



Turun yliopisto
University of Turku

ESSAYS ON REGIONAL ECONOMIC DEVELOPMENT AND INNOVATION ECOSYSTEMS IN THE ARCTIC CONTEXT

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ABSTRACT

This dissertation consists of introductory part and four essays each covering certain aspects to regional development. Three of the essays are research reports from joint and multi-disciplinary research efforts. The main driver for research activities has been to deepen the understanding of regional development in the modern context dominated by phenomena such as urbanization. When the natural and even decades ago forecasted mobility of economic activities seems to be towards central, metropolitan areas and when metropolitan cities produce the majority of national GDP, the concern about differences in regional development becomes justified. As well as urbanization has prompted research projects, the second important issue has been to analyze the need for regional policy. Therefore, it has been studied whether there are – besides pure political reasons – any grounds for active regional policy programs.

The three research reports included in this dissertation are built in case study fashion on the Arctic region – the Scandinavian Arctic, to be precise. The Arctic has been presented as an area, which is struggling with typical challenges of periphery but also as an area of special economic interest due to natural resources as well as experiments in innovation activities. Moreover, since digitalization is unanimously identified, alongside with urbanization, as another mega trend it is reasonable to inspect peripheral communities and their functions from the perspective of rapidly developing technologies, which presumably fade out the importance of geographical locations. The fourth essay in this dissertation deepens the economic approach to the concepts of innovations and technological change.

The general outline of the research consists of three elements. First, the concept of an innovation ecosystem is considered as a platform for regional development. Secondly, the case area is studied to understand the potential need for and requirements to corresponding regional development policy. The second element contains also a study on the economic potential of the case area. Finally, the concept of regional policy is expanded over national boundaries and opportunities for multi-national collaboration are studied.

The research results show that reorganizing local development activities indeed requires a new kind of role for public sector. Oulu Innovation Alliance was investigated as a regional concept and concluded to contain various elements of an innovation ecosystem. Moreover, it is argued that the challenges of Arctic context are efficiently met when public sector adopts a role of an enabler and networker. Studying Arctic innovation systems and their effect on the regional economies can offer new insights to the challenges of other peripheral regions as well.

Keywords: Urbanization, Regional development, Economic policy, Innovation ecosystem, The Arctic

TIIVISTELMÄ

Tämä väitöskirja koostuu johdanto-osasto ja neljästä esseestä, joista jokainen liittyy alueelliseen kehittämiseen. Esseistä kolme on tutkimusraportteja monitieteellisestä tutkimustyöstä, jonka tavoitteena on ollut syventää näkökulmaa aluekehitykseen modernissa toimintaympäristössä, jossa vallitsevina trendeinä ovat kaupungistumisen kaltaiset ilmiöt. Taloudellisen toiminnan keskittyminen metropoli-alueille on taloustieteen kannalta monin tavoin luonnollinen ja ennustettukin kehityssuunta, mikä osaltaan korostaa aluetaloudellisen tarkastelun tarpeellisuutta. Toinen tutkimustyötä ohjannut tavoite on ollut analysoida aluepolitiikan tarvetta, joten tutkimuksen avulla on selvitetty perusteita erilaisille aluekehitysohjelmille.

Väitöskirjaan sisältyvissä tutkimusraporteissa tarkastellaan Skandinavian arktisia alueita aluekehityksen esimerkkeinä. Arktiset alueet ovat tyypillisiä perifeerisiä alueita, mutta toisaalta alueen luonnonvarat ja pohjoisen alueen innovaatiokokeilut ovat lisänneet kiinnostusta alueiden kehittämiseen. Nopeasti etenevän digitalisaation ja teknologisen muutoksen odotetaan häivyttävän eri toimintojen maantieteellisen sijainnin merkitystä, mikä osaltaan vahvistaa tarvetta tutkia myös syrjäisten alueiden toimijoita ja toimintoja. Tämän väitöskirjan neljäs essee syventää innovaatiotoimintaan ja teknologiseen muutokseen liittyvää taloustieteellistä tarkastelua.

Tässä väitöskirjassa esitettävän tutkimuskokonaisuuden voidaan kuvata koostuvan kolmesta elementistä. Ensimmäisenä elementtinä on innovaatioekosysteemi aluekehityksen alustana. Toisena elementtinä kokonaisuudessa on esimerkkialueen tutkiminen sekä aluekehityksen ja -politiikan että taloudellisten mahdollisuuksien näkökulmista. Tutkimustoiminnan kolmantena elementtinä on aluepolitiikan käsitteen laajentaminen yli maiden rajojen tapahtuvaksi yhteistyöksi ja tällaisen yhteistyön mahdollisuuksien arviointi esimerkkialueella.

Tutkimustulokset osoittavat, että alueellisen kehittämistoiminnan uudelleen organisointi edellyttää julkisen sektorin roolin uudistamista. Tutkimuksen kohteena olleen alueellisen ratkaisun, Oulun innovaatioallianssin, todettiin sisältävän useita innovaatioekosysteemin piirteitä. Lisäksi voitiin todeta, että julkisen sektorin toiminnan muokkaaminen muiden sektoreiden toimintaa mahdollistavaksi verkostotoimijaksi on tehokas tapa vastata arktisen toimintaympäristön haasteisiin. Arktisten innovaatiojärjestelmien tutkiminen ja arvioiminen voi tuottaa uusia näkökulmia muidenkin perifeeristen alueiden ongelmiin.

Avainsanat: Kaupungistuminen, Aluekehitys, Talouspolitiikka, Innovaatioekosysteemi, Arktinen alue

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Sami Niemelä
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1 SYNTHESIS

This dissertation consists of three research reports and one, yet unpublished essay each covering certain aspects to regional development and innovations. The main driver for underlying, multi-disciplinary research has been to deepen understanding of regional development in the modern context dominated by phenomena such as urbanization. When the natural and even decades ago forecasted mobility of economic activities seems to be towards central, metropolitan areas and when metropolitan cities produce the majority of national GDP, the concern about differences in regional development becomes justified. As well as urbanization has prompted research projects, the second important issue has been to analyze the need for regional policy. Therefore, it has been studied whether there are – besides pure political reasons – any grounds for active regional policy programs.

The three studies included in this dissertation are built in case study fashion on the Arctic region – the Scandinavian Arctic, to be precise. The Arctic has been presented as an area, which is struggling with typical challenges of periphery but also as an area of special economic interest due to natural resources as well as experiments in innovation activities. Moreover, since digitalization is unanimously identified – alongside with urbanization – as another mega trend it is reasonable to inspect peripheral communities and their functions from the perspective of rapidly developing technologies, which presumably fade out the importance of geographical locations.

The logic of the studies is explained in detail in this introduction section but the general outline of the research is consisting of three elements. First, the concept of an innovation ecosystem is considered as a platform for regional development. Secondly, the case area is studied to understand the potential need for and requirements to corresponding regional development policy. The second element contains also a study on the economic potential of the case area. Finally, the concept of regional policy is expanded over national boundaries and opportunities for multi-national collaboration is studied.

The research presented in this dissertation has been conducted as a multi-disciplinary effort of researchers representing economics, geography and industrial management. As research reports demonstrate, even if each one of the researchers has had their own specific roles in research, the combination of different approaches provide a cohesive and comprehensive view on the topic. Fourth essay

deepens the economic approach to the concepts of innovations and technological change.

As the prevailing research strategy has been based on the thorough and systematic case study of the Arctic as a context for regional economic development, it is self-evident that the results of the studies so far are mainly descriptive by their nature. The main findings are closely related to the case and should be addressed as vital steps to build a cohesive view on the phenomena in the studied context. Obviously, results from these studies are not straightforwardly generalizable – as, according to the chosen research strategy, they were not meant to be. Instead, results should be considered as transferable. The diverse data combined with different analytical tools presented in this study enables the assessment of the applicability of the results in other contexts. In other words, it is possible to consider transferability of the results in other, yet sufficiently similar, cases.

This synthesis consists of four chapters and a summary of research reports. The first chapter describes the key elements of urbanization and regional development. In second chapter, the main prevailing options for regional policy are described. Third chapter consists of the examination of the concept of innovation ecosystem. The fourth chapter introduces the Arctic as a periphery and describes the main case area, Oulu region, as a Northern growth area. The fifth chapter summarizes the findings from three research reports and one essay.

1.1 Urbanization, peripheries and regional policy

The concentration of people, companies and other actors to certain locations is one of the most undisputed mega trends identified. The global urban population exceeded the global rural population for the first time in history in 2007 and it has been estimated that by the year 2050, two-thirds of the population will live in the urban settlements (United Nations 2014). Obviously, there are numerous reasons for this development and most of them are beyond the scope of this study. As far as economies of scale are concerned this accumulation of production activities fits into rational economic logic. Similarly, there are several spatial models for location decisions of companies showing that competing firms tend to centralize nearby each other (see Hotelling 1929).

Almost in a zero-sum fashion, the movement of people and other resources to urban centers means declining population and increasing shortage of certain inputs in other regions. This development can be displayed as a vicious circle, which complicates the economic activities in regions with diminishing availability of factors of production and eventually affects the living conditions for those still remaining in these peripheral areas¹.

From economic point of view, domestic migration when based on the economic incentives is likely lead to positive welfare effects in the long-run – and same goes for the reallocation of capital (see e.g. Porter 1998). Urbanization can be seen as an example of readjusting markets leading to improved efficiency. The concentration of population and economic activities in certain urban locations – typically capital areas with some very noteworthy exceptions, such as Shanghai area in China or Silicon Valley in the US – sets another set of challenge to decision makers. Rapid growth of population in the area brings quickly growing demand for housing, services and infrastructure².

The importance of growing urban centers, main cities, is becoming constantly more visible and policy makers do have a challenging task to balance between regions. At the same time as the economic role of urban areas becomes heavier³, the areas with decreasing economic development seem to require more attention. The regional differences in regional GDP, unemployment or property values illustrate these challenges⁴.

¹ For the discussions about European peripheries see e.g. Bartlett & Prica (2016).

² See e.g. the report of regional development in Finland published by the Finnish government in 2000 (Valtioneuvoston kanslia 2000).

³ For instance, according to OECD statistics the share of Helsinki region's GDP was 36,59% of national GDP in 2013. For Tokyo, the share was 32,02%, whereas for New York the share was 7,73%.

⁴ See e.g. Tervo (2005).

1.1.1 Different peripheries and regional development

With accelerating urbanization there is growing number of areas facing diminishing population⁵ and decreasing economic activities and becoming gradually a periphery. On the other hand, technological development has affected the importance of the geographical location so that the pure distance does not exhaustively define remoteness of a region. Especially with digital goods and services the production can theoretically be allocated globally in a quite limitless fashion. However, this improved connectivity seems to have had only marginal effect on the urbanization development. Aforementioned development path highlights the need to expand the concept of periphery from traditional core – periphery structures⁶ to a dynamic and less geographically fixed one – the need that has been explicated even before digitalization (see e.g. Krugman 1991).

The growing population in certain area means increasing demand for numerous services and it is therefore unsurprising that variety of services is notably richer in urban growth centers. This is one example of many pull factors for migration. Whereas the lack of employment and adequate services create push from peripheral areas, job opportunities and continuously improving supply of services act as a pull to urban locations. (United Nations 2014.)

Peripheral areas do not represent a homogenous set of locations. For instance, some areas are geographically remote, logistically difficult to access, culturally isolated or unattractive due to challenging living conditions. There are declining regions even within close distance to growth centers and there are poorly developing local economies even in countries with otherwise favorable economic conditions. Explanations to uneven regional development vary but consequences are somewhat alike (see e.g. Labrianidis 2017).

For decision makers the observed imbalance between regions in economic – and to some extent general⁷ – development can be a call for action. First, if seen as an undesired development the prevention of reallocation of people and resources

⁵ Quite naturally, the number of areas or regions losing population exceeds the number of regions gaining new inhabitants.

⁶ Geographically defined peripheries are basis for various development programs such as Northern Periphery and Arctic Programme of European Union.

⁷ Here, general development refers to e.g. safety concerns with increasing crime rates, appearing health issues in population or deterioration of infrastructure. In addition, there are concerns related to sustainability issues (United Nations 2014).

should be considered. Obviously, there is a limited selection of tools available for this and from economic point of view there is an imminent danger of welfare losses if markets are intervened. Secondly, policies can be designed to alleviate adaptation to the change. The latter main trail for policy is more suitable for modern economies and hence more applied. The adaptation policies may include different tools and mechanisms to maintain tolerable living conditions in peripheral areas as well as in areas with accelerating growth.

There are several explanations for differences in regional development. Some explanations are connected to well-known and somewhat universal economic factors such as optimization of costs or closeness to markets, whereas other reasons have more to do with human behavior, preferences and personal valuations. Similarly, there are multiple causes for active regional policy – whether aiming at decelerating urbanization or at alleviating the negative effects of the change. (Marshall 1920; Krugman 1998; Porter 1996.)

The so-called new economic geography not only explains the economic rationale behind spatial concentration and cumulative growth, but it also has predicted the observed development path of regional development. Moreover, this approach provides a revised view on the relations between growth centers and peripheries or hinterlands and hence illustrates the complexity of regional development⁸ (see e.g. Fujita et al. 1999).

The efforts to keep different regions populated and maintain certain level of economic activities in different parts of a nation can be justified by, for instance, national security and safety reasons. On the other hand, there are a set of reasons for active regional policy that are connected to different resources and exploitation of them. These resources can be of tangible or intangible nature. The location of raw materials (e.g. oil, gas, ore or wood) is one quite typical example of resources affecting decision making. The intangible resources refer, for instance, to growing tourist industry where different experiences are available only on certain areas (e.g. northern lights, seaside activities or different sceneries and attractions). (Thule Institute 2014.)

Even though it is rather pointless to completely exclude the effects of politics and ideologies from the analysis of regional policies, it is convenient enough to conclude that focusing on the decision making based on the economic factors and resources offers an opportunity to study challenges for and outcomes of different alternatives for regional policy programs.

⁸ For instance, the spillover effect of the growth center to surrounding peripheries may be positive or negative (Tervo 2009).

1.1.2 *Economic aspects*

There are numerous examples, past and present, to illustrate regional policies based on the location of certain resources. Oil and gas fields or natural minerals in the northern hemisphere have been obvious drivers for development in relevant areas. The exploitation of aforementioned resources has required a specific infrastructure and other factors of production (Thule Institute 2014). It is rather safe to assume that needed investments would have been somewhat unlikely if they were left completely for markets to be settled (Conley 2013). On the other hand, the public sector is usually considered to have a significant role in building the basic framework for economic activities. Therefore, public investments on the infrastructure is not *per se* an indication of attempts to affect regional development, but the priorities and selection of infrastructure projects – when it is not possible to carry out all suggested projects – can be thought of as part of a regional economic policy.

From economics point of view, it is important to identify the main drivers and goals for regional economic policies. Since there are presumably a variety of policy tools available for decision makers, understanding the underlying motives for active policy is necessary when attempting to compare the suitability and effectiveness of different policy options. The analysis should be quite straightforward when decisions are strongly based on singular local resources with defined economic value and when the aim of the policies is strictly focused on the capitalization of these resources (see e.g. Conley 2013). However, there are only limited number of cases portraying aforementioned settings. In reality, regional development is usually a mixture of economic and more general political and ideological factors, which obviously complicates analysis, comparison and assessment of different practices. (Sotarauta 2015).

Moreover, depending on the general role of the public sector in the economy, certain economic policies are assumed to affect regional development – even if the policies in question are not directly aimed at tackling regional issues. Obviously, these effects may work in both ways, some policies may increase regional differences by accelerating domestic migration whereas other policies may effectively alleviate the consequences of different regional growth paths. (Valtioneuvooston kanslia 2000.)

1.2 Policy options

It is well known that economic policies consist of a large number of alternative operational tools of which some are complementary whereas some policy tools are practically exclusive, more or less. Decision makers design economic policies according to general political views and according to prevailing political system. For analytical purposes, the set of economic policies are here divided into three categories. First category is formed by different types of subsidies and transfers, which are allocated to economic agents. These subsidies can be direct monetary transfers paid to agents from public budget or they can be indirect such as specific tax deductions.

The second category of economic policy tools investigated in this study consists of public expenditure and public investments. Government funded investments to infrastructure or to capital intensive production activities are demonstration of this kind of policies. In addition, designing and offering public services are essential part of economic policies in this category.

Thirdly, there is an increasing interest towards a new sort of economic policies where public sector is seen more as an enabler, networker or facilitator in economic development. This new public sector economics would set more weight on the markets' ability to find optimal solutions and hence diminish the effects of disturbances to economic development caused by traditional, active economic policy.

Regardless on the composition of applied economic policy tools, it is noteworthy to point out that financing of public sector needs to be solved in any case. A vast number of economic studies have investigated different aspects of taxation, public spending or relations between private and public sectors. In this study, the emphasis is laid on the different strategic paths for economic policies aimed at affecting regional development in peripheral circumstances. Therefore, the financial issues along with general discussion of the governments as economic actors is beyond the scope of this study.

1.2.1 *Subsidies and transfers*

There are multiple drivers affecting policies on monetary transfers and subsidies. Issues regarding income distribution, consumption of goods with externalities such

as education or ideals connected with general social context such as the Scandinavian welfare state concept (see e.g. Soininvaara 1994) are typically considered to act as main motivators for monetary transfers. For regional development, these policy tools seem understandable. Creating incentives to migration and capital movements to desired regions appears as a simple solution. (Tohmo et al. 2001.)

However, there are only few reported experiments of this type of regional policy – at least from most recent years. The unpopularity of redistribution policy can be explained by political and legislative reasons as well as by economic reasons. First of all, there is very little dispute about the notion that sufficiently functional markets will create incentives for economic agents without government intervention. Secondly, since redistributed income must be first collected, there are always associated negative effects on economy – either on economic agents in other regions (if subsidies are financed by taxation) or on future generations (if financed by public debt).

Excess demand or supply in markets should lead to new equilibrium through price mechanism. For instance, if there is a lack of labor force in certain region, this should lead to increasing wage levels and this in turn creates an incentive for migration to the region. This example suits well with resources (e.g. minerals) in peripheral areas and local production activities emerged in those areas as the wage levels in these industries tend to exceed the average wage level in the economy (see e.g. Huskey 1996).

In a far more common case in imbalanced regional development, there is no initial demand for factors of production. On the contrary, some regions are prone with declining level of industrial production and hence with increasing unemployment. With public subsidies it – at least from theoretical aspect – should be possible to attract production activities in certain areas. However, this kind of direct public support from government to companies may be restricted by regulations⁹. Additionally, there are similar limitations in supporting individual citizens with monetary transfers attached solely on the place of residence¹⁰.

An additional complication with subsidies is the difficulty to forecast the effectiveness of them. To ensure the effects on purchasing power, a detailed execution is required. Otherwise there is an imminent possibility that only nominal changes are observed – there are examples of subsidies that are suspected to lead on equal increase in the price, which leaves the real values intact and only negative effects of public financing remains (see e.g. Slesnick 1996; Korkeamäki & Uusitalo 2006; Hiekka & Virén 2008.)

Even though political factors and ideologies behind the willingness to affect regional development are not in the core of this study, it is necessary to state that

⁹ See e.g. article 107 of the Treaty on the Functioning of European Union.

¹⁰ There are some examples of subsidies that are aimed at lowering the barriers to internal migration (e.g. monetary aid to moving) but these subsidies are not designated to any particular direction of migration and therefore they may actually accelerate the centralization of people in growth centers.

affecting economic agents' preferences on location decisions through monetary transfers seems to be complicated. Hence, the rationality of using this kind of policy tools can be thought of being depending on the main reason behind the need for inbound movement of labor and capital. To simplify, if valuable natural resources are found in the peripheral area and exploitation of these resources is in the interest of government, the formation of local production sector and required complementary service sector may be accelerated by subsidies and transfers. To say the least, development policy based solely on the subsidies and transfers seems insufficient to ensure balanced regional development in the modern economy¹¹. (Tohmo et al. 2001.)

1.2.2 Public expenditure and investments

Public investments are widely seen as a quite traditional tool for regional policy. Due to lengthy use of this tool, there are various cases in the literature covering different government investment projects and their effectiveness on the regional development. Similarly, government expenditure related to the production of public services has a long history as an instrument for regional policy. (Vartiainen 1998; Tervo 2005.) This regional perspective is, for instance, strongly highlighted in the on-going discussion about the regional government and health and social services reform in Finland.

For analytical purposes, it is necessary to identify the genuine inducement behind decision making. Especially, with public investment projects the typical mixture of pure economic, national and regional interests makes it somewhat challenging to assess effectivity of these government-driven activities in leveling the differences in regional development. A large investment project acts necessarily as an injection to local economy and there are various different methods to evaluate economic consequences of these injections. For instance, Crecenzi & Rodríguez-Pose (2012) conclude that in European Union the investments in transportation infrastructure have not been successful drivers for economic growth. Moreover, the regional growth was found to be more linked to innovation capacity (*ibid.*).

¹¹ Moreover, it has been argued that in the case of Finland, the main components of the Finnish welfare state system have had more significant effect on the regional differences than the actual regional development policies (Valtioneuvooston kanslia 2000).

As for expenditures, decisions concerning locations of institutions for higher education, central hospitals, public offices or research institutes are easily seen reflecting the prevalent regional policies. Once again, it should be noted that decisions are only occasionally based completely on the regional issues, which complicates the analysis of performance of these policies. However, it is rather obvious that general outline of policy on public expenditures does affect the location decisions of economic agents – individuals looking for university education have to relocate into regions with universities, despite the emergence of new learning methods, such as digital platforms for education. (Turok 2004; Porter 1996.)

It is comfortable enough to state that both public investments and expenditure on services can be used as tools for regional policy. For instance, if general outline of government policy would prefer centralization of inhabitants and companies in certain urban centers, this policy could be partly executed by diminishing government activities in rural areas. On the other hand, it is far more difficult to assess how government activities might work if the desired direction of development would be toward decentralization.

However, it is important to distinguish government activities related to exploiting endowments from pure regional policy. There are numerous examples of vast investment programs aiming at capitalizing resources outside of growth centers, such as the cases with the Arctic minerals and natural resources in the US (Conley 2013).

The desire to utilize natural and other resources in remote, peripheral locations seems as a rational platform for certain regional policy. Additionally, in these cases it is rather straightforward to assess economic aspects of investments and related expenditure – costs and revenues – in sufficiently detailed manner. (Niemi & Hintsala 2016.)

To conclude, for government-induced investment programs and expenditure schemes it is relevant to understand the full spectrum of regional policy behind the decisions. Even if government does not lay any weight on balanced regional growth¹², it may still conduct heavy regional development programs for other reasons. On the other hand, there are numerous examples of regional policies that may appear as almost necessary means to gain certain (national) benefits and usually are rationalized by economic considerations, but actually turn out to be regional policy in its purest form – especially when assessed afterwards.

¹² Within the context of European Union, the regional policy is operationalized as a Cohesion Policy with total budget of 351,8 billion euros for different development programs in 2014 – 2020, which reflects strong emphasis on regional policy.

1.2.3 Public sector as an expert, networker and enabler

For past decade or so, there has been growing interest toward so-called innovation ecosystems as means to describe the formation of modern economic activities and actors. Even though the key concepts in discourse remain somewhat heterogeneously defined, increasing number of studies are considering ecosystem approach as a suitable way to describe dynamics and sometimes rather complex relations and interdependencies of economic agents. From the economics point of view, ecosystem with its key principles does not alter the underlying paradigms of, say, microeconomic models of firms' behavior as economic agents. However, when considering the tools and effectiveness of economic policy – especially in regional cases – application of concepts such as ecosystem and particularly innovation ecosystem may offer deeper understanding than more traditional economic models. (Oksanen & Hautamäki 2015; Oh et al. 2016.)

Within innovation ecosystem framework, the role of the public sector becomes more versatile than is traditionally considered. In innovation ecosystem, public and private sectors collaborate in various ways and the nature of interaction deviates from, for instance, simplified circulation flow model. Public sector is typically modelled as a partner, which has some designated rights – such as regulatory powers – and responsibilities. Obviously, there are innovation ecosystems where the need for public actors is minuscule and the core of the ecosystem consists of an interplay of private sector agents. Similarly, there are innovation ecosystems which are distinctly driven by public sector¹³. The latter represents a setting for a new kind of economic policy and in which public agents act as enabler of activities and builder of networks and arenas for co-operation. (Frenkel & Maital 2014.)

Public sector certainly has a distinctive role compared to other actors in networks or ecosystems for multiple reasons. Here, one important factor defining public agent's role is the access to information and moreover the ability to process gathered information. Public sector is able to collect and analyze data that is not usually available to private actors. Exploitation of this data in purposeful means could transform into a new kind of opportunity to steer development in desired direction (see e.g. Ahlqvist et al. 2012).

In innovation ecosystem context, public sector can bring all key actors together, support the development activities with its resources and rationalize operational choices with analyzed data. It seems reasonable to assume that this type of policy would not become more costly than traditional regional policies with public in-

¹³ For simplicity, the public sector refers here to economic agents such as cities, municipalities, universities, colleges or research institutions which are mainly financed and regulated by government.

vestment projects and expenditure. However, there are some prerequisites for ecosystem associated policies of which the most important is that there must exist a sufficiently mature foundation for an innovation ecosystem to evolve. Moreover, the concept of innovation ecosystem needs to be clarified adequately enough to enable the assessment of the status of local or regional economy.

1.2.4 Dynamics in regional policy – some findings from Finland

As an economy, Finland has gone through rapid stages of evolution from an agrarian society to an economy built increasingly on the service sector. Alongside this general development during post-war period, Finnish economy has become part of global economy and hence dependent on the changes in international markets. These paths of development have indisputably had an effect to the design of the regional development policies.

The general outline of regional development policies has rather clearly followed a three-step process (see e.g. Vartiainen 1998; Tervo 2005; Sotarauta 2015) starting from industrialization policy in the 1960s, which was followed by period of planned regional development policy from the mid-1970s to the late-1980s. The last step on this development is considered to be ignited in the late-1980s when program-based regional development was introduced.

As an economic policy, industrialization policies may be addressed to level otherwise uneven development between certain groups. Obviously, geography may be one – but definitely not the only imaginable one – factor creating the need for balancing policies. Therefore, industrialization can be applied in regional development policy as is demonstrated by the case of Finland. Government affected location decisions in paper and steel industries during 1960 – 1975 reflect the importance of political objectives and a bit less economic reasoning. As effective industrialization may be in improving regional development, it raises serious doubts about viability of economic activities if not continuously supported by public finances.

The second step in the development of Finnish regional policy, the era of planned regional development process, expanded the scope of regional policy to public services, which meant, for instance, that decisions concerning the locations of universities, institutions or public offices were considered also from regional

aspects. It can be argued, that this type of policy program introduces regional development as a horizontal theme for all decision making. In the case of Finland, the geographical dispersion of higher education illustrates – at least partially – this orientation of regional policy. Depending on the prevailing general policy on the nature of publicly provided goods¹⁴, the challenges for this type of policies seem to arise from finances. The costs of the dispersed system may increase since the economies of scale may remain unreachable. Secondly, the heavy emphasis on regional issues may prevent the born of agglomerates with sufficient critical mass to provide renewal of ideas and new innovations to global, intensively competed markets.

In Finland, the third step of regional development meant that development programs became the cornerstones of policy in the beginning of 1990's. Globalization as a mega trend as well as the membership of the European Union in national level have most certainly affected regional economic policies along with the ongoing discussions about competitiveness of Finland in global economy – threats and challenges to the economy have been identified and initial responses to them have been introduced. Program-based development aims at collecting development activities to larger entities and hence improve the strategic coordination of projects (see e.g. Mäkinen 1999). The nature of public sector actors' role in development is changed from active – sometimes even decisive – agent injecting local economies with investments and public services to a more supplementary actor, ensuring sufficient inputs to selected development activities.

Even though the program-based development *per se* does not indicate increasing or decreasing emphasis on the regional development, it most certainly intertwines with thoughts on regional development introduced by Porter in his widely cited studies (see e.g. Porter 1990; Porter 1996). Local clusters, networks or innovation ecosystems refer to setting in which public sector investigates economic development in regions and induces progress with appropriate means – as one group of actors, not necessary even the most essential one – along with private sector actors.

Tervo (2005) summarizes the relation between regional policy and markets and concludes that the economic growth cannot be generated by public sector activities alone. Therefore, an interplay between markets and public sector is required. Additionally, the other notion is that public sector does not – not even in countries with large public sector economies – possess means to affect the general economic development.

¹⁴ In the case Finland, Scandinavian welfare state system translates into publicly financed, publicly produced and publicly distributed goods and services, which are allocated to customers according to universality principle with limited means-testing.

Assessing the development path of Finnish regional policy options for past decades confirms the self-evident assumption that in different contexts and situations, different policies are more suitable than others. That is not to say that there is not constant demand for different policy actions – even in the present context of innovation networks, the government may be repeatedly requested to perform regional actions which resemble the era of industrialization as a main regional policy. Similarly, it can be argued that the most recent policy orientation towards innovation systems or ecosystems would not have been the most suitable choice during the post-war rebuilding period in Finland. Thus, designing regional policy is based on the assessment of regional economic conditions – a maturity of regional innovation system must be defined and evaluated in order to build the most effective selection of policy tools.

Finally, it should be noticed, that even if regional policy was effective in inducing growth centers in different regions¹⁵, on regional level there could still be different development paths between centers and hinterlands. In Finland, the growth of regional centers has not uniformly balanced the development of the regions – cores and peripheries can still be found when analysis is performed within regions. (Tervo 2009.)

1.3 The concept of innovation ecosystem – key definitions and applicability

The concept of innovation ecosystem has become a popular term when describing co-operation of different actors to accelerate technological development and to create new innovations. Previously, the terms such as clusters, networks or plain innovation systems have been used for same, descriptive purposes. The “eco”-suffix owes largely to Moore (1993) who introduced the analogy from ecology to economics. As Oh et al. (2016) demonstrate in their extensive literature study on innovation ecosystems, there definitely exists vagueness in terminology and the academic work on the subject is still in its early stages.

According to Oh et al. (2016) the distinctive features of innovation ecosystems – compared to clustering of actors in Porterian manner or traditional networking concepts – seem to fall into six categories or themes. First, the innovation ecosystem as a concept portrays a systemic nature of diffusion of innovation. The connections and collaboration of numerous actors are regarded as necessary conditions in innovation process. Secondly, innovation ecosystem seems to suite especially

¹⁵ Instead of strong centralization on the metropolitan area.

well describing the nature of development processes in ICT sector. Third category is related to the openness in ideas, innovations and even in product development and design. Again, this factor is in close relation to ICT sector where this type of practices are somewhat usual.

Fourth distinctive feature is the popularity and promotional value of the concept. Similarly, previous concepts (e.g. clusters and networks) have undergone the same path, in which, at least momentarily, some activities were named as clustering just to increase visibility and interest. Fifth theme in the analysis of Oh et al. (2016) is linked to the division of labor. It is argued that in innovation ecosystem the roles of actors in the system are more precisely differentiated than in previous forms of collaboration between actors. Finally, the last distinctive feature states that innovation ecosystems are built more on private than public sector.

Since there is no common, shared and tested definition of innovation ecosystem, it is understandable that the term is used in rather liberal manner. To simplify, as a regional phenomenon, dynamic co-operation between actors is thought to lead to fruitful collisions and co-creation in innovation process (see e.g. Kao 2007). Additionally, entrepreneurial thinking with experimentations supported also – and very importantly so – by public sector activities are identified as essential features of successful and competitive regions. The collaboration of universities, companies and public authorities has obviously been identified as a key factor of success way before the introduction of innovation ecosystem concept¹⁶.

From regional development policy's point of view, the importance of possible confusions and vagueness in the concept of innovation ecosystem should not be exaggerated. To get private sector actors – most importantly companies – involved and to create suitable arenas for these companies to co-operate and co-create with universities and public authorities are widely recognized as an efficient means to generate innovations. As Jackson (2011) states, the innovation ecosystem is linking two economies, the research economy and the commercial economy. In other words, innovation ecosystem as a *modus operandi* requires research activities, commercial actors and collaboration of these. Hence, it is quite unsurprising that if public sector has identified innovations as a potential – and sometimes even an only – source of positive economic development and if there are promising signals about emerging co-operation in the region, there is a strong incentives to channel the public resources to support designing and building of a regional innovation ecosystem. This may explain some of the findings in Oh et al. (2016) about the strong role of the public sector initiating ecosystem activities even though the core of innovation ecosystem relies as well on the private sector actors, the commercial economy.

¹⁶ The seminal work of Etzkowitz & Leyesdorff (1997, 2008) introduced the triple helix concept, which undoubtedly has had a significant effect on the conceptual development of existing innovation ecosystems.

1.3.1 The economic core of an innovation ecosystem

From economic perspective, innovation ecosystem has two definitive dimensions. First dimension is related to reorganizing the industrial relations. In other words, innovation ecosystem refers to certain dynamics in the arrangement of production activities. Second dimension is connected to the public – private relations. Obviously, the definition of an innovation ecosystem does refer also to public sector economics, especially by the introduction of the triple or quadruple helix concept. Whereas the first of these economic dimensions might lead to consider the intentionality of an innovation ecosystem, the second dimension establishes innovation ecosystem as a combination of intentional activities to arrange research, development and production. Undisputedly, it is possible that “natural” development of collaboration of rational companies leads to some co-operative forms that resemble for most parts of what is defined as an innovation ecosystem. It is the role of the public sector that eventually defines the essence of the ecosystem.

The emergence of innovation ecosystem is supposed to change the existing settings in the affected sectors and markets and this change should be observable in economic terms. Depending on e.g. the initial level of competition, innovation ecosystem is affecting both costs and revenues – not only for companies participating in ecosystem but also for other economic agents as the effects are reflected via market mechanisms. To get companies involved in ecosystem, there must be opportunities to gain additional profits. Hence, innovation ecosystem must ultimately appear to lead to decreasing costs, increasing revenues or both.

Despite the increasing popularity of an innovation as a key concept in modern economies, the economic properties of an innovation has remained ambiguous. Since innovation may refer to new products (goods or services) or new production technologies, the outcomes from ecosystem activities may indeed come in the form of cost savings or revenues. Obviously, the fundamental rationale to engage in ecosystem activities – for both private and public agents – is the attempt to increase value added. However, focusing only on the possible economic growth (measured by, say, GDP) reduces the innovation ecosystem as a phenomenon too radically.

From economics’ point of view innovation ecosystem can be seen as the means to achieve (positive) changes. On the other hand, since the functionality of an innovation ecosystem is quite understandably of special interest of decision makers in the case of intentional, public sector driven ecosystem, the measurements are easily steered towards inputs and processes of investigated ecosystem. To satisfy

both of the aforementioned aspects, innovation ecosystem should be translated in economic analysis as a collection of functions rearranging resources and activities to induce change.

1.3.2 Regional shocks, innovation ecosystems and resilience

The general economic development with its fluctuations is bound to have effects on the regional level. Business cycles and their influence on regional development adds another possible cause for regional policy actions. In other words, it is reasonable to recognize and separate the non-cyclical regional development from recession induced development, of which the latter may even refer to case when the economic development on national level is on the balanced growth path and simultaneously certain regions suffer from local recession with its associated consequences, such as rapidly increasing unemployment. The regional or local recessions may have their roots in various factors like industry-specific shocks.

Regions' ability to recover from economic downturns has been recently labelled as resilience, which is used to explain regional differences in the return to growth path after external shocks (Christopherson, Michie & Tyler 2010). Martin (2012) argues that regional resilience consists of four factors: vulnerability, resistance, robustness and recoverability. Unarguably, these properties of regional or local economy are strongly interlinked and, moreover, the aforementioned elements of resilience seem to cover the whole scale of economic activities quite intensively.

As a relatively new concept, regional resilience still needs more research and assessment among academia. However, there are sufficient amount of examples based on the definition that resilience refers to the capacity of a regional or local economy to withstand, recover from and reorganize in the cases of market, competitive and environmental shocks to its developmental growth path (Cooke 2012; Bristow & Healy 2014; Martin & Sunley 2015). Hence, it is comfortable to apply the concept of resilience when considering the options for regional policies.

Regional shock prompts actions from decision makers, but – for the most parts – the policy tools are the same as with gradual, non-cyclical development. Decision makers' ability to identify and apply the correct tools seems essential. Herala et al. (2017) present an extensive study about Oulu region's development in 2009 – 2016 when Nokia Mobile Phones withdrew its production activities from the region and hence caused a somewhat classical case of regional recession with rapidly increasing unemployment. As Herala et al. (2017) demonstrate, the recovery from the

shock has been surprisingly quick¹⁷ and this positive progress is largely due to regional policy encouraging increasing and deepening co-operation and networking of different actors in triple-helix fashion. Moreover, in this case regional shock not only induced new operational solutions but also paved path for regional innovation ecosystem, Oulu Innovation Alliance.

The organization of local economy as an innovation ecosystem seems to be a suitable means to ensure the gradual regional development as well as an effective way to prevent the occurrence of and, if occurring, improve the recovery process from external shocks. Thus, from regional development's point of view it is tempting to emphasize the building of regional innovation ecosystems in policies – and simultaneously reduce the more traditional regional policies with subsidies and public investment policies. However, it should be noted that innovation ecosystem requires certain ingredients of which majority is beyond the control of public sector. In addition, to design regional policy to support the formation and development of regional innovation ecosystem demands proper ways to assess the nature of regional economy – identification of an innovation ecosystem is by no means a straightforward task. Labelling local activities, networks or clusters as an innovation ecosystem without more systematic study is definitely not a satisfactory procedure.

1.4 Northern periphery, the Arctic

As with many peripheries, there are geographical and other obvious contextual reasons to explain the sparse population and desolated essence of the Arctic. Harsh climate conditions with heavy seasonal fluctuation do not alleviate living conditions in these remote – in some cases even isolated – areas. On the other hand, there are vast reserves of natural resources in the Arctic regions igniting continuous economic activities, such as investment projects on the facilities and formation of local production clusters. For instance, based on the geological survey in 2008 the American Arctic was estimated to hold significant shares of world's undiscovered oil and gas resources, 13% and 30%, respectively. O'Garra (2017) estimates that the annual economic value of the Arctic activities in 2016 was \$281 billion. Earlier calculations of the Arctic GDP have resulted in the range of the aforementioned estimate¹⁸.

¹⁷ Northern Ostrobothnia is only region in continental Finland, that has experienced increase (+0,3%) in private sector's workplaces 2012 – 2016, whereas biggest decrease has been in Southern Carelia region (-7,6%) (Statistics Finland).

¹⁸ For example, in 2003 the GDP of the Arctic region was \$225 billion (Duhaime and Caron, 2006).

Despite the fluctuation of the prices of Arctic natural resources, it has been widely reported that the proportional share of the Arctic of the global GDP continuously exceeds the proportional share of the population. The non-renewability of some resources complicates direct conclusions about the economic importance of the Arctic but – for time being – it is comfortable enough to state that the economic activity in the Arctic is not less intensive than in the rest of the world. Valuable resources combined with large-scale investments ensure that the Arctic is not an economic periphery. On national level, the Arctic regions may be important even for the whole nation's wealth¹⁹.

There are slightly differing definitions of the Arctic area, which complicates the analysis of regional development issues. For instance, in some definitions the whole country of Finland is defined as an Arctic area whereas in other cases, like in most studies of Arctic economy (see e.g. Duhaime and Caron 2006; Mäenpää 2008) only Oulu and Lapland regions of Finland are considered as Arctic areas with additional definition of "circumpolar Arctic". From regional development's perspective it is reasonable to apply the latter definition. Additionally, it should be noted that development programs in the North-American Arctic seem to follow quite different path compared to Scandinavian Arctic²⁰. To illustrate differences, in Finland and Norway approximately 10% of the population lives in the Arctic regions whereas the corresponding figure in North-America is approximately 0,2%. Therefore, to highlight the Arctic as a challenge and testbed for regional development policies, it is fruitful to focus on the Scandinavian, circumpolar Arctic.

The interest toward Arctic issues has been on a steady growth path for several years. In addition to natural resources, the speculations about melting of the northern sea route due to global warming have generated various inter-governmental discussions. Moreover, the increasing importance of tourism industry has affected also Arctic area – for instance, as reported by State of Alaska, in Alaska alone the direct visitor spending in 2013 summed up to \$1,8 billion. Leaving issues connected to national safety aside and focusing on economic activities, the Arctic can be seen as a region divided in two different categories. The first category consists of exploitation of Arctic resources. For simplicity, tangible and non-tangible as well as renewable and non-renewable endowment are considered as resources here – the decisive factor is their existence in the Arctic. In the Scandinavian Arctic, mining activities in Kiruna, Sweden and tourism center in Kittilä, Finland can be used as examples of this first category of Arctic activities. The second category

¹⁹ The Norwegian economy is an illustrative example of this kind of situation, whereas in Finland the Arctic dimension is still investigated from wider strategic perspective (see e.g. Thule Institute 2014).

²⁰ As a national strategy, strong emphasis on the exploitation non-renewable natural resources arouses the justified question about the long-term development of northern regions – once the resources are exhausted, substantial withdrawal from the Arctic area seems quite plausible scenario.

represents economic activities that are located in the Arctic but are not, as such, directly linked to Arctic resources. Oulu region with its ICT oriented development activities serves as an illustration of the second category.

Undoubtedly, the Arctic as a periphery has for a longer period of time acted as a serious challenge to regional development policies. Especially, the aforementioned second category of Arctic activities and associated regional policies seems interesting. If it is possible to find suitable and sustainable solutions to induce positive development in these Arctic, yet not directly linked to Arctic resources, regions, these solutions might be helpful in other, less challenged, areas as well. On the other hand, in the case of the first category of activities, regional development policy is quite naturally reduced to cost-benefit analysis of values of resources versus the costs of exploitation of them or to more general political discourse on contradicting views, such as natural values against the economic value of resources.

1.4.1 Current policies and development

Finland became a member of European Union in 1995, preceding of which the Finnish regional policy had already shifted to the era of development programs a couple of years earlier. Thus, to some extent regional development policy of Finland was already becoming increasingly compatible with EU's regional policy in the beginning of membership. Simultaneously with the paradigm shift in the Finnish regional policy, the key drivers for European regional policy were defined (see e.g. Stöhr 1989) and local or regional innovations were identified as key elements in the strategic considerations. The emphasis was laid on the knowledge, technologies and co-operation to form the potential for regional development. Hence, traditional regional policies with government-induced investment and mixture of various subsidies and transfers were seen having only a marginal effect on the balanced development of regions.

In 2000, the economic council published, on the commission from the Finnish government, an extensive report on the regional development after a decade of program-based regional policy. The beginning of the millennium marked also the end of the first period of EU funding Finland had had access to. According to the report, the regional differences were not abolished – it is even unclear whether the gap between regions had narrowed (Valtioneuvoston kanslia 2000). However, due to the prevailing Scandinavian welfare system in Finland, welfare differences between regions are quite modest despite the different economic development paths.

Cheshire & Gordon (1998) divide regional policies – mainly in connection to traditional subsidies et cetera – to zero-sum regional support funding and general growth inducing policies. Additionally, Braunerhjelm et al. (2000) conclude that public sector should identify and acknowledge local clusters or systems based on the knowledge and competence as the foundation for regional development. In 2000, the report to Finnish government suggested quite clearly that the new role for public sector in regional development should be ensuring the framework to regional innovation systems to evolve and supporting the collaboration between actors in different sectors of economy. In other words, the direction of regional policy was concluded almost two decades ago and most of the policy renewals since then have been more or less marginal.

Finland has for most parts followed the designed path in regional policies. Even the abrupt change in mobile phone industry did not alter the main principles of Finnish regional policy – naturally, specific support programs were ignited as a response to local shocks but the foci of programs were kept in increasing knowledge, competences and entrepreneurial activities and not on, say, public sector-driven investment projects²¹. On national level, the economic challenges for public sector are well documented and acknowledged – the engagement to comprehensive regional development programs with subsidies or governmental industrialization projects seems highly unlikely.

Meanwhile, the neighboring countries Sweden and Norway have built their respective regional development programs. Especially Norway has emphasized the need for balanced regional growth since the gap between growth centers and peripheral regions was interpreted to cause serious consequences, such as lack of competent workforce in northern regions²². In both countries, there have existed a mixture of regional support programs representing more traditional development policies. The problems and rather diminutive effects of these policies were identified already in the beginning of the new millennium (Eikeland 1999; Norberg 1999).

To summarize, the current phase of regional development policy in Finland has been already the longest one and it is reasonable to assume that the general outline of the policy shall remain unaltered. It has a strong foundation in the natural development of private sector activities and in the understanding of limited potential of government actions to prevent this development in the global market context. The current regional policies have been put to test when Nokia's mobile phone industry collapsed, which resulted in unforeseen negative effects in some regions in Finland. Finally, the membership of European Union sets limits to national development activities – especially to supporting companies or industries – and

²¹ See e.g. Herala et al. (2017).

²² See e.g. Eikeland (1999).

therefore it has been necessary to adapt regional policy to EU's framework. The northern, Arctic regions do not *per se* seem to present any particular grounds to deviate from the adopted regional policy and the development of the Arctic regions should be built on the assumption of enabling, not directly funding or otherwise financially supporting, public sector.

1.4.2 Oulu as an Arctic innovation ecosystem

The city of Oulu can be regarded as a center of Northern Finland for numerous reasons. With population exceeding 200 000 inhabitants, more than 250 000 when adding the closest municipalities, the hereby measured size of Oulu region alone makes it an exception in the Arctic. Oulu University of Applied Sciences and the University of Oulu are among the largest ones in Finland and even if both universities acknowledge the Arctic expertise and northern opportunities in their strategies, the studies offered and research activities performed by universities of Oulu are somewhat general and similar to other universities in Finland. The structure of production in Oulu has evolved remarkably during the post war decades. Paper and chemical industries dominated production activities for some time but transformation to high-tech oriented production took place from early 1980's on and the apex of this development occurred in the first years of the new millennium.

If the emergence of high-tech and ICT as the dominant industries was rather rapid, the same can be stated about the – at least momentary – collapse of the industry with the negative development of Nokia Mobile Phones. The local clustering of electronic and ICT industries resembled the key concepts of agglomeration economies with the risks and the aftermath when risks were realized (see e.g. Porter 1996). The fluctuation in regional economy has been therefore very harsh and the effects of variation have been numerous. Herala et al. (2017) provide a comprehensive view on the Oulu region's recent development paths and conclude that, as a matter of fact, region's production sector has now been adjusted to a new development path in which the growth is searched from, for example, data-oriented services. To be successful in global competition, industries based on competences and knowledge require favorable conditions for innovations and product development – especially if the local production sector consists more of small and medium sized companies than big, multinational ones. Co-operation between research, development, education and companies is a necessary condition for suitable regional innovation system (see e.g. Etzkowitz et al. 2000; Keeble et al. 1999; Saxenian 2005).

One of the focal instruments in developing regional co-operation in Oulu region has been Oulu Innovation Alliance (OIA). The agreement between the central Research, development and innovation (RDI) organizations, universities and the city of Oulu has provided a suitable platform to ensure the collaboration required in regional development. OIA itself has developed from innovation center-based RDI coordination (2009 – 2015) to innovation ecosystem-based co-operation and co-creation (2016 -) which is aimed at exploiting the results from RDI activities in commercialization. The structure of OIA reveals two noteworthy things. First, the themes of innovation ecosystems state quite clearly the region's key actors' views about the potential growth industries in the future. Secondly, the organizational structure of the alliance and the coordination of ecosystem are designed in a rather lean way. Thus, the direct costs of OIA are estimated to be quite low.

Even though it is too early to make conclusions about the success of the applied regional policy in Oulu, it is, from an analytical point of view, possible to highlight three meaningful findings. First, Oulu is an interesting and somewhat exceptional case for studying regional development in modern, interlinked economy. Secondly, Oulu has definitely been a testbed for the recent mainstream of Finnish regional policy dominated by development programs instead of public sector driven investments or expenditures. Third finding is that the recent regional policy in Finland does not as such ensure immunity from external shocks – ability to resist the effects of fluctuation requires more regional solutions.

To summarize, Oulu is, by definition, an Arctic city that has gone through rapid cycles of development – from industrial production to technology-based growth hub and finally through a severe local economic shock to a new stage of growing service sector based on the high technology and knowledge. Remote location, Arctic conditions and continuous concerns about the attractiveness of the region in the future are simultaneously contextual facts in Oulu as well as in other peripheral areas. Tromsø in Norway and Luleå in Sweden are the neighboring counterparts to Oulu. These three regions form together a group of interesting peculiarities in the Arctic and also among peripheral regions in general. In these regions, the Arctic undoubtedly offers concurrently challenges and opportunities.

1.5 Summary of essays

1.5.1 *Is there an Arctic ecosystem emerging? Oulu region's perspective*

As part of recovery from the sudden change in regional structure of production and local recession with increasing level of unemployment and justified concerns about the future development of the region, the main research, development and innovation (RDI) actors formed Oulu Innovation Alliance (OIA) as a co-operation platform. In 2015, the contract for OIA was renewed and the operational structure of the alliance was revised. New OIA should be a very lean and agile coordination organ with only diminutive separate activities and most of the actual development should be performed by founding organizations. The new functional form of OIA is defined to be based on five innovation ecosystems.

At the same time, there has been increasing interest toward Arctic issues, which is demonstrated, for instance, in the strategies of various actors in Oulu region. Despite the interest and publicly expressed intentions towards the Arctic, there are only limited amount of studies contributing to common, shared understanding of the essence of the Arctic – especially from businesses' point of view.

In this research, a two-step analysis was conducted. The first step was to assess whether the planned new form of Oulu Innovation Alliance has the required properties to become a genuine innovation ecosystem. Preparation documentation and proposed plans of new OIA were reflected from the point of view of key elements of innovation ecosystems as proposed in literature.

The second step of analysis consisted of investigating the Arctic dimension from the planned OIA. To enable this analysis, the Arctic needed to be sufficiently defined as a context and this definition had to be applied to Oulu region in terms of the relevance to regional actors. Here, in addition to aforementioned OIA documentation, data from two recent projects was exploited to illustrate the actors' perception of the Arctic.

For these two research questions, the answers seemed quite unambiguous. First, when evaluated in the planning stage – before the actual operations – the new form of Oulu Innovation Alliance did meet all the prerequisites as an enabler of the development of regional innovation ecosystems. As a response to the second research question, the conclusion was that even if OIA ignited innovation ecosystems to Oulu region, these ecosystems are unlikely to become significantly Arctic ones. The Arctic was not seen as a pervasive factor – at least not in the planning stage of OIA.

Finally, this study showed that, compared to previous attempts to assess the importance of the Arctic dimension for development activities, the innovation ecosystem approach seemed to offer more applicable tools for analysis than, say, the individual project plans and reports or singular strategies of different organizations.

1.5.2 Arctic potential – Could more structured view improve the understanding of Arctic business opportunities?

The general and economic importance of the Arctic has been widely explicated and analyzed, which has prompted decision makers to investigate the Arctic potential more closely. However, the actual Arctic business activities from Oulu regions' companies have yet been far from estimated potential. In this research, the main intention was to develop a model to collect the Arctic views from different strategic and operational levels and to analyze whether there are discrepancies between different levels. This approach was assumed to reveal more precisely the reasons for lacking economic activities in the Arctic.

The model presented in this research paper consists of three different layers and hence the approach is labelled as a layered one. The first layer is the phenomenological approach to the Arctic regions, which should enable not only the identification of essential features of the Arctic from the businesses' point of view but also the analysis of various trends possibly affecting the Arctic potential. The second layer is the strategy analysis, which is upper-level operationalization of different development paths. In this research, it was argued that the second layer must be consistent with the first one.

The third layer in this model is the business context, which means operationalization of the strategic level to the level of practical business operations. With this layered approach it was possible to combine findings from different, and to some extent very heterogeneous, pools of documentation. As an analytical tool, this approach seems to alleviate the challenging investigation of insufficiently defined phenomenon, such as Arctic business.

The analysis performed in this research revealed that the second, strategic layer contained four different development paths that were quite straightforwardly based on the coherent understanding of the Arctic as a context. However, from the third, business layer it was possible to identify resemblance to only two of four aforementioned strategies. Here, it was argued that there is a need for public sector as a

provider of information, builder of common understanding and as a mediator between different actors – otherwise, the Arctic potential will remain inaccessible from the Oulu region's perspective.

1.5.3 Arctic Innovation Hubs: Opportunities for Regional Co-operation and Collaboration in Oulu, Luleå, and Tromsø

The Scandinavian Arctic is an interesting example of regional development in peripheral areas. Three cities (Oulu, Luleå and Tromsø), in three countries (Finland, Sweden and Norway) with strong emphasis laid on the development of local innovation systems and intentions to knowledge-based specialization do face same kind of challenges as well as opportunities. Due to similarities in operating contexts, it seems plausible that co-operation between these cities would be beneficial.

In this research, three cities from northern Scandinavia were analyzed as regional innovation hubs. The main intention of the research was to formulate adequately accurate analytical framework to enable comparison of regions and hence to identify main similarities and differences between them. Comparison of regions was performed to investigate potential forms of collaboration in the Arctic in detail.

The research report contains a literature review on the innovation hub concept as well as numerous case examples from the Arctic innovation hubs. A brief summary of each analyzed region is presented in addition to more detailed description of regional innovation system of Oulu (Oulu Innovation Alliance). Analyzing innovation hubs as platforms for regional economic development required inclusion of commercialization as a core function of regional policy. Therefore, linkages between innovations, collaboration and competitiveness were defined as part of this research.

It was argued that even though all innovation hubs and their commercialization activities have been defined to meet region-specific challenges, the already realized specialization in each region provides a promising basis for co-operation between hubs. The initial division of labor was introduced as an ignition to further discussions.

1.5.4 Technological change in a computable general equilibrium framework

The seminal insight of general equilibrium analysis is to illustrate and elaborate complexity and diversity of market interdependencies. Originally properly introduced in the works of Walras, general equilibrium approach provides a coherent method to examine the total economic effects of various changes in markets. Linkage between factor and good markets is rather evident for modern economics as is the difficulty in assessing the future effects of any foreseen change. During past decades, the framework of computable general equilibrium (CGE) has evolved to increase significantly the applicability of general equilibrium analysis.

In a typical policy analysis, the progression and objectives of the analysis are quite straightforward. The consequences of changes in the taxation structure or restrictions in international trade are relatively easy to model. In these cases, the main purpose of CGE approach is also understandable – main focus is in the total effects of the suggested change. Inputting the distortion to created model brings the anticipated results.

As has been shown, the CGE framework enables the expansion of the scope of the investigated distortions. It is possible to move away from analyzing taxation or trading towards more abstract and – in strictly economic terms – less defined changes. This gives rise to another crucial stage in CGE modelling process: the definition and formulation of the change.

In this essay, the options to include innovations and technological change in a CGE model are introduced and assessed. Dynamic nature of technological change is argued to explain the observed outcomes from policy changes and hence it is justified to adjust standard CGE models to account for economic agents' innovative actions. Moreover, since in political arenas a lot of emphasis has been laid to economies' ability to continuously develop new solutions to increase efficiency or to provide competitive goods for markets, it seems unavoidable to address technological change in economic modeling. As is highlighted in the essay, applicability of different methods to include technological change in CGE modeling is depending on the investigated case. However, the stock of knowledge approach is considered to capture the true nature of innovation processes in the most satisfactory way.

1.6 Conclusions

The main driver for research activities described in this dissertation has been to create a detailed and versatile picture of regional economic development in one of the most challenging peripheries, the Arctic. Moreover, the recent trend of regional policy consisting of different development programs aimed at enabling and facilitating actors of private sector instead of traditional public sector-driven policies, calls for continuous studies and analyzes. So far, only minor proportion of the rather vast literature covering different approaches to modern regional or local economies has been focusing on the peripheral areas.

The Scandinavian Arctic represents a notable exception in the framework of global peripheries. Research and development activities in the region are noteworthy and economic activities diverse. However, one of the research missions in this dissertation was to deepen the understanding of regional development possibilities and during the research a model to assess the essence of innovation system or ecosystem was developed and tested. To be able to conclude the true nature of local economy, it is inevitable to combine information from various sources. In this research, research data consisted of primary and secondary data collected in two different research projects. In addition, it was considered necessary to have different approaches to regional development and therefore, there were multiple paths in the research process covering public and private sector views in both strategic and operational level.

Research efforts reported in this dissertation provide a comprehensive view on the recent Finnish – and for most parts European, as well – regional development policy and its applicability in the very specific context of the northern periphery. It has been shown that efforts and attempts to recover from regional economic distortions seem to adapt to the general outline of the regional policy. Moreover, the re-organizing of regional activities in Oulu region do display somewhat unique properties which, as has been concluded in this research, are indeed operational and practical and not only visions nor strategies.

The latest evolution of regional economic policy relying on private sector agents' innovative activities that are supported and enabled by public sector, has been thoroughly assessed in this research. The case examples from the Arctic and especially from Oulu region demonstrate that with available tools for regional development, the new wave of policies seems reasonable. There are strong indications toward balanced regional growth.

As it has been studied in this research, research, development and innovations will have a substantial role in regional development. Therefore, it is necessary to build analytical tools to evaluate technological change as part of the economic development. Therefore, one possible analytical method has been presented as part of this research in the form of computable general equilibrium (CGE) modeling.

CGE models have been used regularly to assess economic effects of defined changes and regional applications are quite widely used to support decision making. However, the standard CGE models usually omit the dynamics of technological change, which seems highly unsatisfactory since policy decisions are either affecting or directly aimed at innovations and technological change.

Even though research presented in this dissertation is offering a new and multi-angular view on the development of the regional economy in the Arctic, there is still an obvious need for further research. For instance, the Arctic dimension was found to be rather shallow in regional innovation systems, even in the Arctic region. The relevance of the Arctic context to economic activities requires more detailed analysis. In addition, simulation models adapted to assess impacts of distortions to regional economies when taking account for technological change is yet to be defined. A CGE model with technological change embedded for the Arctic region would be useful but, as was concluded in this research, the data requirements are staggering. Continuously developing information technology and digitalization may offer interesting opportunities for CGE modeling in the future.

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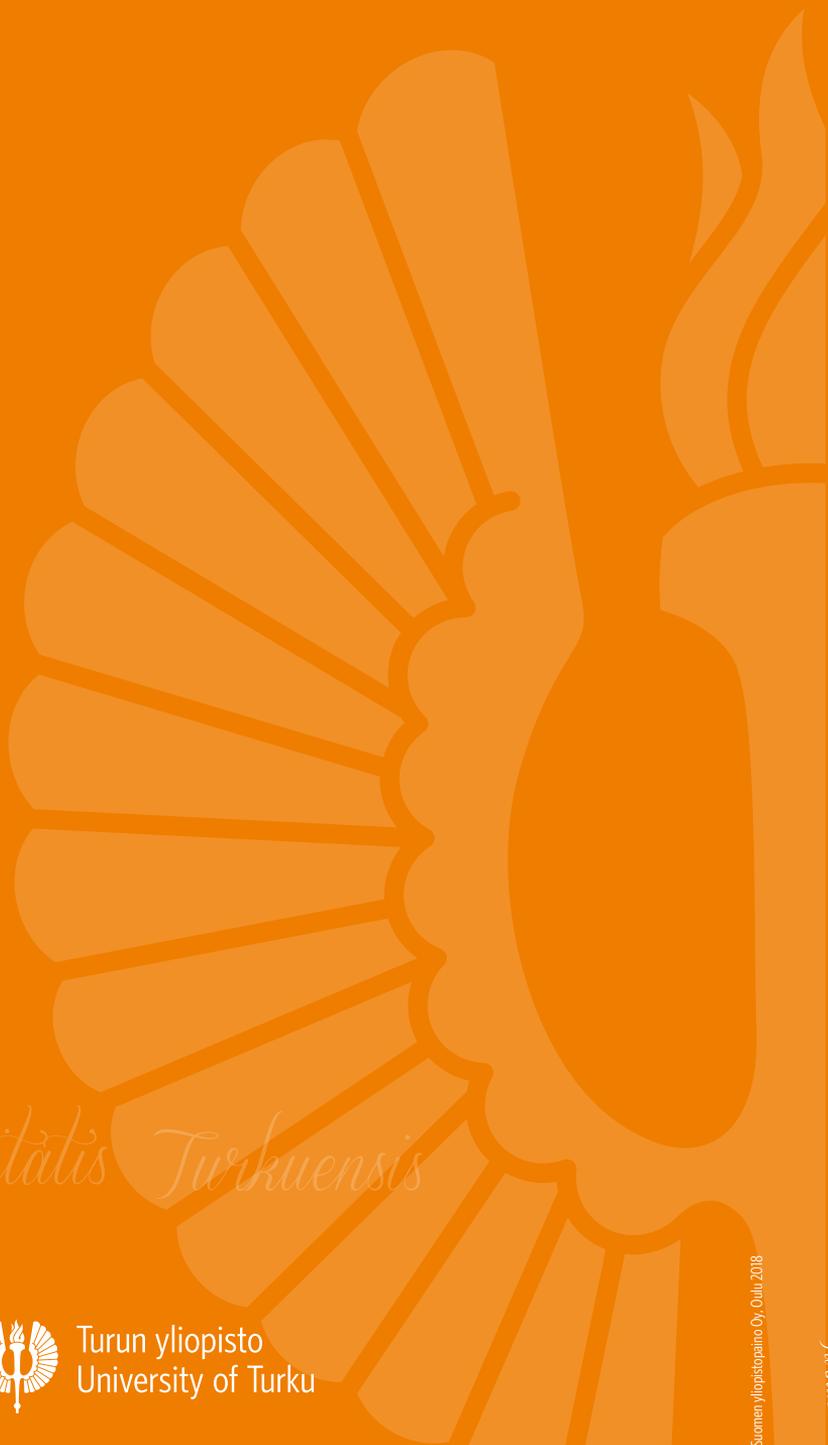
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