Scandinavian Journal of Forest Research

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/sfor20

Characterization of forestry contractors' business models and profitability in Northern Sweden

Thomas Kronholm, Ida Larsson & Emanuel Erlandsson

To cite this article: Thomas Kronholm, Ida Larsson & Emanuel Erlandsson (2021) Characterization of forestry contractors' business models and profitability in Northern Sweden, Scandinavian Journal of Forest Research, 36:6, 491-501, DOI: 10.1080/02827581.2021.1973087

To link to this article: https://doi.org/10.1080/02827581.2021.1973087

Published online: 05 Sep 2021.

SCANDINAVIAN JOURNAL OF FOREST RESEARCH
2021, VOL. 36, NO. 6, 491–501
https://doi.org/10.1080/02827581.2021.1973087

Taylor & Francis
Taylor & Francis Group

Characterization of forestry contractors' business models and profitability in Northern Sweden

Thomas Kronholm, Ida Larsson and Emanuel Erlandsson

Department of Forest Biomaterials and Technology, Swedish University of Agricultural Sciences, Umeå, Sweden

ABSTRACT

Forestry contractors have doubled their share of work in Swedish forests since the 1990s and have thus become important actors in the industry's supply chain. Yet, their profitability has often been low. It is essential for a firm's success to have a well-functioning business model. Therefore, the aim of this study was to characterize business models currently used by forestry contractors and identify differences in the contractors' financial performance in relation to a chosen business model. A survey was sent to all limited liability companies in northern Sweden that were registered to carry out logging or silviculture. One hundred and ninety-eight contractors responded, and their financial performance was analysed based on information in financial statements. The study highlights that there are clear differences both within and between contractor categories in relation to several business model components, as well as their financial performance. Logging contractors had the lowest profitability, measured as return on assets, and also a lower solidity and liquidity compared to silvicultural and mixed service contractors. The largest logging contractors tended to have a better and more stable profitability than small ones, although the differences were small and varied between years. However, a negative trend in profitability was identified for all contractor groups.

ARTICLE HISTORY
Received 1 April 2021
Accepted 20 August 2021

KEYWORDS
Business model canvas; logging; silviculture; entrepreneur

Introduction

Sweden has 23.6 million hectares of productive forest land (Nilsson et al. 2020), covering more than half of the total land area. Thus, forestry is one of the country's most important industries. Nearly half (48%) of the forest land is owned by family forest owners (FFOs), while industrial forest companies own 37% and the remaining 15% is distributed between other private and public owners such as the state, churches and municipalities (Christiansen 2018). In 2019, the forest industry directly employed 70,000 individuals, and the export value of its products was approximately 15 billion euros, equal to 10% of Sweden's total exports (Swedish Forest Industries 2020). To supply the industry with raw materials, approximately 90 million cubic metres (m^3) are harvested from the forests each year (Paulsson 2020).

The forestry contractors are important actors in this supply chain. In the early 1990s, large-scale forest companies in Sweden decided to outsource the majority of their forestry work to independent contractors with the intention of reducing the costs and improving the productivity of forest operations (Ager 2014), and also to gain higher capacity flexibility and reduce the bounded capital in expensive machinery (Erlandsson 2013; Erlandsson 2016). This led to a restructuring of the forestry sector, and, since then, the trend has been for an increasing share of the annual forestry work to be carried out by contractors. A similar development has also taken place in other parts of Europe (Rummukainen et al. 2006). Notably, over the last 25 years, Swedish forestry contractors have more than doubled their amount of forestry work (Roberge 2018). The increased demand for forestry services has consequently led to an increase in the number of contractors. Some years ago, Häggström et al. (2013) estimated that there were approximately 2500 contractors in Sweden whose primary business focus was on forestry work, and an additional 1100 contractors that occasionally provided forestry services. Most of these contractors were either one-man enterprises or small-sized firms with one to four employees. In fact, 44% of the 15,000 people working in a contractor firm in 2017 were the firms' owners and their family members (Roberge 2018).

The growing demand for contractor services has not only been driven exclusively by the forest companies' outsourcing of forestry work but also by FFOs reducing their share of self-employment in forestry. For example, statistics from the Swedish Forest Agency (Roberge 2018) show that they only carry out about 10% of the harvesting by themselves, and their share of planting has decreased from 70% in 1992 to 30% in 2017. The only activity which they still mainly (~60%) carry out themselves is pre-commercial thinning, but the long-term trend for this activity has also been one of a declining share of self-employment. Furthermore, considering that younger generations of FFOs are often less familiar with forestry (Kronholm 2016), the path towards increasing

CONTACT Thomas Kronholm thomas.kronholm@slu.se Department of Forest Biomaterials and Technology, Swedish University of Agricultural Sciences, SE-90183 Umeå, Sweden

professionalization and use of contractors for forest management operations could also be expected to continue.

Based on the positive trend for the amount of work available for contractors, one could expect that the market for forestry contracting would be rather attractive from a business perspective. However, a long-lasting problem for many forestry contractors, not only in Sweden, has been to achieve and maintain the profitability of their businesses (Mäkinen 1997; Rummukainen et al. 2006; Penttinen et al. 2011; Eriksson 2016; Jylhä et al. 2020). In recent years, net profit margins have, in general, been very low (2–3% for the median firm), and in a normal year, as many as 25% of Swedish contractors fail to make a profit (Kronholm et al. 2019). Historically, this has also been the case in Finland (Penttinen et al. 2011). Small contractors (<0.6 million euro turnover) in particular have been found recently to have low profitability (Jylhä et al. 2020).

Several reasons for the weak performance have been highlighted, and the challenges have been found to be similar in several European countries (Rummukainen et al. 2006; Kronholm et al. 2019). One important factor is that the small contractor firms have limited power to negotiate for favourable contract terms and worksites with the large forest companies who are their most important customers (Penttinen et al. 2011; Jylhä et al. 2020). Furthermore, the large customers' frequent use of tendering creates tough price competition between contractors, especially since there are few potential customers within each contractor's radius of operations (Eriksson 2016). Logging contractors also have high investment costs for machinery, and a weak financial situation makes it difficult to develop and expand the business (Mäkinen 1997; Penttinen et al. 2011). In addition, weather-related factors may cause temporary stoppages that are hard to plan for and not always compensated for by the customer. Finally, it has also been noted as being problematic that many contractors have limited business skills (Rummukainen et al. 2006; Jylhä et al. 2020), as they may have started their careers as machine operators or mechanics and thus lack both formal and practical training in management. Some contractors also experience difficulty in participating in courses and other training activities due to lack of time or the related costs (Kronholm et al. 2019).

Figure 1. The study was carried out in the grey coloured area in northern Sweden.

A good business model is essential to any firm's success (Magretta 2002). The business model concept has, over the last two decades, become a popular tool for business analysis and characterization (Zott et al. 2011; Wirtz et al. 2016; Benjaminsson et al. 2019). A firm's business model explains how it creates, markets, and delivers value to its customers and thereby produces profitable revenue streams (Osterwalder et al. 2005; Osterwalder and Pigneur 2010; Teece 2010). Furthermore, it shows the value proposition the firm offers to its customers, who these customers are, how the production and delivery of the product or service is organized, and how the firm is paid for these services (Chesbrough 2010). The business model itself may offer firms a competitive advantage as it will often be more difficult for others to replicate a complete way of doing business compared to only copying a specific product, process or technology (Amit and Zott 2012). Moreover, in a mature industry such as forestry, where many contractors use similar machines from a few manufacturers to serve a relatively small number of customers (Eriksson 2016), the greatest potential for cost savings and innovation may potentially be found in the business model (Amit and Zott 2012).

Although the challenging conditions in the forestry contracting sector have been highlighted from time to time, few systematic studies have so far investigated the Swedish contractors' business models and their business performance. Some have, however, touched on specific components. Häggström et al. (2013), for example, described profiles of forestry contractors but did not investigate how the identified changes in the sector had affected contractors' financial performance. Further, Eriksson (2016), Eriksson et al. (2015, 2017), and Erlandsson and Fjeld (2017) have primarily focused on the customer–contractor relationship and its influences on contractor profitability. Thus, the holistic picture of contractors' current business models and their performance is still unclear. This means that contractors who want to innovate their business models have little guidance on what potential success factors or pitfalls may be related to different types of business models. Therefore, the aim of this study was to characterize the business models currently used by forestry contractors and identify differences in the contractors' financial performance in relation to a chosen business model.

Material and methods

Study area

The study was carried out in northern Sweden, more specifically, in the counties of Norrbotten, Västerbotten, Västernorrland and Jämtland (Figure 1). The reason for this delimitation was that the study was part of an international research project focusing on forestry contractors in regions covered by the Northern Periphery and Arctic Programme 2014–2020 (NPA 2020).

Sampling and data collection

Information about contractors located in the study area was collected from the Retriever Business database. The database

provides company information about all businesses in Sweden, including the financial statements of limited liability companies. In order to identify forestry contractors, the Swedish Standard Industrial Classification (SNI) codes for logging (SNI 02.200) and silviculture (SNI 02.102) were used for sampling. However, only limited liability companies were included in the sample since financial statements are not publicly available for any other type of firm. Following these criteria, 812 companies were identified in September 2018, and their financial statements were collected from the database. By law, companies can hand in their financial statements to the Swedish Companies Registration Office up to seven months after the end of their financial year. Thus, the financial statements for 2018 were collected at a later stage and only for those companies that had answered the survey. To be able to show recent trends in their financial performance, financial statements for the period 2013–2018 were used in the analyses. To use a six-year period for the analysis is in line with previous studies on contractor profitability, such as Penttinen et al. (2011), who applied a seven-year period, and Jylhä et al. (2020), who used a five-year period (also starting with 2013). This follows well the recommendations by Nilsson et al. (2002) that analyses of key financial indicators should preferably be done for a period that extends over a business cycle, but at least three to five years. Finally, when choosing the time period it was also considered that the longer back in time contractors' financial performance is studied, the weaker the connection will be to their current business model characteristics. Thus, a six-year period was deemed to be suitable in this context.

Table 1. Key questions that were used in the design of the questionnaire.

Business model component	Key questions
Services carried out	• What services does the contractor offer? • What proportion of the annual turnover does each service type provide? • Which factors affect the service portfolio composition?
Customers	• How many customers does the contractor have in each customer category? • What proportion of the annual turnover does each customer category provide? • Has the contractor recently changed its main customer? • Which factors affect the number of customers?
Sales of services	• What contract types does the contractor use? • When is the service carried out? • How are deals usually initiated?
Pricing of services	• How are the contractor's services priced? • Who determines the pricing method, the contractor or the customer?
Machines	• How many and what type of machines does the contractor have? • What is the annual production per machine? • What affects the contractor's choice of machines? • How old are the machines?
Personnel	• How many employees does the contractor have? • Are employees working in single or double shifts? • From which regions is the contractor recruiting its employees? • Is the contractor experiencing difficulties in finding new employees?
Sub-contracting and other partnerships	• To what extent does the contractor use sub-contractors for service delivery? • To what extent does the contractor carry out services as a sub-contractor to other firms? • Which services are sub-contracted? • To what extent does the contractor buy other types of services from external providers?

A questionnaire consisting of 36 questions was constructed for data collection. The questionnaire was structured according to the business model components in the framework developed by Benjaminsson et al. (2019). The key questions that guided the questionnaire design are shown in Table 1. The framework is a forestry sector adaptation of the Business Model Canvas (BMC) originally developed by Osterwalder and Pigneur (2010), which has frequently been used for similar purposes in other business contexts (cf. Joyce and Paquin 2016; Jylhä et al. 2020). In addition, a few questions about the contractors' personal motivation for being in the forestry business were included at the end of the questionnaire, but these were outside the scope of this paper as they are not directly linked to the business model.

The questionnaire was distributed by traditional mail in November 2018, and one reminder was sent out to non-responders before finishing data collection. An envelope that allowed the contractors to return the completed questionnaire free of charge was included in both mailings. The questionnaire was marked with an ID number to ensure that the information could be matched with the financial statements collected from the database. Out of the 812 cases in the first mailing, 26 had invalid addresses and could therefore not be reached. In addition, 57 informed us that they no longer carried out logging or silvicultural activities and that the information in the company register was incorrect. Thus, these 83 cases were excluded from the sample.

The questionnaire was filled in by 198 contractors (27%). No significant difference was found between respondents and non-respondents in relation to their geographical location (chi^2 goodness-of-fit test, $p = .386$), or their turnover in 2017 (t-test, $p = .186$). However, based on the information in their financial statements, the respondents had, on average, significantly more employees than non-respondents (t-test, $p = .000$). Their respective average numbers of employees were 4.3 and 2.9.

Analysis

For analytical purposes, the contractors were categorized based on the proportion of turnover generated by logging, silviculture and other types of services. When applying a 51% limit, 106 contractors were categorized as logging contractors, 39 as silvicultural contractors, and 49 as mixed service contractors (MSCs). Raising the limit to 75% of the turnover, the number of contractors in each category was 96, 32 and 66, respectively. The 75% level was deemed to provide a more distinct definition of each contractor category and was therefore used in all descriptions and analyses. The

Table 2. Definitions of financial indicators used in the study.

Ratio	Definition
Net profit margin (%)	Net income/net turnover × 100
Return on assets (%)	(Earnings before interest and taxes + Interest received)/ total assets × 100
Equity ratio (%)	Shareholders' equity/total assets × 100
Quick ratio (%)	(Current assets – stock)/current liabilities × 100

optional levels to use were restricted since categorical response alternatives had been applied in the questionnaire. Further, since size has previously been found to be an important factor for logging contractors' profitability (Jylhä et al. 2020), this group was split into three equally large groups based on their turnover. These groups are referred to as small, medium and large logging contractors and the cut-off points for their turnover were at approximately 430,000 euros and 650,000 euros (recalculated using 10 SEK/EUR). When applicable, differences between groups were analysed with ANOVA or chi2 tests using the IBM SPSS Statistics (version 26) software.

To investigate the financial performance, four financial indicators (ratios) were used (Table 2). Net profit margin and return on assets (ROA) are indicators that measure the contractors' profitability. The equity ratio describes the proportion of shareholders' capital in relation to the total capital and is a commonly used indicator for a firm's solvency (i.e. the long-term ability to pay its debts). Finally, the quick ratio was used for analysing contractors' liquidity, which describes to what extent the firm has cash (and equivalent assets) available for paying its short-term liabilities. These are considered to be important indicators of a firm's current and future success and have been frequently used in similar studies (Mäkinen 1997; Soirinsuo and Mäkinen 2009; Penttinen et al. 2011; Laitinen et al. 2014; Jylhä et al. 2020). All indicator values, except net profit margin, were collected directly from the Retriever Business database.

Results

Services

Only a minority of logging contractors offered services other than cutting and forwarding for final felling or thinning operations (Table 3). The majority (62%) of logging contractors offered cutting and forwarding for both thinning and final felling. The other services that were carried out by at least 10% of the logging contractors could be related to the execution of logging operations, including site planning, machine transportation, extraction of logging residues, road maintenance and motor-manual felling.

Most silvicultural contractors carried out pre-commercial thinning, and the majority also offered planting or motor-manual felling. One in five silvicultural contractors stated that they carried out site planning, and a similar proportion offered silvicultural services other than those listed in the questionnaire. Logically, the MSC group was the most diverse; the most frequently offered services (pre-commercial thinning and motor-manual felling) were offered by approximately half of the respondents.

Table 3. Percentage of contractors in each contractor category offering specific services.

Type of service	Service	Logging	Silviculture	MSC
Logging	Cutting – final felling	87	0	24
	Cutting – thinning	73	0	20
	Forwarding – final felling	88	0	26
	Forwarding – thinning	81	0	26
	Other	7	3	12
Silviculture	Pre-commercial thinning	7	94	55
	Motor-manual felling	12	59	49
	Planting	4	59	14
	Soil scarification	5	6	21
	Other	1	19	5
Other forestry services	Site planning	10	19	26
	Forest management planning	1	0	14
	Wood transportation	2	0	3
	Machine transportation	13	0	6
	Diking works	6	3	9
	Stump harvesting	0	0	2
	Forwarding of logging residues	10	0	11
	Chipping	2	0	3
	Other	3	6	17
Non-forestry services	Agriculture	3	6	9
	Excavation and earthworks	8	3	17
	Road construction and maintenance	13	9	15
	Transport	5	3	11
	Other	1	2	5

Customer preferences and the contractors' own competencies were found to be the two factors that most strongly affected contractors' service portfolios, while company tradition and the competition from other contractors were overall considered to have the least influence (Table 4). Staff availability and the contractors' own economic opportunities were found to have a moderate influence. Competition was found to be the only factor given equal weight by all contractor groups, while there were significant differences (ANOVA, $p < .05$) between at least two of the contractor groups on the other five factors.

In comparison to silvicultural contractors, logging contractors expressed a significantly higher influence on their service portfolio from three factors: (1) customer preferences, (2) the contractor's own economic opportunities, and (3) company tradition. Further, compared to MSCs, logging contractors' services were found to be significantly more affected by staff availability. As with silvicultural contractors, MSCs considered themselves to be less influenced by their own economic situation than logging contractors did. Finally, there was a significant difference between MSCs and silvicultural contractors relating to the influence of competencies within the firm, where the former group was more influenced by this factor.

Table 4. Contractors' average rating of factors affecting their service portfolio on a scale of 1 (low influence) to 5 (high influence).

Factor	Logging	Silviculture	MSC	Total
Customer preferences	4.5[a]	4.0[a]	4.3	4.4
Competencies	4.1	3.7[a]	4.2[a]	4.1
Staff availability	4.1[a]	4.1	3.5[a]	3.9
Own economic opportunities	3.8[a,b]	3.0[a]	3.3[b]	3.5
Competition	2.7	3.3	3.1	2.9
Tradition	2.8[a]	2.1[a]	2.5	2.6

Note: Significant differences ($p < .05$) between groups are marked with pairwise letters.

Table 5. Number of customers according to contractor category.

	Customers, incl. family forest owners			Customers, excl. family forest owners		
Contractor type	Avg.	SD	Median	Avg.	SD	Median
Logging	4.8	8.6	2.0	1.8	1.5	1.0
Silviculture	8.2	12.3	5.0	4.0	6.9	2.0
MSC	8.1	7.8	5.0	2.5	2.5	2.0

Table 7. The average extent to which contractors use specified contract types, on a scale 1 (not at all) to 5 (exclusively).

Contract type (duration)	Logging	Silviculture	MSC
Single assignment	1.6[a,b]	2.6[a]	2.6[b]
<6 months	2.1	1.3	1.8
6–12 months	1.7[a]	2.6[a]	2.1
1 year	2.8	2.8	2.1
>1 year	3.2[a,b]	2.2[a]	1.9[b]
Open-ended	2.3[a]	1.4[a,b]	2.4[b]

Note: Significant differences ($p < .05$) between groups are marked with pairwise letters.

Customers and contract types

When including FFOs, silvicultural contractors and MSCs had, on average, about twice as many customers compared to logging contractors (Table 5). The pattern was similar when excluding FFOs, who individually often only account for a small proportion of the contractors' total turnover. Here, the difference between logging and silvicultural contractors was significant (ANOVA, $p = .032$). Note that this concerns direct customers. In most cases, FFOs who sell timber are indirect customers of logging contractors' services since logging is included in the deal with the forest company that is buying the timber, who, in turn, hires the contractors to do the work. Industrial forest companies and forest owners' associations were the two largest customer categories for logging contractors and silvicultural contractors in terms of turnover. For MSCs, FFOs were, on average, a slightly larger contributor than forest owners' associations, but also, in this group, industrial forest companies were most important. Twelve contractors stated that more than 75% of their turnover came from services sold to FFOs.

Contractors, who typically worked for a primary customer that accounted for more than 75% of their yearly turnover, were asked to state if they had changed customers within the last three years. The response rate on this question indicated that the share of contractors with a primary customer was 90% for logging contractors, 69% for silvicultural contractors and 61% for MSCs. One in five logging contractors and MSCs had changed primary customer over the last three years, while the majority in all categories stated that they had not even considered a change (Table 6). Silvicultural contractors were found to be the least active in looking for new customers, while logging contractors had more often than the other groups considered looking for a new primary customer.

Several significant differences (ANOVA, $p < .05$) between contractor groups were found in relation to the contract types applied (Table 7). It was most common for logging contractors to have contracts running for over a year, which was significantly less common among silvicultural contractors and MSCs. The next most common contract type was a one-year contract which was used by silvicultural contracts to a similar extent, but for this group, it was also the most common type of contract. One-year contracts were somewhat less common among MSCs, although it was not significantly different from the other groups ($p = .057$). Contracts for single assignments were used significantly less by logging contractors than by silvicultural contractors and MSCs. Further, silvicultural contractors also used 6- to 12-month contracts to a significantly higher extent than logging contractors. Contracts with durations shorter than six months were used to a relatively low extent by all groups.

Open-ended agreements were more commonly used than short-term contracts, although silvicultural contractors used such agreements significantly less than logging contractors and MSCs. The majority (58%) of those with open-ended contracts re-negotiated the terms on a yearly basis. Single assignments were the most common contract type for MSCs, and both they and silvicultural contractors used this type of contract more than logging contractors. However, compared to the other groups, the differences between contract types used were smaller in the MSC group.

Nearly all (95%) logging contractors carried out their services over the whole year. MSCs also offered logging services and other types of services all year round or when asked by customers. Silvicultural services were mainly carried out during the bare ground season. It was most common for all groups to have new deals initiated by the customer, although it was significantly less common for silvicultural contractors (Table 8). Silvicultural contractors won significantly more new contracts through tendering than logging contractors.

There was a significant difference (ANOVA, $p = .011$) between logging contractors and MSCs in relation to the choice of pricing method for the services carried out. To a greater extent, MSCs perceived that it was the customer who decided on the pricing method. Logging contractors were most often paid a piece price per cubic metre, which was either determined according to the average stem size and forwarding distance, or a combination of these and other key factors that influence productivity (e.g. ground conditions). MSCs were most commonly paid an hourly rate for their worktime, and the main pricing method for silvicultural contractors was a piece rate.

Table 6. Percentage of contractors with a primary customer who have changed, or considered changing, primary customer over the last three years.

Have you changed customer?	Logging	Silviculture	MSC
Yes	20	9	23
No, but I have actively tried to do so	0	0	3
No, but I have considered actively searching for one	24	9	10
No, I have not considered changing customer	56	82	65

Table 8. Average scores for how a new deal is typically made in each contractor group (1= to a small extent, 5 = to a high extent).

A deal is typically made after …	Logging	Silviculture	MSC
… the contractor has contacted the customer	2.3	2.4	2.3
… the customer has contacted the contractor	4.4[a]	3.8[a,b]	4.4[b]
… the contractor has submitted a tender	1.7[a]	2.8[a]	2.1

Significant differences (p<.05) between groups are marked with pairwise letters.

Machines

The majority (57%) of logging contractors had two machines, 11% had one machine and 17% had 3–5 machines. The maximum number of machines for a single logging contractor was 11. Large logging contractors had, on average, 4.5 machines, which was significantly more than for small and medium contractors with an average of 1.8 and 2.7 machines, respectively (ANOVA, $p = .00$). There was approximately a one-to-one ratio between harvesters and forwarders, and, on an aggregate level, logging contractors had 1.5 harvesters and 1.6 forwarders. Among MSCs, less than half (44%) of the contractors reported that they had machines, and a few of them only had machines for soil scarification. However, as with logging contractors, the largest proportion of MSCs who had machines had one (45%) or two (24%).

The majority of harvesting machines (52%) operated by logging contractors had a weight of more than 16 tonnes (t), and half of these were classified as extra-large (>20 t). The other harvesting machines were mainly medium-sized (11–16 t), as only 6% weighed l**ess** than 11 t. The average annual production per harvesting machine varied between logging contractor groups, and some of these differences were also found to be statistically significant (Table 9).

Forwarders were classified according to their bearing capacity, and the proportions between size classes were almost the same as for harvesters. The majority (57%) were large (>14 t) or extra-large (>20 t), and, again, only 6% were small machines with a bearing capacity under 11 t. In the MSC group, 70% of harvesters weighed more than 16 t, and 55% of forwarders were large or extra-large. However, the proportion of small forwarders was 27%, which was higher than for logging contractors. Large logging contractors had a significantly higher annual production for each medium-sized machine used for thinning compared to the other groups (Table 10). There was also a significant difference between small and large contractors in relation to large forwarders used in final felling.

The three factors that logging contractors considered to have the highest impact on their choice of machines were: (1) the contractors' own preferences, (2) accessibility to maintenance services, and (3) the customers' preferences. Numbers one and three were the same for MSCs, but the firm's financial situation was the second most important factor for this group. Nearly half (49%) of the logging contractors stated that they always buy brand new machines, while only one out of ten always bought machines in the second-hand market. For MSCs**,** the situation was different, as 34% always bought second-hand machines and only 24% always bought new ones. The average age of the logging contractors' machines was 4.6 years for harvesters and 4.9 years for forwarders, but there was a clear difference between small and large logging contractors (Table 11). As with small logging contractors, MSCs also had older machines than the average logging contractor. The average financial depreciation period for both forwarders and harvesters was between five and six years in all groups.

Table 9. Average annual production (m^3) per harvesting machine used by small, medium and large logging contractors in thinning and final felling.

Type of operation	Machine size	Small logging contractor	Medium-sized logging contractor	Large logging contractor	Total
Thinning	S	20,000 (2)	12,300 (3)	15,000 (1)	15,300
	M	12,000 (13)[a]	15,400 (14)[b]	26,500 (13)[a,b]	17,900
	L	9900 (9)[a]	10,800 (9)[b]	30,800 (9)[a,b]	17,100
	XL	–	–	10,500 (3)	10,500
Final felling	S	6500 (1)	2000 (1)	200 (1)	2900
	M	11,800 (13)	20,000 (12)	17,900 (11)	16,400
	L	23,800 (8)[a]	34,000 (12)	58,900 (10)[a]	39,600
	XL	20,000 (1)	61,000 (5)	84,900 (14)	75,700

Notes: Machine size defined by weight: S < 11t; M = 11–16 t; L = 16–20 t; XL > 20 t. Significant differences (ANOVA, $p < .05$) between groups are marked with pairwise letters. The number shown within brackets is the number of contractors in each category that reported volumes for respective machine size.

Table 10. Average annual production (m^3) per forwarder used by small, medium and large logging contractors in thinning and final felling.

Type of operation	Machine size	Small logging contractor	Medium-sized logging contractor	Large logging contractor	Total
Thinning	S	12,000 (4)	5000 (1)	2700 (3)	7600
	M	10,800 (14)[a]	13,900 (15)[b]	23,200 (11)[a,b]	15,400
	L	10,300 (7)	13,800 (9)	26,800 (13)	18,800
	XL	–	–	10,000 (1)	10,000
Final felling	S	7900 (4)	–	2000 (1)	6700
	M	15,800 (11)	17,500 (12)	19,200 (11)	17,500
	L	16,800 (6)[a]	28,300 (11)	44,500 (14)[a]	33,400
	XL	37,500 (2)	55,000 (9)	84,200 (13)	69,400

Notes: Machine size defined by bearing capacity: S <11t; M = 11–14 t; L = 14–17 t; XL >17 t. Significant differences (ANOVA, $p < .05$) between groups are marked with pairwise letters. The number shown within brackets is the number of contractors in each category that reported volumes for respective machine size.

Personnel

A significant difference (chi^2 test, $p = .00$) was found between MSCs and the more specialized contractor types in relation to the work tasks of their employees. In 9 out of 10 logging and silvicultural contractor firms**,** more than 75% of the personnel worked on forestry operations, while this was the case for just 6 out of 10 MSCs. In 26% of MSCs, no more than a quarter of the employees worked on forestry services. Silvicultural contractors had significantly more employees (ANOVA, $p = .034$) than logging contractors and MSC when comparing the information provided in the survey (Table 12). The difference was smaller and not statistically significant when comparing the number of employees reported in the contractors' financial statements. Since silvicultural contractors mainly used seasonal workers, it is most likely that the lower number of employees reported in the financial statements is because it refers to the average number of employees working full-time over the

Table 11. Average age of harvesters and forwarders according to contractor type and size.

	Small logging contractor	Medium-sized logging contractor	Large logging contractor	MSC
Average age of harvesters, years	6.4	4.1	3.4	6.3
Average age of forwarders, years	6.9	4.1	4.0	8.1

Table 12. Number of employees according to contractor type.

	Survey		Financial statement for 2018	
	Avg.	Median	Avg.	Median
Logging	4.5	3	4.4	4.0
Silviculture	11.7	5	6.1	4.0
MSC	5.0	2	3.7	1.0
Total	5.9	3	4.5	3.0

Table 13. Percentage of contractors buying additional services from external partners.

Service	Never	Seldom	A few times per year	Constantly
Accounting/auditing	3	10	15	73
Maintenance	7	16	29	48
Education	7	32	48	14
Machine transportation	40	11	9	40
Economic advice	22	31	22	25
Legal advice	39	51	6	4

Note: Total for each service may not equal 100% due to rounding errors.

year (i.e. two individuals working full-time over six months, or half-time over the whole year, will be reported as one employee in the financial statement).

Most of the logging contractors' employees worked full-time, while MSCs had a more even distribution between full-time and seasonal workers. Logging contractors had, on average, more employees working in double shifts (2.6) than in single shifts (1.4), and large contractors had the highest ratio of employees working double shifts. In other types of forestry**,** it was most common that the employees worked single shifts. The main factor that influenced the decision to work in one or two shifts was the contractors' own choice, followed by the preferences of the employees.

Logging contractors and MSCs mainly recruited employees from their local area. Recruitment in the local area was also most common for silvicultural contractors, but they also recruited from other EU countries to a significantly higher extent than logging contractors and MSCs (ANOVA, $p = .00$). Both logging and silvicultural contractors experienced problems recruiting personnel within their respective areas of expertise. Expressed on a five-point scale, their respective averages on this issue were 4.3 and 4.2. Depending on service type, the averages for MSCs were between 3.3 and 3.8.

Sub-contracting and other services

On an aggregated level, the use of sub-contractors was rather low. On a five-point scale for the level of sub-contracting (low to high), the average was between 1.6 and 2.3 depending on the service category. However, one out of three contractors, mainly logging contractors and MSCs, used sub-contractors for some of their service delivery. Forwarding, cleaning and motor-manual felling were the three most common services to be outsourced to sub-contractors. The results concerning the contractors' own delivery of services as sub-contractors to other businesses were similar in relation to which services were most commonly provided, as well as their frequency. Other types of services that were often bought from external partners were accounting and maintenance (Table 13).

Financial performance

On the aggregate level, the average turnover was fairly stable for all contractor categories over the studied period (Figure 2), although a marginally negative trend could be seen for logging and silvicultural contractors. In 2018, the average turnover for logging contractors was 631,000 euros (recalculated using 10 SEK/EUR). The respective turnovers for MSCs and silvicultural contractors were 619,000 and 368,000 euros.

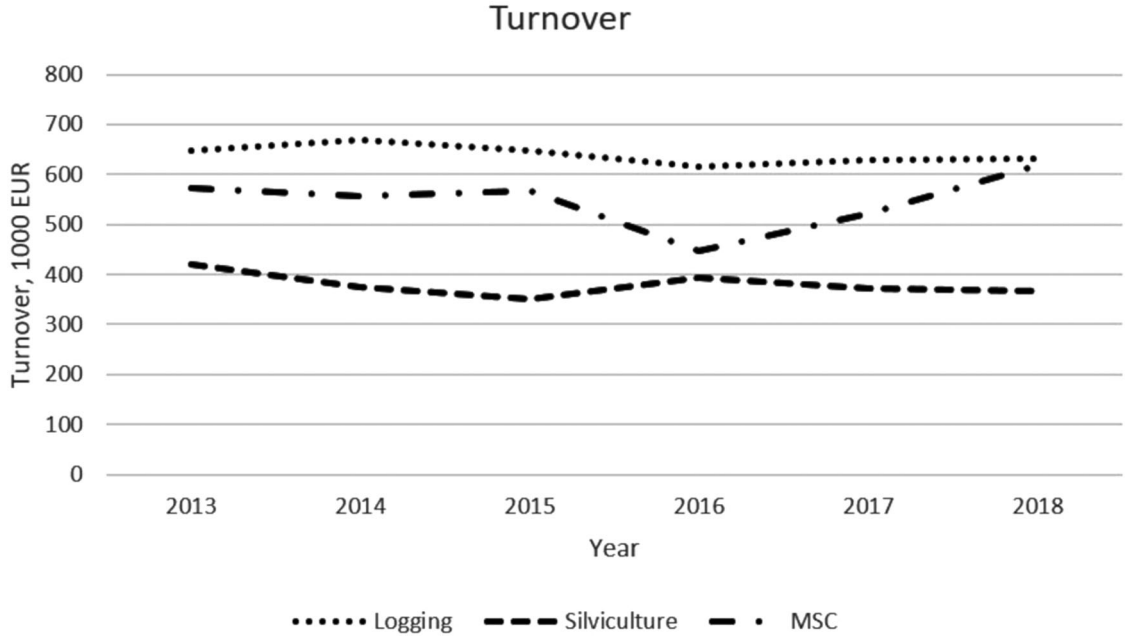

Figure 2. Average turnover according to contractor type.

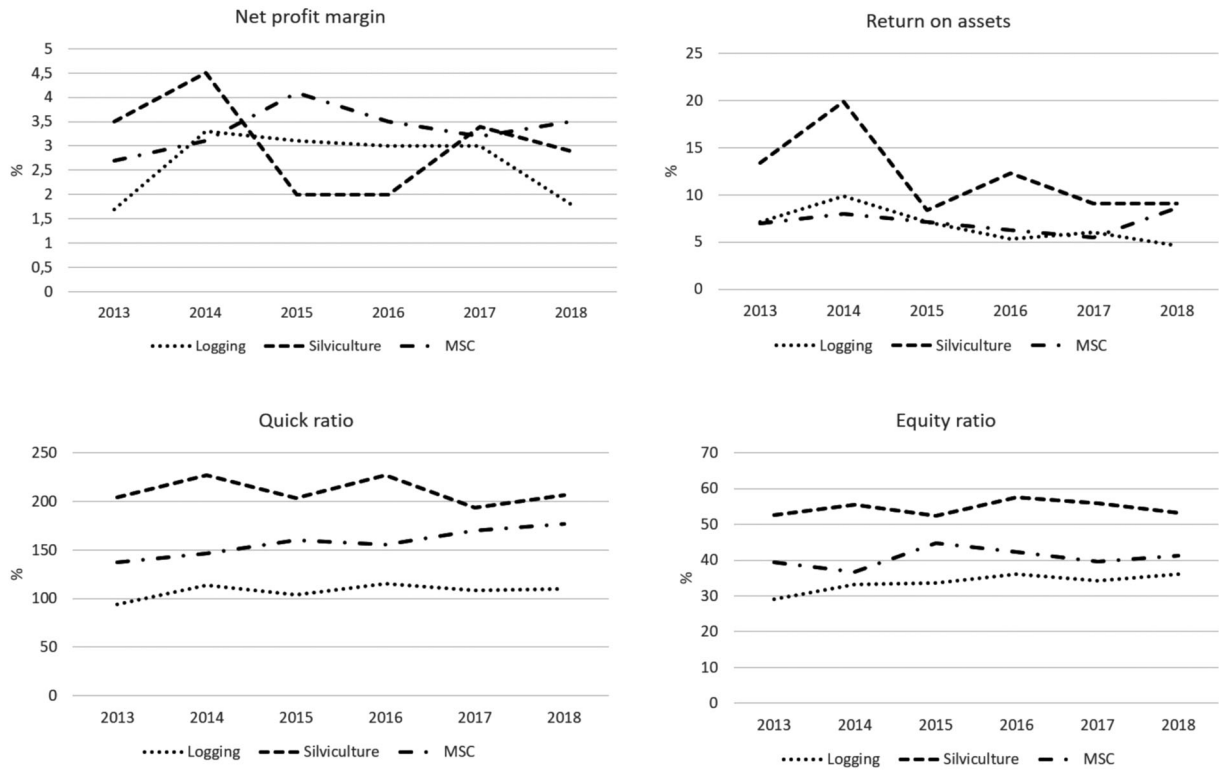

Figure 3. Key financial indicators according to contractor type.

The median net profit margin was between 1.8% and 3.5%, depending on contractor category, with the lowest profitability for logging contractors and the highest for MSCs (Figure 3). One out of five contractors had zero or negative returns in 2018. Looking at profitability in terms of ROA, it was found that logging contractors have recently experienced a negative trend, with the median ROA for this group being 4.6%. Also, the ROA for silvicultural contractors has decreased compared to 2013 and 2014, but since 2015 it has often been 8–9% annually.

Logging contractors financed their businesses with a larger proportion of borrowed capital than the other two groups. The majority of silvicultural contractors had an equity ratio above 50%**,** while the median for the other two groups was 30–40%. Also, silvicultural contractors had a higher share of liquid capital at their disposal, and, in most years, the median quick ratio has been above 200% (i.e. they have twice the sum of cash or other equivalent assets needed to pay their short-term liabilities). In recent years, most logging contractors have also been above the 100% level**.**

When comparing logging contractors of different sizes, a few differences are apparent. Medium-sized contractors tend to be less profitable than other logging contractors, although the differences are small and vary between years (Figure 4). It was also found that the largest logging contractors had lower liquidity than the small contractors. In the former group, the median quick ratio has been around 90% over the last two years. Further, the large contractors also had the lowest equity ratio. As stated above, logging contractors' profitability has been on a downward trend, and no major difference was noticed between the size groups. However, the decline has tended to have been slower for large contractors.

Discussion

This study applied the forestry business model canvas framework (Benjaminsson et al. 2019) to map and characterize Swedish forestry contractors' business models. The canvas framework offered a structured approach to data collection and analysis, and thereby enabled the identification of both similarities and differences between different contractors. Jylhä et al. (2020) applied a similar approach in their qualitative investigation of Finnish contractors' business models, but this is, to our knowledge, one of the first studies that has used this particular framework for a larger survey in the forestry sector. Therefore, the outcomes of this study may also enable further refinements of this particular framework and enhance its future applications.

In this study, forestry contractors were categorized based on the proportion of turnover generated by specific service types, which resulted in three categories, as follows: contractors that specialized in logging, contractors that specialized in silvicultural services, and less specialized contractors with a more diverse service portfolio. This method for classification differed from the one applied by Häggström et al. (2013), who used working time per activity for classification. Thus, the distribution of contractors in each category also differed to some extent. The proportion of MSCs was significantly higher in this study, while the proportion of silvicultural contractors was lower. Only a small difference was noted in relation to the proportions of logging contractors. Since the

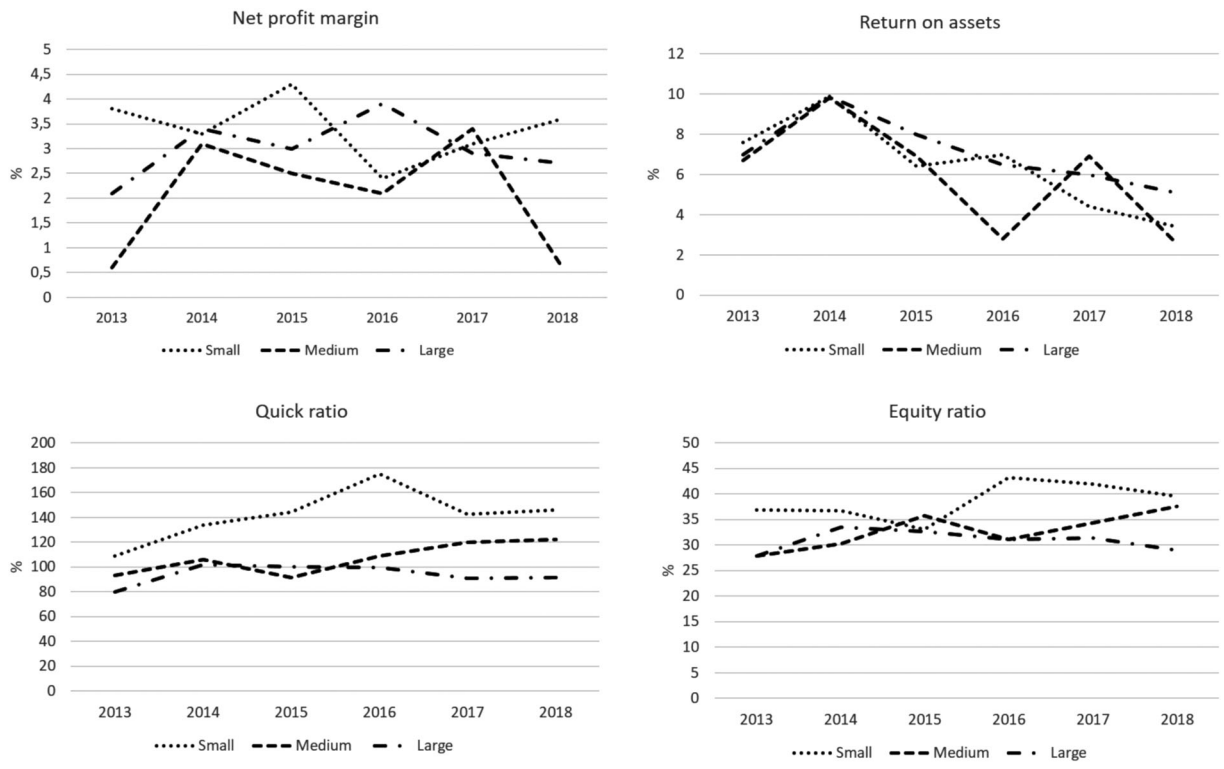

Figure 4. Financial indicators for logging contractors according to size.

information about the proportion of turnover that contractors had attained from specific service types was collected through fixed (ordinal) response alternatives, it was not possible to investigate if a slightly higher or lower level than the applied 75% level would have implied significant changes in the number of contractors in each category. This would have required the use of an interval scale in the questionnaire. However, categorical response alternatives were preferred since they made it easier for contractors to answer the question. This was also considered to lower the risk of a high number of non-responses or uncertain answers since many contractors may not have the exact figures easily available at all times. Since logging contractors typically are highly specialized firms, it is likely that the use of a different level for classification would have affected the other two categories to a larger extent. This assumption is strengthened by the fact that the number of firms classified as logging contractors fell by only 10% when using the 75% level instead of the 51% level, while the drop was close to 20% for silvicultural contractors. Since this made the MSC group larger and thereby also more diverse in terms of contractor characteristics, it would be interesting for future studies to look deeper into this category and, for example, investigate if there are some service mixes that are better than others in terms of profitability.

The results show differences between contractor categories concerning their size (turnover), capital structure, liquidity and profitability. Significant differences related to company characteristics were also identified in several of the components that, together, constituted their applied business model. This was especially true in relation to machines, contract types and pricing of services. The stable turnover for logging contractors during the studied period is in line with the development of the forest industry's costs for thinning and final felling, neither of which changed significantly over the same period (Constantino and Eliasson 2020). Also, the cost for pre-commercial thinning, which was the most common silvicultural service offered, has been fairly stable in comparison with other types of management operations (which have often become more expensive). Considering that logging contractors' profitability is currently experiencing a negative trend, an explanation could thus be that they have been unable to raise prices to the same extent as their own costs have increased. This may, of course, also be the case for silvicultural contractors, but the small number of cases in this group, and a larger variation in profitability between years, raises uncertainty in the assumption. A positive development was found for MSCs over the last few years, but the average turnover for this group was still just above the level in 2013.

The logging contractor category had the lowest profitability in 2018, while silvicultural contractors performed best in terms of ROA and MSCs in terms of net profit margin. Furthermore, although there were some fluctuations between years, logging contractors were never the most profitable category (in median), and in three out of six years (2013, 2017 and 2018), they had the lowest net profit margin. In relation to company size, the differences between logging contractors were, in general, small, even though medium-sized contractors often tend to have the lowest profitability. Looking at the business model characteristics, this could potentially be related to a lower machine capacity utilization rate compared

to large contractors. A high machine capacity utilization rate is an important factor for the contractors' profitability (Mäkinen 1997) and was achieved by the large contractors by having a higher proportion of employees working in two shifts. This assumption is strengthened by the fact that large and medium contractors had machines of approximately the same age, meaning that their investment costs per machine should be fairly equal. Small contractors and MSCs were found to have a different investment strategy, as they focused on buying second-hand machines, which may lower the investment cost but possibly imply higher costs for maintenance and breakdowns. However, this also reduces the need for loans, which would improve their equity ratio.

That logging contractors mainly had one or a few customers with whom they have long-term relationships is in line with previous studies (Mäkinen 1997; Jylhä et al. 2020). Further, as the results show, long-term relationships were also common for the other contractor categories. However, the exact duration of their current relationships was not investigated in this study, but it is not uncommon in this sector for customer relationships to last 15 years or more (Jylhä et al. 2020). A downside of such a strong loyalty towards one specific customer, or the reluctance to look for alternatives, could be that the contractors pass up opportunities to sell their services to better-paying customers. However, strong customer relationships and alignment between the contractor's and the customer's businesses have often been argued to be important success factors for contractor profitability (Mäkinen 1997; Eriksson et al. 2017; Erlandsson and Fjeld 2017). Thus, it may also be considered sensible by both parties to maintain a good relationship as it reduces transaction costs and supports the development of efficient supply chains. The small number of potential customers in the operating area (Eriksson 2016) may also create lock-in effects.

The results indicated that sub-contracting is not very common among contractors in northern Sweden. In Finland, the largest contractors often act as prime contractors for industrial buyers and then use sub-contractors to carry out some of the work, which also seems to be very profitable (Jylhä et al. 2020). Further, since outsourcing of activities has been argued to be a successful growth strategy for contractors (Soirinsuo and Mäkinen 2009), this could also be a strategy to promote in Sweden, since by growing, contractors not only increase their power to negotiate with the large forest companies but are also able to provide better working conditions for their employees. Being an attractive employer can be a strong competitive advantage, particularly since many contractors reported it to be challenging to recruit skilled personnel. However, growth will not per se guarantee success, and, as noted by Soirinsuo and Mäkinen (2009), poorly performing contractors should primarily focus on improving their current business operations before striving for growth.

A limitation of this study is that it only describes the contractors' business models on a general level, based on quantitative data, and can therefore not reveal how different contractors utilize all their resources in practice. In other words, two businesses, which, according to the canvas framework, appear to be rather similar, may in practice work in very different ways. How the company works will, of course, affect its profitability. More studies are thus needed to clarify the success factors behind contractors' profitability and also investigate how they design and innovate their business models in connection to their strategic goals. Another limitation is related to the sample and also the reliability of the data in the national company register. This study only included limited liability companies registered to carry out logging and/or silvicultural services and will therefore not give a complete picture of the forestry contracting sector. For example, the search results in the Retriever Business database indicated that there are more sole traders registered to carry out silvicultural activities than there are for logging. Thus, the study covered a larger proportion of the businesses offering logging services in northern Sweden than it did for silviculture. Based on correspondence with some of the recipients of the questionnaire, it was also evident that the industry codes for all companies are not up-to-date in the national company register. Thus, the sample included some companies that no longer offered forestry services, which affected the response rate, and some companies offering forestry services may also have been missed if they were registered inaccurately.

Conclusions

The study highlights that there are clear differences both within and between contractor categories in relation to several business model components, as well as their financial performance. The factors that most strongly influence the contractors' business models were also found to differ between categories. Finally, the study shows that the forestry contracting business, in general, continues to struggle with low profitability and that there is no indication that this will improve in the near future. Indeed, the current negative trend in profitability may make it even more challenging to find the necessary resources to improve current business models and develop new ones, and to attract competent entrepreneurs and employees to work in this line of business. However, more studies are needed in order to get a deeper and more robust understanding of how the various business model components truly affect contractors' financial performance. MSCs, in particular, are interesting to investigate in order to increase understanding of how different service offerings affect their profitability.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was part of the FOBIA project, supported by the Northern Periphery and Arctic Programme 2014–2020.

References

Ager B. 2014. Skogsbrukets humanisering och rationalisering från 1900 och framåt [dissertation]. Luleå: Luleå tekniska universitet.

Amit R, Zott C. 2012. Creating value through business model innovation. Sloan Manage Rev. 53:41–49.
Benjaminsson F, Kronholm T, Erlandsson E. 2019. A framework for characterizing business models applied by forestry service contractors. Scand J For Res. 34:779–788.
Chesbrough H. 2010. Business model innovation: Opportunities and barriers. Long Range Plan. 43:354–363.
Christiansen L. 2018. Strukturstatistik: Statistik om skogsägande 2017. Jönköping: Swedish Forest Agency. Report 2018/12.
Constantino S, Eliasson L. 2020. Cost in large-scale forestry 2019. Jönköping: Swedish Forest Agency. JO0307 SM 2001.
Eriksson M. 2016. Developing client-supplier alignment in Swedish wood supply: From efficiency engineering to managing performance [dissertation]. Umeå: Swedish University of Agricultural Sciences.
Eriksson M, LeBel L, Lindroos O. 2015. Management of outsourced forest harvesting operations for better customer-contractor alignment. For Policy Econ. 53:45–55.
Eriksson M, LeBel L, Lindroos O. 2017. The effect of customer-contractor alignment in forest harvesting services on contractor profitability and the risk of relationship breakdown. Forests. 8:360.
Erlandsson E. 2013. The impact of industrial context on procurement, management and development of harvesting services: a comparison of two Swedish forest owners associations. Forests. 4:1171–1198.
Erlandsson E. 2016. The triad perspective on business models for wood harvesting services: tailoring for service satisfaction within forest owners associations [dissertation]. Umeå: Swedish University of Agricultural Sciences.
Erlandsson E, Fjeld D. 2017. Impacts of service buyer management on contractor profitability and satisfaction – a Swedish case study. Int J For Eng. 28:148–156.
Häggström C, Kawasaki A, Lidestav G. 2013. Profiles of forestry contractors and development of the forestry-contracting sector in Sweden. Scand J For Res. 28:395–404.
Joyce A, Paquin RL. 2016. The triple layered business model canvas: a tool to design more sustainable business models. J Clean Prod. 135:1474–1486.
Jylhä P, Rikkonen P, Hamunen K. 2020. Size matters – an analysis of business models and the financial performance of Finnish wood-harvesting companies. Silva Fenn. 54:1–23.
Kronholm T. 2016. How are Swedish forest owners' associations adapting to the needs of current and future members and their organizations? Samll-scale For. 15:413–432.
Kronholm T, Sosa A, Bowditch E, Pohlschneider S, Hamunen K, Rikkonen P. 2019. State of the art and development needs of forestry service in the Northern Periphery and Arctic region. Project report. [accessed 2020 October 28]. https://www.luke.fi/fobia/wp-content/uploads/sites/21/2019/11/State-of-the-art-and-development-needs-of-forestry-service-enterprises-in-the-NPA-region.pdf.
Laitinen E, Lukason O, Suvas A. 2014. Behaviour of financial ratios in firm failure processes: an international comparison. Int J Finance Account. 3:122–131.
Magretta J. 2002. Why business models matter. Harv Bus Rev. 80:86–92.
Mäkinen P. 1997. Success factors for forestry machine entrepreneurs. J For Eng. 8:27–35.
Nilsson H, Isaksson A, Martikainen T. 2002. Företagsvärdering med fundamental analys. Lund: Studentlitteratur.
Nilsson P, Roberge C, Fridman J. 2020. Forest statistics 2020. Umeå: Swedish University of Agricultural Sciences.
[NPA] Northern Periphery and Arctic Programme 2014-2020. 2020. Copenhagen: Northern Periphery and Arctic Programme Secretariat. [accessed 2020 October 28]. http://www.interreg-npa.eu/.
Osterwalder O, Pigneur Y. 2010. Business model generation: A handbook for visionaries, game changers and challengers. Hoboken: John Wiley & Sons.
Osterwalder O, Pigneur Y, Tucci C. 2005. Clarifying business models: origins, present, and future of the concept. Commun Assoc Inf Syst. 15:1–40.
Paulsson J. 2020. Gross felling in 2018 and preliminary statistics for 2019. Jönköping: Swedish Forest Agency. JO0312 SM 1801.
Penttinen M, Rummukainen A, Mikkola J. 2011. Profitability, liquidity, and solvency of wood harvesting contractors in Finland. Small-scale For. 10:2011–229.
Roberge C. 2018. Forestry labour force in 2017. Jönköping: Swedish Forest Agency. JO11 SM 1801.
Rummukainen A, Brogt T, Kastenholz E. 2006. Challenges for forestry contractors – various structures but mutual problems in Finland, Germany, Poland and Romania. In: Niskanen A, editor. Issues affecting enterprise development in the forest sector in Europe. Joensuu: University of Joensuu; p. 149–174.
Soirinsuo J, Mäkinen P. 2009. Importance of the financial situation for the growth of a forest machine entrepreneur. Scand J For Res. 24:264–272.
Swedish Forest Industries. 2020. Skogsnäringens betydelse för ekonomi och välfärd. [Stockholm (SE)]: Föreningen Skogsindustrierna. [accesssed 2020 October 28]. https://www.skogsindustrierna.se/om-skogsindustrin/branschstatistik/ekonomisk-betydelse2/.
Teece DJ. 2010. Business models, business strategy and innovation. Long Range Plan. 43:172–194.
Wirtz BW, Pistoia A, Ullrich S, Göttel V. 2016. Business modeles: origin, development and future research perspectives. Long Range Plan. 49:36–54.
Zott C, Amit R, Massa L. 2011. The business model: Recent developments and future research. J Manag. 37:1019–1042.