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From Closed to Open: ICT as an Enabler for Creating Open Innovation Systems in Industrial Settings

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ABSTRACT

Most forestry machines being produced today include a PC that monitors and controls the harvester head, and an information system that stores data on every action the driver or the machine performs. ICT thus provides an opportunity to improve efficiency and competitiveness and possibly also opens up for new ways of working for actors in the forestry industry. The purpose of this study is to investigate how ICT can enable the transformation from selling products to selling services in the forestry industry. We investigate this through performing a Case Study including a number of actors from the Forestry industry in northern Sweden. First, we investigate the barriers for establishing an Open Innovation system in forestry. Then we describe the main steps to be taken and how the use of ICT can enable the establishment of such a system. The case study shows that the forestry industry is committed to working according to a traditional value chain and is committed to a closed innovation paradigm. We argue that the ICT component in Timbercut's forestry machines constitutes a latent potential that can be fully captured through changing the business model and setting up a joint venture with Rewire.

Keywords: Open Innovation, Forestry Industry, Business Model, Value Networks

INTRODUCTION

Information and communication technologies (ICTs) enjoy a pervasive role in most societal context. In the past few decades ICT has come to play a major role in traditional industry settings (Jonsson et al, 2008; Zuboff, 1988). The forestry industry is no exception as it has come to be a high-tech industry in many ways. The mechanization of forestry in Sweden started in the 1960's. The woodsmen started using chainsaws and log-driving and transports by horse were replaced by tractors and lorries. During this decade, productivity increased drastically while the number of forestry workers was reduced by half. The first fully mechanical forestry machines were imported from Canada, the U.S. and Russia. In 1970 6% of the timber was logged with forestry machines. This figure grew and was 65% in 1980. During the 1990's, production was transformed from being of a bulk-character to being more customer-oriented.

A continuous technical development has resulted in the harvesters and forwarders of today. Most machines today include a PC that monitors and controls the harvester head and an information system that stores data on almost every action the driver or the machine performs. ICT thus provides an opportunity to improve efficiency and competitiveness and possibly also opens up for new ways of working. To this end the use of ICT in the forestry industry reflect patterns of ICT usage from other settings where ICT brings with it a potential to transform organizational collaboration (Holmström & Boudreau, 2006; Holmström & Robey, 2005), transform business models (Jonsson et al., 2008) or flattening organizational hierarchies towards an open innovation ideal (Westergren & Holmström, 2008). What is less understood is the ways in which ICT can enable changes. While calls have been raised to be more specific about the ways in which ICT contribute to socio-technical change (Orlikowski & Iacono, 2001; Orlikowski &

Scott, 2008; Rönnbäck et al., 2007) there are few, if any, examples of how ICT can enable transformation across organizations.

The purpose of this study is to investigate how ICT can enable the transformation from selling products to selling services in the forestry industry.

The analysis is guided by the following research questions:

- What are the barriers for establishing an Open Innovation system in forestry?
- How can the use of ICT enable the establishment of Open innovation systems?

We use the open innovation lens in pursuing these research questions. The term Open Innovation was first coined by Henry Chesbrough in 2003. In the Open Innovation paradigm, firms do not try to protect their research to the same extent as in the closed innovation paradigm. Firms bring in knowledge from the research of other firms and also share their own knowledge with them. This can be done through joint ventures, spin-ins and spin-offs. This way of doing business often requires new business models that will be an aid in making sure that the firm captures amount of the value it helped to create (Chesbrough, 2006). It is worth noting that Open Innovation is an emerging field of research and Fredberg et al. emphasize that it is still in a phase that is very fluid (Fredberg et al., 2008). By applying the theories of Open Innovation to an actual case we hope to make a contribution to the development of the field. The Forestry sector is currently organised as a traditional value chain and we will argue that this way of working could be replaced by an Open Innovation system, where the actors are organised in Value Constellations.

We rely on data collected from 2008-2009. During this period we conducted interviews with representatives from the actors within the forestry industry in the northern part of Sweden.

The analysis reveals that there are a number of barriers to be overcome when taking the journey from a traditional value chain to an Open Innovation system. First, we identify these barriers and study them in detail. Second, we illustrate the main steps to be taken and how ICT can enable the transition. Based on the analysis, our conclusion is that ICT can enable new kinds of Business models within forestry. However ICT alone cannot enable the transition. Organizational values and culture within the forestry sector also needs to be changed in order for the transition to happen. ICT is a necessary, but not sufficient part of a solution.

RELATED RESEARCH

Introduction to Open Innovation

The term Open Innovation was first coined by Henry Chesbrough. His first book on the topic: “Open innovation: the new imperative for creating and profiting from technology” was published in 2003. In the book, Chesbrough claims having identified a new paradigm (Chesbrough, 2006).

Traditionally most innovations were done in the Research and Development (R&D) departments of each firm. In the Closed Innovation model, the R&D-staff developed products which might eventually reach the market - sold and distributed by the firm. (Chesbrough, 2006). What characterizes the Open Innovation paradigm is that firms do not try to protect their research to the same extent. Companies bring in knowledge from the research of other firms and share their own knowledge with other firms. Each firm will of course want to claim a certain amount of value from a given innovation, but it is not necessary that the innovation reaches the market through the internal path. Chesbrough defines open innovation as: (...) the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. (Chesbrough 2006, p1)

Open Innovation is an emerging field of research and Fredberg et al. emphasize that it is still in a phase that is very fluid. So far the topic has mainly been dealt with as a pure innovation issue and at the firm level. The research on how to organize for Open Innovation is still very limited in the Open Innovation literature (Fredberg et al., 2008). Vanhaverbeke stresses the need to address a broader scope of analysis

and argues that Open Innovation should be analysed not only at the firm level, but also on the dyad-, intra-organizational- and interorganizational level (Vanhaverbeke, 2006).

Business Model

In their 2002 article, Chesbrough & Rosenbloom set out to answer the question: Why do successful companies often fail to capture value from new technology that they helped to create? According to the authors there are two ways that firms can capture value from new technology (Chesbrough & Rosenbloom, 2002):

1. Through incorporating the technology in their current businesses
2. Through launching new ventures that exploit the technology in new business arenas.

When a firm wants to make profit from an innovation it may be able to successfully use a business model that it has used in the past. In other cases previous business models will not fit the innovation and the firm needs to expand its perspectives to find the right business model in order to capture value from that technology. The fundamental starting point to Chesbrough & Rosenbloom's theories is that a certain technology may have an inherent value, but it remains latent until it is commercialized in some way. (Chesbrough & Rosenbloom, 2002)

The first thing the Business Model must do is to articulate the value proposition. Chesbrough & Rosenbloom define this term as "the value created for users by the offering based on the technology" (Chesbrough & Rosenbloom, p7). There is latent value in the innovation, but what will the actual product offering be and in which form may the customer use it? (Chesbrough & Rosenbloom, 2002). The business model acts as a mediator between technology development on the input side and economic value creation on the output side. (Vanhaverbeke & Cloudt, 2006)

The next step is to let the business model specify the market segment and the targeted customers. It is important to realise that the customer can either value a technology's ability to reduce the cost of a solution to an existing problem, or its ability to create new possibilities and solutions. Different potential customers may desire different latent attributes of the technology. Therefore, there is no single inherent value for the technology. (Chesbrough & Rosenbloom, 2002)

When it comes to identifying the market segment and the customers, Chesbrough & Rosenbloom stress the need to define what they call "the architecture of the revenues". This means addressing issues such as – how will the customer pay? How much do we charge? How will the value created be split between customers, the firm, and its suppliers? Simply selling a product is not the only way. Other options are renting, charging by the transaction, advertising and subscription models, licensing, or even giving away the product and selling after-sale support and services. (Chesbrough & Rosenbloom, 2002)

Value Networks

Normann and Ramirez first introduced the term Value Constellation in 1993. In an article in the Harvard Business Review, they argued that our traditional thinking about value is grounded in the assumptions and the models of an industrial economy. According to this view, every firm occupies a position on a value chain. However, global competition, changing markets, and new technologies opened up new ways of creating value. The authors argue that strategy is no longer a matter of positioning a fixed set of activities along a value chain. Successful companies do not just add value, they reinvent it. (Normann & Ramirez, 1993)

Instead of simply focusing on positioning itself at the right point of a Value chain, the firm should focus on the Value creating system and consider how they can co-produce value with other stakeholders in this system. The authors discuss the success story of IKEA, where the customers actually contribute to this value creating system by assembling the furniture themselves. (Norman & Ramirez, 1993)

Chesbrough & Rosenbloom describe it as a function of the business model to describe the position of the firm in the Value Network. The value network created around the firm determines the role that suppliers, customers and third parties play in influencing the value captured from commercialization of an innovation. (Chesbrough & Rosenbloom, 2002)

Vanhaverbeke & Cloodt argue that innovating firms have to set up and manage inter-organizational networks to be able to commercialize their innovations successfully. It is important to distinguish between these networks and the ones that firms establish to tap into external technology sources in the early stages of innovating process. The latter have received more attention in the academic literature, but the networks that are established to commercialize an innovation are at least as important since they are directly responsible for the market success and profitability of new technologies. (Vanhaverbeke & Cloodt, 2006) The actors in the value-creating system produce value together through rethinking their roles and interrelationships. Hence, value creation is not just adding value step after step but reinventing it by means of a reconfiguration of the roles and relationships among actors of the value creating system. (Vanhaverbeke & Cloodt, 2006)

In sum, value creation in constellations is determined by (Vanhaverbeke & Cloodt, 2006):

1. The resources it assembles
2. The way how it can combine and govern them
3. The value of competing products and the competitive reactions of competing firms and constellations.

Fair value distribution in a value constellation is important, it is crucial that all participants profit from their participation. Some actors are automatically better off in the new constellation compared to the old value creating system. Others might be worse off and have to be compensated to stay committed to the value constellation. (Vanhaverbeke & Cloodt, 2006)

The analysis of interorganizational networks in general and value constellations in particular reveals that research about Open Innovation should be multilayered. Open Innovation from the firm perspective only provides a partial view. Since the different layers are nested, Open Innovation has to be explored simultaneously at different levels. Vanhaverbeke & Cloodt state that they would like to see future research that explores Open Innovation at the individual or unit level on the one hand and at the network and innovation system level on the other hand. (Vanhaverbeke & Cloodt, 2006). Resonating with the notion of value networks in the context of innovation is the notion of 'ecology of innovation' as put forward by Levén (this volume). An ecology of innovation refers, according to Levén, to a way of summing up "the potentials related to innovation and value creation in the context of a heterogeneous set of actors."

RESEARCH METHOD

Case Studies are frequently used as a research method and are being used across academic disciplines in order to generate knowledge about a complex social phenomenon (Yin, 2003). As a research strategy, the Case Study provides a way of collecting data and analysing a contemporary event. Case Studies are usually characterized as descriptive, explanatory or exploratory (Yin, 2003). This study qualifies as the latter.

In his article "Five Misunderstandings about Case-Study Research", Bent Flyvbjerg does a thorough review of the criticism towards the method. The criticism Flyvbjerg had been confronted with usually involved claims that generalization cannot be made from a single case or that the method is subjective and biased by the researchers own interpretations (Flyvbjerg, 2006).

Flyvbjerg rebuffs the criticism towards the method in an organised manner. To start with Flyvbjerg argues from an epistemological point of view. From Flyvbjergs perspective, the learning process of the researcher relies on context-dependent knowledge and the case study produces that type of knowledge. (Flyvbjerg, 2006)

Flyvbjerg stresses the importance of the good narrative. When doing a Case Study there will inevitably be overwhelming amounts of information to work through. Flyvbjerg encourages the researcher to not try and take any shortcuts when doing this. Rather than summing up the researcher should study minutiae and tell the story in its diversity. (Flyvbjerg, 2006) Ultimately an interpretive case study seeks to contribute to theorizing (Holmström, 2005; Truex et al, 2006; Walsham, 1995) which in this particular case is focused on open innovation theory.

We rely on data collected from 2008-2009. During this period we conducted interviews with representatives from the actors within the forestry industry in the northern part of Sweden. The duration of the interviews varied from 50 min to 1h 45 min. They were digitally recorded, and later transcribed. All firm names have been fictionalized in order to protect and respect privacy.

CASE STUDY

Northlog

Northlog is a Logging Contractor Firm. Our informant owns and manages the firm. He will onwards be called “The contractor”. Northlog has three employees. Including the contractor, the total of four persons work shifts on one harvester machine and one forwarder machine. Northlog currently has a 5-year contract with one of Sweden’s largest forest owners.

Knowledge and qualifications

Today, the logging process is close to being completely automated. The driver operates and monitors the harvester and forwarder machines and makes sure everything runs smoothly. He also does various manual quality controls. A key competency required of the driver is that he has to be able to assess the terrain and have a high level of driving technique. The driver also needs knowledge of basic forestry. He needs to be able to assess for instance damages on the stem, skewness etc.

For the contractor to be able to run a well-functioning organization, the computers in the machines have to be in a serviceable condition at all times. When they are not, it is practically impossible to get any work done. According to the contractor there are unfortunately a lot of drivers that have a negative attitude towards the increased computerization.

When asking the contractor which training he prefers the people he hires to have completed, his answer is that there really doesn’t exist any such formal training. He acknowledges that there are Forestry Schools, but his goal when recruiting is to find a full-fledged driver that doesn’t have an effect on the overall productivity. According to the contractor they are however few and far between. He also concludes that he doesn’t really believe that any training programme can produce a fully qualified professional.

Apart from being able to operate the machine in a forest terrain, the driver also needs to have skills in computer- and mechanical engineering. The driver needs to be able to remove, change and repair files when the computers are not working properly. On mechanical matters the driver needs to be able to do trouble shooting, basic problem solving and service on the mechanical parts of the machine.

Information processes

The communication between the driver of the harvester machine and the lorry driver is mainly done through mobile phones and com radio. A Mobitex system is used to send the information about the timber that has been logged each day. The Mobitex device is connected to the PC in the Harvester Machine. A prd-file (production file) is saved on the PC and transferred to the Mobitex device. The driver sends the data from the machines via Mobitex to Skogsbrukets Datacentral (SDC):s server at the end of each night shift. The data contains information about the timber harvested during the day, amounts of timber located on the clear-cut area and amounts of timber that has been conveyed to the road. Mobitex might actually be considered as dated technology, but according to the contractor it does the job and he doesn’t have to worry about poor coverage and getting a good signal.

The PC in the harvester also controls the harvesting unit on the machine which performs the felling and cutting. When preparing for the logging of a new area, Northlog receives an apt-file from the customer. The apt-file specifies the length and diameter that is required by the sawing mills. The file also controls how the harvester cuts, calculates price and detects the optimal length for a certain dimension.

Development of systems

The contractor talks about that he has tried using a NMT450-system for transferring files. In the contractor's case, using this system would mean that instead of taking the route via the Mobitex system he can access the internet and transfer data directly from the PC in the machine. However the contractor is saying that the signal in the NMT network doesn't seem to be good enough yet. It is also hard for him to upgrade his systems in every step of the technological development that takes place, partly because this development is going quicker and quicker. At this point his view is that the satellite technology that is under development might be worth waiting for.

Alpha Forest Corp.

Alpha Forest Corp. is one of the largest forest owners in Sweden. The firm manages its own forest through logging and selling timber to sawmills and pulp mills. Alpha also acquires timber from private land owners. The firm has over 700 employees. Our informant works as a logging manager at Alpha Forest Corp. and has done so for about a year. Her previous position was at Skogsstyrelsen (The Swedish Forest Agency) where she worked for four years. She has a degree in Forestry Science from SLU (The Swedish University of Agricultural Sciences).

Areas of responsibilities

The logging manager manages seven Logging teams. Five of these are external contracting companies and the remaining two, which consists of ten persons in total, are employed by Alpha. Administering wages and invoices from the contractors is within the logging manager's area of responsibilities. She also hosts employee meetings with the individual co-workers and monthly meetings with the teams. She manages most administrative work involving their employment and contracts.

The logging manager is responsible for making sure that the amount of timber logged corresponds to the amount that is supposed to be delivered to a number of saw mills and pulp mills each month.

Procurement

The contractors in the logging manager's unit own the machines they are operating. Alpha only owns the machines that are used by Alpha's logging teams. When new machines are about to be purchased to Alpha's logging teams, the logging manager is the decision-maker. In this decision she tries to weigh in the opinions of the drivers and which brand they prefer. The logging manager also has a say on which machines the contractors choose to purchase.

Information systems

The teams report the volumes logged and forwarded to landing to the logging manager on a daily basis. The volumes are then reported to SDC's server. The logging manager can download the files containing this data from SDC's system and transfer them to her system. These files help her to maintain control over where recently logged timber is located at the moment. She can also get an overview of the amount of timber in the forest warehouse and in the road warehouse.

The logging teams all have access to the web-based information system VALS-web which is developed by Alpha. The teams can log-on to VALS-web from home. In the system, a timeline visualises the objects they are to log during the coming month. The logging manager has estimated the time consumption based on how many cubic metres of forest that should be logged in each area and the average performance of the logging team in that type of forest.

The logging team can download information about each object from VALS-web. One of the things they download is the logging directive which contains all the information about which type of forest the area consists of etc. They can also download map files from VALS-web. This is done continuously and as soon as the logging team has finished logging an object, they log on to VALS-web from home and download all the information they need to move on and start working with the next object. In practice, the movement from one object to the next often does not happen according to the timeline. The logging manager tells me that the deliveries required by the mills often change. This means that she has to reschedule and change the order of the objects on the timeline.

When logging has taken place, the timber stays approximately 5-6 weeks at the landing before it is transported to the mills by the carriers. According to the logging manager she can at any time log on to her systems and see how much timber there is in the road stock and the forest stock. This information is based on the reports that are uploaded from the harvester and the forwarder.

Rewire Communications

Rewire Communications was founded in 1998. The firm currently has 16 employees. In the beginning it served mainly as a product supplying unit, designing and producing hardware for remote monitoring and communication. In 2004, a transition and change of business model was deployed. Today the firm focuses on two different Business Areas; M2M (Machine-to-Machine communication) and Lift Communication. Instead of designing and producing hardware, the firm focuses on Product Development in a wider sense. The focus is now on software and services. Our informant is the CEO and one of the founders of Rewire Communications.

Selling services – a new business model

According to the CEOs point of view there is a prevalent attitude among firms in northern Sweden which means that they are making available rather than selling for example iron ore. Rather than these companies doing it themselves, they are leaving it to other companies to refine and sell the product. When Rewire was founded, the ideas about making available dominated the business. However, the firm chose to change its business model in 2004. Ever since this change Rewire declines business where the customer requests hardware only, and hence is not interested in the service and solutions around it. When changing the business model, Rewire re-negotiated all their customer contracts and worked hard to get the customers to realise the importance of the new business model.

Previously, Rewire worked in a traditional way – with distributors and resellers. Nowadays they work exclusively with partners. To Rewire, a partner is an actor that adds something that leads to finalizing an individual deal. The goal is to create a virtual firm and sometimes it may contain up to five different actors. The point is that they act as if they were a single firm. The CEO tells me that the idea is to combine individual companies that are specialists, pushing the technological development within their field and through that crushing all competition.

Current customers

Rewire's customers come from three different areas. The first two are security and process streamlining. The CEO tells me that he has just starting to see the third one emerge and it consists of companies that want to start changing their business model to harmonise with Rewire's systems. At present most of Rewire's customers are large firms, both Swedish and multinationals. According to the CEO these large firms have embraced not only Rewire's technology, but also their approach - the way they look at things and do business.

One example of a Rewire-customer is the security division of a large multinational firm. Rewire provides the service of managing container surveillance for the firm. Each container is equipped with a device that can detect if the container is opened. An RFID(Radio Frequency Identification)-reader in the port gets information from the devices through wireless signals. The RFID-reader is in turn connected to Rewire's product. Regardless where in the world the product is placed, it is managed from Rewire's head office. All maintenance and support is also done from the office. They can check the signal strength and change the software and configuration. The multinational firm tried to find a solution themselves, but they failed. Then they found Rewire who could deliver a working solution.

A customer that hasn't only used Rewire's systems, but has also chosen to change their business model is a large lift manufacturer. Currently, service of lifts is often done by a schedule. A service technician may visit an individual lift every fifth week. This means that the service firm is applying a way of thinking which says that it doesn't matter if a certain lift needs a new service after three or nine weeks, they go there every fifth week anyway. According to the CEO, the lift companies have based their business

models on this way of working. Through the aid of Rewire's wireless M2M-systems, the lift can order service and spare parts by itself.

The CEO tells us that the number of service occasions is lower with the new business model, and that leads to a larger profit. This has in turn resulted in the lift firm starting to acquire several service companies. According to the CEO they are doing this because it is through service contracts they are going to be making money in the future and not on the actual lift as a physical product. The change of business model has been an upswing for the firm which is now gaining market shares.

According to the CEO, the lift firm is a great example of an old industrial firm that has succeeded in changing their business model. The CEO tells me that they have initiated dialogues with other Swedish industrial companies. There is however a long journey to be taken in a lot of those cases. The main reason for this is that these companies have a separate service organization and product organization. There is often a conflict between them, or at least they have different approaches. The main thing they need to understand following the CEO is that the profit should be made on the post market.

Timbercut

The history of Timbercut started back in 1961, when the a local firm, developing and manufacturing forest machines, was founded. Since then, a number of changes in ownership also resulted in a number of name changes. In 2003, the firm was acquired by a large multinational enterprise. Timbercut got its current name and is today a division within that multinational enterprise. Timbercut is one of the largest manufacturers of forestry machines. The headquarters are located in Sweden. The site contains one of two worldwide Manufacturing plants and the Research and development department. Among the products produced are Harvester and Forwarder machines.

ANALYSIS

Barriers for establishing an Open Innovation system in forestry

To establish an Open Innovation system in forestry would involve a long journey to be taken by all actors involved. All actors will have to implement changes in their way of working. In this section we will identify the main barriers that need to be overcome in order to establish an Open Innovation network.

Traditional approach

Our study shows that the Forestry Industry in the northern part of Sweden is currently organized as a traditional value chain. In order to identify the barriers for establishing an Open Innovation system, we need to study the current traditional value chain in detail.

Figure 1. Traditional Value Chain

As illustrated in Figure 1, the first link in the chain consists of forest owning firms and private forest owners that decide to sell a certain amount of trees on their grounds. They purchase the services of the logging contractors in the next link. The logging contractors cut down the trees and branches are taken

away. The logging contractors need to purchase Forestry Machines to be able to do that. The trees have now been turned into timber and are transported to a landing point. Carriers, which constitute the next link in the value chain, pick up the timber and transport it to a saw- or pulp mill. The timber is turned into planks or paper. The mills pass on the finished product to resellers in different industries.

The process described above and in figure 1 illustrates how the product to be passes through the activities in the value chain in a certain order. The product gains value at every activity, for instance when trees are turned into timber by the logging contractor. This way of doing business reveals a traditional way of thinking about value. This way of thinking and the industry culture that is likely to come with it is in itself an important barrier to overcome in order to be able to work in an Open innovation system.

Skewness in the distribution of resources

If a firm wants to upgrade its technological assets and develop its way of working, investments will need to be made. Investments presuppose financial resources. The actors in our Value Chain are highly varying types of firms. The same goes for the amount of resources that are at each actor's disposal. Alpha and Timbercut Forest are large nationally and internationally based firms respectively. The logging contractors are however usually locally based small businesses with a few employees.

Northlog has three employees and including the owner they are four persons that operate the machines on a shift rota. Our informant is aware of the fact that the Mobitex-system he is using is dated technology. He tells us that he cannot afford to update the technology he uses as soon as there is new technology available. The overall impression given by the logging contractor is that the flexibility of his operations is relatively small. Due to the high cost of the forest machines there is a demand of high productivity around the clock. His main priority is to perform the logging as efficiently as possible and handle urgent production stops as quickly as possible when they occur.

Given this information, there is an evident skewness in the distribution of resources in the value chain. This results in another barrier to overcome - the low flexibility and lack of resources of the logging contractors.

Limited interaction and communication

Figure 1 shows that there is a lack of interaction and communication between the links in the chain other than those directly connected. The innovation that takes place in the chain is likely to be closed to influence from other actors other than the previous and the next step in the chain, if open to any actor at all.

This way of working is also reflected in the ICT systems used. The starting point is that each actor has its own independently developed ICT systems. They are simply using the technology that they can afford and that they themselves believe to be best suited. The contractors that are working for Alpha use the Alpha-developed VALS-web system. If a contractor starts working for another forest owning firm he will be using their system.

The traditional value chain of today shows a low degree of openness to other actors. In fact this way of working shows that the forestry industry in the northern part of Sweden is not only a traditional value chain, it is also committed to a closed innovation paradigm.

The use of ICT as an enabler for the establishment of an Open Innovation system

In this section we will investigate and make a proposal as to how the traditional value chain in forestry of today could be transformed to an open innovation system. To make these changes happen would involve a long journey to be taken by all actors involved. We will illustrate the main steps to be taken.

Change of business model

In the transition we're about to map out, we will be giving Timbercut Forest the role of being the focal firm in a potential Open Innovation network.

Timbercut are currently using a business model that is aligned with the traditional value chain. However, in order to fully capture the value from the technology in Timbercut's machines, the Business model

needs to be changed. The new business model should specify the firm's position within the value network to be created. Timbercut's position in the current value chain is no longer relevant. Instead, we will review the value creating system as a whole and consider how Timbercut can co-produce value with other stakeholders in this system.

Setting up a new venture

One way of handling the transition from the traditional value chain to an Open Innovation network is for the focal firm to seek new partners for a joint venture. Rewire is not a part of the current value chain, but they are geographically located in the region we are studying and they have the experience of assembling and orchestrating Open Innovation networks.

Rewire are among other things specialized in helping firms with the following three activities:

1. Change of business model
2. Transformation from selling products to selling services
3. Implementation of Wireless M2M technology to streamline business processes.

The first step in building the Open Innovation network is for the Focal firm – Timbercut forest, to set up a joint venture with Rewire (Figure 2). This requires a high degree of openness. In order for Rewire to be able to help Timbercut, the latter needs to open up its information channels to a certain degree. Accessing the technical specifications and performing tests with ICT component in Timbercut's machines will enable Rewire to take part in the process of creating new product offerings.

Figure 2. Joint venture between Timbercut Forest and Rewire

Defining the product offering

First off, Timbercut and Rewire need to investigate the needs and wishes of the customers. The Business model should define what product should actually be offered and how it can be used by the customers.

There might be new markets and customers no one has even thought of yet. However, two already existing types of customers of Timbercut are Alpha and Northlog. Timbercut and Rewire should together invite the customers to discuss, assess and address their needs (Figure 3).

Just like between Timbercut and Rewire, this kind of interorganizational knowledge sharing will demand openness from Alpha and Northlog. Access to the Alpha-system VALS-web will be of great help for Timbercut and Rewire to be able to determine how they can design and integrate new services. Access to data from the harvester and forwarder that the Northlog uses may serve the same purpose.

Topics that are being brought up in our interview with the logging contractor are lack of resources, high production rate, problems with finding qualified personnel, negative attitudes towards computerization. These issues are not impossible to resolve and they should be addressed by Timbercut and Rewire when defining the products and services to be sold.

Since keeping a high production rate is central in the operations of Northlog, Timbercut and Rewire should investigate if they can create a service that can streamline production. Problems with finding qualified personnel and negative attitudes towards computerization are problems that can be addressed by

courses and training programmes. However the lack of resources combined with the issues addressed above imply that taking drivers out of production to attend a course may not be doable.

Figure 3. Timbercut and Rewire together inviting the customers to discuss, assess and address their needs.

Reconfiguring the roles

The new Business model should also define the position of the firm in the value network. It is not just the role of Timbercut that is important to define. In the new value creating system, all participating actors will be producing value together. All of the roles in the current value chain need to be reconfigured and reinvented. We have indicated the positions of Timbercut and Rewire in the previous sections, but what will the roles be for Northlog and Alpha?

We have suggested how the problems stated by the logging contractor could be addressed by new services created by Timbercut and Rewire (5.2.3). One problem yet to be addressed is the lack of resources and the constantly high production rate. Northlog is in a vulnerable position in the current traditional value chain. One way of strengthening its position in the value network is through reconfiguring the interrelationship between Alpha and Northlog.

The logging manager's role at Alpha is very multi-faceted. She is in daily contact with several logging teams, saw- & pulp mills and carriers. Apart from that she plans the activities of the logging teams and is the decision-maker on budget issues and procurement of forestry machines. We do not suggest that her role should be reconfigured in the value network. However we do propose that the full potential of her role should be explored.

One way of decreasing the Northlog's vulnerability and give it a stronger position in the value network is to give Alpha a stronger supporting role. An example: Timbercut and Rewire want to sell a service in the form of a training course. The logging contractor is attracted by this offer and realizes the benefits for his personnel to attend. However he cannot afford to take them out of production to complete the course. In a situation like this one it should be possible for the logging manager to pull in another resource to cover. When the Northlog-personnel attend the course, value is created and it is to the benefit of all participants in the value network.

CONCLUSIONS

This study has addressed two research questions: (1) What are the barriers for establishing an Open Innovation system in forestry? and (2) How can the use of ICT enable the establishment of Open innovation systems? In order to answer these questions we performed a case study including key actors

from the forestry industry in the northern part of Sweden. The case study shows how the forestry industry is committed to working according to a traditional value chain and is committed to a closed innovation paradigm. We argue that ICT holds a potential to enable the transition from working according to a traditional value chain to organizing work according to the principles of an Open Innovation system. Our case study illustrates how the forestry industry and its actors are making efforts in moving from a product-oriented approach to a service-oriented approach in their processes. We identified the following main barriers for establishing an open innovation system in the forestry industry:

- A traditional approach to value creation
- Skewness in the distribution of resources
- A limited interaction and communication between the links

We argue that the Forestry Industry in northern Sweden is currently organized in a very traditional manner, in the value chain arrangement that has characterized business relations in the forestry industry since long. This way of doing business reveals what we refer to as a traditional way of thinking about value creation, and a limited capability to see beyond the existing value chain. This traditional approach to value creation is an important barrier to overcome in order to be able to work in an Open innovation system.

The actors in the Value Chain are a highly heterogeneous set of firms. The same goes for the amount of resources that are at each actor's disposal. Alpha and Timbercut Forest are large nationally and internationally based firms respectively. The logging contractors are however usually locally based small business with a few employees. To this end we argue that there is a skewness in the distribution of resources that restrains the technological development.

Finally, the limited interaction and communication between the links is manifested through the fact that each actor uses its own independently developed ICT-systems that are not integrated. We argue that this illustrates not only a low degree of openness to other actors, but also that the actors in our study are committed to a closed innovation paradigm.

These barriers are hampering the evolution of the forestry industry. It should be noted that informed use of ICT can be an aid in overcoming them.

We illustrate the main steps to be taken in reorganizing work according to an Open Innovation system. Changing Timbercut's business model, setting up a new venture between Timbercut and Rewire, inviting the customers and assessing their needs in order to define the product offering and finally, a reconfiguration of the current roles are all important steps to be taken. We argue that the ICT component in Timbercut's forestry machines constitutes a latent potential that can be fully captured through a joint venture with Rewire. Further, we argue that a favourable way of doing this is through the creation of an Open Innovation system. ICT can enable this transition through the interorganizational knowledge sharing that it makes possible.

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