nouvelles pour les entreprises mais pas pour le secteur, sont dominantes. La plus grande part des innovations se situe dans le domaine technologique.

La plus-value de la recherche réside en un regard holistique sur le soutien à l'innovation dans le secteur de la perspective du système d'innovation. Elle repose sur l'analyse des caractéristiques individuelles du système d'innovation – entreprises de prestations de services, d'un système institutionnel et du soutien –. Pour atteindre les objectifs de la recherche, trois méthodes principales ont été utilisées: recherche bibliographique, analyse de documents et interviews d'experts (*Figure 1*).

La recherche laisse penser que le système d'innovation remplit ses trois fonctions pour le soutien à l'innovation mais uniquement de manière insuffisante. Une incertitude considérable est causée par la prédominance des forêts domaniales au niveau de l'attribution des contrats ce qui crée des conditions défavorables pour des appels

d'offres publiques. Les entreprises de prestations de services forestiers ne peuvent pas réduire de telles incertitudes parce qu'il leur manque la connaissance sectorielle, des relations et des informations pour les possibilités d'innovation. La base de connaissances disponible dans le domaine des innovations n'offre aucune aide efficace aux responsables des services pour développer leurs chemins d'innovations et les mettre en œuvre. Du point de vue du système institutionnel l'échange d'informations et la coopération entre différents acteurs ne sont que faiblement marqués. Un groupe formalisé n'existe pas et les entreprises de prestations de services forestiers travaillent ensemble uniquement à un niveau informel. Les régions de Banská Bystrica, Presov et Kosice apparaissent être appropriées pour l'émergence d'un groupe potentiel dans le secteur (*Figure 2*). En outre le marché se révèle être instable parce que l'offre dépasse la demande et la position dominante de la forêt publique écrase les prix des prestations de services. En conséquence les entreprises de prestations de services confortent leur propre position au détriment d'autres et voient ceux-ci davantage comme concurrents que comme partenaires.

En même temps on a établi que le soutien financier du programme était prévu pour le développement du Land dans la période 2007–2013 mais pas pour l'innovation du secteur des prestations de services du secteur forestier. Des conditions sévères de soutien ont empêché ici que le soutien financier ait accompli la fonction d'attraction du système d'innovation. C'est seulement dans la période de programmation 2014–2020 que se sont nettement améliorées les conditions de soutien dans le sens d'un soutien de l'innovation pour les prestations de services forestiers. A l'avenir il se profile une motivation plus forte des entreprises de prestations de services forestiers pour l'application des innovations dans la pratique.

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