

# **Technological change, local capabilities and the problem of restructuring**

Eirik Vatne

Department of Geography  
Norwegian School of Economics and Business Administration/University of Bergen  
Bergen, Norway.

## **1. Place and economic performance**

Economic geography has moved a long way from yesterday's neo-classical location analysis to our contemporary interest in industrial dynamics, innovations, learning and regional embeddedness of business firms. Still we are interested in understanding the same subject matter - how economic activities are connected to specific locations and how business firms use territorial differential resource endowment in their struggle to earn a profit.

The critic of both normative marginalist economics and Marxian structuralist explanations in economic geography has opened up for a search after new models of understanding the firm/space nexus. It should not be necessary here to discuss all the different schools of thought fighting for acceptance during the last fifteen years of academic discourse. What is of more profound interest is how this new turn has brought us in touch with other disciplines outside mainstream neo-classic/Keynesian economics, Marxist economics or traditional management science.

From evolutionary economics we have learned a great deal about innovation, learning and path dependence, about technological change and the dynamics of capitalism. From economic sociology and institutional economics we have learned peopling the economic landscape and understand how deeply rooted production and particular organisation of production is in social life. From social theory we have been inspired to analyse the dual relationship between action and structure and the formation of everyday life. From phenomenology we have been thought that meaning and knowledge are strongly connected to language, symbols and the subject. All of these lines of thought see social behaviour and economic dynamics as embedded in social activities which in some way or another are territorially rooted. Context is developed as a new core concept of social and economic development.

Inside geography we also have seen a remarkable change in different sub-disciplines where the theoretical discourse as in economic geography is much more diverse in search for new models. This has also opened up for the inclusion of economic action and structures both in cultural and social geography.

If this is not enough, mainstream economics has reinvented the spatial dimension in endogenous growth and new trade theory and has at long last succeeded in modelling uneven development. In strategic management theory industrial/territorial clusters are seen as an important explanatory factor for success in a competitive world.

As a result of the inclusion of these new lines of thought in economic geographical analysis, our sub-discipline is well on its way to become an inter-disciplinary approach in itself. This is at the same time both exciting, scaring and dangerous. Exciting, because it brings in a lot of new ideas to be examined and critically inspected. Scaring, because it brings into the discipline such a flood of literature that it is impossible to be updated on all fronts of the different discourses. Dangerous, because it could take us further out on an eclectic quagmire where no concepts or analytical grips are commonly accepted and where the struggle to find a simplifying theory of spatial economic development is drowned in a cacophonous discussion of individual cases and unique events.

Anyway, one consequence of these changes has been a renewed interest in a central object as place in human geography and a project to develop a 'new' regional geography where places are understood as constituted in a wider social context. The locality debate was one attempt, humanistic analysis of place and identity another. The former had relations to structuralism and economic integration, the latter was related to phenomenology and cultural integration. Ideally a reconstructed regional geography has as a theoretical program to analyse individuals as agents, places as context and causality as an iterative process where actions in our daily life interact with structures on a higher level and in dialogue with other social systems outside the object of interest.

In economic geography we also can see a renewed interest in localised societies as a starting point for studying endogenous growth and change. More and more we emphasize path dependence and social embeddedness as crucial factors guiding economic development of nations, regions and places. If the establishment and maintenance of places primarily should be understood as an outcome of human action, an important task in economic geography would be to relate economic activities to a material base, to human agency, former practises and established institutions as they appear in place specific contexts. At the same time places are integrated into a larger social and economic web which makes it absolutely necessary to study the economic development of places also in an extra regional context.

A spatial related society can be studied as a spatial phenomenon constituted under specific material and social conditions. An ontological debate has been going on for ages on the question whether there exists an object called space and if such an object have causal power on man's behaviour and living conditions. Let me agree with Werlen (1992) that space in itself cannot have an independent and direct influence on human behaviour. Space is not an empirical, but a formal and classificatory concept. Knowledge about the spatial location of an object alone will make it unfruitful to deduce anything about that object. In isolation spatial location therefore will always express only formal aspects of a spatial object. Spatial objects can only be a frame of reference for social life, but it gives an opening to understand material and territorial implications of social action in relation to a physical world. In other words;

what is the outcome of social action is dependent on the binding social life has to the material world and thereby to spatial location or territorial context. In the end this implies that only subjects can act and by that change the world. It is social action and social structures created by earlier actions which constitute social life in place specific social systems, not the place understood as a spatial object.

Social actions are therefore formed by specific conditions in spatial related societies. One important condition is what we unprecisely call culture. One definition is:

‘Culture is a set of ideas, customs and beliefs that shape people’s actions and their production of material artefacts, including the landscape and the built environment. Culture is socially defined and socially determined. Cultural ideas are expressed in the lives of social groups who articulate, express and challenge these sets of ideas and values, which are themselves temporally and spatially specific.’<sup>a</sup> (MacDowell 1994:148).

A culture is expressed in conventions which is a set of commonly accepted rules for social behaviour (Storper 1992). Conventions are often not articulated, but regulate social interaction in a ‘hidden’ way through routines or unwritten ‘laws’<sup>a</sup>, but they can also be expressed as formal rules or written procedures and through well established institutions. Such commonly accepted rules for social behaviour will structure human agency. They are the underlying form of collective order which direct social behaviour in specific directions, but not necessarily in a deterministic way. Cultural ideas and values are linked to power relations. Control over cultural ideas and values are an important part of social struggle and political activities. In which way and with what speed conventions are challenged and changed are important elements in the ability social systems have to adapt to a dynamic capitalistic world where competition is the rule and ‘the ways of doing things’<sup>a</sup> are constantly challenged.

In this way economic action and economic life is deeply rooted in social systems. It is difficult to understand economic processes without including social actions and social institutions at the core of a working economy (Nelson & Winter 1984, Hodgson 1988, Granovetter & Swedberg 1992).

Neo-classical economics on the other hand rest on two basic assumptions in conflict with this view (Block 1992). First is the idea that the economy is an analytical separate realm of society that can be understood in terms of its own internal dynamics. Second, neo-classical theory assumes that individuals act rationally to maximise utilities. From such assumptions follow a tendency to ‘naturalise’<sup>a</sup> the economy in the sense that economic arrangements are seen as a timeless product of the need to economize with scarce resources and not as phenomenon which has a specific history and a specific social and territorial context. Social, cultural, and political determinants of economic action are omitted. The result is often an ahistorical and tautological procedure that continually rediscovers the centrality of purely economic motives.

An alternative way to understand economic behaviour in a ‘non-naturalised’<sup>a</sup> way, must be sensitive to historical context and open to factors outside the realm of pure economics. An alternative way will include a different conceptual understanding of the shaping of economic action and by that an alternative theory to understand the world we live in. Block (op.cit) argues that economic systems are primarily formed by three factors; 1) individual actions which could be, but not necessarily are structured by a market, , 2) state actions which regulate and structure the economy through different institutions ableing for example the functioning of the market as a centre for economic transactions, and 3) social regulations

which condition and shape microeconomic choices. We need to analyse all of them to understand the working of an economic system.

There obviously exist some material conditions for economic and social activity which often are linked to natural phenomena as landscape, access to natural resources, built environment and physical infrastructure as road or telecommunication networks. Also human action is materially bound through the physical condition of the body. Mixed with contextually specific social mechanisms this implies that human action is restricted by spatial conditions. The material base of a place specific society, its conventions and institutions interact with human agents and shape the culture of the place. At the same time this culture takes part in shaping the conventions and institutions of a place specific society (Saxenian 1994).

In a modern, globalised world there also exists a continuous reflexive interaction between regional, national or even global institutions or cultures. One crucial point in the debate is if it is the local/regional or national/global culture which is the basic determinant for the shaping of localised conventions and the development of a local social culture. In analysing economic innovation systems geographers as Storper and Saxenian seem to put heavy weight on the subnational level, but evolutionary economists like Lundvall (1992) and Nelson (1993) are more in favour of the nation as the primary level of analysis. Others will argue that it is the contextual situation which will define which level will be of most importance in the structuring of a place.

The importance of skills, routines, practices or conventions in economic life is not of new date. Marshall's famous line (1938) '... as it were in the air' tells us that real life economics hundred years ago also saw the importance of social behaviour for economic performance. But as Weber (1922) proclaimed static analysis and deductive methods made it impossible to analyse the complex relationship between social processes and agglomeration.

## **2 Technology and knowledge production**

Our renewed interest in knowledge and learning and the institutionalisation of knowledge is very much a product of a shift in economic life away from a linear development path towards a more chaotic and change oriented economy, where innovations are a crucial factor of competitiveness. This debate very much emphasises development of technology and knowledge, technology understood as the organisation of the relation between man and machine or principles of organising productive activities. Technology in this respect is important because it constitutes the most dynamic element in economic activity.

In standard procedures in economics the informative aspect of technological knowledge is most in focus. In standard microeconomics technology will be characterised as a public good, mainly developed through scientific processes, easy to diffuse as information and easy to use. Technology is developed as an institutional project aiming to introduce innovations rooted in scientific discoveries or general methodological procedures, developed in research laboratories. Under these circumstances adaptation of new technology has a low cost.

An alternative approach will focus on the technological aspect of knowledge. The tacit nature of technological knowledge both in development and in use will here be in the front line. In

this approach technological knowledge is mainly experience based and therefore specifically connected to the environment where it is developed. It is primarily through the use of technological knowledge one experiences and learns how it functions. Such an experience is also important if one should be able to develop technological knowledge. In this case transfer of knowledge is difficult and the cost of adoption high. If so, technological knowledge will be exclusive and in some sense rivalling. Technological knowledge is firm specific and in some case regional specific. Under these circumstances knowledge is very much a product of non-institutional endeavours mainly based on learning processes which in most senses are 'localised'<sup>a</sup> and specifically linked to the history and experience of the entrepreneur (Antonelli 1995).

Both approaches correspond in some sense with reality and what Antonelli calls generic or 'local'<sup>a</sup> technological knowledge. Localised knowledge is highly idiosyncratic. It is developed through everyday practises in a factory or an office, in interaction with individual experience based knowledge and purchased machinery and processes, through problem solving and

development of tools and equipment, or in interaction with customers, other producers or suppliers of capital, material or equipment. Such knowledge is mainly a result of learning by doing, learning by using or learning by interacting. Even formalised R&D will in this case be characterised as experimental problem solving in development of new products or processes, or a learning process capitalising on earlier developed knowledge.

Generic technological knowledge on the other hand consists of general principles usable under different circumstances and by many different users. Even this kind of technological knowledge is in its root based on tacit learning. But through the use of large resources of labour and capital such knowledge can be fully articulated as one knows most sides of the phenomena one has developed. This form of knowledge can therefore be codified and described in written medium. Generic technological knowledge is often embodied in material products as machinery and can therefore be transferred more easily. Even so, the use of such machinery and the integration of new and existing equipment and procedures is often difficult and costly, and again demand access to tacit, experience based knowledge (Gertler 1995).

Development of knowledge is therefore in most cases an accumulating activity. New knowledge is basically based on already existing knowledge, but in new configurations. Of course we could find elements of radical new innovations from time to time, but generally the 'normal'<sup>a</sup> technological renewal is based on an incrementalistic, experience based process.

Industrial praxis and established production technologies are therefore shaped and maintained by individuals, first through experimenting, later through repeated and co-ordinated actions which again are developed into routines. Such routines or conventions can later be institutionalised as delivered instructions and rules of resolution. Individual actions are therefore integrated into a specific context where agency is 'guided'<sup>a</sup> and the development of firms and even localised places are structured through 'path dependence'<sup>a</sup> and 'embeddedness'<sup>a</sup> (Dosi et al. 1992).

In any respect the development of an economy in general and a firm specific one in particular is based on human action and social structures and institutions which in a dualistic way develop new technological knowledge or economic competence through a complex web of former experiences and practise, daily learning experiences and adoption of generic knowledge. The specificity of much knowledge also has as a result that the development of

knowledge is highly dependent on the contextual situation in which actions are embedded. In this respect the localisation of economic activities and knowledge development are of importance. Some geographical environments and the internal culture seem to be well suited for dynamic and economically sound development of knowledge, other environments can function as a barrier for entrepreneurship and change.

An important research problem in economic geography should therefore be to identify which mechanisms of place specific actions and institutions, past experiences or extraregional linkages are of importance in determining if a place, its institutions and individuals will be able to change and develop in correspondence with a competitive globalizing capitalism or if the place will follow its institutions into a dead end or 'lock-in'<sup>a</sup> situation where stagnation and decline is the future prospect.

### **3. Structuration theory and development of places**

During the early eighties Anthony Giddens (1979, 1981, 1984) developed a theory of structuration which had great influence on the debate on social theory and social development. As Gregory (1994) remarks, it makes most sense to treat Giddens's writings as a research programme underway trying to conceptualise the dynamics of social life and human society. It appears as a loose-knit web of propositions, unevenly developed. Giddens tries to escape from collectivism as well as individualism in a programme, emphasising the dual relation between action and structure which also include the importance of history and space in the constitution of social life.

As the discussion above has shown economic life is deeply integrated into social life and all sorts of routines, conventions or existing cultures as these appear as products of history and man's action in earlier times. At the same time innovations and change are at the core of capitalist development. External shocks can alter a firm's competitive strength, radical discoveries of new materials or new organisational principles can change the way business is done, but still adaptation to such events and the ability to develop an endogenous innovative power is still very deeply rooted in the history and the present environment of the firm. Even for innovative activities context is therefore of paramount importance.

The starting point in structuration theory is that actions create structures and structures restricts action (Giddens 1984). Giddens's point is to put equal importance on action and structure in time and space as time and space-specific structures restrict action, but at the same time actions create history. In other words structural elements as established institutions, relations of power or norm systems will all restrict human agency and 'guide'<sup>a</sup> action in certain directions but not in a deterministic or 'law-like'<sup>a</sup> way. Further, social systems or societies must be understood as social objects which demand repeated action to be sustained. Therefore social systems is not determined once for all but are a dynamic social objects which can be altered through alternative choices of action. Structures in this context are not only barriers for action, but also important elements in the production of action.

To understand social systems we have to analyse present structures as a product of past actions and at the same time analyse action in other interrelated social systems influencing our social system. This implies that explaining the development and maintenance of a social object also has to include a time and a spatial dimension.

Individual actions are connected to the constitution of societies through what Giddens calls social integration and system integration. Social integration takes place through social systems which regulate interrelated actions between co-present individuals and shape social practices. System integration relates to structures and actions outside the co-present social system, from earlier time or from present actions in related social systems but outside own 'locale'<sup>a</sup>. These elements are 'absent'<sup>a</sup> in the moment of action, but are still important elements in the shaping of actions and for the outcome of the structuration process.

In Giddens's mind social integration is formed by routinised interaction between agents who are both present in time and space. A lot of our everyday practises are formed by conventions or norm systems and social routines not consciously activated with every action. But even if the motivation for actions is unconscious, it gives a base for intentional action. In other cases actions are motivated by specific purposes and evaluation of alternatives. Even though the effectuation of intended actions often can produce unintended consequences. Human subjects acting intentionally or unintentionally are therefore important elements in social systems.

Social systems are formed by social rules and control over important resources in society. Social rules have the intention to sanction some sort of behaviour or guide our understanding of social phenomena and meanings. Influence and power in society are connected to investments in authority and property. Control could be achieved through political - authoritative resources or economic - allocative resources.

The rules and resources available in a society will shape the social practises developed in this society. Through communication, power and sanctions interaction systems are guided in specific directions. This implies that actions in everyday life are connected to the long standing development of social institutions. Power relations in such systems will often result in a reproduction of the existing social institutions. To break away from established norm systems and change important institutions, conflicts between individuals/groups of individuals are a necessity or contradictions between what Giddens calls structural principles must appear.

Social systems are not only formed by social rules and routines or through control over resources. As already said, social systems are also formed by a time and spatial specific context, which lays a framework for the meeting of structure and agency. Social integration demand present co-existence of individuals, system integration not. The degree of system integration will be different from society to society. Some traditional societies would be only loosely linked to external action in other present social systems, but more connected to a space specific history. Modern post-industrial societies on the other hand would be in extensive interaction with present social systems, but in less degree linked to history. The relation between present and absent elements in the structuration process will therefore vary between societies. On the one hand society is created in micro of the interaction between individuals and groups co-present. On the other hand society is exposed in macro of forces from absent elements of relevance for the forming and understanding of present social behaviour.

In Giddens's terminology the basic feature of a social system or what we could call society is the clustering of co-ordinated institutions in time and space. Such concentrations follow from what Giddens calls structural principles. This is the organisational principles for the overarching institutional co-ordination of the society, for example capitalism. There also must exist normative elements in a society which can proclaim some sort of legitimate right to

occupy a specific 'locale'<sup>a</sup>. Members of such a society also should accept some sort of common identity.

It is problematic to see the border of such a society and also the closeness or openness of a specific society in time and space. Space specific societies are differently institutionally articulated and they control different material conditions for economic activities. Therefore the joining of the 'present'<sup>a</sup> and the 'absent'<sup>a</sup>, the integrative processes which constitute societies, will be differently structured between societies.

Structuration theory has been criticised for the ontological character of the theory. It is a form of 'grand theory'<sup>a</sup> which is fascinating in its holistic analysis, but problematic when one brings together the details of the different elements of the theory. As a guide for empirical work it is also highly problematic to use the concepts developed and find adequate operational measures.

In human geography structuration theory has attracted a lot of interest because it is one of few attempts in social theory to include the spatiality of social life. Pred (1985) sees 'the constantly becoming of places'<sup>a</sup> as a result of a structuration process where social and spatial structures as places not only acts as barriers for individual or collective human action, but also as fundamentally involved in the production of such actions. This is so because such structures at all times shape the contextual conditions for action and at the same time are the result of the continuously reproduction and transformation of human actions. The becoming and maintenance of places can therefore only be understood as a historical contingent process.

Gregory is more sceptical to Giddens's understanding of spatiality in the structuration of social systems. Structuration theory remains close to the analytics of spatial science by theorising the problem of order as in large measure a problem of pattern. In Gregory's mind it says little about sense of place and symbolic landscapes in the reproduction of social life (Gregory 1989). Referring to Hägerstrand and Heidegger, Gregory argues that time-space relations are not a contentless form in which object exists, but express the nature of what objects are. Social practices therefore depend upon a series of time-space discriminations within and between different projects. Social practices are collateral processes which take place within bounded regions. To enable such projects to develop Hägerstrand argues that there must exist some time-space modalities referred to as capability, coupling and steering 'constraints'<sup>a</sup>. Such modalities can have a concrete form as institutional projects which routinize social action and reproduce structures. Such routinized conduct is important, but failed projects or innovations are of equal relevance to time-geography and the constitution of social life in time-space. In Gregory's mind Giddens runs the risk to minimise strategic intentionality and muting discursive consciousness. Giddens does this by avoiding a discussion of the influence of technical change and diffusion of innovations, and also by not including discursive knowledge or the unknown. He neither discusses the existence of mechanisms for de-routinization 'from the inside'<sup>a</sup> without crisis or external force, and the way routines can become progressively disengaged from the circuits of reproduction. Structuration theory is not very well equipped to conceptualise other forms of society than the traditional static one.

The difference between a closed local routinized reproduction process and an open, complicated, fractured and none-routinized structuration in a globalized world is enormous. The first is characterised by 'community with others'<sup>a</sup>, the second with 'the larger world stretching away from the human body and the human being'<sup>a</sup> (Gregory 1989:188,189). Social

life is increasingly dependent on exchanges with elements which are absent in time and space. This is what Giddens calls system integration. The way societies are embedded in time and space is called 'stretching'<sup>a</sup> time-space distanciation. In the modern world absence in space does not hinder system co-ordination. Structuration theory tries to show how the limitations of individual 'presence'<sup>a</sup> are transcended by the stretching of social relations across time and space.

Writing is one media opening up social interaction in time and space. Likewise is money a medium which makes it possible to extend allocative power in time and space and to allow for a commodification of everyday life. Gregory claims that Giddens treats time-space distanciation as essentially progressive, entailing the gradual widening of systems of interaction. By this he minimises the volatility of these extensions.

'The landscape of contemporary capitalism provides some of the most vivid examples. They are riven by a deep-seated tension between polarization in place and dispersal over space. On the one side, constellations of productive activity are pulled into 'a structured coherence' at local and regional scales, while on the other side these same territorial complexes are dissolved away through the restructuring and resynthesis of labour processes. The balance between them - the geography of capital accumulation - is drawn through time-space distanciation as a discontinuous process of the production of space.'<sup>a</sup> (Gregory 1989:207)

Space seems to be a barrier for the circulation of capital, but this barrier can be transcended through the production of fixed and immobile spatial installations. In this lies a contradiction; in order to overcome space, spatial organisation and immobile configurations are necessary. In Harvey's mind (1982) this fact explains why regional configurations are chronically unstable. In this manner 'time-space distanciation is closely connected to spasmodic sequences of voalization and devolarization and must be embedded in a theorization of locational structures of production and reproduction'<sup>a</sup> (Gregory 1989:208).

This brings structuration processes in touch with location theory and economic geography.

#### **4. The restructuring of a one company town.**

Rjukan is one of the oldest company towns in Norway, established by a few Norwegian entrepreneurs with good relations to foreign capital. The material base was a large waterfall easy to convert to hydro-electric energy. The social base was an invention which could extract nitrogen from the air using a lot of electric energy and process this further into nitrogen fertiliser. Commercial agriculture was in the first development phase at the turn of the century and the market for artificial fertilisers was under an enormous growth. At the same time it was the time of pioneering in the chemical industry. Many competing technologies were fighting to win a share of the high profits waiting. The location of the factory in a remote valley in Norway is explained partly contingently through a Norwegian scientist's discoveries and partly rationally by location economics and territorially fixed energy resources which were not possible to transfer at that time.

From 1907 to 1967 these factories gave work to 1200-1600 people. The town peaked at a population of 12.000 people. Through the first world war and the turbulent twenties and thirties the plant and the place ran into different crises and temporal redundancies, strikes and

high unemployment. In spite of technical changes, economic crisis, social unrest and political struggle the town has provided a fairly stable life over the years for many families and individuals.

This sort of stability was broken in 1962. A new radical innovation in process technology revolutionised the fertiliser industry. Factories based on coal or hydro-power were out-competed by a new process based on oil/later gas and in need of only a tenth of the area, a tenth of electric energy, a third of the labour force and half of the capital needed in the existing technology. The new production technology also included strong economies of scale, the old not, and the input needed in the new process demanded a port location, at least in Europe. The economic fact of this revolution was that most investments in new capacity chose new sites. The old technology and with this the old industrial sites were faded out at once or over some time (Vatne 1981). At Rjukan the company decision was to restructure the activities and reduce capacity and labour in sequences from 1967 and onward with a close down in the late seventies.

Since 1962 the dominant company, individuals, the local and national government and different public agencies have been working to restructure the town to other activities and other businesses. As the figures in table 1 indicate, this job has not been very successful. Almost two thirds of the jobs in manufacturing have disappeared and the population has been shrinking all the time.

Table 1. Jobs in manufacturing in 1960 - 1995

Ownership	1960	1970	1975	1980	1985	1990
1995						
Dominant firm	1600	800	570	626	565	292
300						
Owned by dominant firm						
44						
Small plants under extr. Norwegian control		293	461	480	247	182
148						
Small plants under foreign control			32	52	23	80
79						
Local small firms	26	16	30	26	35	59
63						
Total	1626	1109	1093	1184	870	613
634						
Tinn municipality	9614	8478	7788	7482	7270	6899
6775						

The most striking feature of the table is the external control of the existing manufacturing firms in this locality and the almost totally missing local initiative in job generation. Even though the local economy has run through a small revolution, the overall picture is more or less the same as it has been since the place was founded.

In a newly published study on new establishment, small firm growth and regional development Isaksen and Spilling (1996) show that the degree of new establishment compared with working population generally are weakest in one sided industrial towns. One important conclusion from this study is that the degree of new establishments seem to be a function of the existing industrial structure. In other words an economic structure is reproduced mainly through new establishments in the lines of already existing industries. Municipalities dominated by large firms saw few new establishments. In explaining this, ordinary location economics or political economy want help very much. We have to change our perspective from static analysis of production function or locational factors as supply of energy, labour or capital combined with transportation costs to the dynamic side of value creation as learning, action, innovation, network and internal and external endowments. Can structuration theory and theories of learning and knowledge production give some new insights to this question? Under influence of Pred, let me try.

As a starting point a structural principle is an important element in the creation of a society. The development of our town was shaped in the form of international industrial capitalism and new generic technological principles for chemical production. The implication was the establishment of capitalistic institutions generally and a large, capital intensive, process technological industrial organisation specifically in a peripheral, sparsely populated and traditional agricultural society. A logical implication of this was an influx of labour commonly present at an industrial site and in a small industrial town. The base was laid for a development of a social system which organised and ordered the everyday practices and shaped the norm system and power relations in the society, more or less in correspondence with the overarching principles.

In most place related societies only a few institutional project will dominate in the way that they engage most of the time resources of the agents present. Paid work is the common form and institutional project of economic type is among the most influential elements in the structuration process. Dominant economic projects are in this way a driving force in the production of experiences and knowledge of economic and technological type in a society. They also influence strongly on the division of labour inside the community and in the correspondence with an external world, they influence the social stratification of the society and are among the most important elements knitting together 'present<sup>a</sup> and 'absent<sup>a</sup> in time-space. Institutional projects of economic nature are therefore of special importance in the systemic integration of a social system.

Since social integration primarily takes place in situations where individuals meet face to face, there exists a sort of territorial barrier for such interaction dependent on the physiology of the human body. Localised societies are therefore important arenas for social integration. In a limited area there are restrictions on how many institutional projects can go on at the same time, be it of economic, cultural or political character.

In a causal explanation we will argue that social life starts with human agency which via experiments and social struggle establishes routines and develops practices over time which again develops into institutions and important social objects.

A society will in this way be shaped from the bottom in correspondence with collective interests or in other cases through the uneven power relations present in society. The old agricultural society in the valley can be analysed through the first approach, In this traditionally based social system there was a strong link between the occupation of the

individuals, the fairly equally based control over agricultural land and the rules and sanctions governing the society. The result was a repetitive reproduction of old structures through well established property rights and old traditions, through common identity and belonging to a social and place-related society. As a result; a stable, static society was produced with strong ties to history and internal relations, but weak ties to present and external social systems.

Industrialism introduced to the valley a whole set of new principles in social and system integration. These principles were absolutely not in correspondence with the existing social order built through generations. A large institutional project formed as a commercial industrial organisation was physical grounded in the hillside and bottom of the valley. This project also had its origin in social action executed by knowledgeable agents. But this time the new structures were founded by external agents with some help of cause from the farmers who sold their land and property rights to water resources for cheap money. Also most of those who got their everyday life connected to this institutional project came from outside. In other words the new and dominant project in the valley did not grow organically from local action and struggle. It was established as an externally generated action physically 'present'<sup>a</sup> in the local society, but where the men of action were 'absent'<sup>a</sup>.

That the institutional project came first had a decisive influence for the structuring of Rjukan as a localised society. The migrating workers seeking job opportunities in the new electro-chemical factories had primarily in common that they were poor and wanted to sell their labour power. The company, Norsk Hydro, owned the land and the work place, the apartments and the shops, the means of transportation and the funeral home. They controlled the power elite of the place as engineers and supervisors. Many of those in this social segment were only visiting the valley as part of their careers in a multiplant and later multinational company. They were primarily socialised into the social system of Norsk Hydro as 'company men'<sup>a</sup> and had few relations to the place specific social system which developed in Rjukan. The workers on the other hand stayed on in the local community and soon developed a common identity; first as underpaid labour, next in negation to the conservative agricultural society and later as settlers in a unique landscape. Through this common identity a new local culture was based on collective action of skilled, social, cultural or political character as distinct from the existing agricultural society. These two social systems has existed as spatially co-present but socially disintegrated.

Through common identity and collective action the power of the dominant project could be met. Through their own, but routinized actions individuals could collectively affect the structuration of the society. The agents behind the dominant project controlled most of the allocative resources in the community, but the common people controlled the authoritative resources, at least the local political system. The industrial society were rooted in the town of Rjukan, the agricultural society in the rest of the local municipality. In the local government the labour class had the majority and the rest of the community was often in strong opposition to 'the ruling class'<sup>a</sup>.

The production of these institutions is closely connected to conscious actions from a political elite among the blue collar labourers in situ, but of course with external ideological and organisational links to a larger radical social democratic movement at that time. Locally the same person could be the leader of the union, the leader of the local social democratic party and the mayor of the community. On the other hand the reproduction of the social system seemed after a while to be produced through routinized and often unconscious actions of the majority of the individuals at the place.

An important impact of the dominance the two institutions of 'big capital'<sup>a</sup> and 'social democrats'<sup>a</sup> had upon the local society was to block for alternative institutional projects. Small scale capitalist projects had difficulties for several reasons. The dominant ideology supported co-operative shops. Private shopkeepers were perceived as profitmakers. Norsk Hydro had almost a total responsibility for the infrastructure of this place and most of the stock of dwellings and serviced it with their own employees. This closed a potential market for private craftsmen and service firms. The dominant labour culture also sanctioned individual behaviour differing from the dominant collective values. This happened inside the gates of the factory as well as towards labourers flirting with the values and norms of the agricultural society or that of small scale businessmen.

It is the repeated actions of everyday life which laid the basement for the development of conventions; routines, practices or rules. At Rjukan a dominant economic project had as an implication that the majority of the local adult population were drilled in a specific form of everyday action. In the processing industry the different operations and the division of labour were strongly structured by a specific process technique and it's demand for close supervision and regulation. The danger of malfunctioning and a following explosion, the consequences for the lives of individuals, the installations and stop of downstream activities implied that the work was highly regulated by strict routines and procedures. The practise learned in the factory is broadly speaking to reproduce actions described in written manuals or learned under strong supervision and react according to these instructions if a deviation in the flow of production arrives. The implication of the hierarchical structure of such an organisation is that action first is executed after instruction from higher up in the organisation embedded in manuals and routines or by regular orders.

The end result of this socialisation process was that the local society was inhabited by a large group of clever production workers who knew their routines and could act smoothly in accordance with the logic of the highly idiosyncratic technology present in this society. On the other hand almost none in this society had any experience from other sides of economic activities be it development of products, sale and marketing, contact with the needs of the customers, or understanding of accounting and economic control. A homogenous, deep and narrow knowledge capital was established through the activity of Norsk Hydro. This capital was of cause produced through actions, in the daily activities in the factories and were reproduced day after day, generation after generation. The cultural context of the place also functioned as a filter governing the language the involved learned, their understanding of central problems in life and for the development of the personality of the different individuals. This context contributed to the development of a not always articulated ideology and governed attention and capability to 'read'<sup>a</sup> actions in the local or extra-local environment. Also the material context with the factory as centre in a dramatic landscape, isolated from other social communities, obviously came to affect the development of individuals and advanced a common identity.

Process work is shift work. Work in the process industry has traditionally been men's work. For the female population there were only a few openings in the labour market. A few female jobs existed in the offices and in the cleaning and catering department of the dominant employer. It was primarily in the public sector and in retailing that women found a limited supply of jobs. This limitation in the labour market combined with the symbiotic relation between the factory, the local public sector and the retailing sector all lead to the fact that it was the men's world and daily activities which also structured women's ideology and understanding of the basics in the over-arching society.

Summing up we could say that this small localised society and its structuration process has been one sided both in its social and system integration. Norsk Hydro, the local union/local Labour Party were the dominant players in the forming of the social system. The same agents controlled the links to individuals and institutions outside the local community and to the historically dependent contradictions and forms of understanding of the social order. In other words, Rjukan was a homogenous society in spite of strong conflicts between labour and capital. The existence of locally present institutions and independent defined projects were for such reasons strongly limited. The society was kept together and stable through the reproduction of power relations, through the reproduction of language, practices, conventions and knowledge and not at least of the reproduction of what was not known of alternative economic, cultural or social conducts. The dominant project was of profound importance in this process. This went on until an external shock in the form of a new institutional/technological principle turned the profitability of the dominant project into the red.

Even though such societies look conform and static in a broader view a lot of innovative activities go on on the micro scale. Particularly inside the dominant project a lot of learning and innovative behaviour could be identified. The production was based on generic knowledge of chemical processes and installations, but the adoption of this technology and the transfer from a small scale prototype production unit into a large scale commercial unit was not at all easy. In the first twenty years, a radical innovation had to be further developed and finely tuned on site to reach a satisfactory quality of the products and a sound economic performance. To reach this goal an enormous input of manpower and knowledge were needed, learning by trial and error, refunding of the operations and an obedient agreement of transferring technology from a competing German company. The road further on was also covered with many technological challenges as the transfer of a radical principle for nitrogen production, adjustment and rebuilding new and older equipment to a whole and many incremental improvements in the efficient use of energy or catalysts, in working routines and the quality and type of end products.

So in fact there has been a continuously running knowledge production inside the dominant institutional project of the local community. Knowledge was brought in from outside, via local engineers and from other parts of the larger corporation or consulting and competing firms. Most of these individuals did not stay on in the valley but moved on to new projects in other places. People on the shop floor on the other hand did through their daily work contribute to better tuning of the technical installations and reorganisation of the work processes. But still the new knowledge was basically developed from the already existing knowledge. The path of the knowledge development was already defined by the technology introduced with the construction of the first factories in 1907.

In a larger context the production of knowledge in this society has been cumulative and firm specific. When the process of knowledge production first had started the direction has not been accidental but directed towards fields nearly related to the existing technology. Because Norsk Hydro dominated the place almost totally the result was of course that the whole town and several generations have been carriers of knowledge in a specific type of work which mainly supervised and maintained a large and complex technical installation. The place, the factories and their actors developed in a sort of symbiotic relationship in spite of clash of interests and many conflicts. The result was anyway a social system focused towards a narrow technological and knowledge development path. In the end this led the factory as well as the

place into a trap - a lock in situation - when a new technological principle 'killed'<sup>a</sup> the dominant project. At this time the demand for restructuring was absolute.

Restructuring demands new competence and entrepreneurship. More and more we acknowledge that technological change and innovations are at least partly an endogenous process which mainly develops along lines characterised by experience based knowledge, routinisation of action, and merging 'new'<sup>a</sup> imported knowledge with already established knowledge. Development of innovative capabilities and innovative milieus put some fundamental demands on diverse access to information and experience. In environments characterised by a narrow and single-sided competence, few competing projects and weak relations to other social systems, the ability to be entrepreneurial will be strongly restricted. At its best innovations in such environments often take place as an imitation of already existing firms in the region and this is only into a limited degree innovative action.

In our case even the ability to imitate is strongly restricted, partly because job training inside the dominant project only gave participants insight and knowledge into a few and separate technological functions and no good understanding of the operation of the whole system of different technologies, next because the social context gave no access to commercial training and knowledge of how to run a firm and lastly that the capital intensity in chemical production prohibited any entry into the industry as small scale operations. The locally developed ideology was almost hostile to private entrepreneurship and individualised responsibility for own employment. The opportunity to accumulate capital for later investment in new economic activity has also been problematic for individuals with access to incomes only from a relatively speaking well paid job in the chemical industry.

Successful industrial districts in Italy, Germany or wherever also are characterised by a narrow and specialised knowledge base developed over a long time. They also are characterised by a strong interrelationship between the private and the public sphere. But in contrast to our case they have their social knowledge capital invested in another industry where the division of labour makes it possible to disintegrate the different functions of production and where barriers for entry is low, thus opening the market for individual entrepreneurship and small business development. In such an environment competition even locally, will be strong and act as a dynamic factor in the development of the firm. The capability for continuously technological up grading and organisational change is therefore well developed. The option to learn economic competence 'in action'<sup>a</sup> is also good in these environments.

Because this is part of a historical process, the culture of such an innovative region will be open for entrepreneurship and private initiative and develop an ideology where such initiatives are seen in a larger collective context of the society. By that even the actions of individual capitalist are socially regulated in accordance with some sort of locally developed conventions and sanctions. In successful industrial districts as well as in one-sided industrial communities there is a sort of sharing of interest between individuals controlling allocative respectively authoritative resources. In a one-sided industrial community this consensus is antagonistic, in industrial districts organic.

When the big shock came to Rjukan in 1962 there was no flexibility in the social and material structures developed over sixty years. No skills, economic and entrepreneurial resources available to build a new existence in other directions of economic activities. The ideology of the localised society was neither prepared to individualise the responsibility for the

maintenance of the place. The ruling ideology quite to the contrary would collectivise and externalise the action needed to bring in alternative jobs for the inhabitants. The collective of workers demanded that the large company should create new jobs one by one as the existing jobs disappeared. The local community also expressed through the local government a moral right for local use of the energy resources produced in the valley even though the legal owners were Norsk Hydro (semi-public company) and Statkraft (public utility company). Through the control of authoritative resources locally and strong links to the national political system, local action succeeded in some way to fix geographically the use of energy input for manufacturing. Norsk Hydro was forced to use a lot of the locally produced energy at site or sell it to other manufacturers for local use in a deal to get hold on a licence to transfer some of the energy to the coast for use in other manufacturing activities. The company also had to guarantee for 600 jobs in the community and to fund parts of the activities needed to bring in new firms and create new jobs.

The common feeling among ordinary people in the valley was that the only alternative was to prolong the existing structures or establish new projects in accordance with the technological and institutional framework developed through generations. This was the only way the knowledge capital and the skills of the male population could be used.

As table 1 shows the result of the restructuring process was mixed. Partly because of the age structure of the dominant project many employees were given early retirement. The geographical and institutional mobility in parts of the labour force was good, specially among highly skilled workers and engineers. A new job in Norsk Hydro on a new site was accepted. For the rest the politically prolonged life of the factory gave work for many and the acquisition of new firms should help the rest.

What has materialised of alternative jobs over time is of course in correspondence with the incentives available from public authority or Norsk Hydro and the ordinary factors of location as labour, capital, energy, and overall skills in the community mixed with a calculation of the impact of transport cost and multi-site operations.

First the most striking fact of the restructuring is the almost non-existent local entrepreneurship. Only five small manufacturing firms under local control have been founded through these thirty years of restructuring, two of them taken over by local employees after relocated firms went bankrupt. The first genuine local entrepreneur came in 1985, twenty-two years after the restructuring started. His experience and knowledge came from working in some of the externally owned production plants. The other locally based entrepreneurs started in 1988 and 1992. They all have in common that they belong to a generation growing up after the down-scaling of the dominant project started and with no experience from working in that project. A new generation not socialised into the social system of instrumental factory work, union membership and social democratic ideology gives an opening for alternative forms of action. Still 90 % of the jobs in manufacturing is today under control of external agents. Therefore it is a long way to go before Rjukan is more than a vulnerable branch-plant location.

Looking back to the branch plant established in the valley, the first observation would be that the turbulence has been high. Many have come, many have moved further on to cheaper locations like Portugal or Malaysia. A majority of these new job opportunities have not been produced for former Hydro employees, but for the under-employed female population inside textile or footwear industries. A few but more stable plant establishment have come in energy

intensive production. Here there was an opening for former Hydro employees. New plants also arrived in the mechanical and plastic industries. These industries mostly recruit male workers, but most of them were young people right from school. Former Hydro employees were described as unstable, not willing to learn a new trade and they did not easily fill the function or the work process of a small factory. As soon as an opportunity appeared to return to the dominant project they did, back to safer environment with well known routines, a strong unionised collective and long distance between owner/manager and the shop floor. In other words an ordered world, well understood.

## 5. Conclusion

Knowledge built up over generations was of no commercial value in situ when the dominant project closed down and alternative experiences were asked for. It was the female part of the society not trained in process jobs, who first capitalised on the influx of new opportunities. Next the youngsters were recruited to other parts of the new plants. For both groups a common fact was that most of them were unskilled labour with no former experiences in manufacturing production. This is partly explained by the fact that many of the migrating firms did not ask for skilled workers, only for relatively speaking a cheap and stable labour force doing standardised, repetitive manual work. Many of the new firms did not need highly skilled and well paid labourer as was found among the former Hydro employees. But it is also right to say that the skills learned in the chemical industry was very specialised and difficult to transform to other uses. At the same time the specific social structure at this place made it difficult to retrain and unlearn practices, habits and attitudes to work. When the rules of the game changed and became quite different from what earlier had been reproduced again and again, the social web, the former structuration of the society and the present ideology trapped individuals in an experience and an understanding of social relations not of value any more.

The most serious barrier seemed to be a missing acceptance of the need for private entrepreneurship and innovation in a capitalistic world, and the totally missing understanding of how to do business in a competitive world. No entrepreneurial role models existed in the society, and very few had any experience from small business operations and knowledge of markets, customers and meeting demand. A new generation was needed to generate actors developing new practices and knowledge in alternative settings.

Slowly the place is under transformation. The aspirations of the young generation are formed by a much stronger system integration and the strongly conformistic social integration of former times are abolished (Henriks 1992).

This case shows that norm systems, established conventions and dominant institutions in a place can hinder dynamic restructuring and adoption of new ways of work and interaction. Turbulence is not only generated from outside, but also from former successes inside important institutions of a society. Localised social systems with no capability to innovate and generate new and alternative lines of knowledge is much more vulnerable to change than a dominant project as Norsk Hydro. A firm has the opportunity to move on to another site and still be in the same line of business and follow the same technological path. Norsk Hydro did this when they built two new nitrogen and fertiliser plants at the coast, took over major national fertiliser companies in many countries and restructured the whole business on a European scale. It is now the largest producer of nitrogen fertiliser in the world and in good

health. Rjukan as one of its first plant locations is still alive, but not in good health. The place is still striving to come over the traits embedded in the society after eighty years of a one-sided restructuring processes. Time and space is deeply implanted in the social life of this community as will be in most societies.

For economic geography this lesson tells us that acquisition of new institutions and economic incentives is only a small part of the work to restructure a place related society. Of equal importance is the social system of the place and who the restructuring process has produced capabilities and also restrictions on alternative paths of development. More emphasis should be turned to these sides of economic performance, not only the sunny side of innovation and successful entrepreneurship, but also the dark side and the factors hindering innovative social action, learning and varied access to knowledge in place specific societies.

1) Growth in service jobs has not been large in this town with no hinterland and central service functions. Public activities in school and health care have expanded as else in the country. Manufacturing therefore is still the basic part of the local economic base. Still because of the gradual closedown of the dominant project administrative functions have survived longest and in that respect what is left of the plant is now mostly in the service sector and included here.

2) A public agency was at that time given a monopoly to build and operate the electricity grid in Norway.

### **Literature:**

Antonelli, C. 1995, *The Economics of Localized Technological Change and Industrial Dynamics*. Kluwer Academic Press, Dordrecht.

Block, F. 1990, *Postindustrial possibilities. A critique of economic discourse*. University of California Press. Berkeley.

Carlsson, B. (ed) 1989, *Industrial dynamics. Technological, organizational and structural changes in industries and firms*. Kluwer Academic Publishers, Boston.

- Dosi, G., K. Pavitt & L. Soete 1990, *The economics of technical change and international trade*. Harvester Wheatsheaf, London.
- Gertler, M.S. 1995, *Manufacturing Culture: Regional and National Systems of Regulation*. Upublisert artikkel presentert ved et seminar ved University of British Columbia, 23-25 August, 1995.
- Giddens, A. 1979 *Central Problems in Social Theory. Action, Structure and Contradiction in Social Analysis*. MacMillan, London.
- Giddens, A. 1981, *A Contemporary Critique of Historical Materialism Vol.1. Power, property, and the state*. MacMillan, London.
- Giddens, A. 1984, *The constitution of society*. Polity Press. Cambridge.
- Granovetter, M. & R. Swedberg 1992, *The Sociology of Economic Life*. Westview Press. Boulder.
- Gregory, D. 1989, *Presences and absences: time-space relations and structuration theory*. In Held, A. & J.B. Thompson (eds.) *Social theory of modern societies: Anthony Giddens and his critics*. Cambridge University Press, Cambridge.
- Gregory, D. 1994, *Social Theory and Human Geography*. In Gregory, D., R. Martin & G. Smith (eds.) *Human Geography. Society, Space and Social Science*. MacMillan, London.
- Henriks, C, 1992, *Hvor blir det av Rjukan-ungdommen? Hovedoppgave i geografi*. Institutt for geografi, UiB
- Hodgson, G.M. 1988, *Economics and Institutions: A Manifesto for a Modern Institutional Economics*. Polity Press, Cambridge.
- Isaksen, A. & O. Spilling 1996, *Regional utvikling og små bedrifter*. Høyskoleforlaget, Kristiansand.
- Lundvall, B.Å. (Ed.) 1992, *National systems of innovation. Towards a theory of innovation and interactive learning*. Pinter Publishers, London.
- MacDowell, L. 1994, *The Transformation of Cultural Geography*. In Gregory, D., R. Martin & G. Smith (eds.) *Human Geography. Society, Space and Social Science*. MacMillan, London.
- Nelson, R.R. & S.G. Winter 1984, *An Evolutionary Theory of Economic Change*. The Belknap Press of Harvard University Press, Cambridge, Mass.
- Nelson, R.R. (ed.) 1993, *National Innovation Systems. A Comparative Analysis*. Oxford University Press. New York.
- Marshall, A. 1938, *Principles of Economics. Volume I. 8th edition*. MacMillan London.

Pred, A. 1985, The social becomes the spatial, the spatial becomes the social: Enclosures, social change and the becoming of places in Skåne. In Gregory, D. & J. Urry (eds.) Social Relations and Spatial Structures. MacMillan, Basingstoke.

Saxenian, AL. (1994), Regional Advantage. Culture and Competition in Silicon Valley and Route 128. Harvard University Press. Cambridge, Massachusetts.

Storper. M. 1992, The Limits to Globalization: Technology Districts and International Trade. Economic Geography, 68, 60-93.

Vatne, E. 1981, Teknologisk nyskaping og regional endring - en historisk analyse. In Friis, P. & P. Maskell (eds.) Teknologi - og regional utdvikling - en nordisk antologi. Kritisk samfundsgeografi - bind 1, Roskilde Universitetsforlag, Roskilde.

Weber, A. 1929, Alfred Webers theory of the location of industries. University of Chicago Press, Chicago.

Werlen, B. 1993, Society, action and space. An alternative human geography. Routledge, London.