

Smart rural development

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Интелигентно и находчиво развитие на селските райони

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Най-често терминът „smart” (интелигентен, умен) се асоциира с градски или индустриален контекст и се проявява като „smart cities” (интелигентен град) или „smart manufacturing” (интелигентно производство) и по този начин връзката със селския контекст най-често остава на заден план или бива дори изцяло пренебрегвана. Въпреки това, съществуват също и концепции за „интелигентна специализация” и „интелигентни селски райони”, които са насочени към неградските райони и които се опитват да подобрят перспективите за тяхното развитие. Важен инструмент във всички интелигентни подходи е цифровизацията, без значение дали се има предвид градски или селски район. Специално за селските райони по-добрият достъп до интернет може да помогне за преодоляване на разстоянието до градовете, както и за коригиране на недостатъците на селските райони в логистиката, мобилността и доставките, от една страна, или до медицински грижи за по-възрастното население – от друга.

Новите ИТ решения са в състояние дори да генерират атрактивни алтернативи в селските райони, свързани с нови работни модели и отдалечени работни места, нови възможности за образование и обучение, както и да предложат по-специални („скроени по мярката” на конкретния район) административни услуги. Статията се занимава с научно изследвания въпрос – Как биха могли да изглеждат интелигентните концепции за регионално развитие на селските райони, от една страна, и кои от тези подходи са били вече успешно реализирани и изпитани в селските райони.

Introduction

Since the financial and economic crisis in 2008 manufacturing and re-industrialization enjoy a renaissance on the European economic agenda because decision makers got aware of the important role of the industrial sector as a key driver of research, productivity, and job creation as well as the origin of 80% of the EU's private innovations and 75% of its exports (Tvaronavičienė,

2014; Rezk et al., 2015; Travkina, Tvaronavičienė, 2015; Travkina, 2015). But the new interest in industry goes far beyond Europe since many manufacturing initiatives have been started within the last years in different parts of the world trying to keep or to regain a significant industrial share in the economy. Most of these initiatives are focusing on the fusion of the virtual and the real world, i.e. the linkage between internet and manufactur-

ing, which shall be based on cyber-physical systems (CPS) and dynamic production networks in order to achieve flexible and open value chains in manufacturing of complex mass customization products in small series up to lot size 1 (Ramsauer, 2013). The related concepts use often the term “smart” like smart manufacturing and logistics or Internet of things and services whereas in Germany, the most important industrial EU country, the corresponding approach has been called “Industry 4.0”.

One important aspect of smart approaches is related to the fact that nearly all discussed concepts are targeting urban conditions by neglecting rural environments. At a first glance this seems to be understandable since a lot of research results on entrepreneurship and innovation are related to urban or industrial contexts. So Acs (2002) and Carlino et al. (2007) pointed out that entrepreneurship and innovation tend to be higher in cities and more densely populated regions. A similar result was found by van Oort (2004) who showed in his research that entrepreneurship and innovation tend to be higher in more sectorally diversified regions. Furthermore Duranton and Puga (2001) pointed out that entrepreneurship and innovation tend to concentrate to regions that are less dominated by a small number of large firms and McCann and Acs (2011) were able to show that entrepreneurship and innovation tend to be higher in regions with a large number of multinational companies. Finally McCann and Ortega-Argiles (2013a, 2013b) revealed that entrepreneurship and innovation tend to be higher in regions with a large market potential and in many parts of the world including OECD countries the use of ICT appears to have exacerbated differences between core and non-core regions.

Consequently, by analysing the statistical data it turns out that many European citizens moved to the big cities because they lack the perspective in the country-side, which is accompanied by brain drain and accelerated demographic change with a significant increase of the share of elder population in rural areas (Hercksen, 2013; Prause, 2015a). But a more detailed view into the statistical data also reveals that the overall situation in

rural areas seems not so dramatic. By considering e.g. the situation in Germany it turns out that only one-third of the German population lives in cities, whereas 75% of the population lives in cities with less than 100000 inhabitants and even two-third of German population lives and works in semi-urban and sparsely populated regions (Trapp et al., 2015).

Consequently, a changing policy focus, called “smart specialization” approach, has been initiated in recent years moving from urban towards rural areas with a special emphasis on intermediate regions (OECD, 2011). For these intermediate regions which comprise the transition areas between urban and rural areas a smart policy mix consisting of R&D, training and networking programs together with a prioritization and concentration of resources around regional key topics seems to be a promising approach (EC, 2010; OECD, 2014). The related policy development process involves the gathering of evidence and data, building of public–private partnerships and the monitoring of all political actions and interventions (McCann and Ortega-Argiles, 2013a, 2013b).

The technical implementation of smart specialization concepts in rural areas have been started already. The first steps on this way all over Europe lead towards the creation of “Smart rural areas” in order to extend and adapt the concept of “smart cities” to regional development. Of special interest is the exploration of the possibilities and opportunities of digitization in rural areas. The paper addresses the research question of how new smart regional development concepts for rural areas might look like and how to deploy a strong business impact for smart rural areas.

Digitalization of rural areas

By analysing more deeply the objectives of Industry 4.0 it turns out that Industry 4.0 aims beyond the development and use of cyber-physical systems and dynamic production networks also for energy and resource efficiency, increased productivity, shortening of innovation and time-to-market cycles together with a horizontal and

vertical integration through value networks and an end-to-end digital integration of engineering across the entire value chain (Kagermann et al., 2013). Consequently, internet-linked production facilities and networked manufacturing systems open up a machine-to-machine-communication and interaction, called M2M, which allows to name, identify and trace single products during their whole creation process and later on during their life time, which generates new perspectives for the entire supply chain including product design and development, operations management and logistics (Bauer et al., 2014; Brettel et al., 2014). In this sense, Industry 4.0 represents nothing less than the fourth industrial revolution, comprising 3D printing, big data, Internet of Things and Internet of Services, i.e., all of the ingredients needed to facilitate smart manufacturing and logistics processes (Kagermann et al., 2013).

But which of these features are important for rural areas? By following EC (2007) it can be stated that recent technological advances alongside changes in the global institutional framework are having profound effects upon the development paths of Europe's rural areas. So technology is becoming a crucial means for development, hence technology and even more so ICTs, can be of particular importance for rural areas. But from several studies it is well-known that rural economy is characterised by specific frame conditions like small average business size, which results in a more limited ability to attract investments and market attention (Kalantaridis 2009; Smallbone et al., 2003; Terluin, 2003). Furthermore, entrepreneurship is also difficult in rural areas, as resources may be scarce and networks thin (Stathopoulou et al., 2004).

So it may happen that the widespread use of ICTs can also pose a threat to rural areas in the sense that ICTs expose the weaknesses of rural business and make them more vulnerable to outside competition since rural enterprises may not be able to tap into competitive advantages, conferred by their rural location, beyond lower costs of production (EC, 2007). Another risk area is related to the socio-economic environment of the technology driven processes, which shows

differences between Northern and Southern Europe. In particular, in the countries of "Southern Europe" centralized state structures and a weak civil society lead to hierarchical clientelistic networks inhibiting the building of social capital.

Nevertheless, in Europe a variety of projects try to embrace the use of new technologies for rural development and to bring the country life on the fast track by making it as attractive as the model for "Smart City". A recently awarded German initiative is called "Smart Rural Areas" lead by the Fraunhofer-Institute for Experimental Software Engineering (IESE) in Kaiserslautern (IESE, 2015). In the focus of this approach is the full spectrum of rural problem areas. Due to demographic change and migration to urban areas the supply of the remaining population is a problem in more and more regions, which requires solutions in order to ensure supply, mobility and medical care for less and more elderly population. Similarly, especially for young families' attractive alternatives in the countryside have to be realized to counteract brain drain and to support workplaces and rural economy by developing new working models, mobility solutions and opportunities for education and training. Practically this means that new solutions have to be developed for rural retailing, waste disposal, postal services and all the logistics are becoming more and more inefficient from the perspective of operators. The way to school is too long for many children. The medical care is no longer safeguarded especially for elderly people. At the same time the expansion of broadband networks compared to the situation in cities is lagging far behind. The opportunities to work in "Home Office" are severely restricted. What can be done about it? It is all about the development and application of intelligent IT solutions in order to create networked systems, which can be controlled with a smartphone to be able for example to solve supply and administrative issues.

One big challenge in rural areas is to overcome and connect large areas related to logistics and mobility problems as well as to administrative topics. Some ideas concerning these considerations are:

- “Postbus“: Using the regional bus transport not only for people but also for packages and cargo delivery between fixed stations. Related organisational issues can be solved via mobile IT solutions including shared delivery activities of neighbours.

- Sensors for medical care in flats of risk patients can improve the situation of old and ill people.

- Agriculture can be improved by digitalization through remote consulting, coaching and training between central competence centres and rural entrepreneurs.

- Remote work places in rural areas as well as access of rural SMEs to high qualified workforce can be organized via digitalization.

- Administrational tasks can be improved through e-governmental solutions including application of agricultural subventions, taxation and other administrational tasks.

- Mobile IT systems can improve the cooperation among rural entrepreneurs and farmers by organizing the use of shared resources (i.e. machines), shared transportation and common product marketing.

- Renewable energy sources can be used, managed and shared more efficiently.

Consequently, the targets of smart rural areas are in line with the aims of Industry 4.0, i.e. they are linked with the hope to bring back attractiveness, competitiveness and perspectives to rural areas or respectively to the entire industrial sector in Western countries. Therefore the R&D needs for smart rural areas are comparable to those of Industry 4.0 and go far beyond sophisticated production and logistics expertise, what is also required is especially ICT related knowledge covering cyber security, e-commerce and e-government (Prause, 2015b).

An Estonian Case Study

The Republic of Estonia represents one of the model countries among the Central Eastern countries when it comes to cyber technologies, e-government and internet access of remote areas. The country has a background as transition economy from being a Soviet Republic till 1991 to become an EU member. Within the last 25 years rapid

economic changes have taken place and made Estonia one of the leading innovative countries of Europe including the readiness for Industry 4.0 among Eastern EU states (Dujin et al., 2014; EU, 2014). The following case study of a rural medium sized Estonian production company, which became a European market leader in functional maritime wear is strongly linked to the highly developed internet access of large parts of the Estonian rural areas (Olaniyi and Reidolf, 2015; Prause, 2015b).

Meritex OÜ (the authors changed the company name for publication) started in 1993 and is currently employing a staff of more than one hundred people in four production locations in Estonia with a management headquarters located in a rural area in Western Estonia, where also the cutting and production of components and prepared parts take place. Other important company activities like global sourcing of smart materials (Asia, Sweden, USA), R&D activities (Germany), sewing (Ukraine) of the final products and sales activities are located outside Estonia.

The meeting of the challenge of producing in the rural region with highly limited workforce and selling large volumes of high quality products all over Europe was only possible by understanding and reacting on the opportunities and weaknesses of the region. The well-developed ICT and internet infrastructure all over Estonia played a crucial role for the company's success. Inside Estonia the company facilities are linked via internet and highly developed Estonian e-governmental services make it possible to run the company from the countryside. Special expertise from Estonian specialists is integrated into the Meritex organisation via telework applications at remote work places in the cities of Tallinn and Tartu. Nevertheless Meritex generated a large number of high-qualified and sustainable workplaces in rural areas by training and attracting workforce within the last 20 years. The business processes between the company locations in Estonia and Ukraine are interrelated and synchronised by an integrated company-wide goal system and standardized trans-location processes, which are fixed and illustrated by multi-media process documentation including e-learning tools.

Smart raw materials are sourced from a variety of countries including US, Sweden, South Korea and Taiwan. Sewing work is done for some part of products in Narva (Estonia) and Ukraine. The technology of the business is however guarded and kept in Estonia comprising the main warehouse, ICT, as well as other complicated and technical processes like cutting, prototypes and high end products. For example all the parts are cut in Estonia, shipped to Ukraine and other places for sewing and shipped back to Estonia for assembling. The cost of outsourcing to Ukraine in addition to logistics is half when compared to a complete production in Estonia. The costs are also very stable and could stay the same for coming years and the company is using its good IT system for tracking products and materials.

Over the years the company has established new business structures and models in order to be competitive on developed markets like Germany, Sweden, France, Denmark; and has started to export to more countries, whereas its main competitors from countries like Germany or France export only to 4–5 countries. Nowadays the company sells to 6 major countries: Germany, UK, Finland, Norway, Australia, and Sweden. Germany has the highest sales turnover, followed by Finland, while Norway has the smallest percentage of sales turnover.

The success story of the chosen case is closely linked to smart production and supply chain management in rural areas, which is based on a distributed multi-national production model and the smart Estonian rural infrastructure. The underlying business concept and its related success paved way for a sustainable regional development and demonstrated that even in rural areas high-tech entrepreneurship can be successfully implemented. The Smart Specialization approach for Estonia stressing high-tech and internet related activities even in rural areas promotes entrepreneurial and innovation activities in enterprises comparable to Meritex OÜ. By doing so companies like Meritex help to mitigate and even to reverse the developments of brain drain and accelerated demographic change together with its consequences in supply of work-force, mobility and health care for rural areas.

Conclusions

Smart approaches are mainly discussed in urban or industrial contexts by neglecting rural areas since smart concepts are often attributed to smart manufacturing, smart logistics or smart cities. On European level “Industry 4.0” plays an important role in the smart approaches by aiming to create a horizontal integration through value networks with an end-to-end digital integration of engineering across the entire value chain together with a vertical integration and networked manufacturing systems. For all smart approaches the Internet of things and services represents one key component for implementation.

In a variety of projects first steps are taken on the way towards “Smart rural areas”. This process has been spurred by the introduction of the smart specialisation concept of European Union and the developments in rural areas which are suffering under brain drain and accelerated demographic change with related problems in supply of work-force, mobility and health care. Here the use of new technologies for rural development might be able to bring the country life back on the fast track by making it as attractive as the model for “Smart City”.

The case study of a rural medium sized Estonian production company, which became a European market leader in functional maritime wear, showed how strongly linked the company success was to the highly developed internet access and smart e-services all over Estonia including rural areas. As a consequence of the company’s success related problem fields like brain drain, increasing share of elderly population, supply of work-force, mobility and health care were mitigated and even partly reversed. Consequently, smart approaches can successfully contribute to sustainable rural development.

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(Summary)

Normally the term “smart” is associated with urban or industrial contexts like it appears in “smart cities” or “smart manufacturing” so that the linkage to rural contexts is often neglected. But there are also concepts about “smart specialisation” and “smart rural areas” which target non-urban areas and which try to improve the development perspectives of rural areas. An important instrument in all smart approaches is digitalization, no matter if urban or rural areas are discussed. Especially for rural areas a better internet access can help to bridge the distance to cities and

to overcome rural shortcomings in logistics, mobility and supply problems or to medical care for more elderly population.

New IT solutions are even able to generate attractive alternatives in the countryside for new working models and remote work places, new opportunities for education and training as well as offer more tailor-made administrative services. The paper addresses the research question of how smart regional development concepts for rural areas might look like and which smart approaches for rural areas have been realised and tested already.

Key words: smart rural areas, digitalization, regional development, smart specialization