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Commercialisation and International Market Potential of Finnish Silvicultural Machines

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Recently, the need to mechanise silvicultural operations has increased in the Nordic countries. While several new machine concepts have been developed, the manufacture of silvicultural devices remains at the market introduction stage. Information is required in support of existing and forthcoming Finnish small-scale producers of silvicultural devices, who wish to commercialise and further market their innovations in domestic and export markets. The aim of this study was to identify the opportunities, challenges and market potential of business activities that develop in connection with device or machine production. Small-scale Finnish manufacturers of silvicultural devices, Finnish large-scale harvester manufacturers and international silvicultural experts participated in the study. The results show that participant groups have varying opinions of cooperation methods and export activities, as well as of the export markets with the best potential. According to international silvicultural experts, mechanised planting and pre-commercial thinning have the greatest potential worldwide. However, demand for mechanised pre-commercial thinning and planting has been mainly confined to the Nordic countries. For a foreign firm marketing a new silvicultural machine concept, the most important customers and cooperation partners are locally operating forest firms, machine contractors and research organisations. The results of the study provide a useful overview of the current state of silvicultural device manufacturing in Finland.

Keywords mechanised silviculture, silvicultural device, market potential, commercialisation of technology
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1 Introduction

In general, mechanisation is aimed at improving working conditions and enhancing the quality and cost-efficiency of work (Harstela 2004). For a variety of reasons, the need to mechanise silvicultural operations has recently increased in Nordic countries (Rantala et al. 2009, Rantala and Laine 2010, Ersson 2010) and several new machine concepts have already been developed (Rantala and Laine 2010, Saarinen and Rantala 2010). However, only a few examples of each kind of silvicultural device are in active use in Nordic forests (Strandström et al. 2011). As a result, the manufacture of these devices remains a rather small-scale business. As yet, large-scale harvester manufacturers show no interest in broadening their product range to include such devices, whose markets are viewed as being small (Strandström et al. 2009). A need nevertheless exists for new mechanisation ideas and business concepts that lower the need for human resources in forestry, while providing higher productivity, greater cost-efficiency, and quality improvements. Earlier research into the mechanisation of silvicultural work has focused on productivity, costs and quality (Saarinen 2004, Rantala and Laine 2010, Rantala and Kautto 2011), as well as biological issues (Luoranen et al. 2011). Despite this, the fact remains that mechanisation of silvicultural works will proceed no further without profitable growth in the manufacture of the related machines and devices.

In Finland, one or two mechanical solutions exist for each main area of silvicultural work under mechanisation: planting, early cleaning and pre-commercial thinning. Most such devices are attached to a harvester or an excavator boom-tip and all of them aim towards higher productivity and quality when compared to manual work, separate spot mounding and manual planting, or motor-manual work with a brush saw (Strandström et al. 2011). In mechanised planting, devices carry out both soil scarification and tree-planting work (Rantala and Laine 2010). During early cleaning, such work is based on uprooting, where the device grips and lifts clutches of sprouts from the ground by their roots. In this case, cost-effectiveness is highly dependent on whether pre-commercial thinning is required after the mechanised uprooting (Rantala and Kautto 2011). All pre-commercial thinning devices are based on cutting blades (Strandström et al. 2011). In recent decades, mechanised silviculture devices have also been developed in other countries, but no breakthroughs have been made in commercialising them successfully (e.g. Gustavsson and Moberg 1975, Hallonborg et al. 1995, von Hofsten 1993).

Many challenges have yet to be overcome in the mechanisation of silvicultural operations. Only then can inventions make the transition to becoming innovations, and innovations evolve into commercialised products providing a return to the manufacturer. In Finland, for instance, only 2–3% of all tree plantings and less than 1% of pre-commercial thinning are mechanised, although there seems to be some willingness to increase mechanisation (Strandström et al. 2009). It is forecast that, by 2015, 30% of tree planting and 20% of pre-commercial thinning will be mechanised. Taken together, these work types have a mechanisation potential of around approximately 90% (Strandström et al. 2009). Since existing machine concepts are already satisfactory in terms of competitiveness and the quality of work produced (Rantala et al. 2009, Saarinen and Rantala 2010, Rantala and Kautto 2011), the next step involves finding new methods of commercialising and marketing such equipment.

The manufacture of Finnish silvicultural devices is at the market introduction stage, i.e. only a few firms operate in the markets and the business remains embryonic (Vanhala et al. 2006). Product development and manufacturing costs and unit prices are high. In addition, the need to convince customers of the benefits of new products leads to high marketing costs. When a firm moves to the growth stage, the product gains acceptance in the mass market, sales take off and the market grows rapidly (Markides and Geroski 2005). Contrary to silvicultural operations, revenue growth in businesses based on the manufacturing and marketing of harvester technology has been high, i.e. 10–30% annually since 2000. Mechanisation of logging proceeds and the fight for market share is underway in Russia, Eastern Europe, South America and some parts of Asia. Finnish firms have succeeded in utilising new technology and in commercialising the result-

ing products in the global markets (Asikainen et al. 2009). For instance, approximately 65% of Ponsse's annual revenue is derived from exports.

A firm may be pushed into exporting due to small home market potential (Hollensen 2004). Indeed, a firm's domestic market position is an important determinant of its strategy (Porter 1990). Fierce rivalry in the home market pressurises firms to innovate and upgrade productivity. Domestic rivalry not only creates positive externalities, but also greater innovation that can boost exports (Sakakibara and Porter 2001). Obstacles to exporting make business operations more challenging overseas in comparison with domestic market activities. In the process of internationalisation, three main issues arise: 1) lack of information regarding foreign markets, 2) difficulty in obtaining facilitated credit, and 3) administrative and customs procedures (Kedia and Chhokar 1986, Madsen 1989, Styles and Ambler 1994). According to Bell (1997), major export problems encountered by firms are usually finance-related. Cultural, economic, legal or political impediments may prevent firms from targeting particular markets, or require them to make significant modifications to existing product ranges.

Successful commercialisation of new technologies is the riskiest form of new product development activity (Lehmann and Winer 1997). This generally requires that the know-how in question be utilised in conjunction with other capabilities or assets (Avenel et al. 2007, Greis et al. 1995, Luukkonen 2005), such as marketing, competitive manufacturing and after-sales support. Continuous innovation is probably the only way of gaining competitive advantage (Teece 1998). Large firms usually have the expertise and assets necessary to commercialising an innovation with their own resources (Fiedler and Welpe 2010). Factors such as rapid technological change, flexible production processes and global competition make close collaboration across functions even more crucial to the introduction of profitable and timely new products (Cooper and Kleinschmidt 1995, Griffin and Hauser 1996, Wheelwright and Clark 1992). Extensive investments are usually necessary to turn new technologies into tangible products and successfully take those products to the market (Pondy et al. 1988).

The aim of this study was to identify the opportunities, challenges and market potential of business activities related to the production of silvicultural devices or machines. Another objective was to generate information to support existing and forthcoming Finnish small-scale producers of silvicultural devices (MSDs) to cooperate and commercialise the inventions and market these in domestic and export markets. The main focus was on harvester and excavator-based, boom-mounted devices designed for mechanised tree planting, early cleaning and pre-commercial thinning.

2 Materials and Methods

Data for the study was collected by conducting qualitative, in-depth theme interviews and a questionnaire. The respondents were categorised into three groups. Two of the groups, small-scale Finnish manufacturers of silvicultural devices (MSD, 6 respondents) and Finnish large-scale harvester manufacturers (LHM, 3 respondents), were interviewed face-to-face. Respondents from MSDs included founders, current owners and Chief executive officers (CEOs) of the firms in question, as well as innovators of the main products manufactured by the firms. MSDs' products were intended for mechanised sowing, planting, early cleaning and pre-commercial thinning. Respondents from LHMs included the firms' marketing directors. Furthermore, the third group, international silvicultural experts (ISE, 14 respondents) from eight different countries or geographical areas, answered an Internet questionnaire. This consisted of question categories similar to those used for the interviews. A few questions concerning respondents' opinions about certain statements on the prerequisites of mechanisation were included in the questionnaire. ISE respondents were chosen based on their work experience in certain geographical market areas. The ISEs in question were working in international forest companies, universities or the public administration and represented the following countries or geographical areas: Sweden, Germany, Canada, USA, South America, China, Russia and Eastern Europe (Table 1). To encourage participation, all

Table 1. Main characteristics of the respondent groups: small-scale Finnish manufacturers of silvicultural devices (MSD), Finnish large-scale harvester manufacturers (LHM) and international silvicultural experts (ISE).

Group	N	Method	Group members' background	Field of business / Area of expertise
MSD	6	Interview	Founders, current owners, CEOs, innovators	Machines for sowing, planting, early cleaning, pre-commercial thinning
LHM	3	Interview	Marketing directors	Harvesters, attachments
ISE	14	Questionnaire	International forest companies Universities, state officials	Sweden, Germany, Canada, USA South America, China, Russia, Eastern Europe

respondents were assured that their responses would be handled confidentially.

Semi-structured interviews took place during April–May 2010 at the interviewees' places of work. Each interview took approximately 60–90 minutes. The themes discussed with MSDs were: 1) the commercialisation and markets of the products, 2) export and cooperation, and 3) competition and competitive strategies. The themes discussed with the LHMs were: business opportunities in mechanised silviculture and possible business strategies from the standpoints of 1) cooperation, 2) product export and 3) competitiveness of small-scale manufacturers. All sessions were conducted by the same interviewer. The interviews were documented and analysed individually in retrospect. In the analysis of the MSD and LHM interviews, both convergent and divergent opinions were revealed. Qualitative analysis of the interviews was performed, in order to discern which factors affect manufacturers' success in the commercialisation and marketing of silvicultural devices.

The online questionnaire for ISEs was designed to map the present techno-economic state of silvicultural operations and their probable development trends, as well as the mechanisation potential of these operations in certain international market areas. The questionnaire dealt with all possible concepts of mechanised silviculture, rather than restricting its purview to certain devices that currently exist in Finland or any other country. The Internet survey was conducted during May–August 2010, the related questionnaire consisting of 16 questions considering mechanisation possibilities in the future, potential cooperation partners, the current state of forestry and silviculture, as well as public and professional attitudes towards the mechanisation of silvicultural operations in a specific geographical area. Both closed and open-ended questions were put to the respondents. Because each ISE represented a different geographical area, the ISEs' responses were analysed individually.

3 Results

3.1 Manufacturers of Silvicultural Devices (MSD)

External factors affecting success in the profitable manufacture of silvicultural devices included common prerequisites for entrepreneurship in Finland, such as good operational resources, e.g. general availability of labour and financing, as well as societal attitudes and general and financial support. Firms are not necessarily capable of affecting such issues themselves. The most important internal factors were product image, the firm's image, the firm's ability to cooperate, its networks, and the experience and professionalism of the firm's labour in export, retail and development work. All of these are strongly affected by the firm itself and seem to be highly dependent on the personality of the entrepreneur.

The MSDs remarked that there is substantial resistance towards new working methods and devices in the forest industry. Proof has to be provided of the necessity and profitability of any new method or product. This is often challenging in the case of tree planting and pre-commercial thinning, because an interval of several years must elapse before the results of the new method are apparent 'on the ground'. Furthermore, reliable

research results are often needed to win customers' acceptance of new devices and methods.

The MSDs encountered difficulty in finding suitable partners among resellers and retailers. Networking was considered a slow and laborious process. It was remarked that the best way to find new contacts and build networks was to participate in fairs, exhibitions and events focused on mechanised forest work. Finnish MSDs' products are so differentiated that such firms do no regard each other as competitors. For them, the most important product quality factors are reliability, ease of maintenance, simple functioning principles, low price, high productivity and work quality. Taken together, these factors enable a good price-quality ratio for customers.

The MSDs had diverse business targets: some strove for rapid growth, whereas others preferred to grow at a slower pace. However, all respondents indicated that growth is not necessarily dependent on the firm's aspirations, but the market situation. MSDs regarded long-term growth plans as impossible to formulate, due to difficulties in forecasting future demand for their products.

All MSDs had a genuine interest in exporting, but varying experience of doing so. The bigger firms with diverse products had more experience than the smaller ones. Firms had diverse ways of gaining the experience and knowledge needed in exporting silvicultural devices, e.g. through production and export of other products to foreign markets and by recruiting staff with export experience. Firms with previous export experience had gained information through existing retailers. However, export channels built for the needs of other products were not deemed suitable for the export of silvicultural devices. MSDs emphasised that launching a new product in export markets proceeds slowly and requires a great deal of time and effort, particularly in seeking the right contacts and visibility. They also named Scandinavia as the most interesting export market for their products.

The MSDs were all of the opinion that their domestic businesses must be on a solid footing before making substantial efforts to export. The closest markets geographically were considered the most promising for starting export activities. A lack of partners and slow acceptance of the new silvicultural methods, on which the new products rely, were viewed as key challenges. The MSDs favoured cooperation in exporting, but disagreed on the best partners and on how to build cooperation. When asked about forms of export cooperation, a collective project was the most preferred concept. Export cooperation with harvester manufacturers or forest industry companies was also mentioned. According to the MSDs, while it would be possible to create new devices intended solely for export, an easier, cheaper and less risky route would involve the modification of existing devices sold on the domestic market.

The negative opinion generally entertained of mechanised silviculture was viewed as an obstacle to implementing new methods and cited as the reason for the slow increase in mechanisation. The MSDs believed that attitudes to the mechanisation of silvicultural work often changed when people had the chance to see the machines in action. It was believed that work demonstrations and discussions with forest owners and forestry professionals might also achieve this.

3.2 Representatives of Large-Scale Harvester Manufacturers (LHMs)

According to LHMs, the most important factors in commercialising silvicultural devices are new innovations and cooperation, both of which should be considered during the product development process. While responsibility for new innovations lies with MSDs, without well-functioning cooperation the commercialisation of innovation is considered difficult.

LHMs noted that it is usually vital to begin with several inventions, and then choose the most robust and promising ones for further improvement. When an invention has finally become a new, innovative silvicultural device, it is important to awaken demand by ensuring that the advantages of the new device become widely known and are effectively used in marketing. LHMs considered development projects, networks and various prerequisites, e.g. establishing forms of cooperation and gaining cooperation experience, to be important factors with respect to successful cooperation.

LHMs emphasised the importance of the new silvicultural device's compatibility with their own

products, delivery channels, and existing contacts when deciding on marketing cooperation. The respondents mentioned that a harvester, for instance, can constitute an excellent base machine for silvicultural devices due to its high quality ergonomics and good terrain features. Silvicultural work also offers the potential to diversify machine contractor services, thereby raising the capacity utilisation rate of base machines. Cooperation can also assist both partners in attracting public subsidies, not only for research and development (R&D) activities but also for marketing new products. It was acknowledged that mechanised silviculture increases the operating hours of base machines. In this way, it offers a solution to the problems caused by seasonality. In addition, the mechanisation of silvicultural operations was considered to support the manufacture of harvesters, rather than representing a threat to the business. The LHMs named Scandinavia, North America and Germany as potential market areas for Finnish silvicultural devices.

MSDs and LHMs do not yet engage in deep or long-term cooperation with one another. However, some experience was reported of cooperation with reliable and well-known MSDs in marketing and product development. Challenges in this regard also involved issues such as control of intellectual property rights and after-sales marketing, the latter extending to negotiations over maintenance services.

Cooperation with customers has a long tradition in the harvester manufacturing business. LHMs consider this not only a self-evident form of cooperation, but a prerequisite for continuous product development. Cooperation between harvester manufacturers and silvicultural device manufacturers can be either bilateral or, for instance, take the form of a development project involving the participation of public and private R&D organisations and/or financiers. All of the interviewed LHMs believed that the productivity of silvicultural work can be improved by mechanisation. They also thought it possible to manufacture silvicultural devices as part of a profitable business. While considering it possible that silvicultural works will be mechanised in the future, they expressed uncertainty about when and how this will happen. Until the present day, development in this area seems to have followed a similar path to the mechanisation of timber harvesting.

3.3 International Silvicultural Experts (ISEs)

ISEs noted that the greatest potential for the sale of silvicultural devices lies in South America and Asia, especially China. This is mainly due to the high availability of wood provided by plantations, and rapidly increasing demand for the end-products of global forest firms. Russia also has huge market potential for silvicultural devices, but social changes are required before MSDs can take advantage of this. Scandinavia, Europe and North America were considered markets with less potential. Despite the potential that exists to mechanise silvicultural work, it should be borne in mind that the mechanisation of logging is still underway, and remains the focus, in many regions. Mechanised planting, grass suppression and pre-commercial thinning have the greatest potential worldwide, particularly in South America and Asia. So far, demand for mechanised planting and pre-commercial thinning is mainly confined to the Nordic countries.

As noted earlier by MSDs and LHMs, the export of silvicultural devices requires expertise in local conditions and markets. Active marketing of new products and cooperation with various interest groups are also needed. According to ISEs, for a foreign firm marketing a new silvicultural machine concept in all of the market areas in question, the most important customers and cooperation partners are locally operating forest firms, machine contractors and research organisations. The role of forest firms was considered particularly interesting. State representatives, private forest owners and financing companies were considered the next most important. Financing companies seem to play a significant role, especially in Eastern Europe and Russia, whereas municipal representatives, politicians and public sector agencies were considered to be the least important ones (Table 2).

According to ISEs, forest industry and machine contractors have either a strongly positive or positive attitude towards the mechanisation of silvicultural work, in all of the market areas in question.

Table 2. Key interest groups for a foreign firm marketing silvicultural devices in different geographical areas. A very important role is denoted by the symbol "+++", important by "++", some significance by "+", insignificant by "–" and no response by "×".

	Canada	USA	Sweden	Germany	South America	China	Russia	Eastern Europe
State representatives	++	×	++	+	+	++	+	+
Municipal representatives	–	×	–	+	–	×	–	×
Politicians	+	×	+	+	–	×	–	×
Private forest owners	++	×	+	++	+	+	–	×
Forest companies	+++	++	+++	+++	+++	+++	+++	+++
Machine contractors	+++	×	++	++	+++	+++	++	+++
Financing companies	+	×	+	+	++	+	+++	+++
Research organizations	++	+++	+	++	++	++	+	×
Public agencies	+	×	+	+	–	×	+	×

Table 3. The attitude of different interest groups towards the mechanisation of silvicultural work. Strongly positive is denoted by the symbol "++", positive by "+", neutral by "+/–", negative by "–", strongly negative by"—", and no response by "×".

	Canada	USA	Sweden	Germany	South America	China	Russia	Eastern Europe
Forest industry	++	++	++	++	+	++	+	+
Machine contractors	++	++	++	+	+	+/–	+	+
Forest owners	+	++	+/–	+/–	+	–	+	+/–
Public attitude	+/–	+/–	–	–	+/–	+/–	+/–	+/–
NGO/environmental group	×	—	×	×	+/–	×	×	×

Forest owners' attitudes were also more-or-less positive or neutral, with the exception of China where forest owners were reported to be more critical towards mechanisation, although some negative attitudes also exist amongst the general public. In addition, two of the ISEs referred to non-governmental organisations (NGOs) and environmental groups, evaluating the attitude of such bodies in South America as neutral and in the United States as even strongly negative (Table 3). The overall prerequisites for marketing and launching new mechanisation concepts for silvicultural works look rather positive in the geographical areas concerned.

4 Discussion

Because a very limited number of people have expertise in the questions at issue, the interview and questionnaire participants were purposively selected, in order to ensure that the sample comprised the informative contacts most likely to help achieve the goals of the study. Although the sample was small, almost all Finnish manufacturers of both silvicultural devices and harvesters were included. According to Merriam (2009), sample selection in qualitative research is usually non-random, purposeful and small-scale, because the researcher is seeking a deeper understanding of a specific case. While the results of this study cannot be generalised and applied in other contexts (such a limitation is common in analyses that include the use of qualitative measures), they can provide a deeper understanding of the manufacturing business related to silvicultural machines. The online questionnaire effectively complemented the qualitative analysis of the theme interviews, providing a broader illustration of the product's market potential. In addition, the use of two methods (interview and questionnaire),

combined with the inclusion of three respondent groups, facilitated coverage of all important players in the business.

When embarking on international activity, it is usual to obtain experience from the domestic market first. Based on the results of the interviews, the current state of the MSD market in Finland can be analysed through Porter's (1980) five forces, which provide a framework for industry analysis and business strategy development. These forces include: threat posed by established rivals, threat posed by new entrants, threat posed by substitute products, bargaining power of suppliers and bargaining power of customers. The five forces determine the competitive intensity, and therefore the attractiveness, of a market.

First, the threat posed by established rivals is fairly low. All of the firms are rather small and differ from each other. According to the MSDs, there is no rivalry among them. Profitability is considered low, but the stability of this situation is difficult to estimate because of the early stage of the business's life span. Second, the threat posed by new entrants appearing is reasonably high. For now, the manufacture of silvicultural devices is still a small-scale business. When this business moves into the growth phase, the number of new entrants may increase substantially. Long customer relationships are lacking; from point of view of new entrants, this can be viewed as an opportunity to corner the market. Foreign companies also constitute possible new market entrants. Third, the threat posed by substitute products is reasonably high, but will most likely decrease in the future. Threats could appear, either in the form of a competing firm, or a substitutive silvicultural method. While manual labour is the most probable substitute, in the future the costs of machine work are expected to fall, while manual labour will become more expensive. Fourth, the bargaining power of suppliers is low. This is the least important of the five forces. Suppliers are subcontracting firms acting as providers of single components or raw materials, both of which can be purchased from another supplier. This gives such firms a weak position in negotiations and renders them easily replaceable. Fifth, the bargaining power of customers is fairly low. Customers are mainly small entrepreneurs who work for forest industry or forest service firms. Since current silvicultural devices are attachments to excavators and harvesters, they are not critical to the customers' businesses. However, they can help to alleviate the seasonal problem of fluctuating demand for the base machine and workforce, while enhancing the capacity utilisation of the firm's resources.

Internal factors and business prerequisites shaped by entrepreneurs that effect on the success of MSDs were largely similar to what LHMs were regarded as having importance to the commercialisation of new silvicultural innovations via cooperation and innovative devices. Cooperation, networks, development work, export business and research knowledge were also identified by both groups as being important to business success. It seems that MSDs and LHMs concur on the nature of the key elements forming the prerequisites for a successful business and the commercialisation of new products.

Establishing a workable network and creating the required contacts are challenging tasks for the few, rather small-scale Finnish firms producing silvicultural devices that are mainly intended for planting, early cleaning and pre-commercial thinning. However, since many of these firms need help, especially in planning and executing their export trade, the accomplishment of such tasks would probably be worthwhile. Bearing this in mind, a major advantage would probably be gained by obtaining a partner with existing product delivery and marketing channels, as well as an after-sales marketing organisation. According to Eisenhardt and Schoonhoven (1996), firms are motivated to engage in cooperation if potential partners have complementary goals and objectives, and similar corporate cultures and values. However, rivalry often limits firms' opportunities and willingness to cooperate. Where this is the case, MSDs' opportunities to cooperate with harvester manufacturers largely depend on the market potential of the innovation and the possibilities of using it with harvesters. Both MSDs and LHMs were interested in cooperation with each other, but had divergent opinions on how such cooperation should be arranged. While MSDs could substantially benefit from cooperation in terms of expanding their business, LHMs regard cooperation as unattractive before MSDs engage in larger-scale business activities. Finding

the right partners and the issue of how cooperation should be organised can be considered bottlenecks in realising the business-expansion plans of both kinds of company.

At this stage, it is critical that the reputation of new silvicultural devices is not spoilt by using them in unsuitable working conditions, such as on stony terrain as planting machines. For this reason, marketing efforts should be expanded beyond machine contractors, who in many cases are the end customers of firms selling silvicultural devices. As stated by ISEs, the forest professionals planning and implementing silvicultural works are a key target group in the marketing of new mechanised methods. In addition, the marketing of new methods and products is challenging in mechanised silviculture, because the cost benefits achieved through such innovations are not realised until the later stages of the regeneration chain (Rantala et al. 2009).

Between different geographical areas, there appear to be huge differences in the market potential of, say, planting machines. MSDs and LHMs weighing up foreign markets from the Finnish perspective are cautious and tend to assume that markets close to home have the greatest potential, since they are the most similar to the firms' domestic markets. According to ISEs, this is far from being the case – more distant and different markets, for instance in South America and Asia, may well have greater potential. However, improved expertise, knowledge and investment are required when beginning to export. In sum, MSDs, LHMs and ISEs exhibited significant differences in opinion on the market potential of various geographical areas. The way in which MSDs planned to expand their business into export markets seemed to follow a certain pattern: the Uppsala internationalisation model. According to this model, firms begin operating abroad in nearby markets, only gradually penetrating those farther afield (Hollensen 2004). This model provides one explanation for the differences between MSDs, LHMs and ISEs regarding the market areas with the greatest potential. MSDs examine how the markets handle practical problems and operative work, whereas LHMs and ISEs have a wider perspective.

The export obstacles indicated in many studies (Kedia and Chhokar 1986, Madsen 1989, Styles and Ambler 1994) were also mentioned by the MSDs. Lack of information on foreign markets, finding the right contacts and unfamiliar bureaucratic procedures loom large when MSDs consider whether to enter an export market. Export partner groups or other forms of horizontal cooperation could be a workable solution for Finnish MSDs, since these firms do not feel that they are competing with each other. In the boat industry, for instance, cooperation between small firms has conferred a competitive advantage in terms of gaining access to market information and streamlining development processes (Hentinen et al. 2007). On the other hand, Vuorinen and Kurki (2010) report that boat manufacturers' attitudes towards cooperation are, to some extent, an obstacle to reaping the benefits of networking. Based on the results of the study and experiences from other business sectors, Sweden may be the best foreign market in which Finnish MSDs can engage in export cooperation.

According to Asikainen et al. (2009), low demand for mechanised silviculture has so far dampened harvester manufacturers' interest in the product development of silvicultural devices. However, in Finland the supply of professional forest workers is set to decrease and demand for forest work will grow as forest owners find it more difficult to perform forest work (Strandström et al. 2009). There is also a simultaneous need to decrease silvicultural costs, in order to maintain the profitability of forestry (Uotila 2005). Together, these will increase demand for mechanised solutions.

5 Conclusions

Silvicultural conditions in Scandinavia and in boreal forests more generally are somewhat similar. In particular, Sweden and Finland have a similar history in terms of developing technical solutions for silvicultural work. While both countries engage in similar silvicultural work, the home market of neither is large enough to generate profitable business for MSDs. In other countries, which still benefit from a plentiful labour supply, the pressure to develop or introduce mechanised solutions has not yet arisen.

Even so, interest in mechanised silviculture is widespread and Finnish MSDs can succeed in responding to rising demand, through the right kind of export marketing and cooperation. More detailed research on mechanisation and market potential in the Nordic countries would provide Finnish MSDs in particular with valuable information: these firms denoted nearby markets as the most promising areas in which to begin foreign operations. Such research may also produce the concrete knowledge required by MSDs when beginning their export activities.

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