Stavanger Center for Innovation Research

Program and call for research proposals

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1 INTRODUCTION

New ideas and concepts are the key to prosperity and to the wealth and wellbeing of nations, regions and individuals. As the world becomes more globalized, the advanced, high-wage economies must rely on their applied inventiveness to maintain their future prosperity. This has become an imperative for a rich country like Norway and its oil capital the city region of Stavanger. Furthermore, there is also growing expectations that a large public sector should offer improved and easily accessed services, efficiently produced by innovative processes and distribution channels. Hence the need both for radical reforms and continuous user led innovations. Not surprisingly therefore, innovation has become a major field of study in economics, management, sociology, science and technology, and history.

The University in Stavanger (UiS) and IRIS (International Research Institute of Stavanger) have therefore decided to establish a joint center for innovation research. The main research theme is "Transforming city regions" with a particular focus on the region's enterprises, institutions, and its management and innovation systems. Realizing that most innovation processes take place in organizations, studies of the micro foundations and management of these processes in enterprises and the public sector are essential. Our collaborative studies with industry and governments inform policy and strategy regionally, nationally and internationally.

The purpose of this paper is to present the research program for the center and call for research proposals. The paper draws primarily on theories and knowledge from the private sector. We are convinced that these theories offer insights and research opportunities for the public sector as well.

UiS and IRIS are very grateful to the Stavanger based Gjedebo family for their donation that has made the center possible.

2 THE OBJECTIVES OF THE CENTER

Within its research areas the Stavanger Center for Innovation Research aims at being the premier research community in Norway with a high international reputation. The goal of the center is to qualify for a future "Center of excellence" status. The CoE's *"intend to stimulate Norwegian researchers and research groups to establish centers devoted to long-term basic research of a high international calibre and thereby raise the quality of Norwegian research. The main criterion for selecting the centers is a high level of international scientific quality. This requirement applies to the research to be conducted at the center as well as to the center's key scientific personnel"*[1]. This has

1 The Norwegian Research Council

implications for the research efforts at the innovation center and those being employed or affiliated with the center.

The center will focus on research on innovation and transformation processes in city regions. These processes unfold and are managed in the context of globalization which has implications for transformation processes at all levels in city regions. Globalization, environmental issues and increasing demands for socially responsible business conduct, represents at the same time great opportunities and comprehensive threats for regional development and the well being of its inhabitants. These trends have particular impact on a petroleum related and -dependent region like Stavanger. The region is host to numerous truly global companies, has an international population and an open and vulnerable economy. The Stavanger region is thus a test bed for these globalizing forces. Research on these issues will not only have great interest and impact for this particular city region, but for regions in general.

The Stavanger Center for Innovation Research will encourage research that is based on a deep understanding of the markets and institutions that shape and are shaped by the transformations of regions. The research should be informed by primary data and observations based on direct interaction with employees, managers and regional developers. Our community of scholars will not only develop and test our own theories, but appreciate and build on theories of the decision makers themselves. Through direct communication and interaction the research should both build scientific theories as well as inform the ideas, concepts and theories of decision makers. The center will act as a listening post for business and the public sector by observing technological and organizational trends, understand and interpret these, to be able to develop and communicate novel knowledge to managers, academia, labor unions and students in an interactive mode.

High quality research includes the quest for fundamental understanding combined with considerations of user needs. The field of innovation research is best served by use-inspired basic research (Stokes 1997). High research quality will be combined with user relevance, realizing that managing innovation processes is a complex and demanding task both in the private and public sector. With our focus on the management of innovation processes, we need theoretical models, concepts and frameworks that both enhance our understanding and offer support to decision makers.

3 THE NEED FOR REGIONAL INNOVATION CAPABILITIES

The vital role of ideas and innovation has been explicated by Paul Romer in his seminal paper with the at once deceptively simple and intimidating title “Endogenous Technological Change” (Romer 1990). He treated knowledge and technological change as an endogenous factor of growth, a clear departure from traditional growth theory. His models included agents that optimize R&D investments. Romer enhanced our appreciation of the ubiquitous role of ideas in the economics of our daily lives (designs, recipes, scientific laws, patents, copyrights, trade secrets, business methods and models,

procedures, algorithms, and bootleg copies). The entrepreneur re-entered the front stage. Romer illuminated the inescapable tension between creating incentives for the production of new ideas and maintaining incentives for the efficient distribution and use of existing knowledge – and profits and benefits.

New growth theory also more closely examines the role of infrastructure and government (Hall and Jones 1996; Olsen 2004). In particular this is related to the central notion of knowledge and technology spillovers that arise when firms invest in innovation. Spillovers or externalities may arise for several reasons. First, it is conceivable that technical know how may leak from the innovator to other firms due to imperfect protection of intellectual capital (patents) or the mobility of employees and researchers. Network effects are another potential source of spillovers, which may create benefits for consumers, firms or other stakeholders and participants in the network. In other words, there are many arguments for studying innovation in the context of city regions.

The great debates about globalization in recent years have typically focused on the role of national governments as instruments for promoting the benefits of globalization or, more often, ameliorating its negative impacts[2]. National governments have frequently found themselves in the firing line as anxious and dissatisfied citizens seek protection against what they see as the depredations of global markets, global capital flows, and the integration into the global economy of huge pools of low-wage labor in the developing world. These predictions have turned out to be exaggerated. Even today it is difficult to find a truly global company; national borders still do matter in economic affairs; and it is much too soon to write the obituary of national governments as players in the global economy, despite the encroachments on their traditional authority in various domains.

But from the perspective of city regions, the sense of vulnerability to the forces of globalization is acute, and probably also more warranted. From the regional perspective, the rules of the game are indeed set elsewhere. City regions have fewer resources available to them to cope with the impacts of globalization. Indeed, in many cases regional leadership itself has been eroded as the traditional pillars of the local economy – banks, manufacturing firms, law firms, accountants, etc. – have been acquired by large national or multinational organizations with no particular interest in or commitment to the community. For many city regions, the notion of a ‘borderless world’ is uncomfortably close to the truth.

On the other hand, these communities do possess resources to cope with the challenges of globalization. Much of the hard work needed to cope with these challenges – building infrastructure, improving educational performance, strengthening cooperation between

2 This and the next two paragraphs are based on the report Hatakenaka, S., P. Westnes, et al. (2006). From "Black Gold" to "Human Gold: A Comparative Case Study of the Transition from a Resource-based to a Knowledge Economy in Stavanger and Aberdeen, Industrial Performance Center, MIT.

public and private institutions – is in fact often better undertaken at the city region level than by centralized directives. Local institutions and strategic initiatives may indeed be more suited and coordinated at the local level than the national level. The establishment of Stavanger Center for Innovation Research will focus on one such response*: strengthening local capabilities for innovation*. By 'capabilities for innovation', we mean the ability to conceive, develop, and/or produce new products and services, to deploy new production processes and business models, and to improve on those that already exist. These activities are essential for productivity growth and for sustaining and improving wage rates, and are themselves typically associated with attractive, well-paying jobs. In advanced economies, the links between innovation, productivity growth and prosperity are increasingly well recognized, and there is increasing attention to this set of issues at the regional and local levels. Inhabitants of city regions throughout the advanced industrialized world would surely agree that they should not compete in the battle to pay their workers least. The innovation center assumes that it will take sustained innovation to ensure that we don't have to.

3.1 Transforming the Stavanger region and the need for innovation

The Stavanger region is presently undergoing a radical transformation process and offers great opportunities for highly qualified research on innovation. The region represents a testing ground or a laboratory for new ideas, innovation models and instruments for strategic regional transformation processes. In other words, the Stavanger region should constitute a vibrant empirical field, but the research questions should be relevant for transformations and the renewal of city regions in general. Hence, papers addressing the special opportunities and challenges of the Stavanger region will be given priority. The effect of globalization on these transformations is a central issue.

Local innovative capabilities are themselves subject to the pressures of globalization however. Even regions with significant concentrations of innovative activity today cannot assume that they will be able to hold onto them indefinitely. The range of possibilities here is bracketed by two limiting scenarios. At one end of the spectrum, local companies, recognizing the importance to their own innovation processes of tapping into the global network of knowledge and ideas, reach progressively farther afield to do so, and eventually relocate these activities and perhaps ultimately all of their operations out of the region altogether. At the other end of the spectrum, local companies seek to boost their innovation performance by strengthening their ties with other local firms and with local public research and educational institutions. In this scenario, the local economy emerges as a center of new knowledge creation and application, attracting firms from elsewhere, and stimulating the formation of new local businesses.

These ambiguous effects of globalization on individual firms and on their home societies and their institutions offer great opportunities for research. The center will thus encourage studies of innovation processes as they unfold in real life, seeking in-depth understanding of innovation processes, practices, strategies, technologies and behaviors.

Related to the arguments above, innovation processes in the oil and gas industry and the issue of transforming that sector into a broader energy cluster is of particular interest. Will that industry be "locked in" their present technologies and solutions, or will they implement strategies with intentions to take a lead in developing renewable energy? A desired transformation process will carry the region from utilizing the depletable mineral wealth in the ground to sustainable regional capabilities for wealth creation beyond the natural resource lifetime. Can different regions gain greater og lesser benefits from their natural resources through differentiated innovation capabilities? What role do universities and R&D institutions play in developing, localizing and anchoring such capabilities? The role of culture and other experience related industries are also highly relevant. The fact that the city region of Stavanger enjoys the status as European capital of culture, creates additional incentives to use the region as a "natural experiment". Innovations in the food and culinary industry have wide regional attention, as have the potentially vibrant financial and medical clusters. This raises the question of how clusters come into being, and how or if such processes can be managed. Branding regions as innovative and knowledge intensive has become a policy for marketing the region and attracting talent. Can these efforts be combined with the present image of the "oil capital"?

Studies of process innovations and development of new services in the public sector are also encouraged, in particular user or practice driven innovations emerging in teams and organizations. Having in mind the comprehensive size of the public sector, innovation studies both from an efficiency perspective as well as a product and service development perspective are needed. In general, the papers should focus on the particular resources and capabilities of this region, and how these resources can be used to enhance the competitiveness of this region's enterprises and institutions, the social welfare and well-being of its citizens.

Managing the tension and dilemmas related to these goals – stimulating the growth of knowledge while ensuring that its benefits are widely shared, is a responsibility of governments just as important as fiscal and monetary policy. This perspective underlies the importance of institutions and rules of the game, and how these rules shape and is shaped by the innovation processes in enterprises and the public sector.

4 MANAGING INNOVATION PROCESSES

Twenty years ago Van de Ven stated that "while research has provided many insights into specific aspects of innovation, the encompassing problems confronting general managers in managing innovation has been largely overlooked (Van de Ven 1986). In his opinion, here are some of the key issues that need to be addressed:

- How to develop a culture of innovation in organizations
- How to prepare for innovation while organizing for efficiency
- How to direct attention away from the protection of existing practices

- How to institutionalize and create an infrastructure conducive to innovation

These issues are still pertinent and deserve more research. Although innovation is vital to economic growth and regional competitiveness this system-level observation may not extend to all firms and enterprises. Some organizations thrive as highly efficient or fast followers, in fact many firms have deliberately chosen not to be on the technological forefront, but rather be an agile follower. Second, even those organizations that do prioritize innovation, must nonetheless cater for the ongoing operational demands of today as well as the transformative expected demands of tomorrow. Some organizations do in fact fail because of too much creativity and lack of efficiency in their processes (Gjelsvik, 2004). Third, managing innovation processes requires attention and resources to a wide range of activities, not just R&D and new technology, including design, marketing, operations, supply chains, networks and business models (Tidd, Bessant et al. 2005; Gjelsvik 2007). Fourth, these areas must be managed in an integrated way, underlining the importance of more tacit processes such as organizational learning, organizational culture and structure, as well as leadership. Such processes are hard to observe and imitate by others, and may thus constitute a competitive advantage for firms. Fifth, innovation is influenced and shaped by prior experience. The innovative potential is enhanced or stymied by the learning associated with prior successes and failures. These observations lead to the conclusion that managers and enterprises may have different approaches to innovation. In other words, studies of innovation processes may be enhanced and better appreciated if linked to strategy.

4.1 Innovation and strategy

The theoretical paradigm that dominates the economic and strategic management literature is the resource based view of the firm (RBV) (Link and Scott 2005), first introduced by Wernerfelt and subsequently developed by Barney (Wernerfelt 1984; Barney 1991). This perspective posits that firms often possess different resources and capabilities, that these different resources and capabilities enable some firms to implement strategies that other firms will find too costly or difficult to implement, and that such differences may last for a long time (Barney and Clark 2007). Barney (1991) claimed that valuable, rare, inimitable and non-substitutable resources constitute a source of sustainable competitive advantage. The attributes of these assets are often path dependent, causally ambiguous and socially complex. Teece, Pisano and Shuen extended the RBV framework by introducing the notion of dynamic capabilities (Teece, Pisano et al. 1997). The dynamic capabilities perspective explains why some firms achieve a competitive advantage within industries characterized by unpredictable and rapid environmental changes. A firm's search for new sources of competitive advantage is typically viewed as being evolutionary and path dependent, meaning that technologies and the institutions with them are self-reinforcing.

The dynamic capabilities perspective may be extended to theories of learning. Furthermore, the capabilities to innovate may be interpreted as a dynamic capability as they typically are both socially complex (embedded in the culture) and causally ambiguous. The RBV perspective emphasizes internal forces and their impact on firm performance. Hence, profits are due to an innovative and/or highly efficient

organization, not from an exploitation of market power. In discussing dynamic capabilities, Eisenhardt and Martin noted the importance of technological gatekeepers in organizations, individuals or groups interacting with scientists, inventors in other organizations to combine knowledge and resources in novel ways (Eisenhardt and Martin 2000) . For the focal firm, the point is to gain access to complementary resources and technologies. In other words, resources and capabilities can be generated internally through R&D, strategic investments in technology and learning from innovation processes, as well as externally through research partnerships, technology alliances and networks. Generally, the knowledge economy has brought about a substantial increase in technology partnerships involving firms, universities, research institutions, nonprofit organizations and public agencies. Studies of these relationships and their localizations will enhance our understanding of the innovation processes and transformations of enterprises and their innovation ecosystems.

Innovation and strategy making may be conceived of as co-evolutionary processes. Clayton Christensen has written extensively on this subject, in particular through the lenses of the terms sustainable and disruptive circumstances. He argues that strategies of established firms are viable in sustainable circumstances, when the competition entails making better products for attractive market segments. In disruptive circumstances, "when the initial challenge is to commercialize a simpler, more convenient product that sells for less money and appeals to a new and unattractive customers, the entrants are likely to beat the incumbents. This is the phenomenon that frequently defeats successful companies. Few technologies or business ideas are intrinsically sustaining or disruptive in character. Rather, their disruptive impact must be molded into strategy as managers shape the idea into a plan and implement it" (Christensen 2003). Christensen argues that once the disruptive product gains a foothold in new markets, the improvement cycle begins, until the previously not-good-enough technology eventually improves enough to intersect with the needs for the demanding customers. When that happens, the disruptors are on a path that eventually will oust the incumbents. Some examples: IKEA, Rema 1000, Norwegian, Google, Linux and Amazon.com

In other words, Christensen predicts that incumbent firms will not survive disruptive technologies. Robert Burgelman has introduced the terms "autonomous" and "induced" strategic initiatives to indicate how organizations may balance the need for efficiency and substantial renewal (Burgelman 2002). Autonomous ideas are initiatives that are outside the scope of the corporate strategy at the time they come about, often initiated from individuals or groups in the organization. These ideas are significantly different from induced initiatives in the technology used, employees' competence, customer benefits and/or customers targeted. They typically involve new combinations of competencies that are not currently recognized as being important to the firm. While autonomous initiatives often emerge fortuitously and is difficult to predict, they are not random as they are rooted in and constrained by the company's set of knowledge and distinctive competencies. Initially top management has no clear understanding of the importance of the idea, and what opportunities and risks they represent. Resolving this indeterminacy is a difficult challenge. These concepts are akin to Mintberg's emergent and deliberate strategies (Mintzberg and Waters 1985).

Induced initiatives are ideas that fit with the concept of the official corporate strategy. Their aim is to improve or maintain leadership in the company's core businesses. These efforts are incremental in nature, meaning that the changes are well understood: doing more of what the organization knows how to do well. These concepts underline the need for explication of the actual contexts in which innovation processes unfold. In the public sector, planned and deliberate strategies and innovations may be conceived of as reforms, whereas user or practice initiated innovations may be conceived of as autonomous and emergent. Approved and official strategies may stimulate innovations as well as constrain them. How this balancing act is managed, is a central issue. In the public sector, managers at different levels may encourage innovations, but may feel the politicians' call for control and tight budgets as a major constraint. Handling these paradoxes are highly relevant research issues, in particular at the resource and capabilities level.

4.2 Technology driven innovations

Innovation strategies are not inherently bad or good, it depends on the contexts and circumstances. Above we have used terms like incremental, radical or disruptive circumstances to describe different situations and developments. Furthermore, some scholars underline that innovation strategies are responses to how managers construct and interpret the world.

Emergent technologies are science-based innovations that have the potential to create a new industry or transform an existing one. They include disruptive technologies derived from radical innovations (digital photography, biotherapeutics, portable computers) as well as more evolutionary technologies formed by the convergence of previously separate research streams (electronic banking, internet). Day and Schoemaker posit that established and emerging technologies represent two different challenges for managers and organizations (Day and Schoemaker 2000). Uncertainty in a stable environment is manageable because there are usually only a few discrete outcomes that define the future and robust strategies can be devised to adapt to these possibilities. The character of uncertainty created by an emerging technology is profoundly different. The risks are not just external but also internal, relating to the biases and limitations of people's thinking frameworks. These views call for papers that make explicit the contexts and technologies within which the innovation processes unfold. In many stories of innovation uncertainty and ambiguity are to be reduced and avoided. We welcome papers that show how ambiguity may be managed and utilized in innovation processes.

Most stories on managing emergent technologies are told with the benefit of hindsight. In actuality managers make decisions about pursuing new technologies with highly imperfect information. The reality is that some technologies succeed and others fail. Managers can never know for sure beforehand whether a technology will be a failure or the next dominating design (Utterback 1994). This simple fact should direct our research methods. We tend to celebrate cases of companies that aggressively pursue a new technology that turns out to be wildly successful, and wag our fingers at the companies that took a passive stance and let the opportunity pass. But what happens

when the technology fails? Then the passive firm that didn't invest in the technology appears a winner.

Most studies of innovation have adopted a positivist stance, meaning that researchers treat innovation as a dependent variable and seek to identify and measure the influence of a series of independent variables to "explain" patterns and degrees of innovation (Storey and Salaman 2005). Explanation within this mode of involves identifying the causal relationships between "objective" variables or factors. Numerous variables have thus been identified. In the field of innovation these determinants typically have been factors such as the amount of R&D spent, organizational size, characteristics of the work force, aspects of the regional culture, the degree of concentration of firms within an industrial cluster, and so forth. The dependent variable typically is indicators of innovation, such as number of patents, number of new products etc. A commitment to explanation of this type has direct consequences for the research methodology being used. It will involve obtaining data on the levels or nature of the independent, dependent and mediating variables.

However, many of the explanatory accounts reached by such methods have often resulted in conflicting conclusions, which may arise from a failure to appreciate innovation processes within the context of meaning, identity, knowledge and organization as a key unit of analysis. Studies of innovation processes within the context of the particular organization is documented in "Radikale innovasjoner i etablerte foretak", a joint study by UiS and IRIS (Gjelsvik 2004). More generally, this mode of explanation involves studying and interpreting how those involved in trying to innovate within organizations understand what they are doing and how the organization supports or hinders them. Innovation becomes a result of intention, of deliberate (but clearly not always successful) attempts by organizations and individuals to pursue their ends. This perspective argues that in order to understand how people in organizations tend to act in relation to innovation we need to understand how they see and understand what they and their organizations are doing. We need to research and understand *their* theories, knowledge and meanings – not *our* theories and knowledge. Within this paradigm, our respondents are of interest not for contributing to the testing of our theories, but for the theories they themselves use in seeking to achieve innovation within their organizations.

4.3 Innovation in established organizations

Research on innovation processes in established firms and institutions are sometimes obscured by the fact that it is relatively simple to succeed once with a lucky combination of new ideas and receptive market at the right time; to repeat the performance consistently is quite another matter. Thus the micro dynamics of the innovation process is of vital interest. There's more going on than we have observed (and counted). Consequently we call for papers that document, analyze and develop theory based on detailed micro studies of innovation processes in established organizations. A capability to innovate relates to managing the overall innovation process both as *internal* and *interorganizational* processes. In particular, we welcome papers that endeavour to expand the resource-based theory. In its present form the theory takes the existence of heterogeneous resources as given. We need studies that

address the question: where do the resources come from? We need to move beyond the contention that resources are path dependent. This view is actually an indication of our ignorance about the micro-dynamics of resource development. Why a particular path was taken (and not others), why (or why not) this path is irreversible and inimitable, and how the decisions were made by managers, employees, consumers and clients, are issues to be addressed.

A coherent resource based theory would acknowledge the role of luck in the development of resources, but should also recognize the role of managers taking advantage of their good luck (Barney 1986). A dynamic theory would also point forward. How should resources be further developed to sense and seize future opportunities? It may be the case that theories that use such entrepreneurial actions to explain where resources come from may also explain how resources evolve in the future. Scenario development may be a viable method to sense future opportunities. According to the "dynamic capabilities" view (Teece 2007) enterprises with strong dynamic capabilities are intensely entrepreneurial. They not only *adapt* to business ecosystems, but *shape* them through innovation and collaboration with other firms and institutions. These capabilities may be disaggregated into the following capacities:

- to sense and shape opportunities and threats
- to seize opportunities
- to maintain competitiveness through enhancing, combining, protecting and reconfiguring the firm's intangible and tangible assets.

We need detailed studies of how these dynamic capabilities are developed and sustained over time.

The other critical point emerging from this research is that innovation needs managing in an *integrated* way; it is insufficient to develop capabilities only in selected areas. For instance, there are many firms with excellent R&D departments and the generation of technological solutions, but which lack the abilities to relate them to a market. Others may lack the ability to link innovation to business models and strategy. These "orchestration" capacities undergird an enterprise's capability to successfully innovate and capture sufficient value to deliver superior long-term financial performance. This orchestration management should be researched, in both volatile and more predictable environments.

In generic terms, the innovation process may thus be described and studied as a core set of activities distributed over time:

1. Search and variation
2. Selection
3. Implementation (acquire resources, execute, launch, sustain)

The search process increases the number of ideas (variation) and involves detecting signals in the environment such as new technological opportunities, changing customer or client requirements, legislative pressure or competitor action. The selection phase

may either follow a set of administrative rules or be the result of internal competition. The implementation phase concerns the process of turning those selected ideas and concepts into some form of reality: a new product or service, a change in process, a shift in business model etc.

How these selection mechanisms work is a central research issue. Who defines the rules and is there only one official selection process at work or several competing ones? Increasingly, firms often cooperate with other organizations in their innovation processes, how do they develop joint selection mechanisms? Selection mechanisms and rules are related to decision making. Organizational decision processes often display features that seem to defy basis principles of rationality and sometimes border on the bizarre (March and Olsen 1976; Nelson and Winter 2002). Small and frequent investments offer opportunities to learn from mistakes, as do repeated experiments. Since large investments are usually occasional, major investments have a larger potential to be vulnerable to error. Enterprises can bring discipline to bear to purge bias, delusion, deception and hubris (Teece 2007). As discussed by Christensen in his analysis of disruptive situations, this is not a well distributed skill (Christensen 1997). Being alert to the formal and informal incentives of the decision makers and product champions is a case in point.

Although innovation research increasingly has recognized the significance of innovation in the public sector, the research on public sector entrepreneurship is still in its infancy (Broch, Godø and Røste, 2005). These authors argue that transposing private sector concepts and explanations of entrepreneurship to the public sector is fertile as it may provide inputs and insights for development of new knowledge of public as well as private sector innovations and entrepreneurship. On the other hand, insights from public sector entrepreneurship may inspire revisions of mainstream explanations of why and how people, groups, networks and organizations innovate in the private sector. Comparative studies of firms and public enterprises and institutions are thus encouraged.

At the level of the state, regulations and reforms may be the major trigger for change, in other words innovations driven from above. At the level of individuals, teams or organizations; shared norms, community spirit and idealism may be important drivers. Are these motivators different from firms?

These challenges call for a close analysis of incentives both at the organizational and individual level. Economists typically focus on *extrinsic* and pecuniary incentives such as royalty incomes, raises, promotions, performance-contingent pay, bonuses or research funding. The motivation to work on something because it is interesting, exciting, satisfying, or personally challenging is called intrinsic motivation (Amabile 1993). Intrinsic incentives originate within the individual or the task. An organization cannot directly satisfy intrinsic incentives, but they can provide conditions where such incentives are more likely to be satisfied, such as the provision of autonomy, the assignment of challenging, engaging work. A third class has also been suggested, namely social incentives, which originate from the individual's perceived social relations. A growing body of literature show that people act to either gain social approval or to avoid social disapproval. Social incentives may be particularly important

in teams or organizations to the extent that members develop a high degree of cohesion and mutual commitment, possibly to the point where team or organizational goals become internalized (Gagne and Deci 2005). Storey and Salaman found that in innovative firms innovation was inherently exciting, challenging, playful and precious, which mobilized energy rather than perceived as dangerous and illicit (Storey and Salaman 2005).

A potential source of innovations for novel products and services stems from users, either at work or in their homes. Users may innovate from necessity and direct utility (von Hippel 2005). They may keep their innovations to themselves, or may seek to profit from them. Von Hippel documents that they also may have rational reasons for freely revealing their innovative contributions to the firm that supplied the relevant technology. These issues call for more scholarly attention both from the user's and the firm's perspective. How may user driven innovation be encouraged? Can it be enabled by deliberate product design, or by collaborative mechanisms such as blogs, wikis or creative commons? Are extrinsic motivations such as signalling and prospective employment more important than social motives? What are the features of the firms (and public institutions) which explain differences in their ability and propensity to utilize user-generated external innovations?

Overcoming biases requires a cognitively sophisticated and disciplined approach to decision making. Corrective action includes a coherent design of organizational structures, incentives and routines to leverage and reward creative action, and punish inaction. Secondly, developing open and questioning routines to enable the shedding of established assets and routines that no longer yield value. Managers must reflect on and appreciate the interaction effect between owning established assets and decision making biases. Prejudices against technology from the outside are another challenge which needs to be addressed in order to implement a broader search for ideas. All these issues deserve further research in firms as well as the public sector.

The perspective of open innovation (Chesbrough 2003) shifts the role of internal R&D and internal innovation processes as the primary discovery and variation generating mechanisms to systems design and integration as the key function. This paradigm suggests that firms scan the external environment prior to initiating R&D activities. If this search process succeeds, the firm will use it. The firm constrains internal R&D work to technologies that are not readily available in the market, and/or to those technologies that undergird the firm's core competence. In that case, more specialization and use of intermediaries will result. What are the consequences for the firm and the ecosystem of innovation? The yield from the firm's R&D efforts may increase, encouraging management to further commitments to innovations and R&D spending. On the other hand, the lack of spillovers from other firms may deprive the firm (or the region or industry) from organic growth opportunities. Will the network approach be sustained, or will mergers and acquisitions lead back to internally integrated systems? Do large firms differ from small firms and new entries in their attitudes to a network approach? Do firms with larger internal R&D departments differ from those with small or no such departments? These issues are open for more research.

In disruptive circumstances firms need a new or adapted business model to create and appropriate value (Amit and Zott 2001). What are the dynamic capabilities of firms to identify new business models to take advantage from disruptive technologies? How does the focal firm manage the conflicts between its interests and those of the external partners? Are market contracts more or less prevalent than relational contracts? How are networks and management processes different for technological discontinuities (Utterback 1994) or disruptive innovations (Christensen 1997)? How to convince potential partners to join the network during periods of high technology, market and financial uncertainty and ambiguity? We do not know how the value created by the network is shared among the participants or whether variance in relational and structural aspects of network coordination affects the value realized (Chesbrough, Vanhaverbeke et al. 2006).

The meaning of core competencies may shift with more open innovation systems. It becomes more important to develop skills at incorporating others' specialized technologies and knowledge, rather than developing their own. This works both ways: a more open innovation system provides a broader market for the firm's core competencies, giving support to other companies' products, services and business models. The role of the network orchestrator or stage director is crucial, and is obviously a candidate for a new core competence. When and how is governance shared across the network? How do the members overcome the threat of opportunism due to lock-in situations and investments in specialized assets? Are these issues best researched from an efficiency or power perspective?

If companies increasingly are embedded in networks and dynamic ecosystems, a change in the nature of competition is expected (Chesbrough, Vanhaverbeke et al. 2006). Rival firms may instead collaborate within a network, and compete as a group against other networks or vertically integrated corporations. Are these networks exclusive, and which factors make exclusivity more or less attractive for firms?

Research on innovation networks should embrace the individual level. Most likely these are based on informal ties, and may play a crucial role as transfer mechanism of tacit knowledge flows. The importance of trust and social capital is a highly relevant research topic. Are there differences between industries, regions and firms?

Executing the project lies at the heart of the innovation process, which outputs are both a developed innovation and a prepared market (internal and external). This is fundamentally a challenge in project management under uncertain conditions. The lack of knowledge at the outset and the changing picture as new knowledge is brought in during development means that a high degree of flexibility is required in terms of overall goals and sequencing of activities.

4.4 Clusters and regional innovation systems

Increasingly clusters – regional concentrations of interconnected firms, specialized suppliers, service providers, firms in related industries and associated institutions (universities, research institutions, trade associations etc.) – are perceived to be the

locus of economic growth. In the Norwegian context, Torger Reve and his colleagues have argued that regional industrial clusters are creating more economic growth than more dispersed local enterprises (Reve and Jakobsen 2001). Internationally, theories on clusters are strongly associated with Michael Porter and his seminal books The Competitive Advantage of Nations and On Competition (Porter 1990; Porter 1998). He argues that a region's competitive advantage within an industry is related to

- Factor conditions (the region's position in factors of production, such as skilled labor and infrastructure)
- Demand conditions: the nature of home demand for the industry's product or service
- Related and supporting industries: the presence of supplier industries and related industries that are internationally competitive
- Firm strategy, structure and rivalry: the conditions governing how companies are created, organized and managed, and the nature of regional or domestic rivalry
- Government: investment in education, regulations, competition policy, incentives for entrepreneurs
- Chance: inventions, breakthroughs in basic technologies, major shifts in foreign demand that create discontinuities

The determinants, individually and even more as a system, create the context in which a region's firms are born, collaborate and compete: the availability of resources and skills necessary for competitive advantage in an industry; the information that shapes what opportunities are perceived and the directions in which resources and skills are deployed; the goals of the owners, managers, and employees; and most importantly the pressures on firms and institutions to invest and innovate (Porter, 1990, p.71).

Another strand of research makes efforts to increase our understanding of how successful clusters come into existence. Porter has created a list of conditions, but how do they emerge? Every cluster and industry has a beginning. What are the roles of entrepreneurs? What do we mean by regional leadership? These are important issues in the Stavanger region which strives to develop additional clusters to avoid the dependence of the dominating oil and gas sector.

The emergence of the dominating oil cluster has "branded" the Stavanger region as "The oil capital of Norway". In many parts of the world, this brand does not confer good associations. The introduction of "Branding Innovation" might be more compelling, in other words how innovative clusters and regional innovation potentials can be used in the marketing of the region.

Clusters are not closed systems confined to regional, geographical boundaries. The relevance of cluster research is obviously enhanced by focusing on global innovation networks, in other words how enterprises, regions and clusters collaborate globally to strengthen their positions. The Stavanger region is one of the most internationally oriented regions in Norway and presents itself as "Open Port". The cluster concept has been challenged recently, and the concept of "hubs" has been introduced. Recent studies

of globalization have highlighted three interrelated changes in the global economy: (1) the growth of worldwide production networks; (2) the growing fragmentation or 'deverticalization' of the production process; and (3) a new pattern of geographical industrial clustering, in which activities at the same or adjacent stages in the value chain are located close to each other. These findings point to the need for modifications or extensions to the theory of industrial 'clusters' popularized by Michael Porter, with its logic of agglomeration and industrial specialization at the regional level (Cassidy, Davis et al. 2005). They suggest that it is time to shift away from thinking about regions or locales in terms of more or less self-contained clusters of economic activity, and towards the idea of regions as globally connected 'hubs' (Gereffi and Sturgeon 2004), in which firms – and individuals – are continually making choices about whether to move their assets and capabilities elsewhere and whether to acquire assets and capabilities from elsewhere. The economic development problem in the era of globalization is thus only partly about the internal components, structures, relationships, and processes that are emphasized in descriptions of how clusters operate. It is also about the connections of the region to geographically-dispersed economic networks

Related to these issues is the subject of innovation in institutions and institutions for innovation. The notion of open innovation (Chesbrough 2003) emphasizes that innovations take place within an ecosystem, in which institutions play a key role. A major topic is examining not just how institutions affect innovation, but also how innovation affects institutions and the basic mechanisms of institutional change. The specific feedback loops between different institutions, sets of rules, governance structures, and innovation are still little understood (Malerba and Brusoni 2007). A key issue is understanding the extent to which firms and public organizations have their behaviour determined by the institutional environment, as opposed to whether they are free not only to navigate, but also influence the dynamics of that environment. In the section above, exclusive and collaborative networks were discussed. In that case, what are the implications for competitions policies?

Research suggests that unique regional paths or recipes develop for applying knowledge, commercializing inventions, and creating new industries. Most technology entrepreneurs operate on thin margins and their focus is on short term survival. Often their actions are focused on solving problems or utilizing opportunities. Instead of deliberately planned, entrepreneurial activity is by necessity messy, complex and adaptive. The solutions they adopt are more likely to come from local sources, either through tapping networks of people working on similar things or through serendipitous encounters. Hence the importance of social capital, collaboration, and trust.

Some histories of clusters stress the brilliance and clear visions of one or a few dedicated individuals. Certainly, these are good stories, but their legacy lies in the social organization of their model of innovation and its evolution over time. Having a rich supply of local entrepreneurs is certainly advantageous, but in Silicon Valley it is the institutions that nurture firms which provide a powerful advantage over other regions. Technology firms located in Silicon Valley are capable of rapid growth because there is an understanding and a widespread appreciation of how things are done and how people work together. This set of interrelated institutions is formed over time in tandem with the entrepreneurs and firms that make up the industries in the region. Social scientists

have come to use various names for this structure: *ecosystem*, *innovation system*, a social structure of innovation or an *incubator region*.

Most accounts of cluster formation and regional development include some triggering events coupled with an entrepreneurial spark. Emerging clusters can be accounted for by some initial seeding event. However, what matters most in what happens next. There may well be pre-existing social or natural conditions or resources (in the Stavanger-region: oil, gas, fish, agriculture) that account for the appearance of the first seedlings of growth. The actual shift of a given location into a leading position may have less to do with these pre-existing resources and more to do with the increasing returns derived from the region's social structure of innovation. Many oil rich nations and regions are very poor, in contrast to the Stavanger region. What seem to distinguish clusters that grow rapidly from the stagnating ones are vigorous entrepreneurial activity and the purposeful building of institutions aided by the forces of agglomeration economies.

The second phase starts when one particular location starts to pull ahead of other locations. This may be the result of purely random processes, or some unique resources in the location's development logic or ecosystem. The internal social dynamics seem to be the differentiating factor.

A third phase can usually be identified when a location and industry gain competitive advantages and reach out to new markets. From an evolutionary perspective it is hard to predict which of the locations in the first phase will be the dominant location in this third phase, except by reason of the region's superior command and coordination of localized increasing returns effect. In other words, the initial phases of a cluster development begin as an open window of regional opportunity. There may be strong and deliberate regional factors and decisions underlying the initial steps in this process, or there may be none. The important analytical issue may not be how the seed was planted, but how it becomes related to, supported by and coevolved with the structured and self-reinforcing local economic system. Cluster formation is not a deterministic process. The emergence of clusters may be seen as an co-evolutionary process of opportunities, incentives, luck and competencies in a self-organizing process

In a policy context, clusters are born and develop on the basis of specific regional combinations of knowledge and capabilities, incentives and opportunities. The regional pool of knowledge and social relations contribute to create and define opportunities, but they may also restrain innovation because of myopia.

The importance of scientific knowledge differs from industry to industry. The evidence supports the view of strong agglomeration forces in high-technology sectors, mainly related to the concentration of scientific knowledge. Adequate incentive structures and entrepreneurial activities are also important, but their nature and effects differ across time and space. The initial phases of clusters are influenced by structural conditions, including the interplay between public investments and innovative activities, but *processes* are the essence of what clusters are made of. Cluster formation is a process that relies on the co-evolution of technology, business models and regional supporting institutions. Seeds of clustering may either stick and a cluster forms, or slip away and the nascent cluster fails to develop and grow.

4.5 The innovative university, knowledge, skills and technology transfer

Increasingly, university strategies pursue efforts to stimulate regional development with potential multiple roles (Hatakenaka, Westnes et al. 2006). Universities educate people, engage in problem solving for industries, add to the stock of codified knowledge (publications, patents etc.) and provide space for public dialogues. The implementation of university strategies is enhanced if appreciated that regional innovation-led development may have different pathways. Four such pathways have been identified: indigenous creation of a new industry (Pc's in Silicon Valley), transplantation of new industry into region (the arrival of the oil industry in Stavanger), diversification of existing industry into new (transforming the oil and gas cluster into a broader energy cluster), and upgrading of an existing, mature industry. The success conditions and failure modes of these pathways are different as are the pattern of innovation and the role of universities and research institutions, financial institutions and government. Acknowledging these differences would enhance the relevance and quality of research and improve our understanding of differentiated knowledge and skills transfer mechanisms. Universities and research institutions may contribute to regional innovation processes in many ways, which should be reflected in research. The implication is that these institutions need to think strategically about their regional contributions and knowledge and technology transfer mechanisms. Research on how these strategies come about and are implemented is encouraged.

Part of this picture is a growing awareness of the notion that research based knowledge and technologies from universities may enhance national and regional economic growth and welfare. The key university technology transfer commercialization mechanisms are licensing agreements between the university and private firms, university-based start ups and research joint ventures. These activities may result in financial gains for the university and other benefits such as additional sponsored research and hiring of graduate students and post-doctoral fellows, as well as job creation in the region.

The growth in public and private investments in university-based knowledge and technology has raised important policy questions regarding the impact of such activities on researchers, universities, firms and the respective regions. Since this development is rather new, researchers, university administrators and policy makers seek evidence on specific organizational practices related to incentives, strategic objectives and measurement and monitoring mechanisms. For the same reason, the academic literature is so far not conclusive in these matters. Recent research related to university technology transfer includes faculty participation in technology commercialization (Owen-Smith and Powell 2003), university licensing strategies (Feldman, Feller et al. 2002), university incentives and licensing revenues (Lach and Schankerman 2002), firm linkages to universities (Cohen, Nelson et al. 2002), the performance of licensing firms (George, Zahra et al. 2002), the performance of university-based start-ups (Link and Scott 2005) and antecedents to commercialization speed of university-based inventions (Markman, Phan et al. 2005).

Universities are also confronted with issues related to ethics and social responsibility if a more aggressive strategy for technology commercialization is pursued. Widespread

commercialization might be exacerbating inequalities across departments and destroying the traditional openness of university culture. Nelson points out that aggressive exercise of intellectual property rights by universities is inconsistent with the long-standing tradition of open science and training (Nelson 2001). Consistent with this view, Blumenthal et al found that university scientists engaged in technology transfer-related activities are less likely to share their data with fellow scientists and are – in general – more secretive than comparable university scientists involved in technology transfer (Blumenthal, Campbell et al. 1997). These issues raise fundamental practical and political questions and more research is needed.

Because of the localized nature of successful technology transfer, one may argue that such expertise is hard to imitate and transplant across regions. Theoretical perspectives like institutional theory and evolutionary economics perspectives may explain the persistent differences in effectiveness of technology transfer across locales, and perspectives from the strategic management literature such as the resource based view (RBV) of the firm and social network theory could provide a basis for more insights in future research.

Research should also focus on differentials in the use of research based knowledge. For firms, customers and suppliers are the most important partners in their innovation efforts. Universities and research institutions play a minor role. Why is it so? Pure ignorance or no need? With well established research institutions and a novel university, these are salient issues in the Stavanger region. Understanding the innovation processes in firms and the public sector could inform universities and research institutions how they strategically should adopt and seek opportunities. What are the most salient transfer mechanisms? Is it institutional setups, or do the interpersonal ties of academic researchers affect the use of their innovations by private industry and public institutions?

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