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New business models needed in restructuring wood harvesting business

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Abstract. *The Wood processing industry outsources planning of harvesting and prefers entrepreneurs with several machines for both cutting and forwarding. The first generation of entrepreneurs is retiring, which means an opportunity to restructure the business. Poor profitability and thus difficulty in hiring qualified operators complicate this process. The asymmetry of negotiation powers between industrial customers and harvesting entrepreneurs keeps the profits low.*

A cros-sectional study of the structure of the harvesting business will be made to clarify the problems and success factors in the industry. Obstacles presented by traditions and customs in wood markets and harvesting are described and new ways to resolve them sought. Simulations show that new ways to organize operations and the machine park provide benefits Entrepreneurs used to excel in operating and servicing the machine. The entrepreneur in charge of growing a harvesting company needs managerial and financial skills and appropriate business tools to increase profitability. The traditional capacity supplier business model tends to be like the cooperation business model, and enterprise networks with subcontractors emerge. New business and operation solutions will be introduced to entrepreneurs through articles and seminars. Creating a profitability network will benefit the whole business.

1. Introduction

To be able to optimize the wood raw material flow from stump to the most profitable industrial process, the three biggest integrated forest industry companies in Finland have bought the wood as standing sales (Mäkinen et al. 1997, Rummukainen et al. 2006, Rummukainen & Tikakoski 2006). They know also direct the harvesting and transport operations using up to date GPS-based optimization systems. Metsähallitus (the Finnish State Forest and Park Service) is the only big forest-owner customer of harvesting enterprises. The asymmetry of a big customer and small harvesting enterprises affects price negotiations and has sometimes lead to quite severe restrictions on how the harvesting enterprise has to operate (Alajoutsijärvi et al. 2001). The forest industry is loosening its strict guidance control over the harvesting enterprises, which reduces wood procurement cost by outsourcing harvesting planning and by minimizing the number of partner's, i.e., larger harvesting enterprises.

Since 1970, the productivity of harvesting (volume per worker time) has increased ten times based on rapid development of harvesting machines and more recently their data processing systems (Penttinen et al. 2006). The growth has levelled off in last ten years, because machine development is in the slow growth phase of a mature product. Harvesting enterprises´ measures to increase the operational efficiency have kept the deflated harvesting cost at a constant level

for more than ten years (Penttinen et al. 2006), but costs increased 5% last year alone, causing pressure on harvesting cost (Forest .engine cost index 2008). There is a need to find new means to increase the profitability of harvesting enterprises.

The Finnish Forest Research Institute started a four years project to develop business models for harvesting enterprises in 2007 (Profitability development 2008). The Finnish Forestry and Earth Moving Contractors Trade Association (2008) has been involved in creating objectives for the study. Mäkinen (1993) previously researched the success factors of harvesting companies in the 1990s. Lappalainen et al. (2007) investigated new business models on wood purchasing in Finland, study which concentrated on the business and operations from stump to the mill. Väätäinen et al. (2007) revealed some cost-saving potentials in harvesting operations by simulating new operating methods.

This study tries to develop adapted economic tools for running the business and planning tenders. Some forms of action and traditions restrict entrepreneurs' operations or complicate their relationships with customers and forest owners. This study strives to bring these obstacles to light and replace them with better solutions. A profitability and cost follow-up system based on an enterprise network will be built to offer almost real-time data for analysing the status of the whole branch. Since the study is in its data collecting phase, only preliminary results are available to date.

2. Material and methods

2.1 Machines and enterprises

This study utilizes a systematic database of forest machines in the Finnish Vehicle Administration AKE (2008). register at the end of June 2007. The data includes around 5,-650 machines with owner and machine data. The AKE-registers machine database was purged of invalid enterprises by the checking owner's data and by comparing it with other data sources. Machines owned by a machine vendor, bank, vocational school, mining company and some other non-enterprise organizations were excluded. Machines, which were more than 15 years old when the current owner purchased it, were also dropped. so that 4,-700 machines were used for the analysis of this adjusted AKE-database.

Finland was divided into six areas, in each of which three enterprises from each enterprise class with one, two, or more than two machines were chosen; totalling 18 enterprise groups. A genuine random sampling was performed in each of the 18 groups, the total sample being some 60 enterprises. Owners of sample firms are interviewed personally at their company. To this point, 11 companies have been interviewed, less than 20 per cents having refused the interview. An interview of about two hours consists of questions concerning the company and its operations and budget.

2.2 Economic material

The closing of the books of the five last years for each enterprise to be interviewed was picked from the information supplied by the enterprises to the National Board of Patents and Registra-

tion of Finland analyses were performed using an TA-model (TA-malli) analysis program The adjusted AKE-database was applied to select all closing of the books information for 1999-2006 from the enterprise portal of Statistics Finland. A research laboratory was established at the premises of Statistics Finland to analyse the critical success and failure factors (CSFs and CFFs), including bankruptcy

2.3 Methods

Discrete-event simulation, widely used in analysing the cut-to-length harvesting method (Asikainen 1995, Talbot et al. 2003, Väätäinen et al. 2006a, Väätäinen et al. 2007), provides a yardstick for comparison of different business models in comparable harvesting conditions as well as producing study material for building and testing a holistic cost calculation model for the harvesting entrepreneur. A WITNESS-simulator (1998) model (1998) was developed which includes the enterprise's harvesters, forwarders and machine transfer truck. The simulator harvests all logging sites, which are set as an input matrix. Logging conditions and site location material are based on real harvested data from three forest industry companies in Central Finland (Väätäinen et al. 2007). The simulation model includes the work-shift element, which can be adjusted for the purposes of the study approaches. As advanced elements, the simulation model could encompass the active logging site bank of the contractor, the minimizing option for machine transfers between logging sites, and an adjustable work-shift arrangement for balancing the operations of harvester and forwarder (Väätäinen et. al 2007). More detailed information on the harvesting simulation model will be published soon.

The main tool applied in the enterprise analysis of both an individual enterprise and the whole business was the management accounting ratio analysis. Traditional and developed ratios for this industry were also tested.

3. Structure of the harvesting business

3.1 Big enterprises active

According to Forest statistics (Finnish Statistical ... 2007), there were 1550 harvesters and 1670 forwarders working in Finland, a number is based on monthly inquiries to the forest industry, and State Forest and Forest Management Associations. There is a 25% variation in this average between the high in winter and the spring low. The Finnish Forestry and Earth Moving Contractors Trade Association (2009) state that there are 1,300 harvesting enterprises which own 1,-500 harvesters and 1,700 forwarders. According to The Vehicle Administration registration statistics (2008) there are 4, 100 harvesting machines, which are owned by 1,700 enterprises, thus 2,4 machines per entrepreneur. On top of these figures, there are 550 enterprises with 590 machines more than 15 years old.

About 50% of entrepreneurs own only one machine. A quarter of entrepreneurs own two machines and about ten per cent each own three, four or five machines. Fifty entrepreneurs own eight or more. The biggest company owned 29 machines. The largest enterprises are in eastern and northern Finland. In the Kainuu area, the average enterprise owns 4,2 machines. The

smallest enterprises are in the west and south. In the coastal area an average enterprise owns only 1,7 machines.

3.2 Working conditions

A one or two-shift working system is applied, depending the age of machinery and the policy of the enterprise. A thinning harvester's productivity is 10–30,000 m^3/year. Few big machines operating in regeneration cuttings harvest more than 100,000 m^3/year. Average productivity (Finnish Statistical...2007) for both harvesters and forwarders has been at slightly over 30,000 m^3/year for more than ten years. The harvesting capacity of active enterprises has long been fully utilized.

According to the entrepreneurs interviewed in this study, the biggest problems with the industry customers, besides low payment are, naturally, excessive supervision in choosing work sites and problems with thinning where undergrowth is not cleared before cutting. There are big differences in pre-clearances between customers and the area of the country. The biggest problem for the whole harvesting business is the lack of skilled workers. Low payment but high skill requirements is one reason, problems with the schooling system is another.

3.3 Organization form varies

The three biggest forest industry companies buy 85% of industrial raw wood in Finland (Mäkinen et al. 1997). Two of these have started to give entrepreneurs larger areas to harvest. Some of these entrepreneurs do it all by themselves, some have sub-contractors and some join a network, which makes the agreement with the company. The third company continues to negotiate directly with all harvesting enterprises. Today, all three big industry companies have their own scaling and data transfer systems, so that a harvesting enterprise can work only with one customer with each machine. Smaller sawmills and forest management associations do not impose any special requirements on data transfer systems.

Entrepreneurs have all kinds of organizations to meet the industry's requirements. Often an entrepreneur owns both harvesters and forwarders. In some cases, the major contractor completes his capacity using sub-contractors. Competition legislation prevents harvesting entrepreneurs fixing prices, forcing each one to negotiate directly with a much stronger industry representative. Increasing the size of the harvesting enterprise may increase its negotiation power with the industry. In major contractor – sub-contractor organizations, there is usually specialization in machines, smaller machines for thinning, and more efficient machines for regeneration cuttings.

4. The harvesting business economy

4.1 General conditions

In 2006, the value of the enterprise harvesting business was 325 mill. € (Finnish statistical 2007). Moreover, forest owners´ own work can be estimated about 100 mill. €. Total harvesting volume was 50,8 mill. m^3. The harvesting enterprise and professional loggers´ work input was 8,000 man-years. For comparison, the stumpage incomes for the forest owners at the same time were

1700 mill. €. In 2007, the average stumpage price for pine logs ballooned from 54 € to 71 € per m^3 from January to June, because of high demand for sawn wood. At the same time, the harvesting cost increased 5%, but only a few entrepreneurs could write that increment into their agreement (Fig. 1).

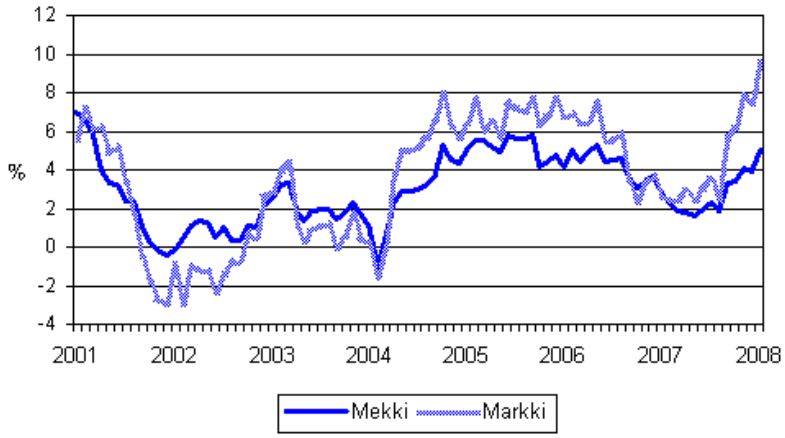

Figure 1. Cost changes in forestry (Mekki) and earth-moving contracting (Markki) in 2001-2008 (Forest and ... 2008)

There has been a big variation in harvesting enterprises´ profitability, although a fifth of them returned a negative result (Väkevä & Imponen 2001). In autumn 2007, the views of machine entrepreneurs were positive as far as financial results in logging businesses were concerned (Jaakkola 2007). The forest industry plans to compensate for decreasing imports by domestic removals, which means in practice that more logging sites will be less productive and more work will be done on wetlands and marshes. Most entrepreneurs saw their company's financial performance as stable, but about 22% declared negative results (Jaakkola 2007).

4.2 Profitability consideration

Harvesting volumes have changed, so that the motor-manual method exceeded the mechanical method in 1990, but in 2007 the former represented only some 2%. Surprisingly, the unit costs have decreased so that even total unit costs are less now than in 1990. The average unit harvesting cost has decreased because of the cost decrease in regeneration felling. At the same time, cost trends have been very challenging.

Interviews have shown that similar enterprises, even of the same size, can dramatically vary in profitability. However, enterprises tend to need plenty of capital and might suffer from lazy capital although the interest rates have been moderate in recent years.

5. New initiatives in organizing business

5.1 New customers and services

New opportunities to improve the profitability of harvesting have emerged. Business expansion,

diversification of the machine park, improving service supply, new lines of work and new customers are examples of such opportunities. Because most forest owners live far away from their woodlands, the opportunity arises for harvesting enterprises to offer its services direct to forest owners. It emerged in the interviews that one enterprise had hired a forest planner so that it could offer the forest owner a turnkey service from planning to harvesting and even soil preparation and planting, including plants. The price negotiation power of the enterprise and customer is then at the same level.

Energy wood harvesting is booming. Many entrepreneurs interviewed harvested stumps and cutting debris for big companies. The profit expectations in offering turnkey services may be greater. The entrepreneur and/or forest owner network is maintaining a local bio-energy power plant, charging for the heat produces.

Maximizing machinery uptime is important in the forest machine business and in cost-optimization of asset management. Multi-functionality of machines is appreciated as a way of increasing operating time. There are already so-called combi-machines, which both cut and forward. An excavator can harvest in winter and plant in summer, for example. More detailed research is still needed to evaluate the profitability of various machine combinations (Kärhä & Peltola 2004). There is also a need for effective forwarders to work on poorly bearing soils.

5.2 Cost effective operations

Entrepreneurs need means of evaluating the profitability of different types of work, customers and machines. One example is re-organizing the harvesting machine transfer between logging sites. Traditionally, 70–80 % of Finnish harvesting enterprises own a machine transfer truck (Väätäinen et al. 2006b). Relying on outsourced machine transfers or co-owning the truck is not usual. Where the transfer truck is owned, the transfer cost increases sharply when the volume cut decreases below 35,000 cubic metres per year (Fig. 2) (Väätäinen et al. 2006b). Including the driver's wage costs, increases the cost further.

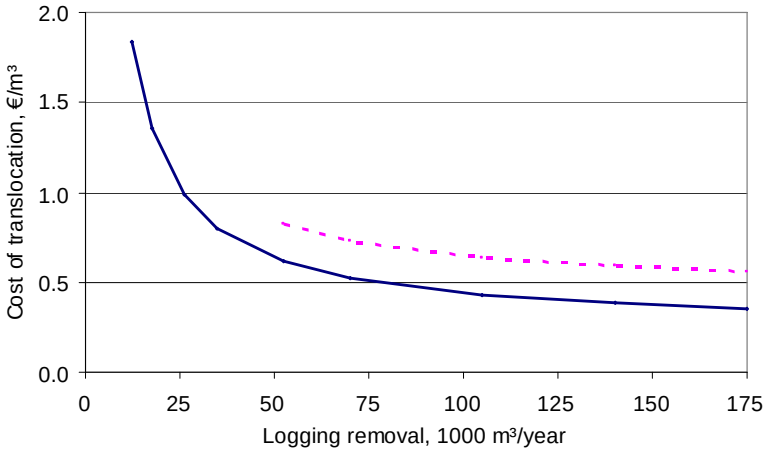

Figure 2. Cost of the harvesting machine transfers depending on the yearly harvesting volume [The continuous line shows cost without the separate truck drivers´ wage cost, the dashed line with drivers´ cost] (Väätäinen et al. 2006b).

Two or more small logging companies co-owning the machine transfer truck will gain cost-efficiency in machine transfers and, thus, in total logging costs. The cost saving is most significant when two contractors own only one harvester-forwarder system each. When the number of harvesting machines increases, does the availability of instant transfer decrease? What is the maximum number of logging machines for one relocation truck, and what is the economic influence when machines wait for the transfer – these are interesting questions still to be resolved. The performance of the relocation truck, the importance of some other operations approaches, such as the effect of harvesting the entrepreneurs' active logging site reserves and the influence of contracting for more than one customer are questions to be analysed later (Väätäinen et al. 2007).

5.3 Business models

The basis of the business model consideration could be seen as the *value proposition*, focusing the customer relationship. Moving from the traditional capacity sales business to cooperation, the critical parameters are: (i) the amount of work-in-hand of the entrepreneur and, in the future, (ii) the opportunity of serving several customers at the same time. Transport costs tend to increase in the case of transaction-oriented operations (Väätäinen et al. 2007).

One of the three big industrial corporations distributes the work-in-hand to the relevant area enterprise. Today, an enterprise can serve only one big customer because of incompatibility. Although information and communication technologies (ICT) are heavily used, the opportunity to utilise information for enterprise management is negligible.

6. Discussion

The whole forest industry sector faces new challenges, starting with the cheap dollar and ending with extreme Russian export duties due to come into force on January 1, 2009. The wood procurement demand tends to exceed capacity, which is limited particularly by the availability of operators and the unexpectedly mild winters. The machine technology is quite mature. The industrial customers tend to outsource even planning to their major enterprises. Similar networking with contractors and sub-contractors in other businesses will be used as a benchmark. However, there are several bottlenecks, starting with the availability of the cutting site reserves. Developing action procedures and business models challenges the traditional methods. The opportunities for management accounting and information systems in supporting the management and operations have only been modestly exploited. Profitability and cost structure studies have shown this rather unfavourable trend. Improved operational procedures, utilisation of information systems and application of management accounting and information systems support improved profitability.

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