To own forest or not? Vertical integration in pulp and paper sector

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Abstract

Vertical integration in forest industry refers to firms that provide large portion of wood from their own or controlled forests. Access to resources and competition for cost effective acquisition of industrial raw material are some of the main concerns and advantages for globalized forestry corporations. However, quantitative studies in this topic are still lacking especially at the global scale. This analysis is based on the logistic regression analysis on dichotomous variable whether company owns forest land or not. Data is based on sample of 52 forest companies reported in TOP 100 A Global Forests, Paper & Packaging Industry Survey, and the information provided with regards to corporate forest holdings and corporate financial performance available in corporate sustainability and other reports for year 2012. In results, we see that decision on vertical integration is significantly affected by the firm size, sales and profitability of the company. The influence of location and other relevant factors of firm performance are discussed to the extents that the data allows.

Keywords: vertical integration, industrial forest ownership, transaction cost theory, logistic regression

Introduction

Companies have to take strategic decisions to organize their management, production, sales, and decide the distribution within a business in a way that makes them less vulnerable to outside forces. Access to resources and competition for cost effective acquisition of industrial raw material are some of the main concerns and advantages for globalized forestry corporations. According to Lähtinen and Toppinen (2008), both short-term efforts to increase cost-efficiency and long-term investments in value-added creation are crucial for sustaining competitiveness of forest industry. Consequently, there is an increasing interest on effective management of semi-natural forests and fast-growing plantations to meet demand deriving from increasing global consumption of forest products (e.g. Barua et al. 2014). Companies can secure access to raw material by harvesting from their own forests or they can purchase wood from local or global markets (Lönnsted and Sedjo 2014). Additionally, the businesses of timber investment management organizations (TIMOs) are growing and possibilities of alternative timber growing schemes (e.g. outgrowers) are becoming more popular.

However, the determinants of industrial forest ownership are not well understood especially at global level. Therefore, from the theoretical locus of the resource based view and transaction cost theory, this study explores factors affecting vertical integration to forests in pulp and paper sector.

Theoretical background

Transaction cost theory explains the firm boundaries with respect to the markets (Coase 1937). The theory can be simplified to explain the firm's decision on input procurement between producing itself (vertical integration) and purchasing from markets. The choice of vertical integration is justified when it minimizes the transactions costs which include e.g. costs of negotiating, monitoring, and enforcing of various contracts. In addition to the decision between "making or buying", an array of intermediate solutions can exist between buying on the market and full integration, including long-term contracts, strategic alliances, and joint ventures (Williamson 1991, Ménard 2004).

According to Pfeffer and Salancik (1978), the procurement of external resources is an important tenet of both the strategic and tactical management of a company. They developed resource dependence theory regarding the optimal divisional structure of organizations, recruitment of board members and employees, production strategies, contract structure, external organizational links, and many other aspects of organizational strategy. The resource based view of the firm (RBV) suggests that differences in resource endowments explain the variances between firms' performance (Barney 1991, Peteraf 1993, Wernerfelt 1984). The firms' performance is also linked to managerial decision on the acquisition, integration, and deployment of resources (Sirmon et al. 2007, Sirmon et al. 2011). Firms acquire resources that provide them a competitive advantage in a product market, so these assets can be considered to be strategic (Barney 1986). The resources need to be valuable and rare, and difficult to replicate or substitute (i.e. so called VRIN, see Barney 1991, Peteraf 1993). The resources are thus valuable to the extent that customers value a firm's output (Barney 2001, Prem & Butler 2001, Sirmon et al. 2007).

The strategic importance of forests as an asset is less examined in the scientific literature. In previous research Niquet and O'Kelly (2010) concluded that pulp and paper producers in Sweden and New Zealand increase the degree of vertical integration with increasing fiber specificity, capital intensity, forest ownership concentration and uncertainty. Similar transaction costs factors have been shown to be important determinants of vertical integration among pulp and paper producers by Ohanian (1994) and Wang (2005). The forest ownership concentration and price uncertainty might be especially relevant determinants for vertical integration in areas where timber markets are immature. Conversely, the forest ownership can cause barrier to entry for the competitors (Li and Zhang 2014). This happens when the local wood markets remain thin and the competitors face increased costs in market entry (O'Laughlin and Ellefson 1982, Salop and Scheffman 1983).

Data and methods

This study focuses on the sample of 52 forest industry firms which are listed on TOP100 Global Forests, Paper & Packaging Industry Survey (PwC, 2013). Corporate operational information concerning categories of demography, business, and forest status (specific indicators see Table 1) in 2012 is collected through browsing PwC report, PPI report, corporate financial report, corporate sustainability report, as well as other public sources (*available on request*). This study focuses forests that are used for productive purposes ignoring the stand specific forest characteristics (species, rotation period etc.). The indicator "Other forests" refers forest areas that are under protection or otherwise outside of production.

Table 1. List of selected corporate operational indicators

Corporate demographic indicators	Business indicators	Forest indicators
Geographical location	EBITDA	Owned forests
Employees	Total sales	Controlled forests
Operating segments	Operating Profitability	Other forests
	Assets	
	Raw material usage and sources	

Descriptive statistics and logistic regression model are used as methodology to explore the corporate vertical integration status. In the logistic regression model, the relationship between corporate vertical integration and corporate financial performance will be examined. Corporate vertical integration is measured by the corporate forest ownership, based on which a dependent dummy variable is established. The variable takes the value of 1 if the firm has the forest ownership and takes the value of 0 if the firm has not. Corporate business indicators (e.g. EBITDA, total sales) and corporate demographic indicator (e.g. employees) are set as independent variables in the model. The probability

of a firm's choice to have the forest ownership (P(yi=1|xi)=F(xi′β)) could be modeled by the natural logarithm (ln) of odds of choice as follows:

$$logit\ (p) = \ln \frac{p}{1-p} \qquad (1)$$

where p is the probability of the choice of having the forest ownership while 1-p is the probability of the choice of no forest ownership. Along with the transformation, the linear function of the model is:

$$\text{logit}\ (p) = \mathbf{X\beta} + \boldsymbol{\mu}, \qquad (2)$$

where X is the matrix of independent variables, β is the vector of estimated coefficients, and μ is the vector of error term.

Results

Current state of forest ownership at the firm level

Based on our data, in 2012, 29 out of 52 sampled firms have the forest ownership, 19 firms do not have forest ownership, and 4 firms do not have public information available. Among the firms which have forests ownership, Metsä group from Finland owns and manages the largest amount of forests (11.4 million ha), all of which are located in Finland. However, Metsä group is a cooperative, which gathers together 123 000 private forest owners and therefore it is debatable whether or not it should be included in the sample. Weyerhauser from USA has the second largest forests (8.1 million ha), and among which 69% of forests are located in Canada, 30% are located in USA, and 1% are located in Uruguay. The Top 6 forest owner and manager and their forest locations can be seen from Table 2.

Table 2. Top 6 forest owner & manager and their forest locations

Firm	Headquarter	Domestic ownership (%)	Million (ha)	Forests location
Metsä Group	Finland	100	11,4	Finland 100%
Weyerhauser	USA	30	8,1	Canada 69% USA 30% Uruguay 1%
Domtar	Canada	100	6,7	N.A.
UPM	Finland	35	4,5	Finland 35% Uruguay 10% US 3% Others (control) 52%
Mondi	South Africa	20	2,3	Russia (control) 80% South Africa 20%
Arauco	Chile	67	2,2	Chile 67% Argentina 16% Brazil 9% Uruguay 8%

The forest ownership status of the Top 5 forest industry firms (listed by PPI, 2012) can be seen from Table 3. International paper mainly has its forest ownership in Brazil, Russia and USA. However, Oji Paper and UPM have relatively diversified global forest operations. Stora Enso (which for example

has separated its forest ownership under the holdings of Bergvik Skog in Sweden and Tornator in Finland) is for example currently the largest land owner in Uruguay. Procter & Gamble does not own any forests at all, maybe because of its concentration on non-forest product segments and within paper segment to B to C business hygiene products that are less forest resource intensive. More analysis will be conducted to study the link between product diversification and corporate forest ownership.

Table 3. Forest ownership status of the TOP 5 forest industry firms

Firm	Headquarter	Forests location	
International Paper	USA	Brazil 61% Russia (controls) 24%	US 15%
Procter & Gamble	USA	no forest ownership	
Oji Paper	Japan	Japan 43% Brazil 16% New Zealand 10% Laos/Thailand 9%	Indonesia 9% China 6% Australia 6% Canada 1%
UPM	Finland	Finland 35% (Tornator) Uruguay 10%	US 3% Others (control) 52%
Stora Enso	Finland	Russia (controls) 49% Brazil 29% China (controls) 10%	Western Europe (controls) 9% Uruguay (controls) 3% others < 1%

Breakdown of industrial forest ownership at the country level

Table 4 sorted countries by the amount of forests (ha) that owned by sampled forest industry firms in this study. Besides, the amount of controlled forests and forests uses for other purposes by firms are also listed in the table. Sweden has the largest amount of forests that owned by firms, Brazil and USA ranked the second and the third. Finland has the largest amount of controlled forests that can be accessed by firms.

Table 4. Country level forest ownership status by sampled firms

Country	Owned forests (ha)	Controlled forests (ha)	Other (ha)
Sweden	3252000		600000
Brazil	2797273	102300	601697
USA	2783160	232400	
Chile	1704337		157000
South Africa	914218		150000
Finland	887000	11400000	
Uruguay	743683	23752	

Results from logistic regression model

Table 5 shows means, standard deviations, and the multicollinearity of independent variables as measured by VIF in the model. Assets and operating profitability have a relatively high VIF (4,527 and 5,345, respectively), showing a high multicollinearity risk with other variables (possibly since they are alternative measures for size and profitability of company). Thus, these two indicators are left out when estimating the logistic regression.

Table 5. Means, standard deviation, and the multicollinearity test

	Mean	S.D.	VIF
Employees	19097	241334	2,183
Total Sales ($million)	5741	5983	1,286
EBITDA	0,121	0,088	1,071
Assets ($million)	12186	20742	**4,527**
Operating profitability ($million)	655	1953	**5,345**

Z-score transformation is used to standardize values of employees and total sales, since these two variables are measured in different scales. Results in Table 6 demonstrate the relationship between corporate financial performance (indicated by total sales and EBITDA) and the choice of forest ownership. Corporate size (indicated by number of employees) is set as a control variable. Generally, Nagelkerke R Square (0,372) shows a quite good ratio of goodness of fit of the model. In specific, total sales has a positive beta coefficient (2,553) and it is significant at the 0,05 level, which indicates that for a one-unit increase of total sales, the expected change of the choice of P(own forest)/P(don't own forest) is 12,852. Similarly, EBITDA has a positive beta coefficient (11,486) and it is significant at the 0,05 level, which indicates that for a one-unit increase of EBITDA, the expected change of the choice of P(own forest)/p(don't own forest) is 97370,436. Thus, a firm would have a very strong preference of having forest ownership when its total sales and EBITDA are increasing. Employees, as a corporate size control variable, have a negative beta coefficient (-1,799) and it is significant at the 0,05 level as well. It indicates that the increase of employees would lead the preference of no forest ownership rather than owning it. The Hosmer and Lemeshow Test in this model is significant ($p = 0,02 < 0,05$), which indicates that there is a difference between observed and predicted value of variables. This diagnostic test shows there might be some bias in this model, so we will try to modify this problem with larger sample size in the next stage of the study.

Table 6. Logistic regression model

Independent Variables	Model			
	B	Exp(B)	Sig.	
Z-total Sales ($million)	2,553	12,852	0,013	**
EBITDA	11,486	97370,436	0,031	**
Z-Employees	-1,799	0,165	0,027	**
Constant	-0,987	0,373	0,158	
Nagelkerke R Square			0,372	
Hosmer and Lemeshow Test			0,02	

Discussion

In results, we see that decision on vertical integration is positively affected by the sales and profitability of the company. If companies increase their sales they are likely to choose vertical integration. Similarly, higher profits in the form of slack resources could motivate for forest ownership. Controversially, a large company size in terms of number of employees reduces the probability to own forests. This might be due to the increased transaction costs as the number of employees grows. Thus, corporate strategic decision on vertical integration should bear in mind the balance between profitability and costs at the global level.

Forest ownership has become an important strategic issue in low cost and high productive areas where timber markets are not working efficiently. This is supported by the fact that majority of forest resources owned or controlled by the top 5 companies are located outside of North America or Europe, which have been the “traditional” pulp and paper production regions with established timber

markets. South America has become a hot-spot area of the corporate forest ownership, and forest owners are multinational firms rather than only local firms. Comparatively, South Africa also has large amount of forests owned by firms, however, local firms are dominant.

Hence, in the future, the competition on forest based raw material might be fierce due to reasons of e.g. population growth, forest conservation oriented national policies, and bioenergy policies. Corporate strategic importance of owned or controlled forests, investment locations, and product segments might affect firms' global presents and performance. Thus, for the further study, the relationship between firm's financial performance and corporate forest ownership will be explored by controlling corporate product diversifications and asset locations.

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