Knowledge as a factor to improve competitiveness for a firm in rural Norway

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Abstract

Aker Verdal produces steel jackets for the offshore industry and is situated in Trøndelag in peripheral Norway. The firm has about 600 employees and a yearly production value of about 200 mill. $. The main competitors are in the southern part of Europe, for example Dragados in Spain. The wage level at Dragados is about 50% lower than at Aker Verdal, but Aker has won several contracts in the later years. One reason for this is that Aker has a knowledge component that contributes to the compensation for higher wage costs.

The firm wants to analyze how it acquires and develops knowledge capital by looking at: · Identification: What are the central knowledge processes that take place · Measurement: What kind of indicators can be used · Management: How is management of knowledge integrated in the general management of the firm

In this paper we will look at Aker Verdal as a case study and see how knowledge as a factor to improve competitiveness can be understood in a theoretical framework. We will also analyze the advantages and disadvantages of peripheral location and its influence on knowledge creation and development.

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1. Introduction and theoretical considerations

In the research literature and in the public debate there have been many attempts to define what can be put into the concept of a knowledge based or a knowledge driven economy. From one point of view knowledge can be looked at as a commodity that can be bought and sold within a market economy. Another perspective is how knowledge is created and exchanged within a company, between companies, between companies and research institutions and between companies and other parts of society. A third perspective which is often looked at, is how the spread of knowledge actually takes place and how the development of information and communication technology has importance for the speed, the volume and the content in the exchange of knowledge.

The systems of production both in the private and public sectors have developed in such a way that it has become more important to have a closer look at how the concept of knowledge, as a factor of production, has developed compared to other factors such as physical capital, labour and raw materials. In 1996 OECD published a study that analyse historical trends how the knowledge based economy has developed the last 20 years. In this study the knowledge economy is defined as:
"Economies which are directly based on production, distribution and use of knowledge and information" OECD (1996).

In the earlier analysis of growth in developed countries one of the main results was that labour and capital played a central role in explaining economic growth while other factors of production such as organisation, technology and knowledge also played a part. One assumption was made that the producers combined the factors of production in the best way and that the knowledge that was necessary to do this was available.

In the traditional macroeconomic growth theory little emphasis was put on the analysis of the creation of knowledge until 1990 where Romer (1990) came with his concept of endogenous growth theory. This shift in perspective had a great influence on growth theory and also the analysis of regional growth and how to stimulate regional growth.

Schumpeter (1943) made new developments in innovation theory where he stressed the entrepreneur's ability and possibilities to create new developments. Schumpeter used the concept of innovation in the following connections:

- New products
- New production processes
- New materials
- New organisation of the production process
- New markets

Schumpeter pointed out that new knowledge often was important for innovations, but that this was not the situation for every new innovation. He also stressed that it was vital for the ability to innovate how existing knowledge could be distributed and developed further. This line of thought is picked up again in the 1990's where emphasis on networks, made easy by information and communication technologies (ICT) was focused in theoretical debates and case studies.

2. Indicators for a knowledge economy

One starting point for a more operational attitude to the knowledge economy is the report from OECD mentioned earlier, but one main problem with this report is that it has too broad and general definitions of the knowledge economy. More resent contribution to the research literature from among others by Van Oort (2004) and Raspe, Van Oort and de Bruijn (2004) developed criteria for a knowledge economy which is possible to use in actual analysis. The indicators used in this paper are mainly taken from the work mentioned above.

Eight indicators for a knowledge economy

1. Education level

This indicator is based on statistics where the population is divided into groups according to level of education.

2. Share of the working force employed in "creative sectors"

First we pick sectors that are looked at as creative, e.g. design, and then we use statistics to calculate the share of employment in these sectors.

3. Information and communication technology (ICT)
This can be measured by looking at sectors that have a relatively high usage of computers and terminals

4. Communicative skills
Under this criterion sectors are chosen where communicative skills are especially important, e. g. parts of business services.

5 Research and development
Here is research and development intensity in the sectors measured and sectors picked that have relatively large research and development costs compared to employment and production.

6. High tech and medium tech production sectors
According to this criterion sectors are picked according to the technological content of their production methods

7. Technical innovations
A high degree of innovation ability is defined as production sectors that often create new products or services.

8 Creative non-tech sectors
According to this criterion sectors are picked that has a larger than average ability to make organisational and/or knowledge developments.

All of these eight indicators can be described statistically. Even though not all concepts and definitions are equally valid, one can say that we have a knowledge driven economy if the region has high values on all the indicators that are proposed. To make the analysis more convenient these eight indicators are reduced to three.

Main indicator A: Knowledge workers

This means that we have high values on the indicators education level, share employed in creative sectors, use of ICT and communicative skills.

Main indicator B: Innovation ability
This means that we have high values on technical innovation ability and creative non-technical sectors.

Main indicator C: Research and development
This means that we have high values on the indicators research and development and share of companies with high technological level.

These three criteria define the level of a regions knowledge economy and the next main question is then if a region fulfilling these criteria of a knowledge economy is growing faster than other regions. The results from countries like Holland and Norway are that regional knowledge economies do not all the time grow much faster than other economies. We find several examples that regions with strong clusters often grow faster than regions that in general have a high score on the criteria for a knowledge economy.

3. How to measure what knowledge means for the competitive situation of a firm.

This is a field of research where several companies have showed interest but where we have seen few results. One of the most known projects is the so called MERITUM-project which was started up as a EU initiative. The six countries that participate in this program are Spain, France, Sweden, Finland, Norway and Denmark.

MERITUM: **ME**asu**R**ing **I**n**T**angibles to **U**nderstand and Improve Innovation **M**anagement

The conceptual point of departure for the MERITUM project was that when a company produces its commodities we can divide the inputs that company uses into two groups:

- Labour, capital and raw materials
- Intangibles

In the accounts of company we also look at:

- Ordinary assets such as machines, buildings etc

- Financial assets
- Immaterial assets

One important part of the work in the MERITUM-project was to find standards to measure immaterial assets. This is important because the company has a need to measure and identify the level of knowledge and thereby to increase the company's competitive situation. Intangibles are in the MERITUM-project defined by Canibano (2004) in the following way: "Intangibles: Non-monetary sources of probable future economic profits lacking physical substance, controlled (or at least influenced) by a firm as a result of previous events and transactions and may or may not be sold separately from other corporate assets."

One result that has emerged from companies participating in the MERITUM-project is that a method to evaluate the value of intangible assets has improved their ability to manage and direct the development and use of knowledge. Another result from the project is clearer rules about how to bring intangible assets into the ordinary bookkeeping. The bookkeeping part of the project is interesting but will not be commented further here. The focus here is how the company can make its management more effective so that the generation and development of knowledge takes place in such a way that it actually improves the company's competitive position.

There is a need to clarify the concept intangibles and intellectual capital. Both concepts are used about non-physical resources. the concept intangibles are in most studies more linked to management and accounting while the concept intellectual capital is often used to analyse how the business community develops. We use an analysis in three phases to determine the value of the intangible assets and knowledge capital:

Identification: Here one must look at knowledge in relation to the processes that are central for value creation in the company
Measurement: Here one must find a useful and operational set of indicators to measure of what the knowledge capital actually consists
Management: Here one must develop a management system for the company that takes care of the affect and relations that knowledge capital has to achieve the company's objectives, which is usually a maximization of profits.

For the company it is crucial that it make clear what is its core competence and which knowledge capital is related to it. The company also needs to identify the networks in which this knowledge is distributed.

It is vital to make the change between the stock and the flow of the knowledge capital of a company:
Knowledge as a stock: That means that a company must be able to identify what it can use

Knowledge as a flow: That means that the company must know how it can influence the creation and development of the knowledge capital

In general it would have been a good idea to have general criteria to measure both the stock and the flow of knowledge so it could be possible to make comparisons between companies. Results from the MERITUM-project show that it is not easy to develop general criteria because it is almost impossible to define the core competences of a company without going more specifically into the production processes of the firm.

<u>From intangible assets to knowledge capital</u>
On the operational level the definition of concepts of knowledge capital can be as follows:

1. Human capital: Defined as the knowledge the employee has and uses in the operations of the company. Often looked at as the employee's level of education and expertise in the company.
2. Structural capital: Defined as the knowledge that is left in the company when the employees have left which for example can be patent rights, company routines, databases and so on.
3. Relational capital: Defined as all human capital and structural capital that are linked in networks with all external relations the firm has, for example contracts with other firms to marked channels and so on.

A definition commonly used is then:
The company's knowledge capital equals the total of the human capital and the structural capital and the relational capital.

Collection of data for the analysis of knowledge as a part of the company's competitive situation

The MERITUM-project Canibano (2004) lists 15 indicators under the heading of human capital, 9 indicators under structural capital and 6 indicators under the heading of relational capital. This makes it possible to look at the guidelines from the MERITUM-project and see this in relation to the core competence of companies, for example the one that will be used as an example in this case, Aker Verdal. These indicators will give an indication of the knowledge capital the company has and which changes that take place when we look at:

- A change in inputs of goods and services
- New capital equipment
- New relational or co operational agreements with other companies
- New recruitment or new developments of labour with new qualifications
- The development of new technologies in the firm
- New research and development operation
- New training programs for the labour force
- In the framework of our research program one must find persons in key positions to register what kind of knowledge transfers that takes place.

Tacit knowledge will be a central concept in this connection and it is important to study the codifying processes that take place when the workers' tacit knowledge is transferred to explicit knowledge for the company. The concept of tacit knowledge was first developed by Polanyi (1960) and has then become a central concept in many articles and actual projects; see Lundberg and Maskell (2000).

In the actual project where we are studying transfer of knowledge and competitive situation for Aker Verdal we will use Porters definition of a firms competitive situation.

4. Aker Verdal as a study object

Aker Verdal is a company that produces equipment to the offshore sector where the North Sea is the main marked, but in later years Aker Verdal has produced equipment that is used offshore of Canada and in the Mexico Gulf. The company had a total production of about 250 mill $ in 1998. The main product from Aker Verdal is steel jackets and this market has experienced big changes in the demand situation in the later years. In 1999 there was a sharp

downturn in the order situation and about 600 of the companies 1200 employees were temporarily or permanently without a job. In 2000 the marked situation changed rapidly to the better and the order situation from 2000 and until 2005 has been reasonably good with a new upturn in 2005.

In the problematic years of 1998-2000 the company had extensive educational programs for temporarily laid off employees. These programs have been evaluated as reasonably successful but there has been no extensive analysis of how these programs influenced the company's competitive situation. On this background the central research questions from the company have been:

1. Which processes generate development of knowledge within the company
2. How can we actually analyse and describe how knowledge leads to reduced costs or increased quality in the production
3. How does this development of knowledge at Aker Verdal spread into the business community in the region

One of Aker Verdal's most important competitors for steel jackets for the offshore sector is the company Dragados in Spain. Dragados has a wage level which is about the half of what Aker Verdal has, but still Aker wins contracts. This has lead the managers of Aker to the conclusion that Aker must have a knowledge component that Dragados does not have and one of the main objectives of the research project is in more detail to analyse what is the main content of this knowledge component is and how it can be developed further.

Pilot project: Indoor building of jacket components

To develop the effectiveness of the production processes and to work independent of climate changes Aker Verdal builds many of the important and resource consuming parts of the jacket indoors. Earlier the company had to build up indoor constructions (scaffolds) so the workers could do the welding operations. This was a costly and time-consuming way of producing and the company was thinking of changing to indoor mobile lifts or different types of mobile platforms that could put the worker in the right position to do the welding operations. A team was put together with workers from the company (welders), engineers and they contacted different producers of mobile lifts and platforms. A new mobile platform was introduced and used in production and one crucial phase of this development was how to identify the workers

tacit knowledge about how things could be done and recode this tacit knowledge to explicit knowledge in the cooperation with a producer of mobile lifts and platforms.

Conclusions

If we look back to how we defined a knowledge economy we can say that Aker Verdal fulfils main factor A, a high degree of knowledge workers, reasonably well. The employees educational level is relatively high and the company has an active attitude to give the workers both general further education and specialized knowledge for the processes that the workers actually do. The company is situated in a part of Norway called Nord-Trøndelag which is a part of Norway with a relatively low educational level. But compared to Spain it is high. The company's rural location in Nord-Trøndelag is compensated by networks to the technology centre of Norway which is Trondheim and the company's ability and resources to maintain and develop knowledge networks with actual partners.

The theoretical discussion about communicative skills is central for the firm and in this project. The increase in competitiveness that the "Lift-project" gave was depending on the fact that the involved employees had the necessary communicative skills. The innovative factor in this project is to a large extent developed within the company so the innovation factor and possibilities in the region is not of a great importance here. The same can be said about the system for the research and development where it looks important to have R&D-firms that actually can communicate.

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