



Paper to be presented at the  
DRUID Society Conference 2014, CBS, Copenhagen, June 16-18

## **The Effects of Exogenous Shocks on the Development of Regional Innovation Systems**

**Krister Salamonsen**  
University of Nordland  
Bodø Graduate School of Business  
krister.salamonsen@uin.no

### **Abstract**

This paper draws on previous studies related to the evolutionary aspects of regional innovation systems (RIS), and contributes to these venues by examining how an exogenous shock reduced organisational thinness, fragmentation, and lock-in and thereby facilitated path creation and RIS emergence in a peripheral region. A longitudinal case study approach, based on primary data from 55 interviews conducted between 2008 and 2012, is used to investigate how a region was affected by the sudden entry of a multinational oil company, and its following activities. A multi-level analysis illustrates how an exogenous shock facilitated change at the firm, public and macro (regional) level. This provides a holistic understanding about the complex mechanisms that underlie regional transformation. The analysis illustrates how the entry of the oil company reduced organisational thinness by stimulating the establishment of external firms. As a result, the existing regional actors managed to reduce their organisational lock-in by adapting their existing skills and resource bases with new knowledge provided through interfirm relationships (reduced fragmentation). This led to a strengthening of the institutional structure, and further contributed to regional path creation. An emerging RIS was observed in the wake of the transformation from path dependency towards path creation.

# The Effects of Exogenous Shocks on the Development of Regional Innovation Systems

## **Abstract**

This paper draws on previous studies related to the evolutionary aspects of regional innovation systems (RIS), and contributes to these venues by examining how an exogenous shock reduced organisational thinness, fragmentation, and lock-in and thereby facilitated path creation and RIS emergence in a peripheral region. A longitudinal case study approach, based on primary data from 55 interviews conducted between 2008 and 2012, is used to investigate how a region was affected by the sudden entry of a multinational oil company, and its following activities. A multi-level analysis illustrates how an exogenous shock facilitated change at the firm, public and macro (regional) level. This provides a holistic understanding about the complex mechanisms that underlie regional transformation. The analysis illustrates how the entry of the oil company reduced organisational thinness by stimulating the establishment of external firms. As a result, the existing regional actors managed to reduce their organisational lock-in by adapting their existing skills and resource bases with new knowledge provided through interfirm relationships (reduced fragmentation). This led to a strengthening of the institutional structure, and further contributed to regional path creation. An emerging RIS was observed in the wake of the transformation from path dependency towards path creation.

## **1. Introduction**

For decades, innovation as a measure for economic development has been central in developing policy initiatives at a national scale. This gave birth to the concept of national systems of innovation which emerged in the 1980s (Asheim et al., 2011). This concept can be defined as a system where private and public firms, universities, and governmental agencies interact while aiming for the production of science and technology within national borders (Niosi et al., 1993, p. 212).

Since the early thoughts of the nation as a geographical determinant for innovation, however, the role of regions in contributing to innovation and national economic development has been raised. A region can be viewed as “a territory less than its sovereign state, possessing distinctive supralocal administrative, cultural, political, or economic power and cohesiveness, differentiating it from its state and other regions” (Cooke et al., 1998, p. 1573). This emphasizes that regions, whether being central or peripheral, has its unique sets of traditions, competencies and institutional composition.

The increasing focus on regions as important contributors to innovation and national economic development have fostered the concept of regional innovation systems (RIS). A regional innovation system can be seen as the institutional infrastructure facilitating innovation among producers in a region (Asheim and Gertler, 2005), including actors such as firms, support agencies and research institutions (Cooke et al., 1998). The RIS concept has mainly been studied in core regions characterized by knowledge-intensive industrial sectors

where firms possess well-developed innovative capabilities (Doloreux and Dionne, 2008); a trend characterised as the “Silicon Valley fever” (Benneworth, 2003). In smaller, peripheral regions, the capacity to innovate and stimulate growth patterns will often suffer from the absence of relevant actors with rich resource bases and technological capabilities. Also, existing literature has failed to capture the way in which RIS reconstruct and evolve over time (Tödtling and Trippl, 2013).

This paper aims to develop existing literature by illustrating how a RIS emerged due to the moderating effect of an exogenous shock on organisational thinness, fragmentation, and lock-in. The following research question is thus posed: “How can exogenous shocks stimulate the emergence of regional innovation systems”?

A small and resource deficient region in northern Norway makes up the empirical context, and the exogenous shock is represented by the entry of a multinational oil and gas company which facilitated regional transformation. Longitudinal data from 55 interviews is used to analyse the case and to illustrate how the region developed from 2008-2012. The focus of the analysis is to shed light on how the exogenous shock affected RIS emergence. Three variables of path dependency, which particularly relates to problem regions (Isaksen, 2001), are identified and elaborated. First, the issues of organisational thinness is discussed by looking at how the composition of firms developed due to firm establishments and start-ups. Second, I investigate how the degree of fragmentation was reduced, thus facilitating interaction and collaboration at the firm and public authority level. Finally, I illustrate how the lock-in of existing regional firms and the public institutions was reduced resulting from path creation processes.

In the following sections, first a presentation of existing literature about regional innovation systems and path dependency is presented. A particular focus will be directed towards organisational thinness, fragmentation, and lock-in. Furthermore, the methodology and a description of the empirical context is presented. Next, I present the findings and discuss the evolutionary process of RIS emergence. Finally, the study’s conclusions and implications are discussed, before closing with a discussion about the limitations of the study and suggestions for further research.

## **2. Theoretical Framework**

### **2.1. Regions and Regional Innovation Systems**

The role of regions in contributing to innovation and national economic development receives increasing attention. Scholars from different research fields have studied region-specific phenomena through a variety of lenses, and a number of concepts have emerged. Some have looked at proximities as a mean for interfirm collaboration (Knoben and Oerlemans, 2006, Balland, 2012), and innovation (Boschma, 2005, Weterings and Boschma, 2009). Others have focused upon systemic structures, such as industrial clusters (Porter, 2003, Karlsen, 2005, Brenner, 2006) and regional innovation systems (Cooke, 1998, 2001, Doloreux and Dionne, 2008, Asheim et al., 2011, Tödtling and Trippl, 2013).

Regional innovation systems (RIS) have been defined in several different ways. For example, Asheim and Coenen (2005, p. 1173) defines RIS as a “[...] constellation of

industrial clusters surrounded by innovation supporting organisations”. Cooke et al. (1998, p. 1581) defined RIS as systems “[...] in which firms and other organisations are systematically engaged in interactive learning through an institutional milieu characterised by embeddedness”. While the first definition specifically includes the concepts of clusters and innovation, the latter definition views RIS more loosely. In general, RIS consists of four basic elements; firms, institutions, knowledge infrastructure, and innovation-driven policies (Doloreux, 2002), which can be divided into two subsystems: the knowledge application and exploitation subsystem (firms), and the knowledge generation and diffusion subsystem (institutions, knowledge infrastructure) (Autio, 1998). Furthermore, RIS are shaped by traditions, existing industries and inherent knowledge bases (Tödtling and Trippl, 2013), and they are characterised by interactive learning, knowledge production, proximity (spatial agglomeration, reduced transaction costs, and cultural/social belonging), and social embeddedness (Doloreux, 2002).

Several scholars have attempted to illustrate that RIS take on a number of shapes and characteristics, thus a number of typologies exists (Cooke et al., 2000, Asheim et al., 2003). For example, Asheim (2002) refers to three main types of RIS; 1) territorially embedded regional innovation networks, in which innovation activities are premised by the relations between actors located within the region (i.e. spatial proximity). Little or no interaction exists between firms and knowledge institutions; 2) regional networked innovation systems, in which R&D institutions and other supporting infrastructure are added. The actors in this type of RIS are still embedded in a specific region, but the interaction between firms and supporting infrastructure is more of a deliberate nature; and 3) regionalized national innovation systems, which are characterized by less dependency on localised learning and spatial proximity. In this type of RIS, national and international organizations often provide knowledge to regionally embedded firms and institutions (Asheim and Coenen, 2005).

Empirical studies have illustrated that RIS characteristics are very much based on idiosyncratic conditions, thus there exists no universal conceptual model (Doloreux and Parto, 2005). Cooke and Morgan (1998) illustrates this conceptual ambiguity by stating that, by a strict reading of current literature only three regions deserves the status as RIS; Silicon Valley (high-tech), Emilia-Romagna (automotive and agro-food), and Baden-Württemberg (automotive and ICTs). Related to this view, Andersson and Karlsson (2006) depicted an illustration of what constitutes a ‘complete’ RIS structure. According to the authors, the core of a complete RIS is based on specialised and concentrated firms and knowledge. This core is surrounded by complementary and supporting firms which, in turn, operates according to institutions (structures which facilitate collaboration and knowledge spillovers/transfer), infrastructure (physical, technological, and knowledge), and incentives (sources of financial inputs) available in the region (Andersson and Karlsson, 2006). This view on RIS denotes the optimal composition of ingredients, and thus represents an extreme angle of approach.

Tödtling and Trippl (2005) extends the concept by illustrating that also sub-optimal RIS exists despite being limited by different types of, and degrees of, deficiencies. The authors related different RIS deficiencies to three typical “problem regions”; peripheral regions, old industrial regions, and fragmented metropolitan regions, and suggested a number of tailor-made innovation policies to handle such deficiencies (Tödtling and Trippl, 2005). The results of their study provides a richer conceptual understanding of RIS, and also a

method for studying RIS in less favourable regions. Moreover, their findings strengthen the notion of regions being idiosyncratic entities (Isaksen, 2001).

Existing studies have focused mainly on successful regions, thus there exists limited knowledge about RIS in smaller regions (Doloreux and Dionne, 2008). Part of the explanation to this fact may refer to the way in which innovation is viewed. Some successful regions and agglomerations are recognized by their ability to develop radical innovations which even has the potential to influence global markets. Such areas are often recognized by rich institutional structures consisting of leading firms and institutions, and focused R&D activities. Weaker regions will often suffer from the absence of actors with rich resource bases and technological capabilities, thus innovation activities tends to be incremental and reactive (Sternberg, 2000, Tödtling and Kaufman, 2001). Rather, weaker regions are often dominated by SMEs that tend to suffer from liabilities additional to their small size (Cooke, 1996).

RIS emergence depends on idiosyncratic regional conditions. For example, the ability to innovate differs among regional firms due to varying degrees of sectorial specialisation (Tödtling, 1992). Furthermore regional firms differ in their ability to engage in interfirm interaction (Cooke and Morgan, 1998). At the regional level the capacity to build up relevant institutions, financial resources, and policy orientation also affect the propensity of RIS to emerge (Braczyk et al., 1998).

By taking a broad view, in this paper the concept of RIS incorporates “[...] all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring” (Lundvall, 1992, p. 12). Also, innovation is viewed in a broad sense by including incremental changes such as small changes in products and processes, and new organisational tools, not only radical innovations (Freeman, 1995, Tödtling and Trippl, 2005).

## **2.2. Exogenous Shocks on Organisational Thinness, Fragmentation, and Lock-in**

While RIS and agglomerations such as clusters are often associated with superlatives, peripheral/rural regions exists at the other end of the economic geography scale. Peripheral regions are often associated with low levels of R&D and innovation, lack of extra-regional linkages, and lack of knowledge providers and support institutions (Tödtling and Trippl, 2005). These problem areas relates to the following question; why do some regions manage to renew themselves, whereas others are unable to break free from declining trajectories (Martin and Sunley, 2006)?

The negative descriptions illustrated above can often result from different types/degrees of path dependencies. Path dependency refers to processes or systems whose outcome evolves as a consequence of the process’ or system’s history (Martin and Sunley, 2006, p. 399). While path dependency denotes a more general view of systemic characteristics, three particular concepts have emerged from the path dependency literature, i.e. organisational thinness, fragmentation, and (negative) lock-in (Grabher, 1993, Isaksen, 2001, Asheim et al., 2003, Martin and Sunley, 2006). These concepts emerged because of their relatedness to particular problem regions such as peripheral regions (organisational thinness), metropolitan regions (fragmentation), and old industrial regions (lock-in) (Isaksen, 2001, Tödtling and Trippl, 2005).

Organisational thinness refers to a scarcity of relevant actors (key organisations, firms and institutions) which possess resources that can facilitate innovation activities (Tödtling and

Trippl, 2005). This can stem from regional deficiencies such as lack of decision-making powers, financial resources, or policy orientation (Tödting and Kaufmann, 1999). Studies have shown that attracting or facilitating the creation of such missing resources depends on either influencing regional supply, or by stimulating regional actors to establish extra-regional linkages (Isaksen, 2001). Innovation is not generated in isolation by relying exclusively on firms' existing resource bases (Doloreux, 2002), thus external/extra-local linkages have shown to be of particular importance because it provides access to information, knowledge, and technologies that are rarely generated within geographically bound regions (Bunnell and Coe, 2001). Scholars support the view that the inflow of external knowledge, related to existing knowledge in a region, has the potential to enhance interactive learning and growth (Tallman et al., 2004, Håkanson, 2005, Boschma and Iammarino, 2007).

Fragmentation refers to situations where relevant firms exist but do not interact (Kaufmann and Wagner, 2005) due to either a lack of trust between regional actors (Isaksen, 2001), or simply because regional actors are unfamiliar with one another and thereby fail to see potential synergies (Nilsson and Moodysson, 2011). As a result, interactive learning, innovation activities and the pace of new firm establishments is often lower than other regions (Tödting and Trippl, 2005). Moreover, a lack of network embeddedness may impair firm performance (Lechner and Leyronas, 2012, Salamonsen and Henriksen, 2014). Previous studies have suggested that fragmentation can be mitigated by improving relational assets that can lead to closer interfirm collaboration between regional firms (Isaksen, 2001, Tödting and Trippl, 2005). Isaksen (2001) claims that policy measures can facilitate such relational behaviour by inviting and engaging regional actors to take part in shaping collective programs, or by providing bridges between regional firms and resource providers.

Finally, lock-in refers to situations where sequential patterns of activity and behaviour forms a fixed trajectory; a trajectory which becomes costly and difficult for actors (firms, organisations, support institutions, etc.) to break free from (Setterfield, 1997). Lock-in thus has the potential to hinder development and innovation because actors become unable to adapt to changing environments (Narula, 2002, Tödting and Trippl, 2005).

Previous studies have illustrated that within regions, information sharing and knowledge development occurs more frequently among actors due to localized linkages and the "stickiness" of information (Asheim and Isaksen, 2002, Boschma, 2004, Bell, 2005). This is in line with the findings of prior studies focusing on different concepts of industrial agglomerations (Cooke, 2002, Porter, 2003, Dahl and Pedersen, 2004, Ellison et al., 2010). However, these characteristics are not solely beneficial. If regional actors are bounded by common beliefs, norms and values, and also suffer from a lack of external orientation, the results may be harmful (Hassink and Shin, 2005). This was illustrated by Grabher (1993), who provided an account of how the successful industrial district in the German Ruhr area experienced dramatic decline during the 1960s and 70s. Grabher illustrates how the reliance towards iron and steel production led the Ruhr area into the "rigid specialisation trap", resulting from functional, cognitive, and political lock-in. These lock-ins were characterised by strong ties between regional actors (core firms, suppliers, local authorities, and governmental bodies), long-term stability and predictability of demand for iron and steel, and demand for supply services supporting the major plants. Years of specialisation and

investments towards predictable market structures led to a situation where actors, due to collective rigidity and inflexibility, failed to react to the industry's downturn (Grabher, 1993).

Cooke et al. (1998, p. 1578) stated that regional economies are suitable contexts for studying issues of lock-in, particularly when regions reconverts from older to newer industries or when regions go through restructuring processes within path-dependent sectors. Such restructuring may occur when organisations face externally driven alterations. Externally driven alterations are termed exogenous shocks, described as events external to the firm that has the potential to significantly influence the destiny of the firm (Newey and Zahra, 2009, p.83). Examples of such events are terrorist attacks (Li and Tallman, 2011), financial recessions (Haas and Horen, 2012), and economies transforming from closed to open (Meyer-Stamer, 1998). If organisations are reluctant to restructuring, they often prefer to maintain their status quo. Therefore, exogenous shocks (changes in a firm's surroundings) have shown to function as a powerful mean for reduction or even disruption of lock-in (Grabher, 1993, Narula, 2002, Doloreux and Dionne, 2008). Vergne and Durand (2010, p. 752) even sees exogenous shocks as a requirement to "[...] shake the system free of its history".

Scholars have suggested a number of means for escaping regional lock-in. One example is path creation processes (Garud and Karnøe, 2001, Stack and Gartland, 2003). Path creation entails the gradual emergence of new paths, side by side with the old path (Schienstock, 2007), and this has shown to be a successful process when regions diversify into related industries by building on inherent resource bases (Boschma, 2007). The transformation process has shown to depend on the commitment of change agents, such as entrepreneurs, politicians, and scientists (Schienstock, 2007).

Moreover, studies have illustrated that path dependent trajectories don't need to be fully abandoned in order to adapt to new paths (Boschma, 2007). Conversion, i.e. the use of previous knowledge to develop new technologies, and "layering", i.e. the addition of new technology while still employing previous technologies, are mentioned as modes for new path creation (Simmie, 2012). Others have suggested that diversification into related industries, or upgrading of existing industries, as potential means for restructuring (Anderson, 2000, Best and Xie, 2006, Martin and Sunley, 2006).

The previous sections of this paper discussed the concepts of regional innovation systems, and the potentially mitigating effects of exogenous shocks on three innovation barriers; organisational thinness, fragmentation, and lock-in. By employing a broad view on innovation (Freeman, 1995), this study assumes that exogenous shocks has the ability to lower innovation barriers, and thereby transform regional actors' path dependencies towards path creation processes. As a result of the transformation from path dependency to path creation, due to the reduction of organisational thinness, fragmentation, and lock-in, sub-optimal RIS can emerge in peripheral regions (Tödtling and Trippl, 2005). Finally, in peripheral regions which are often characterised by weak institutional structures, an assumption can be made that the interconnection between the different layers of regional actors is of high importance.

### 3. Method

#### 3.1. Design, Data Collection and Data Analysis

Due to the need for further empirical insight about regional innovation systems in peripheral regions, a longitudinal case study approach was chosen (Yin, 2009). I investigate a small coastal municipality in northern Norway in order to illustrate how an exogenous shock facilitated regional development and institutional restructuring. The rationale for selecting the particular region is its major transformation from a state of stagnation and decline, to a situation of prosperity and expansion due to increased oil and gas activity in the region. Section 3.3 provides a thorough description of the case region.

In order to address the study's research question, the dataset comprises both primary data and secondary data. The primary data consists of 55 semi-structured interviews, collected between 2008 and 2012 (Table 1). The secondary data mainly consists of reports published by Norwegian research institutions (both private and public), based on quantitative and qualitative data related to petroleum developments in Norway. In addition, statistical data from the national statistics bureau (Statistics Norway) have been used for demographical insight.

Interviews were mainly conducted with individuals representing firms and public institutions within the region, but also individuals representing national firms and other institutions were interviewed. The interviews followed a narrative approach (Pentland, 1999), where informants were encouraged to speak freely around themes derived from literature. In order to obtain richness in the dataset, three categories of informants were included; business representatives, public officials and sector experts<sup>1</sup>. The reason for this variety in, and number of informants, is for the purposes of triangulation and reduced informant bias, and for the desire to acquire rich descriptions (Eisenhardt and Graebner, 2007). On average, each interview lasted for 45 minutes, while interviews with key personnel lasted up to two hours.

During 2008, a rich fieldwork was conducted in order to obtain contextual insight. In addition to 18 formal interviews, several firm visits were made and two regional oil and gas conferences were attended. In the following years further interviews were conducted, mainly being interviews with new individuals, but also follow-up interviews with central informants. Forbes and Kirsch (2011) argued that there is a need for further qualitative empirical studies in order to fully understand emerging industries, and that scholars must gather and analyse data that document the larger context of industry creation more fully. This study was

Table 1. Overview of informants

Year	Firm representatives	Public officials	Sector experts	Total
2008	11	5	2	18
2009	8	3	0	11
2010	6	1	1	8
2011	6	2	2	10
2012	5	2	1	8
Total	36	13	6	55

<sup>1</sup> Sector experts refers to individuals which possess specialised knowledge about oil and gas developments.

carried out in parallel with a number of events that eventually facilitated regional development. The data material thus managed to capture the evolutionary aspect of how a region transformed due to an exogenous shock, by monitoring events as they unfolded. This approach made it possible to acquire data that may have been difficult to obtain in later stages (Forbes and Kirsch, 2011).

All the semi-structured interviews were recorded and transcribed verbatim. As a first step of the data analysis, the Nvivo software was used as a tool for coding the material into three first-order categories; stagnation and decline; exogenous shock, orientation and restructuring; and emerging regional innovation system. These initial categories were based on the evolutionary aspect of the regional transformation. A second stage of the coding process was conducted by integrating first-order categories with the theoretically driven concepts of organisational thinness, fragmentation, and lock-in. Parts of the coding process was undertaken with the aid of fellow researchers, thus strengthening the reliability of the interpretations and categorising.

Finally, the analysis included a process of credibility strengthening. First, when the interviews were transcribed, written copies were sent back to each informant for confirmation. All the transcribed interviews were accepted, except for two which required parts of the information to be excluded due to issues of confidentiality. A second round of member checking was conducted by allowing key informants to reflect upon main findings and interpretations (Sykes, 1991).

### **3.2. Empirical Context**

The focal region is a small coastal community situated in northern Norway, with a population of 7397 (2013 Q3). The municipality is one of three city centres in a larger administrative region consisting of 18 municipalities and a population of 78164 (2013 Q3). The focal region has long traditions in primary industries such as agriculture and fisheries, and also a long history of basic mechanical services related to offshore vessels.

Data from Statistics Norway<sup>2</sup> shows a rapid reduction in the number of firms operating in traditional low-tech industries (agriculture, fishing, and wholesale and retail trade in particular) from 2002-2013. In 2002 the aggregate number of firms in the region was 720, and this number was further reduced to 693 in 2005. In 2013 the number had increased to 792. Between 2002 and 2013, agriculture, fishing, and wholesale and retail trade represented a decrease of 68 establishments while construction, real estate activities, and other service activities represented an increase of 112 establishments. In effect, the entry of the oil and gas industry counterbalanced the decrease in the aggregated number of regional firms. This alteration shows that the regional composition of industries is moving from a dominance of primary industries towards more contemporary and value-added sectors represented by the oil and gas industry.

In addition to the change in the industrial composition, other variables further illustrates how the region has transformed. The regional population increased from 7225 in 2006 (Q4) to 7397 in 2013 (Q3)<sup>2</sup>. The increase of 172 citizens is not substantial, but more importantly, the population had changed from years of decline to a modest annual increase. In

---

<sup>2</sup> Statistics Norway: [www.ssb.no](http://www.ssb.no)

Table 2. Oil and gas related establishments and their turnover<sup>3456</sup>

	2006	2008	2010	2011	2012
Establishments	6	13	17	21	23
Turnover (million Euros)	7.5	16	35	41	57

addition to an increase in the population, there has been a substantial increase in labour mobility. A large amount of workers commute from nearby municipalities, thus illustrating an increased employment in the focal region. The local airport experienced an increase from 49.000 to 79.000 passengers in the period between 2006 and 2012. This increase positively affected existing hotels and motels, and it facilitated the construction of two new hotels which nearly doubled the local hotel capacity. In addition to the increase in air passengers and overnight stops, a number of other micro variables had been affected, such as increased housing prices due to higher influx.

With regards to the educational level, the regional population lies well below the national average in terms of higher education. In 2012, 26% of the national population had a lower university degree, and 6,5% had a higher university degree. At the region level, the numbers were 20% and 4,4% respectively. When looking at the same data from 20 years earlier, at the region level higher education accounted for 11,9% and 1,9%, thus an increased level of the population have higher education today<sup>3</sup>. This development is in line with the national educational level, however in percentage the increase has been lower at the regional level.

Secondary data also illustrates a substantial increase in oil and gas related activities at the firm-level (Table 2). In 2012, regional firms reached 57 million Euros in supply services; an 87.5% increase from 2006. The number of firms supplying the oil and gas industry increased from 6 to 23 in the same period, including new start-ups and national/international firms' branch establishments (The firms/turnover in table 2 does not include building and construction, or other non-specific oil and gas related activities). Furthermore, secondary data shows that the number of employees working directly towards oil and gas related activities has increased by 154 from 2007 to 2012. By the time of concluding this study, this number had further increased to approximately 250<sup>7</sup>.

Finally, from late 2008 to the conclusion of this study (December 2013), about 150 million Euros had been invested in infrastructure projects and firm establishments in order to serve current and future oil and gas related activities<sup>7</sup>.

<sup>3</sup> Andersen, M., Johansen, M., Norvoll, T. and Nyvold, C. E. (2009). Levert 2008, Nordland. Petroleum Related Supply Industry in Northern Norway (Petroleumsrelatert Leverandørindustri). Kunnskapsparken Bodø.

<sup>4</sup> Norvoll, T. and Nyvold, C. E. (2011). Levert 2010. Petroleum Related Supply Industry in Northern Norway (Petroleumsrelatert Leverandørindustri i Nord-Norge). Kunnskapsparken Bodø.

<sup>5</sup> Nyvold, C. E. and Steffensen, T. (2012). Levert 2011. Petroleum Related Supply Industry in Northern Norway (Petroleumsrelatert Leverandørindustri i Nord-Norge). Kunnskapsparken Bodø.

<sup>6</sup> Nyvold, C. E. and Steffensen, T. (2013). Levert 2012. Petroleum Related Supply Industry in Northern Norway (Petroleumsrelatert Leverandørindustri i Nord-Norge). Kunnskapsparken Bodø.

<sup>7</sup> Henriksen, J. T. and Sørnes, J.-O. (2013). Ripple Effects of the Skarv Development - Final Report, 2013 (Ringvirkninger av Skarvutbyggingen - Sluttrapport 2013). UIN-rapport 1/2013. UiN, University of Nordland.

## **4. Empirical Findings**

Besides geographical proximity to the offshore developments, the reason why the oil company initially announced their establishment in the focal region can be largely explained by national policy pressure. Since the Norwegian oil era began in the 1970s, southern and south-western parts of the country has experienced the most rapid development in terms of direct impacts from the oil and gas industry. During the last decade, however, the offshore activities have moved northwards thus representing opportunities for small regions along the Norwegian coastline. Bearing in mind the rapid development in southern parts of the country, public officials in most northern Norwegian coastal municipalities are now, more than ever, claiming that regions surrounding oil and gas projects deserve to gain from the industry's presence. These signals are extended by national policies, and directed towards oil companies which seek to apply for offshore prospects. In other words, in this study the exogenous shock could be partly explained by national policy pressure related to stimulating development in peripheral regions. A quote from an oil company representative illustrates this backdrop; "When the (petroleum) directorate awarded us the oil field license it was indirectly conditioned by a requirement to emphasize local content".

In order to illustrate how the region transformed from a state of stagnation and decline to an emerging RIS, and also to provide guidance to the paper, tables 3, 4 and 5 display quotes that illustrate how the concepts of organisational thinness, fragmentation, and lock-in were affected by the exogenous shock that was introduced in 2009. The following paragraphs discusses this transformation.

### **4.1. Organisational Thinness**

Peripheral regions often suffers from organisational thinness (Isaksen, 2001, Tödting and Trippel, 2005), and this was very much the case in this study. As presented in the overview of the empirical context, during the last decade the region had experienced a rapid decrease in the number of traditional/low-tech firms. However, the regionally aggregated number of firms increased due to an increase in other industries; notably construction, real-estate activities, and other service activities. This increase was observed particularly from 2007 to 2008, soon after the oil company made its first announcements indicating the future role of the region. The increasing number of firms operating in construction, real-estate activities, and other service activities did not relate exclusively to oil and gas related activities. However, it illustrates a general upswing in the regional economic activity (c.f. chapter 3.2.).

Table 2 shows that the number of firms directly operating in the oil and gas industry nearly quadrupled between 2006 and 2012. In particular, when the base operator (a leading international oilfield services business) established in 2008 after being awarded the contract for onshore services and supply, a number of related firms followed. By 2013 there were 23 firms, consisting of national and international contractors, oil companies (2), base operators, suppliers, consultants, engineering firms, etc., most of which were branches of large firms' headquarters located elsewhere. The rapid increase in the number of (external) oil and gas related firm establishments soon led to a richer institutional structure.

According to the informants, the most important establishment was that of the oil company's permanent location of key project functions in the region (2008). In the

Norwegian context, oil companies mostly emphasise centralising of project functions to headquarters, thus ignoring physical presence in their host region. When oil company representatives established, a channel for external knowledge sourcing was created between regional firms and the national and international oil and gas market. Notably, the oil company's regional purchasing division facilitated the opportunity for regional firms to interact and react to first-hand knowledge about potential business opportunities. By the time of concluding this study, 14 employees worked at the oil company's local office. Also, in 2011 a second oil company established in the region. In 2013 the two oil companies entered into an agreement to co-locate central project functions related to Northern Norwegian offshore activities (subsea storage and fabrication facilities). The presence of the two oil companies also caused their major national and international contractors to establish branch offices in the region. This further mitigated regional firms' disadvantages related to a lack of geographical proximity towards potential customers.

A number of oil and gas related firms were co-located in an office building that was opened in 2011, thus signalling a common oil and gas related industrial profile. Soon after the opening a number of firms established, thus further strengthening the sectorial specialisation. By the end of 2013, 20 firms were located in the office building, employing close to 150 people. This attracted the establishment of an interregional incubator, several consultants, two educational institutions, and a personnel training agent, all of which focused their activities towards oil and gas related problems and opportunities. The accumulated number of firms operating directly or indirectly towards the oil and gas industry passed 50 by 2013. With regards to employment, secondary data shows that 250 people were directly engaged in the regional

Table 3. The effects of an exogenous shock on organisational thinness

Pre 2008	2012
<u>High organisational thinness:</u> Weak institutional structure. Small firm dominance, and absence of R&D institutions.	<u>Medium organisational thinness:</u> Strengthened institutional structure. A number of key actors established within the region (national and international contractors/suppliers, oil companies, incubator, etc.).
“The industrial composition lacks most of the critical actors necessary to constitute a competitive system, such as the industry's heavyweights (main suppliers and oil companies), R&D institutions, and proactive entrepreneurs. We need to build ourselves up from scratch” (interregional public official)	“The fact that they (the oil company) established key project functions (purchasing and HSE coordinator) in the region was key for the realisation of the developments that have taken place” (sector expert)
“The engineering capacity is poor, and the engineering milieu is fragmented. That is a bad combination” (firm representative)	“A number of firms have established around the new supply base, and others are knocking on our door” (public official)
“I would like to see an educational programme related to the industries that potentially might characterise the future of our region, such as subsea engineering and metallurgy” (firm representative)	“The ‘office building’ is now hosting many of the leading oil and gas firms. In addition, we notice the increasing number of knowledge-intensive actors (engineers, consultants, etc.). <i>It's a different kind of buzz in the lunch area</i> ” (firm representative)

oil and gas industry. An important component of this number is the share of skilled engineers. 14 of the 50 firms operating in the regional oil and gas industry included engineering as a key activity. The engineering capacity, combined with an incubator and several technology based firms, had emphatically strengthened the number of knowledge intensive workers in the region.

## **4.2. Fragmentation**

At the firm level, this study shows that the regional firms had no tradition in interacting with one another part from basic supplier-customer relationships. Nor did regional firms emphasise or engage in external firm networks. At the public level, regional authorities and other public institutions did not interact with regional businesses. Nor did public authorities engage in interregional or national arenas. This resulted in a state of fragmentation where private and public actors operated independent of one another, and more importantly, no linkages existed with external firms and institutions. In 2008, firm representatives, public officials, and sector experts expressed their concerns about this issue, thus signalling the need for an arena to discuss and exchange ideas/problems. In addition, firm representatives and sector experts expressed their concerns about the public authority's lack of extra-regional relations towards oil companies/major contractors, and public authorities from successful oil and gas provinces. The statements in table 4 (left column) illustrates this situation.

As a result of the exogenous shock, i.e. the entry of the oil company, a number of developments commenced. First, the oil company conducted extensive rounds of informational seminars for regional firms and the public authorities. One of the main messages was that firms and public officials needed to form regional and interregional networks, and more importantly: seek to establish extra-regional relations. As a result of this call, first an interregional alliance of potential suppliers was established. Later, in the autumn of 2008, eight regional firms established a formalised strategic alliance. Second, the oil company arranged meetings between regional firms and main contractors. This resulted in a binding collaborative agreement between the regional alliance and one of the oil company's main contractors. The alliance was later awarded a maintenance contract towards the main contractor. By the time of concluding this study, the regional alliance comprised 660 employees, and reached a turnover close to 13 million Euros (2013).

In parallel with the developments at the firm level, the public authorities initiated several initiatives. First, in collaboration with oil company representatives, they established an arena where the public authorities could discuss and exchange ideas with firms, contractors, landowners, etc. This measure was highly appreciated by the informants, as it led to a mutual understanding of current and future challenges and opportunities. A second initiative included learning and the acquisition of knowledge from similar Norwegian regions hosting major oil and gas projects. Visits were made to the nation's leading oil and gas provinces in order to learn from their success, and also to establish relations to public officials and businesses. As a result of these activities, the public authorities were able to comprehend the demands of the new industry and thereby facilitate means for development (e.g. facilitate infrastructure).

Table 4. The effects of an exogenous shock on fragmentation

Pre 2008	2012
<p><u>High fragmentation:</u> Limited interaction between firms at the regional and interregional level. No interaction with external firms and institutions.</p> <p>No relations between public authorities and regional firms.</p> <p>“They (regional firms) express their concerns about the challenges they are facing (entering O&amp;G industry), <i>but really they don’t seem to try and do anything about it</i>” (sector expert)</p> <p>“We are not involved in any public arena” (firm representative)</p> <p>“In this part of the country there is no tradition in collaborating across organisational borders. This is a problem because probably this is the only way for regional firms to compete (aggregate size and capacity)” (sector expert)</p> <p>“Probably, the most demanding task is to reach interregional transparency and consensus among private and public actors” (public official)</p> <p>“We (regional firms) lack three crucial things in order to develop in the oil and gas industry; financial resources, specialised skills, and networks towards established actors in the industry” (firm representative)</p> <p>“They (regional public officials) should visit the established supply bases down south in order to <i>realise what this is all about. They can’t just sit still down at the city hall, they need to learn from others that have succeeded</i>” (sector expert)</p>	<p><u>Medium-low fragmentation:</u> Regional alliances and networks. Formal contact with national and international firms.</p> <p>Public authorities engaged in national arenas (public and private). Frequent interaction between firms and public authorities.</p> <p>“<i>We have realised the importance of keeping a close dialogue (with the oil company), and to illustrate that our role is to facilitate what they require</i>” (public official)</p> <p>“<i>We currently look at the possibility to ‘go it alone’</i>” (firm representative)</p> <p>“One of the things we have emphasized the most, is that regional firms have to join forces in order to possess the necessary capacity and skillset” (oil company representative)</p> <p>“<i>Make sure nobody could say; you haven’t spoken to me. That became a mantra</i>” (oil company representative)</p> <p>“The alliance was established because of their (oil company) emphasis on us doing so. They expressed concerns about the viability of stand-alone firms” (firm representative)</p> <p>“Just recently we established a forum which include all the key players in the region. Public institutions, oil companies, main contractors, landowners, and regional suppliers gather for quarterly meeting where we raise common problems, and inform one another about our whereabouts” (public official)</p>

The quotes in table 4 illustrates how the exogenous shock affected regional actors’ ability to overcome a high level of fragmentation. Central in the findings is the role of the oil company in facilitating interaction between firms and public authorities at the regional and national level.

### 4.3. Lock-in

In 2008 when the first external firms had established in the region, existing firms were unable to respond to the new sets of opportunities. Moreover, firm representatives expressed concerns about firms' missing resources and capabilities. According to public officials and sector experts, however, the main problem related to regional firms' determination and willingness to respond. The quotes in table 5 (left column) illustrates and exemplifies that the regional actors were marked by inertia and reluctance towards change.

Regional firms' lock-in became further evident later in 2008 when the oil company arranged several informational seminars. Traditionally, oil companies have based their contracts on extensive and complex structures which, in effect, excludes small firms with limited capacity and skillsets. As a result of this commonly known tradition, the first seminars had limited attendance explained mainly by the firms' perceived lack of fit with the oil company's needs. However, in this study the oil company chose to adapt the contract structure in order to provide the opportunity for regional firms to deliver products and/or services to parts of the project. An oil company representative stated;

“When we first came here we soon realised that none of the local firms had the necessary skills or capacity to supply us with their products or services. In order to comply with the regional industry, *we have divided a number of our contracts into 'packages' of different sizes*. This way, if regional firms are able to meet our operative requirements they are very well positioned for potential contract awardment (due to their localisation)”.

A combination of the adapted contract structure and a direct and repeated flow of information from the oil company led a number of firms into a state of reorientation. One example is the establishment of a regional strategic alliance which, collectively, managed to develop their existing skills and capabilities to the new market. A different example relates to a newly established firm which was awarded a contract towards the oil company. Three years later that same firm delivered its products to a second oil company. This example also illustrates that the exogenous shock facilitated long-term effects.

In addition to the number of firms establishing in the region, two cases of firm acquisitions took place. In 2012 a local firm working with traditional mechanical fabrication was acquired by one of the largest Norwegian oil and gas contractors. The large firm's motive for the acquisition rested on the strategy of positioning for present and future oil and gas prospects in northern offshore projects. The acquisition did not result in the dismissal of local workers. Rather, the large firm spent vast resources on training the existing workforce in order to adapt to new customer demands. This acquisition had a strong effect on the original firm's level of lock-in, and it extensively developed the skills and capabilities of the local workforce. Later the same year, a small regional engineering firm was acquired by a major international contractor. As with the other case, the large firm's reason for the acquisition also rested on motives of positioning, nor were any of the existing workers dismissed. For the original firm, the acquisition resulted mostly in increased access to resources and markets, and increased capacity due to further employment. Originally the small firm did not particularly suffer from lock-in, thus the effects of the acquisition were limited.

With regards to the public authorities, public officials stated that the initial contact with the oil company was established in 2006. At that time the oil company had not yet

Table 5. The effects of an exogenous shock on lock-in

Pre 2008	2012
<p><u>High lock-in:</u> Firms heavily dependent upon, and locked-into traditional low-tech industries.</p>	<p><u>Medium-low lock-in:</u> Firms still related to existing activities, but adapted to new and more complex market demands</p>
<p>Public authority marked by inertia and aversion towards change (investments in infrastructure, areas for industrial purposes, etc.)</p>	<p>Public authority characterised as proactive and risk-willing</p>
<p>Private-public interaction characterised as “old boys network”</p>	<p>Oil company established direct, continuous, interaction with both firms and public institutions</p>
<p>“Regional firms don’t have the skills and resources necessary for operating towards the oil and gas industry. No firm will be awarded a contract just because of their location, or because the employees are nice and friendly. Contracts are awarded based on basic rules of competition” (national public official)</p>	<p>“If we had sat down and just waited for their announcement (supply base localisation), nothing <i>would ever have happen. It’s simple.. we needed to take this risk</i>” (public official)</p>
<p>“Regional firms seem to be satisfied with their current whereabouts” (sector expert)</p>	<p>“It’s a general perception in the region that now things are happening. Most actors try to orientate towards the signals that have been given by the oil company” (sector expert)</p>
<p>“If you ask a random business manager what they can deliver to the oil and gas industry, you will receive a vague response, if any” (sector expert)</p>	<p>“Keeping in mind that none of them (regional suppliers) have ever delivered products or services to the oil and gas sector, they genuinely impressed us” (oil company representative)</p>
<p>“Right now, there are only two people in the county administration working with oil and gas related themes. On top of everything, this is done as an addition to their existing job description! I really <i>don’t see how these two individuals are able to take care of the number of tasks that awaits</i>” (sector expert)</p>	<p>“Two years ago they (regional firm) were awarded a contract towards ‘the oil company’, and now they are working on a contract for a different oil company. This illustrates that they have managed to adapt to the oil and gas industry, and also that they have done a proper job” (public official)</p>
<p>“Some of the regional firms attend to their (the oil company) <i>information seminars, but that’s about it. None of the regional firms dear to step it up and genuinely go for it</i>” (public official)</p>	<p>“We have performed these activities for years, but things have changed. First of all, we have to comply with the strictest HSE standards in the industry” (firm representative)</p>
<p>“<i>I don’t think we realize the gravity of this development</i>” (firm representative)</p>	

determined the final location of their onshore supply base. Initially, public officials were reluctant to take action prior to the choice of supply base locality because of the financial risks associated (i.e. no contract could be signed with the oil company due to several potential supply base sites). As a result of increased interaction with oil company representatives,

critique from sector experts regarding the expectancy, and knowledge acquired from visits to successful Norwegian oil provinces, the public authorities initiated a project related to the development of an alternative supply base area. Despite the risks associated, the public authorities initiated extensive investments in order to prepare areas destined for industrial purposes. In 2008 the oil company decided to locate the supply base at the public authority’s newly developed industrial area, and this facilitated a rapid development due to the immediate availability.

**5. Discussion**

The aim of this paper was to investigate how exogenous shocks can stimulate path creation processes and RIS emergence in a peripheral region. Figure 1 illustrates the interconnection between the theoretical concepts used to analyse the empirical data. The empirical findings suggests that exogenous shocks can reduce organisational thinness, fragmentation, and lock-in, and thus transform actors’ path dependencies towards path creation processes. As a result of this transformation, RIS can develop (Figure 1).

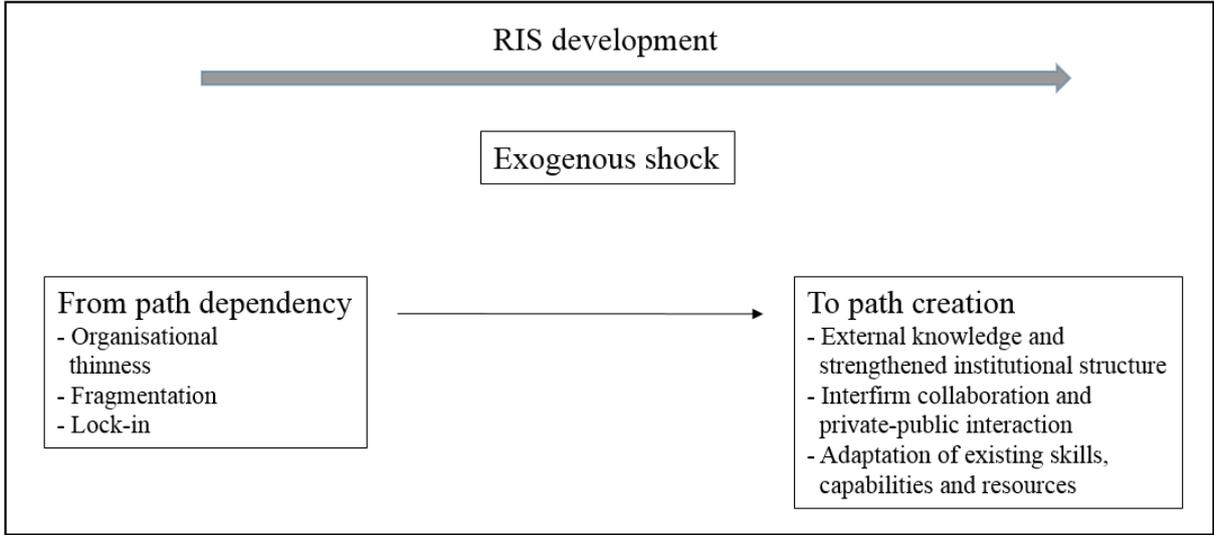


Figure 1. The effects of exogenous shocks on path dependency and RIS development

Previous studies have suggested that exogenous shocks has the potential to inflict significant change (Newey and Zahra, 2009, Vergne and Durand, 2010, Li and Tallman, 2011, Paruchuri and Ingram, 2012). The empirical findings in this study supports this existing knowledge, by illustrating that such external pressures indeed represents powerful change agents related to positively affecting path dependency. In addition to these concurring findings, the multi-level analysis has provided additional knowledge by illustrating how the exogenous shock also facilitated change at the public and macro (regional) level. This provides a holistic understanding about the complex mechanisms which underlie regional transformation. The empirical findings thus suggest that the strength of regions is likely to depend on the collective efforts of, and relations between, actors represented at different levels and disciplines in a business environment. Arguably, this could be of particular importance when regions are stuck in path dependent trajectories. Interview data from oil

company representatives further strengthens the findings, and it also provides rich accounts about how exogenous shocks can function as change agents.

Peripheral regions are characterised by weakly developed structures to support innovation and by the lack of extra-regional linkages (Tödtling and Trippel, 2005). In particular, the lack of a developed knowledge infrastructure (Autio, 1998) represents a barrier for innovation and development. Prior to the exogenous shock, the region in this study shared the characteristics of typical problem regions. In particular, regional actors (firms and public authorities) were locked into declining path dependent trajectories, and they suffered from a lack of external orientation and relations (Hassink and Shin, 2005). Furthermore, the empirical findings identified the three liabilities which often characterises problem regions; organisational thinness, fragmentation, and lock-in (Grabher, 1993, Isaksen, 2001, Tödtling and Trippel, 2005). This further strengthens the argument that regions often suffers from a combination of these deficiencies, independent of region-specific features (Tödtling and Trippel, 2005).

With regards to organisational thinness, the empirical findings strongly indicated how the entry of the oil company reduced this type of deficiency. The exogenous shock reduced organisational thinness in three major ways. First, when the multinational oil company established it attracted the establishment of a number of its customers (present and potential), and it caused the development of an onshore logistics and supply base. Secondly, it fostered a new set of business opportunities which attracted the establishment of support institutions and several smaller firms supplying oil and gas related products and services. Thirdly, the shock generated a number of developments, such as infrastructure projects and construction of offices and industrial buildings. This in turn stimulated an extensive increase in general, non-oil and gas specific, industries. These findings illustrates the positive effects of external firms establishing within regions (Tallman et al., 2004, Håkanson, 2005). The influx of external firms and institutions strengthened the overall institutional structure, it increased resource accessibility, and it narrowed the industry's sectorial specialisation. The critical mass of actors resulted in a self-sustaining market structure (Doloreux and Dionne, 2008).

As with the organisational thinness, empirical findings indicated how the exogenous shock also reduced the degree of fragmentation. When the oil company approached firms and the public authorities, regional actors were encouraged to seek the establishment of networks and more formalised collaboration in order to increase competitiveness. First, an interregional network of potential suppliers was established. This facilitated the initial exchange of information and knowledge across firm boundaries. Moreover, it initiated a process of trust-building among regional firms which led firms to overcome deeply rooted and one-sided competitive tensions (Isaksen, 2001). Secondly, a regional strategic alliance was established as a result of communicating with the oil company. This alliance was later awarded a maintenance contract through a partnership with an international contractor. These developments are in line with recent studies which have shown that firm performance is positively related to firms' connectedness in regional networks (Lechner and Leyronas, 2012, Salamonsen and Henriksen, 2014). Furthermore, it illustrates the value of external linkages as a source for knowledge acquisition and access to markets (Bunnell and Coe, 2001, Boschma and Iammarino, 2007).

The empirical findings illustrated, clearly, that the exogenous shock represented a functional mean for the reduction of lock-in. Prior to the shock the regional actors were trapped into a fixed trajectory due to high degrees of organisational thinness and fragmentation (Setterfield, 1997), and due to deeply rooted common beliefs, norms and values (Hassink and Shin, 2005). Lock-in has shown to prevent the ability of actors to adapt to changing environments (Grabher, 1993, Narula, 2002), and this was eminent in this study. In the period after the oil company had established, regional actors were unable to comprehend and react to the information provided by the oil company. Only after the oil company had arranged several informational seminars, regional firms initiated restructuring processes. Notably, regional firms started searching for regional partners in order to obtain synergies through resource combinations. Common for all regional firms was the lack of previous experience from operating in the oil and gas industry, thus the reduced lock-in relates particularly to the ability of adapting existing skills and knowledge bases (Anderson, 2000, Asheim and Gertler, 2005, Martin and Sunley, 2006), and resources (Boschma, 2007) to new markets demands.

The exogenous shock mitigated the liabilities of fragmentation and lock-in. However, the region still suffered from organisational thinness due to two main reasons. First, the lack of a knowledge generation and diffusion subsystem (R&D community and support infrastructure) (Autio, 1998) affected the ability and means of regional firms to conduct knowledge-intensive innovation. Secondly, the existing regional firms were characterised by a state of transformation. The exogenous shock made firms focus only on the process of adapting to new sets of demands by restructuring their existing skills and capabilities. These assumptions are also based on the phase of the systemic transformation. As the data in this study were collected between 2008 and 2012, no information about how the region developed from 2013 and onwards is included. However, the reduction of the organisational thinness occurred rapidly in the years following the exogenous shock, and by the time of concluding this study that development was continuing due to further firm establishments.

Due to the inflow of external actors and their ability to provide knowledge to regionally embedded firms and institutions (Asheim and Coenen, 2005), and the subsequent path creation processes (Martin and Sunley, 2006, Tödting and Tripl, 2013), the region had transformed into an institutional environment where embedded firms and organisations systematically engaged in interactive learning (Cooke et al., 1998). Based on this development, the focal region can be characterised as an emerging territorially embedded regional innovation network (Asheim and Isaksen, 2002), or what Cooke (1998) termed “grassroots RIS”. This supports previous studies that have illustrated the potential for (sub-optimal) RIS to emerge in “problem regions”, nurtured by common language, culture and territorial identity (Kaiser and Prange, 2004).

## **6. Conclusions and implications**

Several conclusions can be drawn from this study. First, it illustrates that exogenous shocks have the potential to mitigate or even disrupt the systemic deficiencies of organisational thinness, fragmentation, and lock-in. Second, the exogenous shock in this study (the entry of a multinational oil company) dissolved path dependencies by stimulating change in existing

industries, and by attracting new establishments. Both of these notions illustrate the importance of external forces in facilitating path creation, and also that “shock treatment” can facilitate the emergence of regional innovation systems due to enriched institutional structures and sectorial specialisation (Doloreux and Dionne, 2008).

A third conclusion refers to the potential strength of regions. Despite the potential for introversion and being inflicted by different types of path dependencies due to common language, culture, and territorial identity, deeply rooted traditions may also represent a favourable basis for restructuring and path creation. If regional actors are able to utilise existing skills and resources from existing industries in order to adapt to new industries, regional transformation can be obtained. Such processes will, however, depend on the presence of a critical mass of firms and institutions, and the interconnection between them

The main theoretical contributions of this study are twofold. First, the findings and conclusions have provided novel accounts of how a RIS emerged in a peripheral region. This is a process that has received minor attention in previous studies. Secondly, this study has illustrated that the mitigation of organisational thinness, fragmentation, and lock-in, has the potential to transform a region from path dependency towards path creation. Common for both these notions is the powerful role played by exogenous shocks in creating change and development in less favourable regions. This paper also develops the RIS literature by illustrating that peripheral regions have the potential to develop into regional innovation systems, albeit sub-optimal. This study thus strengthens an under-developed stream in the RIS literature, and it further extends the scope of the concept by providing insight about RIS processes in regions differing from the likes of Silicon Valley.

Policy-makers should draw attention to the potential effects that major organisations may have when entering small regions. If policy-makers have the ability to influence such corporations, policies should emphasise the strengthening of communication and interaction between regional firms, and between regional firms and the major corporation. Large corporations are powerful agents which has the potential to alter and develop existing trajectories that are often deep-rooted in regions.

## **7. Limitations and Further Research**

Owing to the features of the case region and to the study’s methodological approach, the findings from this study cannot be directly transferred to different contexts. Furthermore, an immediate concern can be raised about the definitional issue related to the RIS concept. In this paper I claim that a RIS emerges due to the effects of an exogenous shock. This statement is subject to critique because of the difficulties in how to observe RIS. Still, this issue is discussed in recent papers proposing that RIS take on a number of shapes and has different degrees of innovative intensity.

This study does not specifically consider the aspects of learning. Therefore, for further research one interesting issue would be to study in greater detail how absorptive capacity (Cohen and Levinthal, 1990) affects the ability of regional firms to learn from, and materialise upon, new knowledge created by exogenous shocks. Previous studies have mainly covered cases of negative exogenous shocks, thus another interesting issue would be to look more closely into similar cases of successful exogenous shocks. This would further extend existing

knowledge about how regions are affected by external pressures. Finally, further research should focus more on the way in which RIS emerge.

While much of the findings in this study supports existing knowledge, the author hopes that this paper has provided a contribution by proposing an alternative multi-level framework for studying regional transformation and RIS development. Hopefully the results from this paper will spur further research in this venue.

## References

- Andersen, M., Johansen, M., Norvoll, T. and Nyvold, C. E. (2009). Levert 2008, Nordland. Petroleum Related Supply Industry in Northern Norway (Petroleumrelatert Leverandørindustri). Kunnskapsparken Bodø.
- Anderson, A. R. (2000) Paradox in the Periphery: An Entrepreneurial Reconstruction?, *Entrepreneurship & Regional Development* 12(2), pp. 91-109.
- Andersson, M. and Karlsson, C. (2006) Regional Innovation Systems in Small & Medium-Sized Regions. in: B. Johansson, C. Karlsson and R. R. Stough *The Emerging Digital Economy: Entrepreneurship, Clusters and Policy*, pp. 55-82 (Berlin: Springer-Verlag).
- Asheim, B., Isaksen, A., Nauwelaers, C. and Tödtling, F. (2003) *Regional Innovation Policy for Small-Medium Enterprises*, (Cheltenham/Lyme: Edward Elgar).
- Asheim, B. T. and Coenen, L. (2005) Knowledge Bases and Regional Innovation Systems: Comparing Nordic Clusters, *Research Policy* 34, pp. 1173-1190.
- Asheim, B. T. and Gertler, M. S. (2005) The Geography of Innovation: Regional Innovation Systems. in: J. Fagerberg, D. Mowery and R. Nelson *The Oxford Handbook of Innovation*, pp. 291-317 (Oxford: Oxford University Press).
- Asheim, B. T. and Isaksen, A. (2002) Regional Innovation Systems: The Integration of Local 'Sticky' and Global 'Ubiquitous' Knowledge, *Journal of Technology Transfer* 27, pp. 77-86.
- Asheim, B. T., Smith, H. L. and Oughton, C. (2011) Regional Innovation Systems: Theory, Empirics and Policy, *Regional Studies* 45(7), pp. 875-891.
- Autio, E. (1998) Evaluation of RTD in Regional Systems of Innovation, *European Planning Studies* 6(2), pp. 131-140.
- Balland, P.-A. (2012) Proximity and the Evolution of Collaboration Networks: Evidence from Research and Development Projects within the Global Navigation Satellite System (GNSS) Industry, *Regional Studies* 46(6), pp. 741-756.
- Bell, G. G. (2005) Clusters, Networks, and Firm Innovativeness, *Strategic Management Journal* 26(3), pp. 287-295.
- Benneworth, P. (2003) In Celebration of the Ordinary Region, *Regions Magazine* 247(1), pp. 11-13.

- Best, M. H. and Xie, H. (2006). Discovering Regional Competitive Advantage: Route 128 vs. Silicon Valley. DRUID Summer Conference 2006. Copenhagen, Denmark.
- Boschma, R. (2004) Competitiveness of Regions from an Evolutionary Perspective, *Regional Studies* 38(9), pp. 1001-1014.
- Boschma, R. (2007) Path Creation, Path Dependence and Regional Development. in: J. Simmie and J. Carpenter Path Dependence and the Evolution of City Regional Economies, pp. 40-55 (Oxford: Oxford Brookes University).
- Boschma, R. and Iammarino, S. (2007). Related Variety and Regional Growth in Italy. SPRU Working Paper No. 162. Brighton, University of Sussex.
- Boschma, R. A. (2005) Proximity and Innovation: A Critical Assessment, *Regional Studies* 39, pp. 61-74.
- Braczyk, H., Cooke, P. and Heidenreich, R., Eds. (1998). Regional Innovation Systems. London, UCL Press.
- Brenner, T. (2006) Identification of Local Industrial Clusters in Germany, *Regional Studies* 40(9), pp. 991-1004.
- Bunnell, T. G. and Coe, N. M. (2001) Spaces and Scales of Innovation, *Progress in Human Geography* 25(4), pp. 569-589.
- Cohen, W. M. and Levinthal, D. A. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation, *Administrative Science Quarterly* 35(1), pp. 128-152.
- Cooke, P. (1996) The New Wave of Regional Innovation Networks: Analysis, Characteristics and Strategy, *Small Business Economics* 8(2), pp. 159-171.
- Cooke, P. (1998) Introduction. Origins of the Concept. in: H.-J. Braczyk, P. Cooke and M. Heidenreich *Regional Innovation Systems*, pp. 2-25 (London: UCL Press).
- Cooke, P. (2001) Regional Innovation Systems, Clusters, and the Knowledge Economy, *Industrial and Corporate Change* 10(4), pp. 945-974.
- Cooke, P. (2002) Regional Innovation Systems: General Findings and Some New Evidence from Biotechnology Clusters, *Journal of Technology Transfer* 27, pp. 133-145.
- Cooke, P., Boekholt, P. and Tödting, F. (2000) Governance of Innovation in Europe. *Regional Perspectives on Global Competitiveness*, (London: Pinter).
- Cooke, P. and Morgan, K. (1998) *The Associational Economy: Firms, Regions and Innovation*, (Oxford: Oxford University Press).
- Cooke, P., Uranga, M. G. and Etxebarria, G. (1998) Regional Systems of Innovation: An Evolutionary Perspective, *Environment and Planning* 30(9), pp. 1563-1584.
- Dahl, M. S. and Pedersen, C. Ø. R. (2004) Knowledge Flows Through Informal Contacts in Industrial Clusters: Myth or Reality?, *Research Policy* 33(10), pp. 1673-1686.

- Doloreux, D. (2002) What we Should Know About Regional Systems of Innovation, *Technology in Society* 24(3), pp. 243-263.
- Doloreux, D. and Dionne, S. (2008) Is Regional Innovation System Development Possible in Peripheral Regions? Some Evidence from the Case of La Pocatière, Canada, *Entrepreneurship & Regional Development* 20(3), pp. 259-283.
- Doloreux, D. and Parto, S. (2005) Regional Innovation Systems: Current Discourse and Unresolved Issues, *Technology in Society* 27, pp. 133-153.
- Eisenhardt, K. M. and Graebner, M. E. (2007) Theory Building from Case Studies: Opportunities and Challenges, *Academy of Management Journal* 50(1), pp. 25-32.
- Ellison, G., Glaeser, E. L. and Kerr, W. (2010) What Causes Industry Agglomeration? Evidence from Coagglomeration Patterns, *American Economic Review* 100(3), pp. 1195-1213.
- Forbes, D. P. and Kirsch, D. A. (2011) The Study of Emerging Industries: Recognizing and Responding to some Central Problems, *Journal of Business Venturing* 26(5), pp. 589-602.
- Freeman, C. (1995) The 'National System of Innovation' in Historical Perspective, *Cambridge Journal of Economics* 19(1), pp. 5-24.
- Garud, R. and Karnøe, P. (2001) Path Creation as a Process of Mindful Deviation. in: R. Garud and P. Karnøe *Path Dependence and Creation*, pp. 1-38 (Mahwah, NJ: Lawrence Erlbaum).
- Grabher, G. (1993) The Weakness of Strong Ties: The Lock-in of Regional Development in the Ruhr Area. in: G. Grabher *The Embedded Firm: On the Socioeconomics of Industrial Networks*, pp. 255-277 (London and New York: Routledge).
- Haas, R. d. and Horen, N. v. (2012). International Shock Transmission after the Lehman Brothers Collapse. Evidence from Syndicated Lending. MPRA Paper No. 36001.
- Hassink, R. and Shin, D.-H. (2005) The Restructuring of Old Industrial Areas in Europe and Asia, *Environment and Planning* 37(4), pp. 571-580.
- Henriksen, J. T. and Sørnes, J.-O. (2013). Ripple Effects of the Skarv Development - Final Report, 2013 (Ringvirkninger av Skarvutbyggingen - Sluttrapport 2013). UIN-rapport 1/2013. UiN, University of Nordland.
- Håkanson, L. (2005) Epistemic Communities and Cluster Dynamics: On the Role of Knowledge in Industrial Districts, *Industry and Innovation* 12(4), pp. 433-463.
- Isaksen, A. (2001) Building Regional Innovation Systems: Is Endogenous Industrial Development Possible in the Global Economy?, *Canadian Journal of Regional Science* XXIV(1), pp. 101-120.
- Kaiser, R. and Prange, H. (2004) The Reconfiguration of National Innovation Systems - The Example of German Biotechnology, *Research Policy* 33(3), pp. 395-408.

- Karlsen, A. (2005) The Dynamics of Regional Specialization and Cluster Formation: Dividing Trajectories of Maritime Industries in to Norwegian Regions, *Entrepreneurship & Regional Development* 17(5), pp. 313-338.
- Kaufmann, A. and Wagner, P. (2005) EU Regional Policy and the Stimulation of Innovation: The Role of the European Regional Development Fund in the Objective 1 Region Burgenland, *European Planning Studies* 13(4), pp. 581-599.
- Knoben, J. and Oerlemans, L. A. G. (2006) Proximity and Inter-organizational Collaboration: A Literature Review, *International Journal of Management Reviews* 8(2), pp. 71-89.
- Lechner, C. and Leyronas, C. (2012) The Competitive Advantage of Cluster Firms: The Priority of Regional Network Position over Extra-regional Networks - a Study of a French High-tech Cluster, *Entrepreneurship & Regional Development* 24(5-6), pp. 457-473.
- Li, S. and Tallman, S. (2011) Mnc Strategies, Exogenous Shocks, and Performance Outcomes, *Strategic Management Journal* 32, pp. 1119-1127.
- Lundvall, B. (1992) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, (London: Pinter).
- Martin, R. and Sunley, P. (2006) Path Dependence and Regional Economic Evolution, *Journal of Economic Geography* 6(4), pp. 395-437.
- Meyer-Stamer, J. (1998) Path Dependence in Regional Development: Persistence and Change in Three Industrial Clusters in Santa Catarina, Brazil, *World Development* 26(8), pp. 1495-1511.
- Narula, R. (2002) Innovation Systems and 'Inertia' in R&D Location: Norwegian Firms and the Role of Systemic Lock-in, *Research Policy* 31(5), pp. 795-816.
- Newey, L. R. and Zahra, S. A. (2009) The Evolving Firm: How Dynamic and Operating Capabilities Interact to Enable Entrepreneurship, *British Journal of Management* 20(1), pp. 81-100.
- Nilsson, M. and Moodysson, J. (2011). Policy Coordination in Systems of Innovation: A Structural-Functional Analysis of Regional Industry Support in Sweden. CIRCLE Electronic Working Paper Series. No. 2011/09, Lund University.
- Niosi, J., Saviotti, P. and Bellon, B. (1993) National Systems of Innovation: In Search of a Workable Concept, *Technology in Society* 15(2), pp. 207-227.
- Norvoll, T. and Nyvold, C. E. (2011). Levert 2010. Petroleum Related Supply Industry in Northern Norway (Petroleumsrelatert Leverandørindustri i Nord-Norge). Kunnskapsparken Bodø.
- Nyvold, C. E. and Steffensen, T. (2012). Levert 2011. Petroleum Related Supply Industry in Northern Norway (Petroleumsrelatert Leverandørindustri i Nord-Norge).. Kunnskapsparken Bodø.

Nyvold, C. E. and Steffensen, T. (2013). Levert 2012. Petroleum Related Supply Industry in Northern Norway (Petroleumsrelatert Leverandørindustri i Nord-Norge). Kunnskapsparken Bodø.

Paruchuri, S. and Ingram, P. (2012) Appetite for Destruction: The Impact of the September 11 Attacks on Business Founding, *Industrial and Corporate Change* 21(1), pp. 127-149.

Pentland, B. T. (1999) Building Process Theory with Narrative: From Description to Explanation, *Academy of Management Review* 24(4), pp. 711-724.

Porter, M. E. (2003) The Economic Performance of Regions, *Regional Studies* 37(6&7), pp. 549-578.

Salamonsen, K. and Henriksen, J. T. (2014) Small Businesses Need Strong Mediators: Mitigating the Disadvantages of Peripheral Localization Through Alliance Formation, *European Planning Studies*. doi: 10.1080/09654313.2013.876975

Schienstock, G. (2007) From Path Dependency to Path Creation: Finland on its Way to the Knowledge-Based Economy, *Current Sociology* 55(1), pp. 92-109.

Setterfield, M. (1997) *Rapid Growth and Relative Decline: Modelling Macroeconomic Dynamics with Hysteresis*, (London: Macmillan).

Simmie, J. (2012) Path Dependence and New Technological Path Creation in the Danish Wind Power Industry, *European Planning Studies* 20(5), pp. 753-772.

Stack, M. and Gartland, M. P. (2003) Path Creation, Path Dependency, and Alternative Theories of the Firm, *Journal of Economic Issues* 37(2), pp. 487-494.

Sternberg, R. (2000) Innovation Networks and Regional Development—Evidence from the European Regional Innovation Survey (ERIS): Theoretical Concepts, Methodological Approach, Empirical Basis and Introduction to the Theme Issue, *European Planning Studies* 8(4), pp. 389-407.

Sykes, W. (1991) Taking Stock: Issues from the Literature on Validity and Reliability in Qualitative Research, *Journal of the Market Research Society* 33(1), pp. 3-12.

Tallman, S., Jenkins, M., Henry, N. and Pinch, S. (2004) Knowledge, Clusters and Competitive Advantage, *The Academy of Management Review* 29(2), pp. 258-271.

Tödttling, F. (1992) Technological Change at the Regional Level: The Role of Location, Firm Structure, and Strategy, *Environment and Planning* 24(11), pp. 1565-1584.

Tödttling, F. and Kaufman, A. (2001) The Role of the Region for Innovation Activities of SMEs, *European Urban and Regional Studies* 8(3), pp. 203-215.

Tödttling, F. and Kaufmann, A. (1999) Innovation Systems in Regions of Europe - A Comparative Perspective, *European Planning Studies* 7(6), pp. 699-717.

Tödttling, F. and Trippel, M. (2005) One size fits all? Towards a Differentiated Regional Innovation Policy Approach, *Research Policy* 34(8), pp. 1203-1219.

Tödting, F. and Trippel, M. (2013) Transformation of Regional Innovation Systems: From Old Legacies to New Development Paths. in: P. Cooke Re-framing Regional Innovation Systems - Evolution, Innovation and Transition, pp. 297-317 (London: Routledge).

Vergne, J.-P. and Durand, R. (2010) The Missing Link Between the Theory and Empirics of Path Dependence: Conceptual Clarification, Testability Issue, and Methodological Implications, *Journal of Management Studies* 47(4), pp. 736-759.

Weterings, A. and Boschma, R. (2009) Does Spatial Proximity to Customers Matter for Innovative Performance? Evidence from the Dutch Software Sector, *Research Policy* 38(5), pp. 746-755.

Yin, R. K. (2009) *Case Study Research - Design and Methods*, 4th ed. (Thousand Oaks, CA: Sage Publication).