

JOURNAL OF SECURITY AND SUSTAINABILITY ISSUES

ISSN 2029-7017 print/ISSN 2029-7025 online

2015 December Volume 5 Number 2

[http://dx.doi.org/10.9770/jssi.2015.5.2\(7\)](http://dx.doi.org/10.9770/jssi.2015.5.2(7))



The paper was published with support from the Baltic-German University Liaison Office from funds of the German Academic Exchange Service (DAAD)™

ORGANISATIONAL INNOVATION STRATEGIES IN THE CONTEXT OF SMART SPECIALIZATION

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Abstract. Regional economic performance is positively linked to entrepreneurship capital because it creates new direction for public policy that focuses on instruments to enhance entrepreneurship capital. However, studies related to Entrepreneurship and Innovation had somewhat established a disadvantage position for knowledge-intensive enterprises located in rural area.

The EU Smart Specialization approach supports the promotion of innovation activities in regions and embraces the concept of open innovation, not just investment in R&D but a system approach that exploits complementarities, promises high potential, are new and aimed at experimenting and discovering technological and market opportunities that can provide learning spill overs to other economy.

This paper present a case study of an Estonian production company for Maritime function wear. This example reveals that despite the fact that the company's headquarters is located in Western Estonia countryside (peripheral part of Europe and rural part of the country) an enterprise can gain the position of an international market leader based on inter-regional operations. The discussed model highlights how high – tech enterprises can benefit from different smart specialization strategies in different regions by implementing organizational innovation strategies. The underlying business concept and its related success factors, exhibits strong affinities with the concept of smart production and logistics in relationship with fractal enterprises, paved way for a sustainable development and demonstrated that even in rural areas high – tech entrepreneurship can be successfully implemented.

Keywords: entrepreneurship, innovation, smart specialization, knowledge intensive enterprises, fractal enterprises, rural innovation

Reference to this paper should be made as follows: Olaniyi E. O; Reidolf, M. 2015. Organisational innovation strategies in the context of smart specialization, *Journal of Security and Sustainability Issues* 5(2): 213–227. DOI: [http://dx.doi.org/10.9770/jssi.2015.5.2\(7\)](http://dx.doi.org/10.9770/jssi.2015.5.2(7))

JEL Classifications: O15

1. Introduction

Innovation policy plays a crucial role for regional development because innovation is closely linked to economic growth and performance (Tvaronavičienė 2014; Travkina, Tvaronavičienė 2015). Also innovation and research in the 21st century are increasingly becoming international endeavours and most innovations originate from multiple sources, with many drawing in components or technologies developed in multiple locations (Hayek 2002; Rezk *et al.* 2015; Pather 2015; Tvaronavičienė, Černevičiūtė 2015). Innovation especially through creation of new companies and new business fields is seen as a key factor to achieving economic success of a firm, region or any nation. A restricting factor to this however is the non-availability of human competence in managing projects and/or entrepreneurial activities. Innovativeness is important because products or services that are more innovative are more likely to offer unique benefits to customers and occupy distinctive places in the market place (Fiet 2002). Studies on Entrepreneurship and Innovation however had suggested a disadvantage position for knowledge-intensive enterprises located in rural area. One argument in this regard is that entrepreneurship and innovation tend to be higher in cities and more densely populated regions (Acs 2002; Carlino *et al.* 2007; Pather 2015). Furthermore, Van Oort (2004) found out that entrepreneurship and innovation are seen to be higher in more sectoral and diversified regions. Acs and Szerb (2011) also showed that entrepreneurship and innovation tend to be higher in regions with a large number of multinational companies. Finally McCann and Ortega-Argiles (2013) revealed that entrepreneurship and innovation are mostly concentrated in regions with large market potential. These results arguably indicate significant disadvantages for business operations of knowledge – intensive companies in rural areas (Prause 2014). Traditionally, the EU had based its development policies on infrastructural projects, tackling of unemployment and internationalization. However, it has been accepted by policy makers that while these project have merits, they are still lacking in consistency and in the integration of fund allocation, government spending, and outcomes (Vanthilloet, Verhetsel 2012). Thus, it is not far fetching to admit that some regions are richer than others, and some regions do catch up faster than the others (De Groot *et al.* 2001). The disparities among the regions can only be reduced through innovations (Kaufmann, Wagner 2005; Audretsch, Keibach 2004). There is a huge gap for new concepts and strategies for the type of development that can offer direction on how to increase competitiveness and support innovation in the sub regions (MacKinnon *et al.* 2002). According to Michael and Rodney (2010), studies of the organizational strategies of Chinese companies is seen as an evolution of business strategies and their management practices, this is because the Chinese were able to match such programs to the fitting regions. This is in agreement with the fact that there is the need for regional economic policies that will ensure that management research and practices are specific to the needs of each region and can increase the likely hood of entrepreneurship discovery.

One perspective for the non – core regions lies in the smart specialization concept of European Union, which represents a new innovation union flagship programme of the European Commission, aiming not only to foster EU-wide economies of scale in high technology and knowledge-intensive sectors, but to accelerate the dissemination of smart technologies throughout the EU economy (EU, 2014). The principles embodied in the concept are fundamental to the construction of the Europe 2020 agenda, and closely linked with the regional development objectives of the reformed EU Cohesion Policy (Łapczyński, 2008) ; McCann, Ortega-Argilés, 2013). Foray (2012) explained that the selection of smart specialization should take place when local entrepreneurial commitment and development have achieved a sufficient level of stability and coherence. Thus a self-discovery or entrepreneurial discovery process is related to the Smart Specialization approach of the EU which supports the promotion of innovation activities in regions (OECD 2014), so that the regional success will depend on the entrepreneurial performance and its related capacity to build public – private partnerships and cooperation and there shows possibilities for successful and knowledge-intensive enterprises to operate from rural regions. Smart Specialization embraces the concept of open innovation, not just investment in R&D but a system approach that exploits complementarities, (Larosse 2013) promises high potential, are new and aimed at experimenting and discovering technological and market opportunities that can provide learning spill overs to other economic sector (Foray, Goenega 2013).

Smart specialization also pave the way towards the fractal model which is an organisational starategic approach

for inter-regional enterprises that are trying to adapt to the “smart technologies” in their regions of operation. Warnecke (1996) coined that concept of a fractal enterprise in the context of modern operations management and highlighted self-similarity, self-organization, self-optimization, goal-orientation, and dynamics as winning attributes of flexible and adaptable manufacturing organizations as well as intrapreneurship as a success factor. The “fractal units” of an inter-regional operating company can be considered regional adapted organizational parts of such a company consisting of a flexible relationship network made up of autonomous, but interdependent manufacturing fragments into the organizational structure which is capable of producing highly complex patterns that merges all the enterprise functions of an integrated organization to improving the speed of operations (Canavesio, Martinez 2007; Shin *et al.* 2005).

This paper aim to (a) present an approach that will facilitate continuous and quick adaptation of inter-regional operating enterprises to smart specialization strategies by using fractal concepts. Methodologically, it pursues a case study approach to analyse the fractal manufacturing organization and (b) draw conclusions concerning the smart specialization entrepreneurial discovery concept. Since the smart specialization is an innovation policy that focuses on regional growth, the authors offer an insight on opportunities for new complementarities and inter-regional innovation opportunities that can lead to building local capabilities, improving local supply chains that will lead to investment and lasting innovation and spill-overs. This work follows the following structure: the next part talks about the relationship between innovation, regional development and Smart Specialisation strategy and how these concepts encourage entrepreneurial discovery. The third section presents the method used for the work. The case of study an Estonian Maritime function wear company and highlights of how this local high – tech enterprise became an international market leader by implementing an organisational innovation strategy was presented in the fourth part. The fifth section discusses how the company activities is similar to the fractal organization concept and its alignment to the EU smart specialisation. It concludes with some insightful thoughts on entrepreneurial discovery process.

2. Innovation, Regional Development and Smart Specialisation

It has been discovered that most times, regions are faced with the challenge of scarce resources and limited funding to tackle structural development, social and economic problems that they constantly battle with (Baier *et al.*, 2013). Therefore, countries government are gradually adopting the intricacy of regional development, working on how to ensure that poorer and smaller regions catch up in terms of development with counterpart mega cities in the countries (Vanthilloet, Verhetsel 2012). Presently, the EU is working on improving and upgrading the educational system, R&D, business excellence and linking universities. The universities especially are encouraged to be the champions of such regional economic development by harnessing talented individuals into the regions where they operate in order to encourage open exchange of knowledge on a global scale (Șerbănică 2012). While there have been debates on the reasons behind the pace at which some regions move, whether fast or slow, it is important to note that growth takes place in variety of form and shape in different locality. This could suggest that the role path of each region or cluster will differ from each other even within the same region. Also, there might still be sub regions in the same regions, making it difficult to predict roles, actions and outcomes of the process (Morgan 2015). Each region will be different with issues peculiar to them alone, thus the decentralization of diverse skills set that are connected and “tailored fit” should be considered when developing policies for each region (Vanthilloet, Verhetsel 2012). Arguing why national innovation policy should incorporate regional strategy, Howell (2005) explained that national and pan-national policies will sometimes have different influences in the regions and these policies can be managed if regional differences are taken into account from the inception.

Furthermore, even though innovation activity is priority in EU policy programmes, in technological advancement and regional policy (the most prominent being R&D and technological advancement) some of the discussions on regional development while bearing in mind the actions and supporting tools, have neglected to consider the absorptive capacities of the institutions like the universities, polytechnics, vocational training institutions, research institutions, technology mediating organisations, technology licensing offices and innovation centre for innovation in the less developed regions (Tödting, Trippel 2005). De Groot, Nijkamp,

Acs (2001) elucidated it as the “*the ability of regions to develop new technologies, to assimilate existing technologies, to effectively break vested interests aimed at keeping existing technologies in place, to organise the institutions that protect property rights, and to create innovation-prone environment.*” One fact however, according to Tödting and Trippl (2005) is that, regional innovation systems are not self-sustaining, they are still in principle tied to national, international actors and innovation systems. Regions should not be seen in an isolated form but as openly connected ecosystems that is intertwined with other markets (Gianelle *et al.*, 2014). They are also in part linked to past build ups and activities (Valdaliso *et al.* 2013). According to Foray (2012), structural evolution ‘*is an accumulative process that links the present and future strengths of a regional economy in a particular domain of activity and knowledge*’. He emphasised that the collective outcomes of the new activities will surely lead to strong and abiding structural change and diversification building on existing industrial knowledge with economic impact. A case in point as explained by Lindqvist *et al.*, (2013) is how the declining region of Lahti, Finland was able to develop a new concept of innovation to save its declining prosperity after the fall of its trade with the Soviet Union in the early 90s. Lahti was a large region without a university and instead of its people to see it as a setback they capitalised on this very seemingly weakness by going into partnership with four other universities outside the region to create a university technical know-how tailored to the necessities in the region. This can be referred to as “practice based innovation” which is not based on the R&D activities but on the ability to collaborate and import knowledge and competences creating a technology bank.

Smart specialization strategy (S3) was introduced by the European Commission to contribute to inclusive growth between and within EU regions by strengthening territorial cohesion, manage structural change, create economic opportunity and enable skills development, better jobs and social innovation (Dziemianowicz, Peszat 2014). It was developed by economists in a bid to come up with a concept of smart public spending and innovation enabling process. Due to the challenges of scarce resources and limited funding that regions constantly face, the S3 is an essential tool to accomplishing beneficial economic and social impact through most promising sectors thereby fostering tangible prosperity across board (Baier *et al.* 2013). This is hoped to bring about a change in economic situation of Europe, better globalisation and sustainable jobs creation (Landabaso, 2014). Summarily, the three main phases of the smart specialization policy process according to Foray *et al.* (2011); Del *et al.* (2013); Lindqvist *et al.* (2013), are; (1) design: Identification and reinforcement of entrepreneurial discovery by facilitating development in the economy of knowledge-intensive activities that generate experimentation and discoveries, (2) implementation: the coordination and complementary investment through support and strengthening of the emerging trends so that the most promising projects can grow and become solid drivers for regional economic growth and (3) evaluation: the assessment of the outcome so that the support of a particular line of business will not be discontinued too early nor continued so long that subsidies are wasted on non-viable projects.

The Smart specialization addresses regional growth challenges by opening new opportunities for the member states, local and regional authorities to strengthen the region’s competitiveness and innovation (Camagni, Capello 2013). Regional development is an important policy issue for the European Union (EU) and the EU Structural Funds aim at supporting regions lagging behind in their development or facing structural problems. Moreover, regions and local authorities in Europe developing policies for innovation from a bottom-up perspective have to develop their own distinctive policies, but must compete for, receive, absorb and integrate funds and programmes developed at a national or EU level (Foray 2011). Nicos *et al.* (2014) emphasised that S3 should not be misconstrued as an industry specialization but should be seen as a blend of R&D, innovation and production area specialization that reduces the disparities between less advanced regions and more technologically advanced ones. A lot of empirical works have supported geographical (national and regional) approach to innovation in line with this theory. In today’s Europe, the patterns of innovation which are majorly territorial and often recognised are: Imitative innovation area; Smart and creative diversification area; Smart technological application area; Applied science area (Prause 2014).

2.2. The concept of *Entrepreneurial discovery*

The smart specialization strategy (S3) emphasises that concerning innovation, companies should work together with higher institutions, research centres, and government, thus, aligning with the concept of embeddedness (Smart Specialization in England 2014). McCann & Ortega-Argile's (2014) discussing on the process of entrepreneurial discovery, explained that it entails policy makers to first examine the potential of each region and then develop policies that will foster the development of entrepreneurial behaviours and activities in these areas. These policies are not in any way limited or narrowed to a specific region but are aimed towards developing the capacities and capabilities of such regions. Since Smart specialisation insists on embeddedness of existing local industries, its strategies should be based on regional and innovation research and on regional economic transformation (Vanhilloet and Verhetsel 2012). This means that entrepreneurial players include but are not limited to universities, business organisations and associations, research institutes, inventors, SMEs and businessmen, who have the ability to embark on entrepreneurial exploration processes and create innovations centred on these discoveries (McCann and Ortega-Argile's 2014). Foray, (2012) explained that entrepreneurial discovery process has to do with targeting projects towards exploration, experimentation and learning on future outcomes in different sectors complementarities as well as in R&D and Innovation. The entrepreneurial campaign will comprise of harmonized knowledge and taking advantage of spill over aftermath which include modernisation, broadening, evolution or deep-seated base (Landabaso 2014) as seen in Figure 1.

Foray (2013) insisted that this is slightly different from entrepreneurial innovation which are innovations undertaken by individual firms or business man to reduce the cost of R&D and innovation and bring monetary gain from good projects, using the concept of using pulp to create paper, he explained that entrepreneurial innovation is a case of transition from one useful entity to a whole new set of new and collective tools that can serve as catalyst for a new enterprise or collaborations from two different actions called entrepreneurial discovery. Some of the S3 element that can be delivered at the local region are: building local capabilities, improving local supply chains that leads to investment and collaboration, leveraging on the diverging economic prospects of social innovation, scouting for viable hubs for S3 (Smart Specialization in England 2014). For growth to occur, the focus should not only be on the diversification of technology on itself but on the pattern in which the process occur (Nicos *et al.* 2104). S3 encourages regions to develop their innovation actions around pre-existing structures and inter connected diversification which will bring improvement of local linkages/collaborations for new entrepreneurial activities (EU 2014). Furthermore, at this foundation level, it is critical that regions considers building each S3 strategies from existing strategies in order to learn from the experiences and take advantage of the benefits (Querejeta *et al.*, 2013).

It can be deduced that "capacity building" and "funding streams" make regions to collaborate with more skilled actors from another regions leading up to economy of scale (EU 2014). It will further enable development and prompt evolution of new accomplishments which will lead to abiding innovation and spill-overs which will differentiate the regional structures by creating new designs, critical mass, networks and clusters within a differentiated structure (Foray 2012). Thus, prioritisation will no more be done by some detached individual or group of people in the government but by public-private collaborations where entrepreneurs give new information on new discoveries and the government in turn evaluate these possibilities and end up commissioning capable actors to achieve it. The outcome of S3 should be evidence through sector and inter sector change and work structures that are moved towards more productive solutions that brings lasting impact on the economy structure (Sobczak 2014).

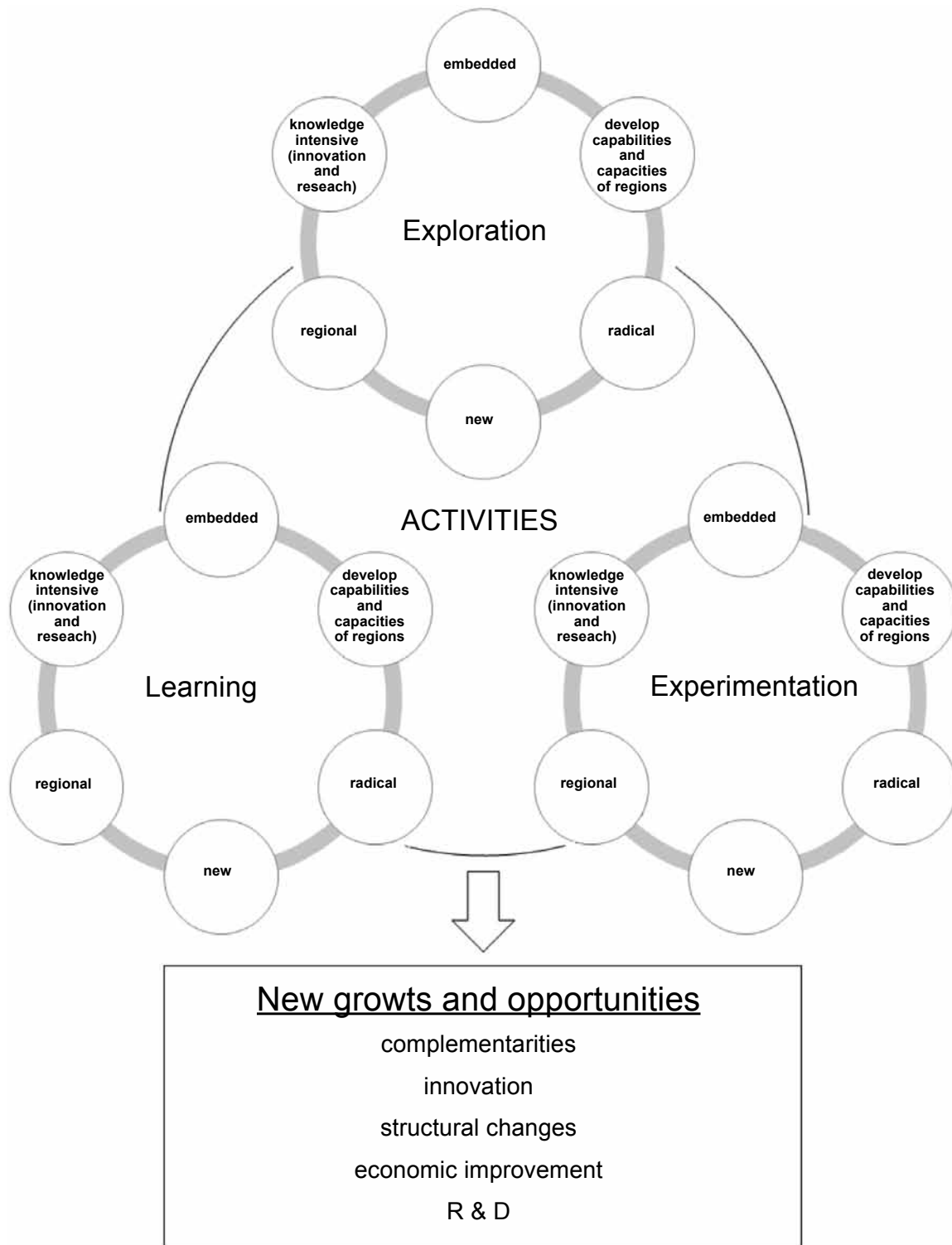


Figure 1. Smart specialisation entrepreneurial discovery process

Source: Created by authors

Since discoveries are usually summed up to learning curves, these activities lead to spill-overs, creating a whole new set of opportunities (Foray 2012). It is however important that these outcomes are designed in a way that the outcomes are optimised in order to spur new growths from other fields as well. An important question in this context is related to the appropriate organizational structure of a company which can benefit from different smart specialization strategies, especially in the case of an inter-regional operating enterprise. One solution can be to organize the company in a way so that the regional units can adapt and benefit optimally from the different regional smart specialization strategies which could lead to the concepts of smart manufacturing as well as to fractal companies.

2.3. Smart manufacturing, fractal companies and entrepreneurial discovery

After years of losing ground in global manufacturing share and value added many manufacturing initiatives have been started all over the world to re-establishing and regaining an industrial share in the economy (Berger 2013). A very promising approach seems to be the linkage between internet and manufacturing that leads to concepts of smart manufacturing and logistics which aim for cyber-physical systems and dynamic production networks in order to develop flexible and open value chains in the manufacturing of complex mass customization products in a small series up to lot size one (Ramsauer 2013). Smart manufacturing should bring the competitiveness in the manufacturing and high-tech sectors back to Western countries especially to those countries with a high innovation level, sophisticated ICT infrastructure, and highly qualified workforce. Unfortunately smart manufacturing is still a concept and there are still many open questions concerning standards, technical solutions as well as appropriate business structures and models. Solutions are complex and can only be attained in cooperation and knowledge sharing since sophisticated production expertise is not sufficient for the implementation, it also requires ICT knowledge in cyber security, e-commerce and e-government, the integration of the SME sector and new business models (Prause 2015). The new value chains of smart manufacturing will change towards a fragmentation which has been seen already before in other monolithic industries like music or the media (Dujin *et al.* 2014). Such a fragmentation is related to a rise of trade benefits arising from lower entry barriers for SMEs, the “slicing up” of the aggregate value chain, as well as the entry of new countries bearing low labour costs (Belussi & Sedita 2010). This fragmentation will also impact significantly upcoming business structures and business models in manufacturing sector which motivated already in the 1990’s long time before smart manufacturing was in sight Hans – Jürgen Warnecke to coin the concept of a fractal company.

Warnecke (1996) published his visionary concept of a fractal enterprise in the context of modern operations management and highlighted self-similarity, self-organization, self-optimization, goal-orientation, and dynamics as winning attributes of flexible and adaptable manufacturing organizations. In his approach he stressed intrapreneurship as a success factor of fractals and he pointed out that fractal organizations are linked via high performing ICT systems and they decide individually about the type and scope of access to their data. Warnecke’s classical fractal concept was further developed by several scholars like Canavesio and Martinez (2007) who worked on manufacturing fractals describing an innovation activity that deploys the “fractal units”-a flexible relationship network made up of autonomous, but interdependent manufacturing fragments into the organizational structure. This concept is capable of producing highly complex patterns that merges all the enterprise functions of an integrated organisation to improving the speed of operations (Shin *et al.* 2007). To achieve this, each component within the process system responds to real time demand. The management of integration between a company administration and the manufacturing level can be tasking and challenging and it determines how far the company can go in achieving its strategic objectives. Different methods of management has been observed to give room for flexibility and speed in resolving issue, in giving room for generation and execution of ideas and process (Strauss & Hummel 1995).

The manufacturing fractal assumes that the manufacturing facility is composed of small components, or fractal objects which have the ability to adapt quickly to changes in the environment. Each fractal must have a coordinated individual and consistent system goal (Noori, Lee 2000). In other words, even though the fractals are independent organised units, they must have objectives that will accurately define the attributes of the firm as a whole (Sandkuhl, Kirikova, 2011). Canavesio and Martinez, (2007) theorised networking between organisations as a notable choice for survival and profit increase, however, before it can be fully realised there must be a management structure in place that states clearly the roles, functions, tasks, objectives such as risk management to threats, increased portfolio of skills, resources and economy of scale, goals, and so on between actors and resources involved. SMEs are sometimes forced to go into different forms of collaborations and networking, sometimes they work as virtual entities using the advantage of e-business to enhance their competitive advantage. This can be cost effective especially where they are agile enough to ride on the wave of the much bigger and grounded enterprise (Panetto, Molina 2008). It is true that efficient factory and exceptional quality product will remain the focus for achieving operational effectiveness, rapid product development and manufacturing in an organisation, but, the fractal flexibility will provide a competitive advantage (Noori, Lee 2000). The manufacturing fractal or-

organisation especially is designed to combine the logistic attributes of lean production with the strategic configuration of agile capabilities (Raye 2012). Raye considered this as the future solution to the manufacturing system. Fractals give room for the integration of information and the manufacturing structures that especially help in the alliances of the fractals as they work together (Panetto, Molina 2008). Sometimes in an organisation, each project is seen as a fractal and it is autonomous, self-optimizing, self-learning and goal-driven entity. Here experiences are combined to achieve the deliverables and each project stores the information which is in turn use as learnings to allow room for future improvement. As it is seen in project management, fractals are set of projects in a portfolio but each project runs on its own is still connected to others and the overall strategic objective of the firm (Canavesio, Martinez 2007). The broader and overall goals are made centrally and information is cascade down the fractals implying that the fractal unit is organised bottom-up, units at the topmost levels take up project that otherwise cannot be handled by the lower ordered fractals hence ensuring teamwork for the entire project and guarantying a firm delegation of authority (Strauss, Hummel 1995). The organisational central database provides a holistic view of the company's overall system and is used to make schedules and to execute them. This way information flow is constantly improved for better resource allocation (Shin *et al.* 2005). For example, decisions such as task scheduling, cost controlling, salary payment or even budgeting can be simplified and delegated or attached to the use of IT (self-optimising). This requires little supervision as middle managers will no longer be as important as they are in everyday companies. It will also ensure timely information that will help fractals to make decisions and respond to issues as they come up (Strauss, Hummel 1995). Through this system, control is less complicated and easily understood (Ryu *et al.* 2003). On employees' orientation, a fractal is a part organisation which gives room for entrepreneurship to all employees. Each tasks like quality, use of resources, work speed, and consistency is solved autonomously. One key factor to bear in mind is that each project is given to and executed by the most suitable fractal even if it is with collaboration with other fractals (Strauss, Hummel 1995).

3. Method

This is an explorative study of the activities and the structure of a unique enterprise that has managed to successfully operate in the rural area of Estonia, in the Balti region of Europe. It was chosen as a single study unit. As it appeared, this firm used purposefully an innovative operating and organizational model which is different especially when compared to other innovative rural firms around it. The goal in building methodological approach is about working towards what is most suitable to answering the research question(s) and what is most important is the ability of the methodology strategy to relate to the aims and objectives of the research (O'Leary 2009 p.92). Guided by this, a qualitative approach for this research was used due to the exploratory nature of the research which aims to produce according to Mason 1995 and Jack, 2010: "A rounded understanding of rich, contextual, and detail data that can also be generalised in some way", interviews were conducted. This work is mostly based on data collected in March 2014 during a face-to-face open-ended interview with the founder and the CEO of the enterprise. This helped to gather richer context description that is needed for exploration as suggested by Miles & Huberman, A. Michael, Saldana (2014). Additional information was from 15 interviews with regional key informants, homepage of the firm and its annual report. The interview was recorded and transcribed. Holistic coding was used and was based on theoretical constructions that were used to arrange the data. In vivo coding was used to better understand the things "through the eyes of the entrepreneurs" and process coding to describe and explore the actions (Miles & Huberman, A. Michael, Saldana, 2014). Based on thematic categorization (Kvale 2007) the analysis is presented as a narrative.

4. A case study on regional fractals

Armel OÜ (*the authors changed the company name for publication*), is a successful Estonian medium-sized production company for functional maritime wear whose headquarter is located in the rural part of Estonia, but operates in the global level and exports most of its production to different part of Europe. Estonia is a small country situated in Eastern border of European Union (EU) next to the Baltic Sea and used to belong to the Soviet Union until 1991. Since the beginning of 1990s rapid economic changes has taken place which has placed Estonia as one of the leading innovative country of Europe (EU 2014). Armel started in 1990s and currently employs staff about one hundred and twenty in four production locations in Estonia. The challenge of produc-

ing in the rural region with highly limited workforce and selling large volumes of these high quality products to different European countries and some other countries spur the firm into understanding the opportunities and weaknesses of the region and consequently adjust its production accordingly and also find new innovative solutions to overcoming them.

At the initial stage, the objective was to outsource of the production of its products and then distribute them to different markets but it was difficult to get the right partner. The company was also finding it difficult to cope with real demand, timeline and quality. As at the time, it has already built a clientele base in Germany, five of which were quite substantial hence the need for a change in strategy since for his kind of business to thrive, it was important it stayed close to skilled labour force and the potential partners. It was also business wise to be geographically close to the market in Europe because the product is cheap and production is usually in big volumes, it was challenging to transport over long distance. As a result of this, small production units were established in different rural parts of Estonia where every locality even though has its limited amount of skilled staff was suitable for this enterprise and locality specific working environment. The company established new business structures and models in order to be competitive with developed markets like Germany, Sweden, France, Denmark and other exporting countries, whereas its main competitors from countries like Germany or France export only to 4-5 countries.

It has a large group of sales team in different countries that are in close contact with the customers in order to deliver valuable information and report different taste of different markets for product innovations. Smart raw materials are sourced from over a variety of countries including US, Asia, Europe. All the R&D are done in-house in the rural factories. New certifiable products are tested in certified test-houses in other European countries especially in UK and Denmark. According to the CEO “when the steps are getting bigger, we need the help from the scientific partners, and experts”. He said this in relation to the firm’s cooperation with scientific partners from Estonia and Germany. Having realised that the Estonian labour cost are on high on end and the availability of staff is limited for the larger volumes the company was producing, the technology, core of the production, the main warehouse, IT, as well as other complicated and technical processes like cutting, prototypes, high end products are limited to Estonia. The low end products that can be controlled and are capital intensive are outsourced. “*We do have the main warehouse here, we buy most of the materials here, we cut everything here with fully automatic equipment, we do IT, design, prototype. We produce high end products here and low end products we give out.*” – CEO. Armel capitalises on the low production cost of some regions, for example all the parts are cut in Estonia, shipped to Ukraine and other places for sewing and the semi-finished products are shipped back to Estonia to assemble and for final quality control. This way it is easier to control the end product quality. The cost of outsourcing to these places in addition to logistics is half when compare to a complete production in Estonia. The costs are also very stable and could stay the same for years making it easy for Armel to plan ahead and budget. The firm also uses this to control quality because sometimes two people are put to the same work to reduce errors.

5. Discussions

5.1 The fractal organisation of Armel

Considering Foray *et al.* (2012) explanation on the evolutionary pathway of innovation system, which he said is dependent on inherent structures and the adaptation of radical transformation and according to Nicos *et al.* (2014), for growth to occur, the focus should not only be on the diversification of technology on itself but on the pattern in which the process occur. Hence the case of Armel was used to study the pattern of its activities that led to its growth and success. Its corresponding organisational structure enjoy all characteristics of fractals, i.e. they are self-similar, self-organising self-optimising, goal-oriented, and dynamic as mentioned earlier and even though they are legally independent they are organisationally linked. This innovative fractal method for using strengths of different regions and dealing with weaknesses of the rural location of the headquarters is a classic example of the radical transformations to regional innovations as suggested by the S3 policy by Foray. Considering the attributes of the fractal model:

Self-similarity: According to Sandkuh & Kirikova (2011), fractals are self-similar units repeated on various levels. Armel ability to establish and locate small production units in different parts of rural regions of Estonia can be likened to this. The different production units are self-similar in the way a job is performed, in how goals are formed and pursued and even in how challenges are resolved. Although the pursuit of goals could be diverse but there is always an inherent structure in place that guide the overall activities resulting to fractals with identical goals but different structures and are organised in such a way that they fit the specific project at hand. Like in some cases the ability to handle a particular machinery or expertise seen in the case of technology. Armel similar units of the production has also helped it to have a clear and in-time overview of the process.

Self-organization: This is the unique features of fractals which makes them flexible and able to respond quickly to turbulent influences without the bureaucracy that is known in typical firms. Raye (2012) called it “self-evolve in response to internal and external stimuli”. So far Armel has experienced successful business entry strategy in all the countries it moves to. It has remain flexible to any changing environment it finds itself and is constantly looking for ways to succeed in any given environment by considering the absorptive capacity of such environment. It employs expert form different countries like UK, France, Germany, Finland, Norway so that it is in touch with the realities in these nations. This helps the company to know immediately whenever there is a change in preference for any of the products and adjust accordingly for any region. This attributes of self-organization in the fractal company as explained by Strauss & Hummel, (1995) ensures reduction in inventory, improved service, and enables mechanisms of change, learning teamwork, communication and customer management. As pointed out in this example, a firm has to be flexible in production when some work is outsourced into different cultural environment. It has to be economically reasonable, so that it is possible to overcome the risks and problems that can occur because of longer distances, logistics and different cultural environmental differences. Language barrier and cultural differences are overcome with visualization, pictures and videos regarding the company’s potential problems, risks and the right working methods are delivered over long distances.

Self-optimising: Characteristics like flexibility or team orientation are usually accomplished through open distributed systems, usually enhanced through IT e.g. EDI (Strauss, Hummel 1995). Armel is constantly adapting appropriate ways to become self-optimising and this is achieved through the use of an IT system used for integration. It has a software for production process; wages are calculated automatically removing middle management – all staff can track and access how much they are making per day making the operation cost effective. This is applicable to most of its factories and it reduces a lot of unnecessary paper trail also saving cost. Aforementioned, Panetto and Molina (2008) considered this as the attribute of a fractal that gives room for the integration of information and the manufacturing structures that help in the alliances of the units as they work together.

Goal Orientation: A fractal network can manage a set of companies that could be virtual and linked to achieve organisational goals (Canavesio, Martinez 2007). A fractal does not determine its own goals but create them through environmental adaptation making each fractal intelligent with the ability to make decisions on set of activities made by its self especially as it has to do with goal formation e.g. regulation, propagation an conflict detection/resolution) (Shin *et al.* 2009). This way each fractal goals are tailored to match and complement each other as necessary (Shin *et al.* 2005). Armel’s processes are recorded for tracking and learning purposes and circulated to all production site. Armel uses E-learning tools for products information and the production steps are sent in pictures and circulated to all units. This supports Ramsauer (2013) conclusion that a very promising approach to smart manufacturing and logistics is in the support ICT gives in providing the linkage between internet and manufacturing which aim for cyber-physical systems and dynamic production networks in order to develop flexible and open value chains in the manufacturing of complex mass customization products in a small series up to lot size one. The e-learning tools according to Strauss & Hummel (1995) also help to cascade the broader and overall goals that are made centrally down to the fractals hence ensuring teamwork for the entire project and guarantying a firm delegation of authority.

The dynamism: Dynamism relates to how firms are constantly working on how to build and sustain relevance in the market place. Canavesio & Martinez (2007) pointed out that manufacturing companies in particular

find themselves in a constant pressure on how to keep up with globalisation, substitution, changing demand patterns, competition, and cost. Armel uses good forecasting system to achieve good timeline and meet real demand. The company has an IT system for tracking products and materials. This is also used to integrate the whole company, making it easy to run a virtual company. While production is taking place in one country, sales administration, invoicing and selling could take place in another. There are back up plans and resources and risk management on event of delays and other unforeseen challenges.

5.2 Alignment with Smart Specialisation Strategy

S3 strategies such as experimenting, finding complementarities with high potential and discovering technology and market opportunity are in line with all the activities Armel has been involved with since its inception. Thus the need for new concepts and strategy such as innovativeness as mentioned by MacKinnon *et al.* (2002) can open up a whole new way to support innovation in sub regions and will lead to strong and abiding structural change and diversification building on existing industrial knowledge with economic impact. McCann & Ortega-Argile's (2014) suggested that the potential of each region should first be examined in order to know what is needed to foster the development of entrepreneurial behaviours and activities in these areas. That Armel was able to change and tailored its overall strategy to that of its environment in order to be competitive globally, re-emphasised the need for regional economic policies that management research and practices should be specific to the needs of each region in order to increase the likely hood of entrepreneurship discovery. Even though staying in Estonia means staying close to skilled labour force and the potential partners the management knew that to complete successfully globally it has to change and they were right. Today Estonia can only absorb 1% of its products, the rest of the products (99%) are exported. The emerging trend of this firm is promising to S3. Today, the company has made remarkable growth and at the present has a staff strength of over 120 with 4 production sites all located in small counties in Estonia with population that ranges between 23,000 and 36,000. This is not only inspiring but can also serve as a major driver for economic growth in small regions. Also since disparities are reduced through innovation Armel has been able to bring down the barriers that young starting businesses usually face in similar rural area. Supporting the argument of Dziemianowicz, Peszat (2014), this will contribute to inclusive growth between and within the regions by strengthening territorial cohesion, manage structural change, create economic opportunity and enable skills development, better jobs and social innovation. Furthermore, looking at one of the policy process of S3 by Foray *et al.* (2011); Del *et al.* (2013); Lindqvist *et al.*(2013), such as the identification of an entrepreneurial activity, Armel is a company that can be identified for its innovative process and knowledge intensive activities. For example, Armel is an organisation that believe a good product is one of the major attributes that give a company competitive advantage, its major investments is in product development (a knowledge intensive activity). This innovation stance is customer driven and to stay ahead of its competitor it ensures it presents new innovations every year. The sales team are constantly in contact with the customers, and most of the product innovation ideas comes from them.

According to Vanthilloet and Verhetsel (2012), S3 must be embedded in local industry and its innovation must be regional. Armel activities can be likened to self-discovery or entrepreneurial discovery process that is related to the Smart Specialization approach of the EU which supports the promotion of innovation activities in regions. OECD (2014) explained that regional success will depend on the entrepreneurial performance and its related capacity to build public – private partnerships and cooperation, thereby encouraging successful and knowledge-intensive enterprises to operate from rural regions. Armel have gone into partnership with research organisations closely related to universities in Tallinn, Estonia and Freiburg, Germany. For example, there is an ongoing project with these organisations to create “intelligent lifejacket” a radically innovative high tech product that is called intelligent lifejacket that will be useful people who use it. Although previously it deliberately did not asked for support or external funding, for this cooperation, it is making use the opportunities of programmes provided by the government to support scientific cooperation in the field of product development. This suggests that Armel activities align with the S3 strategies by Smart Specialization in England, (2014) which states that companies should work together with higher institutions, research centres, and government in order to align with the S3 concept of embeddedness.

Experience in different cultural environments helped the firm to be ready for possible mistakes, and over 20 years of experience with the Eastern European countries also serve as a competitive advantage, this will be absent in a company that has so far worked only in Germany. This is an organisational innovation where medium sized firms can win a lot. By doing so, the company operates in various regions which are all enjoying their own smart specialization strategies even if they are not named as such. Thus the concepts of fractal enterprises can be used to achieve the strategy smart specialization in the regions. The German activities of the company for example are related R&D activities, the Estonian ones are related to high – level manufacturing, ICT operations and logistics, the Ukrainian units are focusing on sewing activities in mass production whereas the company activities in the sourcing regions are focusing on the purchase and delivery of smart materials which are special part of the smart regional development strategy. The regional units of the company enjoy the characteristics of fractals so that the company can be considered as a fractal enterprise in the field of manufacturing. Armel has been able to fulfil the requirement of Foray (2012), that the selection of smart specialization should take place when local entrepreneurial commitment and development can achieve a sufficient level of stability and coherence - the concept of entrepreneurial-discovery process whose outcomes have been optimised to spur new growths and a whole new set of opportunities.

6. Conclusions

The success story of the case company is closely linked to entrepreneurial innovation, export marketing and smart production and supply chain management which is based on a distributed multi-national production model. The underlying business concept and its related success paved way for a sustainable development and demonstrated that even in rural areas high – tech entrepreneurship can be successfully implemented. One perspective for the non – core regions lies in this self-discovery or entrepreneurial discovery process that is related to the Smart Specialization approach of the EU and it supports the promotion of innovation activities in regions (OECD 2014), so that the regional success will depend on the entrepreneurial performance and its related capacity to build public – private partnerships and cooperation and there shows possibilities for successful and knowledge-intensive enterprises to operate from smaller regions. The Smart specialization embraces the concept of open innovation, not just investment in R&D but a system approach that exploits complementarities (Larosse 2013) promises high potential, are new and aimed at experimenting and discovering technological and market opportunities that can provide learning spill overs to other economy sector (Foray, Goenega 2013).

Furthermore, since the Smart Specialization strategy suggests that Entrepreneurs should be at the fore front of discovering R&D and innovation actions that are best for the growth of each region. The Smart Specialization entrepreneurial discovery should be a combination of the knowledge about science, technology and engineering, including the knowledge of market growth potential, potential competitors as well as the whole set of inputs and services required for launching a new activity (Foray *et al.* 2011), as seen with Armel. The case study firm has its root founded in a small region but was able to rise about its confines and expanded beyond its territory to build a company that is not only self-sustaining but also international by using a method that can be linked to the fractal approach. This gave it the opportunities for the development of powerful intelligent control techniques with integrated adaptation, learning, self-diagnosis, reconfiguration and repair. The regional units of the company are adapted fractals to the regional Smart Specialization strategies so that the company enjoys the structures of a fractal manufacturing enterprise.

Finally, this case contribute to the theory development of fractals. It expanded on the opportunities for the rural enterprises which has not been highlighted before. It also raises the need to study the topic further. For instance, a firm has to have certain absorptive capacities to successfully implement the fractal model and ensure that its activities support the organisational strategic objectives. These needed capacity should be discussed. Furthermore, while it can be agreed that there are other firms that have been able to rise above environmental limitation to succeed, there are also different approaches and strategies employed by these firms to achieve their goal. Hence the need to also study the overall or cluster patterns of entrepreneurial process in other small regions in relation to the S3.

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