The Effects of Value-adding Strategy and Cost Levels on Financial Performance of Finnish Sawmills

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The Finnish sawmill industry has been placed in a predicament due to changes in the business environment since the 1990s. Along the predicament, the industry has shifted its focus on customer-oriented products from production-oriented products. This can be a manifestation of a surge of value-adding strategy which aims to add premium value on products and has been emphasized in academia. Studies on the effects of value-adding strategy on financial performances are very few and no studies have taken into account the existence of strategic groups in the industry. This study scrutinizes the effects of value-adding strategy as well as cost levels of Finnish sawmills on their financial performances with information of strategic groups.

The study employs multiple linear regression analysis and cluster analysis to analyze financial performance and of 180 Finnish sawmills from 2002 to 2011, although not all the data was utilized due to lack of certain information.

The study found that value-adding activity positively impacts the performance, especially in the longer term. In addition, investment in the previous year as a mean to implement value-adding strategy can enhance the performance of a firm. As for the costs side, higher material cost and salary generally hamper the performance in the short term. However, the study found the positive effect of salary that improves the performance when the information of strategic groups is taken into account. Although it is impossible to tell which components of salary contribute performance due to the nature of the data that the study used, the importance of investing in human resource should be acknowledged.

Avainsanat — Nyckelor — Keywords
Value-added, Value-adding, Cost-efficiency, Strategy, Sawmill, Financial performance
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1. Introduction

1.1 Finnish forest sector and the sawmilling industry

The forest sector including both forestry and forest industries plays a vital role in Finland, in terms of both economic and societal aspects. First, the Finnish forest sector produced approximately 7.1 billion euro in 2011, corresponding to 4.3 % of the Finnish total GDP (Finnish Forest Research Institute, 2012). It may seem a small portion, and the figure has been falling these years as the share used to be over 10% three decades ago. The sector, however, still holds a crucial part in Finnish export. The share of export of the forest sector in Finnish total export is larger than that of electric and electronics industry. The shares were 20% and 13% respectively in 2011(Finnish Forest Research Institute, 2012).

Second, the forest sector is an important source of employment, especially in the rural area. Although the forest sector provided 69,000 jobs in 2010, corresponding to only 2.8% of labour force in Finland in 2010, the figure increases in the rural area compared to the urban area as depicted in Figure 1-1 (Finnish Forest Research Institute, 2010). In contrast, manufacturing industries including electronics, electronic and optical products, electrical equipment, machinery and vehicles provided 114,000 jobs or 4.6% of total labour force in 2010 (Statistics Finland, 2012) and its share may decrease in the rural area. As the proportion of labour force in the forest sector surpasses 5% in some rural area, it appears that the sector is a crucial source of income in these areas.

Figure 1-1. Proportion of employed persons by forest centre, working for the forest sector (incl. furniture industry), 2010
Adapted from: Finnish Forest Research Institute (2012).
Within the forest sector, a number of industrial branches have an essential role, and they are inter-connected to each other as for example in wood material flows (Figure 1-2). Industrial roundwood that is not suitable for wood-product industries are consumed by pulp and paper industries and by-products of wood-product industries, such as saw dust, is consumed to produce energy or sold to the pulp and paper industries.

The sawmill industry is one of the most significant industries among these and constitutes a critical part in Finnish forest sector. The value generated in the sawmill industry accounts for 17% of the forest sector and the sawmill industry hires approximately 40% of total workforce in the sector (Finnish Forest Research Institute, 2010).

A sawmill processes raw materials, or logs to sawnwood. The process starts with debarking logs, and continues to sawing boards from logs, squaring the edges, cutting to length, kilning, grading and packaging (Hansen & Juslin, 2011). Planning may be done at a sawmill too. Almost all sawnwood produced in Finland is softwood sawnwood (FAOSTAT, 2013). Softwood sawnwood is mainly meant for structural uses such as construction, but also consumed for woodworking, furniture manufacturing, and packaging purposes.
substitution of sawnwood includes, for example, particleboard such as Oriented-Strandboard (OSB), and fibreboard. The quality of Finnish sawnwood can satisfy the high demanding end-users (Finnish Forest Industries Federation, 2012), because Finnish sawmill industry can take advantage of high-quality raw material with dense annual rings.

The business environment of the sawmill industry has drastically changed since 1990s due to fiercer competition, as a result of increased globalization, new competitors from emerging economies, substitute products and slower market growth (e.g. Jonsson 2011, Lähtinen 2009, Toppinen et al. 2006). Consequently, Finnish sawnwood production decreased and the industry weakened its presence in the EU, as it used to produce almost 12% of the total European lumber production but the figure fell to 9-10% (FAO, 2013).

1.2 Brief Analysis of the sawmilling industry

In simple terms, a profit of a firm is the subtraction of the total cost from the total sale as Equation 1-1 shows:

$$\Pi = PQ - \Sigma p_i r_i$$  

where $\Pi$, the total profit of a firm, is defined as the difference between the total sale and the total cost. On one hand, the total sale is the product of the average price of all products [$P$] and the quantity of all products sold [$Q$]. On the other hand, the total cost is represented by the sum of resources consumed [$r_i$] multiplied by their prices [$p_i$]. The costs comprise of cost of raw material, labour, and other costs. Briefly assessing these elements can reveal the situation in which the sawmill industry operates.

**SALES [$PQ$]**

On the sales side, the situation seems relatively gloomy at present. Both the price and volume dropped sharply in 2008 due to the financial crisis, although the volume had been increasing since the beginning of 1990’s and the price since the beginning of 2000s, as shown in Figure 1-3. The volume of goods sold is estimated by the production of sawnwood in Finland and the price is represented by the unit price of exported sawnwood, since the export has constantly accounted for 60 to 70% of the total production according to FAO (2013). Both production and consumption of sawn softwood in Europe in 2011 are still below the 2007 level by -10% and -15% respectively (UNECE, FAO, 2012). It would be inevitable for sawmills to be affected by the crisis for a few more years to come at least.
In addition to the slowdown of the economy, the main markets of Finnish sawmill, Western Europe and Japan, started to opt for OSB and engineer wood (Lähtinen & Toppinen, 2008). This may cause a greater threat to the sawnwood export than the economic slowdown itself because the low demand for sawnwood in the main markets can be permanent whereas the slowdown can be temporal. New markets for the sawmill industry, however, have been steadily growing and may compensate the lost markets. These include increased demand in construction as substitution of other materials such as concrete and sawnwood with special characteristics to meet customer’s need.

Comparing Finnish sawmill industry with other producing countries such as Sweden and Germany brings another perspective. The unit prices of Sweden, Finland, and Germany are in the similar range and are higher than European average (Fig 1-4). In addition, all three countries export a significant amount of their production. Sweden, Finland, and Germany exported 70%, 63%, and 31% of their production in 2011 respectively according to FAOSTAT (2013). Thus, the sawmill industries of the two nations are similar to the Finnish sawmill industry and reasonable examples to compare.

Finnish unit price of exported sawnwood is significantly higher than European average, as shown in Figure 1-4. This may indicate that the Finnish sawmill industry focus on higher quality or more specialized products. The unit price is not particularly high or low compared to Sweden and Germany. The price development, however, indicates that Finnish sawnwood has become more expensive than any other compared countries, as depicted in Figure 1-5. This might suggest that Finnish sawmills has been focusing on more expensive products than others.
As for production, Finland has been struggling while Germany and Sweden have constantly increased their production except in 2008, as shown in Figure 1-6. The price has not been high enough to compensate the low level of production, and the total export value has been stagnating compared to Sweden and Germany, especially during the last decade, as shown in Figure 1-7.

![Figure 1-4. Unit Price (real price) of Exported Sawnwood ($/m³) in 1980–2010. 2010 Source: FAOSTAT (2013) ![Figure 1-5. Index of unit price of exported sawnwood Source: FAOSTAT (2013)
The cost side appears to be relatively harmless. The main components of costs for Finnish sawmill industry, namely material and employment cost are discussed here. First, raw material cost constitutes over 50% of the total cost in the Finnish sawmill industry in the 2000s (Lähtinen, 2009), and the price fluctuation in saw logs directly influences the performance of sawmills. Raw material cost is more or less stable or even decreasing as Figure 1-8 depicts, except for 2007 and 2008 when Russia announced that it was going to raise the tariff on softwood raw materials drastically. Russia increased the tariff from 6.5% to 20% in 2007 and to 25% in 2008, and intended to increase to 80% in 2009, which did not materialize. As Russia entered WTO in 2012, it is unlikely that Russia will suddenly increase the tariff sharply. One of the factors to push up the price of raw materials in the near future is
the increased demand of emerging markets such as China. Another factor is the emergence of environmental consciousness, which has resulted in forest conservation and increased use of bioenergy, which may decrease the supply of logs to sawmill industry.

Figure 1-8. Real roadside prices in non-industrial, private forests
Three months moving average, monetary values are deflated using wholesale price index (1949=100).
Adapted from Finnish Forest Research Institute (2012)

Nonetheless, these factors would not affect the prices significantly in the short term. This is because Finland produces large amount of industrial round wood domestically and its self-sufficiency\(^1\) has been above 90% after 2007, according to FAOSTAT (2013). Because roundwood is bulky and difficult to transport, raw materials tend to be consumed locally. In addition, it is still possible to harvest more wood in a sustainable manner in Finland. Although 66.9 million m\(^3\) of wood per year can be removed in a sustainable manner from domestic forests, the Finnish forest sector harvest 49.5 million m\(^3\) on average from 2009 to 2011 (Finnish Forest Research Institute, 2012). In other words, more than 135% of current consumption level could be met in a sustainable way. Therefore, the increased domestic wood supply can buffer the increased demand for raw materials from the emerging market. Thus, higher demand from abroad will influence the Finnish prices of sawnwood indirectly rather than directly.

\(^1\) The ratio of the import to the domestic consumption
By contrast, the second factor directly affects the Finnish prices because it may limit the access to the forest resources. The increased use of bioenergy may affect the supply for pulp and paper company and indirectly affect the sawmill industry.

Second, the overall employment cost has actually decreased in the industry as a whole. Although the real earning in wood-products industries has increased to about 184% of 1980 level in 2010, the number of employees in the sawmill industry has fallen by 55% over the same period (Finnish Forest Reseach Institute, 2010, 2012). Supposing that total employment cost in the industry is represented by the product of the earning and the number of employees, the employment cost has shrunk to about 83% of 1980 level in 2010. This indicates that the increase in salary has been compensated by the increased efficiency.

It is reasonable to assume that the employment cost relative to other countries such as China or Eastern European countries is more important than the cost relative to the past in Finland. Nevertheless, the sawmill industry has developed to be capital intensive, which requires a large amount of investment to obtain the economy of scale, rather than labour intensive. Therefore, the labour cost should not be an urgent factor to affect the industry’s performance.

In sum, the Finnish sawmill industry has declined and been suffering from low prospects in sales and possibly relatively high cost due to the fiercer competition. This is a serious issue in the Finnish forest sector as well as Finnish society as a whole, for the industry constitutes an indispensable part in the sector and in Finnish society.

While the industry faces gloomy outlook, value-adding strategy seems to hold a high potential for the industry. Value-adding strategy has been studied and found crucial for sawmills by many scholars (e.g. Cohen 1992, Roos 2001, 2002, Lants 2005, Lähtinen & Toppinen 2008, Brege et al. 2010). Value-adding strategy could fight against ever-fiercer competition and diversified demand of markets. Luckily, the industry is blessed with abundant high-quality forest resources, advanced in high technologies, and has an access to the highly educated potential employees. Translating these supreme resources into higher sales by value-adding strategy is one of the important issues for the industry.
2. Aim of the study

As discussed above, the presence of Finnish sawmill industry has weakened. It is of great importance to tackle the problems that the industry faces since the sawmill industry is such an integral part of the Finnish forest sector and the entire Finnish society as well.

Since Finland has advantages in abundant high-quality forest resources, high technologies, advanced machines, and educated employees, it makes sense to pursue value creation in order to regain the competitive advantage and to make a healthy profit. It is important, however, to investigate whether value-adding strategy could improve the performance before pursuing the strategy blindly.

Empirically, the objective of this study is to clarify the relationship between the financial performances and value-adding strategy and cost levels in different types strategic groups within the Finnish sawmill industry as well as at the whole industry scale. The research questions of the study are as follows:

1) Do value-adding strategy and cost levels enhance or damage the performance in the whole industry level and if so, how?
2) Do the effects of these strategies change depending on different types or strategic groups of sawmill companies and if so, how?
3. Theoretical Background: Perspectives on Strategic Management of Industries

The nature of competition faced by a company is affected by a myriad of factors. Many studies have shown that both internal and external factors are important for a firm to be successful (e.g., Hawawini et al. 2003, Mauir and Michaels 1998, Spanos and Lioukas 2001). The internal and external approaches look at the different sides of the same coin. Both investigate sources of performances of firms and ways to outperform others. On one hand, internal factors, or internal resources, are ones that can be dealt within a firm. An approach to focus on internal factors has been taken by several scholars and developed into the Resource-Based View (e.g., Penrose 1959, Wernerfelt 1984, Barney 1991). On the other hand, external factors, or an industrial structure, refer to ones that are out of a firm’s control. Porter (1980) has developed frameworks to analyse external factors.

3.1 Internal factors: the Resourced Based View

3.1.1 RBV

One prominent theory about internal factors is the Resource-Based view (RBV). The RBV is a theory that attributes a firm’s success to its both tangible and intangible resources (Wernerfelt, 1984). Figure 3-1 illustrates the overview of the RBV.

![Figure 3-1. Basic framework of Resource-Based View](Reproduced from Barney (1991) and Rumelt et al. (1994))
According to Barney (1991), two fundamental assumptions of the RBV are (1) that a firm can be considered as a set of resources and each firm has different sets (the assumption of firm resource heterogeneity) and (2) that the resources are very difficult to copy (the assumption of resource immobility). Barney (1991) cites Daft (1983) and defines resources as “all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness”.

Nonetheless, the definition and two assumptions of resources are abstract to assess a firm and identify its resources. It is not clear what is and is not a resource for a firm. Barney (1991) developed VRIN framework to identify a firm’s recourses. VRIN framework examines whether or not the possible resources are valuable, rare, costly to imitate, and non-substitutable. The RBV with VRIN framework can complement Porter’s notion of five forces; the RBV assesses what a firm’s internal strength and weakness are, which five forces does not include (Barney et al., 2011).

These resources bring “competitive advantage” (Barney, 1991) which in turn contributes to performance. Competitive advantage and performance are sometimes used interchangeably, but they are very different concepts. On one hand, a sustained competitive advantage refers to “implementation of a strategy which is not simultaneously implemented by others” (Barney, 1991). On the other hand, performance refers to economic rents that a firm gains as a result of the implementation of a strategy (Rumelt et al., 1994).

The RBV has generated spin-offs with different approaches, i.e. the knowledge-based view (Grant, 1996), the natural-resource-based view (NRBV) of the firm (Hart, 1995), dynamic capabilities (Teece et al. 1997), and has linked to other perspectives, i.e. institutional theory (Oliver 1997), and organizational economics perspective (Combs and Ketchen 1999). Based on these developments of the RBV, Barney et al. (2011) conclude that the RBV has reached maturity as a theory and call it Resource-based Theory (RBT).

### 3.1.2 Empirical studies

Many empirical studies to test the theoretical assumptions of the RBV have been done, and
Barney and Arikan (2001) and Newbert (2007), for example, provide a meta-analytic review of empirical results. Newbert (2007) systemically identified 55 previous empirical studies and concluded that 53% of the tests were empirically supported. The level of support is rather modest or low considering the popularity of the RBV. Newbert (2007) notes that this is not particularly low compared to empirical support for other strategic management theories. For instance, a similar study done by David and Han (2004) find only 47% of tests of Transaction Cost Economics (TCE) were supported. Barney and Arikan (2001) find far stronger support for the RBV, but this is because they reviewed articles of which results are consistent with the RBV as Newbert notes (2007).

Newbert (2008) tests elements of the RBV based on Barney (1991)’s conceptual mode and finds that value and rareness are related to competitive advantage, that competitive advantage is related to performance, and that competitive advantage mediates the rareness-performance relationship. The evidence that competitive advantage mediates the value-performance relationship is not supported. Based on the result, Newbert (2008) argues that a direct test “between resources/capabilities and performance may be incomplete.”

### 3.1.3 Limitation

The RBV has its limitations, which some scholars have been criticizing. One of the fundamental problems is the tautological nature of the RBV (Priem and Butler 2001, Lockett et al. 2009). Priem and Bulter (2001) cite Barney’s following important statements about the RBV and argue that it is trapped in a circular reasoning.

The essence of the RBV is “that valuable and rare organizational resources can be a source of competitive advantage (Barney, 1991)”. On one hand, Barney (1991) defines resources as *valuable* “when they enable a firm to conceive of or implement strategies that improve its efficiency or effectiveness” and “when they exploit opportunities or neutralize threats in a firm’s environment”. On the other hand, Barney (1991) defines *competitive advantage* as a firm “implementing a value creating strategy not simultaneously being implemented by any current or potential competitor”.

In essence, valuable and rare resources bring competitive advantage, but “rarity and value in
Another serious problem is the problematic empirical testability of the RBV. Since the
definition of resources is tautological and all inclusive (Priem & Butler 2001), identifying
resources in empirical studies is extremely difficult. The nature of resources and the
assumption of firm resource heterogeneity exacerbate the situation. Intangible resources,
which are often critical, are usually very difficult to assess, and thus researchers are prone to
focus on tangible resources that are easier to observe. The assumption of firm resource
heterogeneity means that each firm in a sample is unique. Because of this, it is difficult to
obtain meaningful messages across the sample (Lockett et al. 2009).

3.2. External factors: Porter’s five forces

The external approach analyses on firm management the industrial structure that is out of the
firm’s control. The competitive advantage according to the RBV originating from resources is
realized in a market and the performance is determined as a result of competition. The
external approach focuses the types and intensity of competition a firm faces in the market, or
matters outside a firm.

3.2.1 Five forces

Porter’s five forces model is a theoretical tool to assess an industry and firms within it. These
forces determine a structural environment of an industry and influence how the firms behave.
Porter (1980) identified five such forces as follows: the bargaining power of buyers, the
bargaining power of suppliers, the threat of new entrants, the threat of substitute products or
services, and the rivalry among existing firms. Brandengurger and Nalebuff (1996) added the
sixth force, the power of complementors. The forces determine the nature of competition and
the potential profitability of the industry as a whole.

Porter (1980) suggests three potentially successful generic strategies for firms: overall cost
leadership, differentiation, and focus, as illustrated in Figure 3-2. Overall cost leadership and
differentiation are the strategies that target an industry-wide segment. The cost leadership
strategy aims to win others by offering buyers low cost products/services. It often requires the
high market share to gain the economy of scale and other factors including better access to raw materials. The differentiation strategy aims to establish a unique position not through the low cost. Differentiation can be implemented in many ways, e.g. by design or brand image, technology, special features, as well as by combinations of these factors. The focus strategy is targeted at particular segments, which can be buyer groups, segment of product line, or geographic market. The focus strategy as well as the differentiation strategy cannot bring a high market share by definition.

Other than these three generic strategies, a firm can take various kinds of strategies. Firms with similar strategies in an industry form a strategic group and the whole industry can be mapped accordingly. The dimensions of grouping are, for example, specialization, cost position, product qualities, and vertical integration.

### 3.2.2 Strategies and strategic groups

A strategic group refers to a group of companies in an industry that employs similar strategies (Porter, 1980). Due to “mobility barrier” which is similar to the entry barrier but inside an industry, a firm cannot easily move from one to another strategic group. Among strategic groups in an industry, it is likely that one group or a number of groups have more profit potential than the others.

It is important to note that the identification of strategic groups in an industry should rely on similarity in business models or strategic combination of firms and not on the performance. It
is possible that the performance of a certain strategic group is higher than the others. Nonetheless, since the performance is a result of operations with certain business models and strategic combination, it can differ significantly within the same strategic groups depending on how well a firm implements strategies. Therefore, the performance should not be taken into account upon identifying strategic groups.

The differences in the ways the five forces influence each strategic group can explain why profit potential differs among strategic groups. For instance, luxury carmakers face very different competition compared to their counterparts in low-priced car markets. The threat of substitute products for luxury carmakers may come from an expensive yacht, whereas that for cheap carmakers may exist in a motorbike market. In other words, the intensity and sources of the five forces differs from one strategic group to another and thus, strategic groups behave differently in response to the five forces. The profitability of a firm, therefore, possibly depends on the characteristics of the industry, the characteristics of the strategic group, and the relative position of the firm within the strategic group (Porter, 1980).

This view to focus on external factors involves a problem, although it provides a very powerful and beneficial insight for a manager of a firm or an analyst. Wernerfelt, who is one of the pioneers in developing the RBV, disagrees to put too much focus on the external environment because analysis on external factors provide a manager with generic advice, and this advice is no longer useful once other firms implement it (Lockett et al. 2008).

### 3.3 Value-added and cost levels

From a managerial view of point, value-added and cost levels are crucial notions. Value-added, i.e. how much value premium a firm produces, and cost-efficiency, how little cost a firm consumes, as expressed in Equation. 1-1. The value-adding activity refers to the activity “to economically add value to a product by changing its current place, time, and form characteristics to characteristics more preferred in the marketplace (Coltrain et al. 2000).” in a broad sense. In other words, “value-added” is the difference between the value of output and input of products/services as a result of a firm’s economic activities. In this study, “value-adding” is mostly used as adjective and emphasizes the act of adding value, whereas “value-added” is used as a noun and refers to value that is created.
Value-added and cost-efficiency can be linked to external and internal views, as both theories may be considered as two sides of the same coin. In the internal view of the RBV, on one hand, value-added and/or cost-efficiency are achieved by employing company’s resources by specializing either on adding value or increasing the efficiency. In the external view of Porter, on the other hand, a firm pursues value-added and/or cost-efficiency through selecting company’s strategies corresponding to market segments such as differentiation and cost-leadership in response to Porter’s five forces.

Focusing on value-added and efficiency provides researchers with an approach to assess what is important for success of a company in a basic manner even with limited purely quantitative data without any qualitative information.
4 Empirical studies on internal and external factors affecting competitiveness of sawmills

4.1 Strategies

In empirical studies, factors of competitiveness in sawmill industry have been approached from strategic point of views both from the external and the internal perspectives especially since 1980s. Existing literature on strategic aspects related to sawmill industry presents conflicting results. Porter (1980) argues that a firm should adopt only one of the three generic strategies mentioned above to be successful, otherwise a firm loses its direction and cannot form a competitive advantage, or becomes “stuck in the middle”. Studies, especially the earlier ones (e.g. Niemelä & Smith 1997, Hansen et al. 2002) showed that many sawmills adopt combination of the generic strategies. Some firms even adopt all of the strategies, which is the same as not having any strategies at all. Hansen et al. (2002) suggested that employing several strategies simultaneously hampers performance of a firm.

For sawmills, it is difficult to focus on exclusively one strategy because sawmills end up producing wide range of products suitable for several markets in the process due to heterogeneous raw materials (Niemelä and Smith, 1997). Brege et al. (2004 cited in Brege et al. 2010) explained that this problem is related to “divergent product logic”, meaning that “a sawmill has to make full use of the entire sawlog”. Wright (1987) in general and Hansen et al. (2002) in the context of the sawmill industry suggested that larger companies suffer less from adopting multiple strategies because they can afford multiple mills and personnel specialized in different tasks, whereas smaller ones that lack necessary resources would struggle more.

In the 1980s and 1990s, the sawmill industry started to shift to emphasize customer oriented and differentiated products from mass production around the globe including USA, Canada, Finland, and Sweden (e.g. Rich 1986, Bush & Sinclair 1991, Niemelä & Smith 1996, Brege & Överberg 2000, Korhonen & Niemelä 2005). Traditionally the forest industry had been production-oriented and focused mainly on producing commodities with low cost (Hansen and Juslin 2011). Due to changes in nature of competition as a result of, for example, increased globalization, environmental concern, and slower market growth (Hansen and Juslin 2011, Ojala et al. 2006), the industry has shifted to pay more attention to customer side.

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2 Berge et al.(2004) is in Swedish and it is cited in Berge et al. 2010
3 cited in Brege et al. (2010)
rather than production side. Niemelä and Smith (1996) clearly showed that companies were shifting to emphasise product differences in North America and Finland. Bush and Sinclair (1991) investigated the largest hardwood lumber producers in the USA and found the similar trend among large sawmills while smaller ones in the sample appeared not to adopt any particular strategies.

The size of sawmills affects their strategies as Wright (1987) suggested theoretically and several studies have shown empirically (Niemelä & Smith 1997, Roos et al. 2001, 2002). Whereas small- and medium-sized firms likely adopt differentiation and focus strategies, larger ones tend to employ cost leadership strategies and some combinations (Niemelä & Smith, 1997). Conflicting results have been shown concerning whether the most or the least active very large firms are in activities. On one hand, Niemelä and Smith (1997) and Lähtinen and Toppinen (2008) show that the largest companies invest the most in value-adding activities in the North America and Finland. On the other hand, the results of Roos (2001, 2002) and Brege et al. (2010) both in Sweden indicate that the largest sawmills are the ones that are the least active in value-adding strategy.

The region in which sawmills operate also influences the choice of strategies. Niemelä and Smith (1996) found that sawmills in Finland focus more on customer-oriented and differentiated products than their counterparts in the North America. They regard this is natural considering the fact that Finnish sawmills export large amount of products and thus they have become more customer-oriented. In addition, the emphasis on differentiation reflects Finnish sawmills’ cost disadvantage against European competitors (Niemelä & Smith 1996).

### 4.2 Value-added and cost levels

In the context of sawmill industry, the concepts such as “value-added” have been used more frequently these days (e.g. Cohen 1992, Roos 2001, 2002, Lants 2005, Lähtinen & Toppinen 2008, Brege et al. 2010), instead of terms like customer-made, customer-oriented, differentiated products, and differentiation and market-oriented strategies.

In the context of studies in the sawmill industry, “value-adding” strategy refers to a strategy
that enhances the value creation activities in a firm to enhance the value creation potential of a company and transform its products to something more than just a commodity. The “value-adding” strategy comprises, for instance, advanced technological processes and market-oriented production to pursue better customer service, planning, stress grading, and producing special dimensions of sawnwood (Lähtinen & Toppinen, 2008). Roos et al. (2002) identified several forms of value-adding strategy of production in Swedish sawmills such as planning, drying to order, and length trimming. Other studies (e.g. Lähtinen and Toppinen 2008, Brege et al. 2010) include focus on customer-oriented marketing as well as technical processes. In essence, the value-adding strategy in the sawmill industry is a strategy to rise value premium of a commodity and to differentiate its products in the market.

Value-adding strategy has linkages to differentiation and focus strategies of Porter’s three generic strategies as well as to the RBV, as discussed in the previous chapter. As mentioned above, sawmills have difficulties implementing only one of the three strategies and thus Porter’s theory cannot be directly applied in the industry. By contrast, the concept of “value-adding” can grasp the reality of the industry better than Porter’s theory since the products of the industry tend to be commodities and the distinction between value-adding strategies and others is clear. This may explain why “value-adding” strategy as a term has been used more recently in the studies.

The importance of value-adding strategy has been emphasized by many scholars (e.g. Bush & Sinclair 1991, Cohen 1992, Cohen & Sinclair 1992, Idassi et al. 1994, Hansen & Juslin 2011, Toivonen et al. 2005). Nonetheless, the effect of value-adding strategy had not been always positive in earlier days according to Brege and Överger (2000 cited by Brege et al. 2010). Brege et al. (2010) explain this is because 1) sawmills are “Stuck in the middle (Porter1980)” since they have to produce wide range of products to make the full use of heterogeneous materials and 2) the barriers to imitate within the industry is low and value-adding strategy is rather difficult to implement.

At the early stage before 2000, the focus in studies was on identifying the strategy types and lacked the analysis of the relationship between strategies and performance of a firm. Studies that include performance of a firm are relatively new, except for a few (e.g. Cohen and Sinclair 1992). Recent studies acknowledge generally positive relation between value-adding strategies and performance such as Roos et al. (2001, 2002) in Sweden, Hansen et al. (2006)

As for efficiency, several studies have been conducted around the world (e.g. Campbell and Jennings 1990, Puttock and Prescott 1992, Baardsen 2000, Nyrud and Bergseng 2002, Nyrud and Baardsen 2003, Salehirad and Sowlati 2005). The efficiency in these researches, however, is treated as performance and a proxy of a success instead of explanatory variable of success, and therefore the direct relationship between efficiency and success of a firm still remains unclear. Moreover, studies that include efficiency as explanatory variables indicate mixed messages. According Roos (2001), there is no clear evidence that higher efficiency improves performance in Swedish sawmills, whereas Lähtinen and Toppinen (2008) find negative correlation between cost-efficiency and short-term performance in Finnish sawmills.

### 4.3 The remaining gap

Although these previous studies have revealed topical facts in the field, gaps still exist between the findings made in the literature and the reality in the sawmill industry. The analysis and discussion in the previous studies are limited in the industry scale or a specific group of sawmills such as one categorized by size and provide or suggest only general results. Some firms in the industry are operating in a very different environment depending on their strategic groups and hence, research that is more detailed is needed to take into account differences among firm groups. Roos et al. (2001, 2002) studied the performance depending on strategic groups in Sweden. Nevertheless, their emphasis is on identifying company groups instead of examining differences in performance among groups. Besides, such a study has not yet been conducted in Finland.
5 Data and Methodology

5.1 Data

The data used for this study were obtained from three different sources. The first source of the data were the official financial statements of Finnish sawmill companies received from the reports of Balance Consulting (2006, 2009, 2012) comprising information on performances such as ROI and Equity Ratio and descriptive information such as employment cost, the number of employees, and value-adding per employee. In the data, there are altogether information on 180 companies over the period from 2002 to 2011, which comprises a panel of 1075 observations in total. In the Balance Consulting reports used in this study, some data such as value-adding per employee were only available in 2005, 2008, 2010, and 2011, the number of panels with all the financial figures and information about value-adding and employment cost are 362. The second and the third data sources provided annual production amount of sawmills. The second source has actual production amount of 19 Finnish sawmills in 2005, which was gathered in connection to studies of Lähtinen et al. (2008, 2009). Financial performances of 17 of these 19 companies are available in the data from reports of Balance Consulting. The third source is a website named “The Sawmill Database” created and maintained by Nylinder and Stål (2013), which contains production capacity of sawmills around the globe. In the website, 59 Finnish sawmills are listed and 32 of them have information on production capacity in 2011. Among these, financial performances of 19 companies are available in the first dataset.

Outliers were omitted from the data because these represented unusual events such as merger and bankruptcy and thus disturb the result of analyses. Some variables of a firm in the dataset from Balance Consulting (2006, 2009, 2012) were extraordinary large or small. These outliers were omitted if the value of variables exceeds certain limits. Cases with less than -100 or more than 100 for ROI, less than -100 or more than 150 for Turnover growth, and more than 10 for Quick Ratio were excluded. After trimming, financial figures of 180 companies over 9 years composed 1065 observations, among which 345 observations include amount of value-added and employment cost.

As for the cases with production information, a preliminary cluster analyses identify firms that are very different from others. The number of firms with information on production is 17
in 2005 and 19 in 2011 and 36 in total.

The sampling is determined by data availability in the sources and might be biased, but 180 companies seem adequate. The sum of turnover of those companies accounts for 42.1% of the total turnover of Finnish wood-products industries in 2010 according to Finnish Forest Research Institute (2012). Considering wood-products industries include industries other than the sawmill industry such as the furniture industry and the reports of Balance Consulting cover almost all of the major sawmills in Finland, the data represent significant part of the Finnish sawmill industry.

5.2 Methodology

This study scrutinizes the effects of value-adding strategy and cost levels on financial performance of the Finnish sawmills both at industrial and strategic group level. The following four steps are taken (Figure 5-1): 1) regression analysis to reveal the effect of strategies on performance in the whole industry level 2) cluster analysis to form strategic groups, 3) comparison of the company groups to assess the differences between them and how value-adding and performance are linked, 4) regression analysis with dummy variables of company groups to investigate the effect at strategic group level. The first step corresponds to the first research question and the rest are for the second research question.

![Figure 5-1. Four steps in the study](image)
5.2.1 Regression Analysis (1)

In order to assess effects of strategies on performance in the whole industry level, which corresponds to the first research question, linear multiple regression analysis was performed. The first source of data, i.e. Balance Consulting dataset sufficed the purpose, and thus the number of panels was 345. The effects of independent variables defined below on financial performance is analysed using the following model;

\[ y_i = X_i \beta_i + \epsilon_i \]  

(5-1)

where \( y \) is the vector of value of an endogenous variable, \( X_i \) is the matrix of independent variables, \( \beta_i \) is the vector of coefficient, and \( \epsilon_i \) is an error term. Linear regression assumes following properties: 1) normally distributed data, 2) homogeneity of variance, 3) linear relationship between dependent and independent variables (Field, 2009).

Financial performance figures were employed as the dependent variables in the regression analysis. Performance of sawmills was analysed from four perspectives; profitability (ROI, %), liquidity (Quick Ratio, %), solvency (Equity Ratio, %), and turnover growth (Growth, %). Return on Investment (ROI) measures relative profitability: the proportion of yield to the invested capital, Quick Ratio measures the company’s ability to meet its short-term liabilities purely from its current financial assets, Equity Ratio measures ability to withstand losses and to fulfil its commitments in the long term (Committee for Corporate Analysis, 2006), as summarized in Table 5-1.

ROI is preferred to ROE in the study for the following four reasons. First, the denominator of ROI includes both shareholders’ equity and invested interest-bearing external capital, whereas that of ROE is only shareholders’ equity. Second, ROE can be enhanced by increasing the financial leverage, namely the inverse of Equity Ratio, which is irrelevant to a firm’s performances. In other words, a firm with lower Equity Ratio has higher ROE than another firm with the same net result. Third, Lähtinen and Toppinen (2008), a study made previously with similar data, employed ROI. Using the same financial indicator helps to compare the results. Fourth, ROI can ignore the effect of tax. For all of these advantages, this study adopts ROI instead of ROE as an indicator of profitability.

Profitability, liquidity, and solvency are the three important dimensions to assess performance
in financial statement analyses (Laitinen, 2000). Growth in this study measures the annual turnover growth. This growth does not measure success of a company per se, but is an indicator of competitiveness according to Laitinen (2000). In addition, turnover growth can represent an immediate response from a market. Laitinen (1991, 2000) summarizes the interaction among these indicators and states “a change in the growth of revenues will lead to a change in profitability, which will then affect liquidity and solvency”.

As for explanatory variables, indicators of value-adding strategy and cost levels are included. Value-added is an accounting concept and is defined as Equation 5-2 in the accounting theory (Committee for Corporate Analysis, 2006). This figure, or “gross value-added”, includes all the value that a company creates in its operation by transforming a raw material to products. This type of variables is used in Lantz (2005) and Lähtinen and Toppinen (2008) to assess the level of value-added.

$$\text{Gross Value Added} = \text{Operating Margin} + \text{Personnel Expenses} - \text{Gains on Sale of Fixed Assets Included in Operating Income}$$

(5-2)

In contrast to the concept of value-added in accounting, value-added created as a result of value-adding strategy refers only to production with a purpose of manufacturing products with value premium that is not comprised in the commodity products. Thus, value-added in this context excludes value created merely by transforming raw materials to commodity products. In other words, value-added in this context only includes additional value created by transforming commodity into more differentiated products. Roos et al. (2005) and Brege et al. (2010) employ this kind of variables.

Because it is impossible to distinguish the value in commodity products and additional value created by value-adding strategy due to the data limitation, this study employs the former type of value-added, or gross value-added. The level of value-added of a firm is assessed by efficiency to create value, which is measured as a proportion of gross value-added to the internal resources that are consumed within the sawmills to create the value. These resources are approximated by the sum of personnel cost, companies’ facilities such as a factory and other assets. Thus, the level of value-adding efficiency is assessed as in Equation 5-3.
The simple indicator of value-added instead of value-adding efficiency would be the share of gross value-added in turnover expressed in Equation 5-4. This indicator, however, has the perfect linear relationship by definition with the variable named material (Equation 5-7) described below, and thus causes multicollinearity. Therefore, the model employs value-adding efficiency instead of this simple variable.

\[
Value\ \text{added} = \frac{\text{Gross Value added}}{\text{Turnover}} \tag{5-4}
\]

For cost levels, two variables named Material and Salary, both of which are proportion to turnover, are included. Cost efficiency means how efficient a firm is to produce output with input, or cost. In other words, cost efficiency is proportion of output or performance to input consumed as expressed in Equation 5-5. Previous studies, however, use the concept differently (e.g. Lähtinen and Toppinen 2008).

\[
\text{Cost Efficiency} = \frac{\text{Turnover}}{\text{Personnel expenses} + \text{Material and Ext. service cost}}
\]

Lähtinen and Toppinen (2008), for instance, regard cost efficiency as how little cost relative to its output a firm consumes. They assess cost efficiency by variables that are proportion of costs to turnover. Nonetheless, these variables cannot indicate the effect of the low costs directly as the value of variables could decrease when a firm is successfully implementing either cost efficiency or value-adding strategy. On one hand, it is obvious in the former case that the value of the variable increases as a firm reduces cost when turnover is constant. On the other hand, the latter case is also possible in theory when a firm added more value and increases turnover when the cost is constant. In order to avoid confusion, this study treats Salary and Material merely as indicators of cost levels, not as “cost efficiency”.

The first cost variable is an indicator of material and external service cost proportional to turnover named Material calculated as Equation 5-6. Essentially, Material is the turnover...
minus “gross value-added” which is then divided by turnover. Therefore, it has the perfect linear relationship with a share of gross value-added to turnover. Furthermore, this variable includes costs other than material and external service such as administrative cost. However, personnel cost and material cost constitute a major part of sawnwood production, and thus, other costs included in the variable should be negligible.

\[
\text{Material} = \frac{\text{Turnover} - (\text{Operating margin} + \text{Personnel expenses})}{\text{Turnover}}
\]  
(5-6)

The second cost variable is \( \text{Salary} \), which is the proportion of employment cost to turnover as shown in Equation 5-7.

\[
\text{Salary} = \frac{\text{Personnel expenses}}{\text{Turnover}}
\]  
(5-7)

Partial correlations were calculated to identify interrelationships between Profitability, Liquidity, and Solvency in order to avoid the effect of some unknown third factors. Two-tailed Pearson correlation was calculated to examine the relationship between profitability and growth. Partial correlations can illustrate true relationship between two variables by leaving out effects of control variables that may have impact on both. It is reasonable to assume that three financial measures, i.e. ROI, Quick Ratio, and Equity Ratio used as dependent variables in the model are interconnected one another, and the effect of control variables should be omitted in order to emphasize the true relationship between two variables examined.
### Table 5-1. Summary of variables in Regression analysis*

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Indicator of</th>
<th>What to measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on Investment</td>
<td>Profitability</td>
<td>Relative profitability, i.e. the yield which has been generated on the Invested Capital</td>
</tr>
<tr>
<td>Quick Ratio</td>
<td>Liquidity</td>
<td>Ability to meet its short-term liabilities purely from its current financial assets</td>
</tr>
<tr>
<td>Equity Ratio</td>
<td>Solvency</td>
<td>Ability to withstand losses and to fulfill its commitments in the long term</td>
</tr>
<tr>
<td>Growth in Turnover</td>
<td>(Competitiveness)</td>
<td>Annual turnover growth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Indicator of</th>
<th>What to measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value-adding Efficiency</td>
<td>Efficiency of value-adding activity</td>
<td>Proportion of value-added to the resources that are consumed to create value</td>
</tr>
<tr>
<td></td>
<td>Costs of materials and external service</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td>Proportion of material and external service cost to turnover</td>
</tr>
<tr>
<td>Salary</td>
<td>Cost of employment</td>
<td>Employment cost per employee</td>
</tr>
<tr>
<td>Investment</td>
<td>Amount of investment in the current year</td>
<td>Proportion of investment in the current year to turnover</td>
</tr>
<tr>
<td>Investment (-1)</td>
<td>Amount of investment in the previous year</td>
<td>Proportion of investment in the previous year to turnover</td>
</tr>
</tbody>
</table>

*Independent variables are fitted to each dependent variable, in other words, four different models with one dependent variable are computed each time
5.2.2 Forming clusters

Cluster analysis reveals groups with similar attributes within datasets. Unlike discriminant analysis, the cluster analysis does not require prior knowledge of group membership. The clusters formed by the analysis does not necessarily make sense all the time, especially when the number of observations is small.

Cluster analysis is similar to factor analysis in a way that both analyses do not distinguish dependent and independent variables. The most important difference is that cluster analysis reduces the number of observations by grouping them into smaller set of clusters, whereas factor analysis reduces the number of variables by grouping them into a smaller set of factors, according to Burns and Burns (2009).

In this study, two-stage cluster analysis as Pung & Stewart (1983) proposed, was employed. The procedures executed at the both steps were the same, but the purposes differed. The first step determined the number of clusters followed by the second step that formed the clusters.

In this study, the hierarchical cluster analysis using Ward’s method was employed for the analysis. Simplified, the principal functions of hierarchical cluster analysis were the following ones: At the beginning, each observation was treated as one cluster, and then clusters were combined so that it minimizes distance of each observation within a cluster at each step until all observations were merged into one big cluster. In Ward’s method, distances between clusters are measured by calculating the total sum of squared deviations from the mean of a cluster. Since units of variables differ, each value of variables is transformed into Z score.

This method has been used widely and provided good results in previous studies (e.g. Aldenderfer & Blashfield 1985, Arthur 1992, Bush & Sinclair 1991, Roos et al. 2002). Moreover, Punj & Stewart (1983) analysed previous studies and showed that Ward method performed better than alternative techniques.

In this study, two-stage cluster analysis was performed three times. Since production information is derived from two different sources (Lähtine, 2008 and 2009, Nylander & Stål 2013), it is unclear whether these data can be merged. Thus, the first analysis is done for the
data that includes two dataset from both sources. The second and the third analyses are done for each dataset separately.

*Unit price* and the *share of value-added* are included in criteria of cluster analysis. These variables are calculated as presented in Equation 5-8 and 5-9. *Unit Price* expressed in Equation 5-8 is approximation of the average price of products of a firm and the *share of value-added* in Equation 5-9 indicates how value-adding oriented a firm is.

\[
Unit \ Price = \frac{Turnover}{Production} \tag{5-8}
\]

\[
Share \ of \ Value \ added = \frac{Gross \ Value \ Added}{Production} \times \frac{1}{Unit \ Price} \tag{5-9}
\]

### 5.2.3 Comparing Clusters

On the final step, clusters were compared one another on variables that represented characteristics of a firm such as the number of employees and efficiency as well as on average performances of clusters. One-way analysis of variance (one-way ANOVA) was computed to compare means of the variables and performance of clusters.

Following variables compare cluster; *Unit Price, Share of Value-added, Number of employees, Value-adding efficiency, Material, Salary, Investment, Lagged investment, ROI, Quick Ratio, Equity Ratio, and Growth.*

### 5.2.4 Regression Analysis (2)

In order to clarify the effect of strategies on performance in strategic group level, regression analysis in this step includes dummy variables that represent strategic groups from cluster analysis. For the sake of comparison, the model and variables used are the same as regression analysis in the first step except for dummy variables.

At the end of the chapter, Table 5-2 summarizes the methodologies that the study employs.
<table>
<thead>
<tr>
<th>Method</th>
<th>Step 1 and Step 4</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method</strong></td>
<td>Linear multiple-regression analysis</td>
<td>Cluster analysis</td>
<td>ANOVA</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td>362</td>
<td>36 (19 in 2005 and 17 in 2011)</td>
<td></td>
</tr>
<tr>
<td><strong>Variables</strong></td>
<td>(Dependent variables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ROI, Current Ratio, Equity Ratio, Growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Variables</strong></td>
<td>(Explanatory variables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Value-adding efficiency, Salary, Material (+Strategic group for Step 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>Balance Consulting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(+ Lähtinen (2005) and Nylinder and Stål (2013) for step 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>Lähtinen (2005) and Nylinder and Stål (2013)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6 Results

6.1. Step 1: Regression Analysis (1)

Figure 6-1 illustrates interdependencies among dependent variables. The results are as expected, i.e. financial figures are interconnected, especially Quick Ratio and Equity Ratio. ROI and Equity Ratio have weak correlation, and there is no evidence that ROI and Quick Ratio are correlated. Growth in turnover is also linked to ROI.

The correlations between explanatory variables in regression models presented in Table 6-1. Table 6-1 provides a preliminary test to check whether multicollinearity may cause problems in modelling. With the exception that Salary and Material are negatively correlated (-0.763), no such problems arise. This relationship would have to be kept in mind, if unstable beta coefficients appear in the regression models.

Figure 6-1. Relationship between dependent variables: Tow-tailed Pearson correlations between ROI and Growth and partial correlations among ROI, Quick Ratio, and Equity Ratio.
### Table 6-1. Two-tailed Pearson correlations between the independent variables

<table>
<thead>
<tr>
<th></th>
<th>Value-adding Efficiency</th>
<th>Material</th>
<th>Salary</th>
<th>Investment</th>
<th>Investment (-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value-adding Efficiency</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>-0.45 *</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>0.14 *</td>
<td>-0.76 *</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment</td>
<td>-0.08</td>
<td>-0.28 *</td>
<td>0.21 *</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Investment (-1)</td>
<td>-0.04</td>
<td>-0.34 *</td>
<td>0.20 *</td>
<td>0.12 *</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* Significant at 1% level

### Table 6-2. The estimation results for testing the effects of value-added, costs, and investment for financial performance of Finnish sawmills (standard errors in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>ROI</th>
<th>Quick Ratio</th>
<th>Equity Ratio</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>90.1* (8.48)</td>
<td>-5.02* (0.85)</td>
<td>23.51 (20.71)</td>
<td>86.29* (21.79)</td>
</tr>
<tr>
<td>Value-added Efficiency</td>
<td>21.69* (2.15)</td>
<td>2.66* (0.22)</td>
<td>33.64* (5.24)</td>
<td>8.88 (5.52)</td>
</tr>
<tr>
<td>Material</td>
<td>-93.29* (8.23)</td>
<td>5.27* (0.83)</td>
<td>-0.36 (20.11)</td>
<td>-83.98* (21.16)</td>
</tr>
<tr>
<td>Salary</td>
<td>-133.16* (10.19)</td>
<td>3.04* (1.03)</td>
<td>-58.11* (24.89)</td>
<td>-134.04* (26.18)</td>
</tr>
<tr>
<td>Investment</td>
<td>-4.02 (3.23)</td>
<td>0.99* (0.32)</td>
<td>18.05* (7.88)</td>
<td>11.37 (8.29)</td>
</tr>
<tr>
<td>Durbin-Watson statistic</td>
<td>1.384</td>
<td>0.707</td>
<td>1.992</td>
<td>1.857</td>
</tr>
<tr>
<td>N</td>
<td>345</td>
<td>345</td>
<td>345</td>
<td>345</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.632</td>
<td>0.319</td>
<td>0.173</td>
<td>0.127</td>
</tr>
</tbody>
</table>

* Significant at 1% level

### Table 6-3. The estimation results for testing the effects of value-added, costs, and lagged investment for financial performance of Finnish sawmills (standard errors in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>ROI</th>
<th>Quick Ratio</th>
<th>Equity Ratio</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>103.39* (8.48)</td>
<td>-4.25* (0.85)</td>
<td>52.09* (20.71)</td>
<td>91.03* (21.79)</td>
</tr>
<tr>
<td>Value-adding Efficiency</td>
<td>19.83* (2.15)</td>
<td>2.42* (0.22)</td>
<td>29.77* (5.24)</td>
<td>7.38 (5.52)</td>
</tr>
<tr>
<td>Material</td>
<td>-106.61* (8.23)</td>
<td>4.55* (0.83)</td>
<td>-28.84 (20.11)</td>
<td>-89.07* (21.16)</td>
</tr>
<tr>
<td>Salary</td>
<td>-141.38* (10.19)</td>
<td>2.63* (1.03)</td>
<td>-72.73* (24.89)</td>
<td>-133.92* (26.18)</td>
</tr>
<tr>
<td>Investment (-1)</td>
<td>-12.12 (3.23)</td>
<td>0.47 (0.32)</td>
<td>-6.06 (7.88)</td>
<td>5.14 (8.29)</td>
</tr>
<tr>
<td>Durbin-Watson statistic</td>
<td>1.936</td>
<td>0.903</td>
<td>1.999</td>
<td>1.939</td>
</tr>
<tr>
<td>N</td>
<td>344</td>
<td>344</td>
<td>344</td>
<td>344</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.660</td>
<td>0.307</td>
<td>0.198</td>
<td>0.125</td>
</tr>
</tbody>
</table>

* Significant at 1% level
Most of the models do not suffer from autocorrelation as the values of Durbin-Watson statistic are around 2 except for the model with Quick Ratio. The values of Durbin-Watson statistic for models with Quick Ratio are 0.707 for the model with investment and 0.903 for the model with lagged investment, both of which are below 1 (Table 6-2 and Table 6-3). This suggests that these two models for Quick Ratio suffer from positive serial correlation, whereas other models appear to be free from the problem. Durbin-Watson statistics for other models appear to be around 2 and thus, those models are free from autocorrelation.

Table 6-2 and Table 6-3 summarize the results of regression for financial figures. Comparing those two tables, whether to include the investment in the current year or lagged investment seems irrelevant to the explanatory power of models and effects of other variables. According to the results in Table 6-2 with current investments, the impacts of explanatory variables on performance are similar for ROI, Equity Ratio, and Growth models. Among these models, Value-adding Efficiency has positive impact on performances, which magnitudes are always smaller than other variables except the model for Equity Ratio. No statistical evidence is gained for the effect of Value-adding Efficiency on Growth. Material and Salary negatively affect performances and magnitude of the effect of Salary is larger than that of Material. Investment affects Quick Ratio and Equity Ratio positively. Meanwhile, investment (-1), or investment in the previous years, seems to have no impact on any performances.

As for Quick Ratio, variables influence differently compared to other performance figures. Material and Salary have positive impact, and magnitude of Material is larger than that of Salary. The result may not be reliable due to Multicollinearity.

The explanatory power of the models measured by R squares is the strongest for profitability (ROI, 0.632 and 0.660), weak for liquidity (Quick Ratio, 0.319 and 0.307), and very weak for solvency and growth (Equity Ratio, 0.173 and 0.198 and Growth, 0.127 and 0.125). Compared to the previous study of Lähtinen and Toppinen (2008) and studies in other industries (e.g., Roberts and Dowling, 2002, Hsu and Boggs 2003), the explanatory power of models seems sufficient.
6.2. Step 2 & 3: Cluster Analysis and ANOVA

The results of cluster analysis and comparison of clusters are presented with figures which illustrate the relative position of firms on axes by unit prices and the share of value-added and with tables which summarize characteristics of clusters. The cluster analysis were performed three times for each dataset “combined”, “2005” and “2011”: The first-phase cluster analysis is to identify outliers and the second-phase cluster analysis is to determine the number of the clusters. Results from the third-phase cluster analyses are presented in this chapter.

Each cluster is named after its relative position to others. Group 1, 2, and 3 are those that are close to each other. Among those three groups, the upper right group is named Group 1, the lower left group is Group 3, and Group 2 is located between Group 1 and Group 3. Group 4 and Group 5 are those groups that are far from Group 1, 2, and 3. As an exception, these rules do not apply to clusters in the dataset “2005” due to unique positioning of groups compared to other dataset.

6.2.1. Dataset “Combined”

Information of the firms both from year 2005 and 2011 is included in the dataset “Combined”. Firms in the dataset “Combined” were divided into five groups by cluster analysis after eliminating outliers identified in second-phase cluster analysis.

According to results in Figure 6-2, majority of firms belong to Group 1, 2, and 3 which unit prices range from approximately €150 to €300. Among these groups, Group 1 has higher value-added share in proportion to the whole sale. Firms in Group 2 have higher unit prices than Group 3 and the share of value-added is slightly higher in Group 2 than Group 3. Group 4 is high in both unit price and share of value-added whereas Group 5 is low on unit price and a little bit higher value-added share than the average.

To limit the comparison among Group 1, 2, and 3, which comprise the majority of the population, ROI differs significantly at 10% significance level, although no evidence is found among all five groups. Group 1 achieves the highest ROI and Group 3 the lowest. Growth is the highest in Group 1, but it seems no logical order in other groups. Equity Ratio is also the
highest in Group 1 followed by Group 2 and then Group 3 among the three. Quick Ratio is the lowest in Group 1 among the three groups.

In order to assess whether Group 1 is unique from other groups, Group 1 is compared to Group 2 and Group 3 in the dataset “Combined”. As a result, the number of employees, investment, and investment (-1) are additionally found to be different between Group 1 and other two groups as well as Value-adding efficiency and Material, which are also found different among all clusters. In contrast, no statistical evidence is found that Unit price and Share of Value-added differ between Group 1 and other two.

Among whole population after trimming, member sawmills in Group 4 and 5 differ from the sawmills in Group 1, 2, and 3. Both Group 4 and 5 are in the same unit price range, but varies significantly on the share of value-added, and their ROI is well above the average of the population, although Quick Ratio and Growth are the lowest among all.

![Figure 6-2. The relative position of clusters in the dataset “Combined”](image)

Each dot represents the value of ROI for each company.
**Table 6-4. Average values of Clusters in Dataset "combined" (standard errors in parentheses)**

<table>
<thead>
<tr>
<th>Clusters</th>
<th>Cl. 1 (n = 5)</th>
<th>Cl. 2 (n = 15)</th>
<th>Cl. 3 (n = 6)</th>
<th>Cl. 4 (n = 2)</th>
<th>Cl. 5 (n = 3)</th>
<th>Total (n = 32)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cluster Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Price ***</td>
<td>247.878 (32.960)</td>
<td>243.285 (23.971)</td>
<td>179.280 (22.149)</td>
<td>479.532 (28.542)</td>
<td>66.066 (21.82)</td>
<td>230.153 (88.392)</td>
</tr>
<tr>
<td>Share of Value-added ***</td>
<td>0.241 (0.056)</td>
<td>0.121 (0.029)</td>
<td>0.088 (0.032)</td>
<td>0.336 (0.088)</td>
<td>0.208 (0.084)</td>
<td>0.155 (0.082)</td>
</tr>
<tr>
<td><strong>Sawmill description</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of employees [***]</td>
<td>119.600 (133.100)</td>
<td>61.313 (44.176)</td>
<td>50.167 (49.962)</td>
<td>31.000 (19.799)</td>
<td>38.333 (13.503)</td>
<td>64.281 (55.809)</td>
</tr>
<tr>
<td>Value-adding efficiency [**]</td>
<td>0.457 (0.218)</td>
<td>0.351 (0.066)</td>
<td>0.280 (0.069)</td>
<td>0.633 (0.138)</td>
<td>0.359 (0.17)</td>
<td>0.369 (0.14)</td>
</tr>
<tr>
<td>Material [***]</td>
<td>0.759 (0.056)</td>
<td>0.879 (0.029)</td>
<td>0.912 (0.032)</td>
<td>0.664 (0.088)</td>
<td>0.792 (0.084)</td>
<td>0.845 (0.082)</td>
</tr>
<tr>
<td>Salary [***]</td>
<td>0.146 (0.024)</td>
<td>0.079 (0.017)</td>
<td>0.075 (0.03)</td>
<td>0.258 (0.13)</td>
<td>0.124 (0.034)</td>
<td>0.104 (0.058)</td>
</tr>
<tr>
<td>Investment [*]</td>
<td>0.084 (0.072)</td>
<td>0.035 (0.051)</td>
<td>0.035 (0.035)</td>
<td>0.047 (0.058)</td>
<td>0.173 (0.299)</td>
<td>0.056 (0.099)</td>
</tr>
<tr>
<td>Investment (-1) [***]</td>
<td>0.304 (0.536)</td>
<td>0.024 (0.022)</td>
<td>0.058 (0.034)</td>
<td>0.028 (0.011)</td>
<td>0.050 (0.061)</td>
<td>0.079 (0.222)</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROI</td>
<td>7.000 (7.514)</td>
<td>2.450 (3.947)</td>
<td>-1.683 (6.048)</td>
<td>8.050 (5.445)</td>
<td>4.667 (4.858)</td>
<td>2.944 (6.455)</td>
</tr>
<tr>
<td>Quick Ratio</td>
<td>0.760 (0.416)</td>
<td>0.881 (0.832)</td>
<td>0.883 (0.44)</td>
<td>0.350 (0.071)</td>
<td>0.533 (0.404)</td>
<td>0.797 (0.651)</td>
</tr>
<tr>
<td>Growth</td>
<td>9.940 (7.454)</td>
<td>0.781 (7.005)</td>
<td>5.987 (17.548)</td>
<td>-4.450 (3.182)</td>
<td>-2.233 (3.6)</td>
<td>2.463 (9.863)</td>
</tr>
</tbody>
</table>

*** Significantly different among clusters (p < 0.01)
** Significantly different among clusters (p < 0.05)
* Significantly different among clusters (p < 0.10)

Inside square bracket [] is the results of comparison between Cl. 1 and Cl. 2 and Cl. 3 combined.
6.2.2. Dataset “2005”

After eliminating outliers, 12 firms in dataset “2005” were categorized into three clusters (Figure 6-3). Comparing to results from the dataset “Combined” and the dataset “2011” identified further in detail, naming of clusters in the dataset “2005” differs due to the unique relative position of firms in the dataset “2005”. Clusters are named as follows. Group 3 has lower unit price but relatively high value-added share. Group 2 and 3 have relatively similar unit price, but Group 1 has considerably higher share of value-added.

The results in Table 6-5 show that only Material differs among groups at 1% statistical significance level. Group 2 has the highest Material and the lowest Value-adding Efficiency and Salary among the groups on average. Group 3 has the completely opposite characteristics of Group 3, in other words, its Value-adding Efficiency and Salary is the highest and Material is the lowest among the groups. Group 1’s characteristics are in the middle of those two. As for investments, Group 1 is the highest and Group 3 the lowest.

When compared to Cluster 2 and Cluster 3 combined, Cluster 1 is different in terms of Unit Price, the number of employees, Investment, and Investment (-1).

Although any variables of performance differ among the group significantly, Group 3 has the highest ROI and Group 1 the lowest. In contrast, Group 1 is the highest and Group 3 is the lowest in Growth and Equity Ratio.
**Figure 6-3.** The relative position of clusters in dataset “2005”
Each dot represents the value of ROI for each company

<table>
<thead>
<tr>
<th>Clusters</th>
<th>Cl. 1 (n = 5)</th>
<th>Cl. 2 (n = 5)</th>
<th>Cl. 3 (n = 2)</th>
<th>Total (n = 12)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Cluster Variables</th>
<th></th>
<th>Unit Price</th>
<th>Share of Value-added</th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 5)</td>
<td>(24.52)</td>
<td>(0.025)</td>
<td>(0.026)</td>
<td>(64.126)</td>
</tr>
<tr>
<td>Unit Price <strong><em>[</em>]</strong></td>
<td>216.387</td>
<td>238.534</td>
<td>77.687</td>
<td>202.498</td>
<td></td>
</tr>
<tr>
<td>Share of Value-added**</td>
<td>0.158</td>
<td>0.094</td>
<td>0.164</td>
<td>0.132</td>
<td></td>
</tr>
<tr>
<td>Sawmill description</td>
<td></td>
<td></td>
<td></td>
<td>(0.041)</td>
<td></td>
</tr>
<tr>
<td># of employees[***]</td>
<td>109.400</td>
<td>32.600</td>
<td>38.500</td>
<td>65.583</td>
<td></td>
</tr>
<tr>
<td>Value-adding efficiency</td>
<td>0.409</td>
<td>0.348</td>
<td>0.437</td>
<td>0.388</td>
<td></td>
</tr>
<tr>
<td>Material***</td>
<td>0.842</td>
<td>0.096</td>
<td>0.836</td>
<td>0.868</td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>0.099</td>
<td>0.061</td>
<td>0.104</td>
<td>0.084</td>
<td></td>
</tr>
<tr>
<td>Investment [*]</td>
<td>0.054</td>
<td>0.020</td>
<td>0.000</td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td>Investment (-1)[*]</td>
<td>0.055</td>
<td>0.022</td>
<td>0.015</td>
<td>0.035</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROI</td>
<td>4.740 (5.379)</td>
<td>5.400 (5.393)</td>
<td>6.850 (4.313)</td>
<td>5.367 (4.834)</td>
<td></td>
</tr>
<tr>
<td>Quick Ratio</td>
<td>0.900 (0.274)</td>
<td>1.180 (1.469)</td>
<td>0.650 (0.495)</td>
<td>0.975 (0.935)</td>
<td></td>
</tr>
<tr>
<td>Equity Ratio</td>
<td>37.500 (9.902)</td>
<td>31.920 (33.575)</td>
<td>18.350 (8.273)</td>
<td>31.983 (22.348)</td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>4.880 (6.836)</td>
<td>2.640 (16.257)</td>
<td>-4.050 (2.475)</td>
<td>2.458 (11.137)</td>
<td></td>
</tr>
</tbody>
</table>

*** Significantly different among clusters (p < 0.01)
** Significantly different among clusters (p < 0.05)
* Significantly different among clusters (p < 0.10)

Inside square bracket [] is the results of comparison between Cl. 1 and Cl. 2 and Cl 3 combined.
6.2.3. Dataset “2011”

After eliminating three firms that appear extraordinary, remaining 17 firms were clustered into four groups (Figure 6-4). Group 4 has extremely low unit price and high value-added share. Group 1, 2, and 3 seem to be on a right up line, Group 1 being on the top right on the line, meaning higher unit price and share of value-added, and Group 3 being left down on the line.

Material, salary, and investment are found to differ significantly among groups at 1% statistical significance level. Value-adding efficiency is the highest in Group 1 and lowest in Group 4. Group 4 seems an outlier that the primary cluster analysis did not identify as it only consists of one firm and its Value-adding efficiency is lowest although it has the highest share of value-added.

Material is highest in Group 3 and the lowest in Group 4 and second lowest in Group 1. Salary is the highest in Group 4, the second highest in Group 1, and the lowest in Group 3. Investment is the highest in Group 4 followed by Group 1, and investment (-1) is the highest in Group 1. Although Group 4 seems extraordinary, Group 1, 2, and 3 has characteristics that can be predicted by their relative position on Figure 6-4.

Group 1 is significantly larger in the number of employees and investment (-1) than Group 2 and Group 3 combined. However, no evidences are found for other variables to differ.

No performance variables have significant differences among groups. Among Group 1, 2, 3, Group 1 and Group 3 have the highest and lowest ROI respectively as predicted by its relative positions on Figure 6-4. Again, Growth is the highest in Group 1.
Figure 6-4. The relative position of clusters in dataset “2011”. 
Each dot represents the value of ROI for each company.

Table 6-6. Average values of clusters in "2011" after trimming (standard errors in parentheses)

<table>
<thead>
<tr>
<th>Cluster Variables</th>
<th>Clusters</th>
<th>Cl. 1 (n = 3)</th>
<th>Cl. 2 (n = 8)</th>
<th>Cl. 3 (n = 5)</th>
<th>Cl. 4 (n = 1)</th>
<th>Total (n = 17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Price ***</td>
<td></td>
<td>254.733 (25.814)</td>
<td>247.335 (26.978)</td>
<td>183.207 (31.431)</td>
<td>42.822 (0)</td>
<td>217.749 (90.234)</td>
</tr>
<tr>
<td>Share of Value-added ***</td>
<td></td>
<td>0.227 (0.025)</td>
<td>0.123 (0.028)</td>
<td>0.083 (0.025)</td>
<td>0.296 (0)</td>
<td>0.14 (0.068)</td>
</tr>
<tr>
<td>Sawmill description</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of employees[***]</td>
<td></td>
<td>115.667 (157.052)</td>
<td>77.250 (54.936)</td>
<td>38.600 (22.909)</td>
<td>38 (0)</td>
<td>69.765 (73.243)</td>
</tr>
<tr>
<td>Value added efficiency</td>
<td></td>
<td>0.329 (0.121)</td>
<td>0.330 (0.065)</td>
<td>0.252 (0.067)</td>
<td>0.204 (0)</td>
<td>0.300 (0.082)</td>
</tr>
<tr>
<td>Material***</td>
<td></td>
<td>0.773 (0.028)</td>
<td>0.877 (0.028)</td>
<td>0.917 (0.028)</td>
<td>0.704 (0)</td>
<td>0.860 (0.088)</td>
</tr>
<tr>
<td>Salary***</td>
<td></td>
<td>0.141 (0.03)</td>
<td>0.082 (0.012)</td>
<td>0.081 (0.025)</td>
<td>0.163 (0)</td>
<td>0.097 (0.034)</td>
</tr>
<tr>
<td>Investment***</td>
<td></td>
<td>0.078 (0.068)</td>
<td>0.036 (0.045)</td>
<td>0.026 (0.038)</td>
<td>0.518 (0)</td>
<td>0.069 (0.125)</td>
</tr>
<tr>
<td>Investment (-1)[***]</td>
<td></td>
<td>0.438 (0.71)</td>
<td>0.024 (0.02)</td>
<td>0.041 (0.031)</td>
<td>0.120 (0)</td>
<td>0.113 (0.207)</td>
</tr>
<tr>
<td>Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROI</td>
<td></td>
<td>3.500 (4.626)</td>
<td>0.339 (5.701)</td>
<td>-3.760 (1.404)</td>
<td>0.300 (0)</td>
<td>-0.912 (5.371)</td>
</tr>
<tr>
<td>Quick Ratio</td>
<td></td>
<td>0.567 (0.378)</td>
<td>0.700 (0.302)</td>
<td>0.840 (0.518)</td>
<td>0.300 (0)</td>
<td>0.694 (0.38)</td>
</tr>
<tr>
<td>Equity Ratio</td>
<td></td>
<td>27.600 (11.678)</td>
<td>28.025 (24.38)</td>
<td>25.060 (28.82)</td>
<td>47.700 (0)</td>
<td>28.235 (22.62)</td>
</tr>
<tr>
<td>Growth</td>
<td></td>
<td>10.633 (12.263)</td>
<td>2.013 (5.088)</td>
<td>0.380 (11.527)</td>
<td>1.400 (0)</td>
<td>3.018 (9.24)</td>
</tr>
</tbody>
</table>

*** Significantly different among clusters (p < 0.01)
** Significantly different among clusters (p < 0.01)
* Significantly different among clusters (p < 0.10)

Inside square bracket [] is the results of comparison between Cl. 1 and Cl. 2 and Cl. 3 combined.
6.2.4. Throughout all the dataset

Table 6-7. Summary of variables that are significantly different in cluster analyses

<table>
<thead>
<tr>
<th>N after trimming</th>
<th>Variables that significantly differ among groups</th>
<th>What group1 is unique from other groups</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined</td>
<td>Price, Share of Value Added, Value Added Efficiency, Material, Salary</td>
<td># of Employees, Value Added Efficiency, Material, Investment, Lagged Investment</td>
<td>ROI is significantly higher in Group1 compared to Group2 and 3</td>
</tr>
<tr>
<td>Dataset 2005</td>
<td>Price, Share of Value Added, Material</td>
<td>Price, # of Employees, Investment, Lagged Investment</td>
<td>Different relative position of groups</td>
</tr>
<tr>
<td>Dataset 2011</td>
<td>Price, Share of Value Added, Material, Salary, Investment</td>
<td># of Employees, Lagged Investment</td>
<td></td>
</tr>
</tbody>
</table>

Throughout cluster analysis, characteristics of firms such as Value-adding efficiency, Material, and Salary were found to be significantly different among clusters. Generally, Value-adding Efficiency and Salary is the highest in Group 1 and the lowest in Group 3, and the order reverses in the case of Material.

Although no significant differences among groups were found for the number of employees, the number is always the largest in Group 1 followed by Group 2 and Group 3 in all the results. At least the number of employees in Group 1 is always found to be different from that of Cluster 2 and Cluster 3 combined.

In addition, investment and lagged investment in Cluster 1 often differ significantly compared to the other two. The lagged investment seems differ more between Cluster 1 and the other two than investment in the current year.

As for performances, no evidence is found that they differ between different groups of sawmills. However, there seems certain tendency at least among Group 1, 2, and 3. ROI and Growth is usually the highest in Group 1, followed by Group 2 and Group 3 except for ROI in 2005 and for Growth in the dataset “Combined”. Quick Ratio of Group 1 is often the lowest among Group 1, 2, and 3. Moreover, Quick Ratio of Group 4 and 5 tend to be the lowest among all groups. Equity Ratio of Group 1 is highest followed by Group 2 and 3 except for 2011.

Furthermore, higher unit price seems to be associated with higher share of value-added and vice versa in the dataset “Combined” and in “2011”. In the dataset “2005”, no clear relation between unit price and the share of value-added is found. Nonetheless, there seem certain
groups within which the higher unit price is strongly associated with higher share of value-added.

Although no statistically significant differences in performance among groups are found, it appears that higher value-added coincides with higher performance. A firm with higher unit cost can outperform competitors when it also achieves higher share of value-added.

6.3. Step 4: Regression Analysis (2)

Table 6-8 describes correlation between independent variables of the new models. Because of the availability of dummy variables, the population of variables dramatically decreases to 26, which limits reliability of the model. Among independent variables, Salary and Material (-0.75), Dummy1 and Material (-0.81), Dummy1 and Salary (0.79), and Dummy1 and Dummy2 (-0.58) seem to have linear relationship and suggest the presence of multicollinearity. It is notable that Dummy1 significantly correlates with Salary and Investment (-1) positively and with Material negatively. Meanwhile, the models seem free from autocorrelation as the values of Durbin-Watson statistic are around 2.

Table 6-9 and Table 6-10 summarize the results of multiple linear regression which include dummy variables for information of company groups. Compared to the previous multiple linear regression in Step1 which results are summarized in Table 6-2 and Table 6-3, no signs

Table 6-8. Two-tailed Pearson correlations between the independent variables for the model with dummy variables

<table>
<thead>
<tr>
<th></th>
<th>Value-adding Efficiency</th>
<th>Material</th>
<th>Salary</th>
<th>Investment</th>
<th>Investment(-1)</th>
<th>Dummy1</th>
<th>Dummy2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value-adding Efficiency</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>-0.36**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>0.15**</td>
<td>-0.75**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment</td>
<td>-0.16</td>
<td>-0.43*</td>
<td>0.22</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment(-1)</td>
<td>-0.20</td>
<td>-0.29</td>
<td>0.22</td>
<td>0.28</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy1</td>
<td>0.43*</td>
<td>-0.81**</td>
<td>0.79**</td>
<td>0.36</td>
<td>0.45*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dummy2</td>
<td>0.01</td>
<td>0.30</td>
<td>-0.42*</td>
<td>-0.21</td>
<td>-0.30</td>
<td>-0.58**</td>
<td>1</td>
</tr>
</tbody>
</table>

* Significant at 5% level.
** Significant at 1% level.
of coefficient changed among those that are found to be significant. As for dummy variables, no evidence was found that dummy variables contribute to financial performance except for Dummy1 for Equity Ratio in Table 6-9. Thus, information of strategic groups did not provide any additional or meaningful results in the regressions.

Table 6-9. The estimation results for testing the effects of value-added efficiency seeking Indicators for financial performance of Finnish Sawmills with information of strategic group (standard errors in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>ROI</th>
<th>Quick Ratio</th>
<th>Equity Ratio</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>87.58 **</td>
<td>-6.51 (7.53)</td>
<td>-347.24 (231.96)</td>
<td>185.07 (110.63)</td>
</tr>
<tr>
<td>Value-adding Efficiency</td>
<td>26.58 *** (7.93)</td>
<td>3.75 ** (1.76)</td>
<td>125.64 ** (54.28)</td>
<td>-36.30 (25.89)</td>
</tr>
<tr>
<td>Material</td>
<td>-87.72 **</td>
<td>7.39 (7.32)</td>
<td>385.59 (225.56)</td>
<td>-161.76 (107.58)</td>
</tr>
<tr>
<td>Salary</td>
<td>-222.44 *** (39.29)</td>
<td>-5.30 (8.73)</td>
<td>-213.03 (268.89)</td>
<td>-302.32 ** (128.24)</td>
</tr>
<tr>
<td>Investment</td>
<td>14.83 (14.51)</td>
<td>2.32 (3.22)</td>
<td>171.13 * (99.3)</td>
<td>-2.9 (47.36)</td>
</tr>
<tr>
<td>Dummy1</td>
<td>5.11 (3.32)</td>
<td>0.53 (0.74)</td>
<td>49.26 ** (22.69)</td>
<td>8.64 (10.82)</td>
</tr>
<tr>
<td>Dummy2</td>
<td>-0.22 (1.58)</td>
<td>-0.09 (0.35)</td>
<td>5.62 (10.83)</td>
<td>-5.26 (5.16)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Durbin-Watson Statistic</th>
<th>2.015</th>
<th>2.639</th>
<th>2.592</th>
<th>1.705</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>R²</td>
<td>0.845</td>
<td>0.279</td>
<td>0.383</td>
<td>0.337</td>
</tr>
</tbody>
</table>

* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 6-10. The estimation results for testing the effects of value-added efficiency seeking Indicators for financial performance of Finnish Sawmills with information of strategic group (standard errors in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>ROI</th>
<th>Quick Ratio</th>
<th>Equity Ratio</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>105.9 ***</td>
<td>-10.8 (7.75)</td>
<td>-285 (261.1)</td>
<td>88.26 (114.44)</td>
</tr>
<tr>
<td>Value-adding Efficiency</td>
<td>22.8 * (11.03)</td>
<td>5.87 ** (2.3)</td>
<td>146 * (77.37)</td>
<td>-5.78 (33.91)</td>
</tr>
<tr>
<td>Material</td>
<td>-105 ***</td>
<td>11.45 (7.5)</td>
<td>321.4 (252.68)</td>
<td>-68.1 (110.75)</td>
</tr>
<tr>
<td>Salary</td>
<td>-234 ***</td>
<td>-4.42 (8.34)</td>
<td>-284 (280.99)</td>
<td>-269 (123.16)</td>
</tr>
<tr>
<td>Investment (-1)</td>
<td>4.75 (3.42)</td>
<td>0.43 (0.71)</td>
<td>40.8 (24.01)</td>
<td>10.44 (10.52)</td>
</tr>
<tr>
<td>Dummy1</td>
<td>-0.53 (1.63)</td>
<td>-0.1 (0.34)</td>
<td>3.27 (11.42)</td>
<td>-5.04 (5.01)</td>
</tr>
<tr>
<td>Dummy2</td>
<td>-0.11 (4.41)</td>
<td>1.44 (0.92)</td>
<td>32.89 (30.92)</td>
<td>16.26 (13.55)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Durbin-Watson Statistic</th>
<th>1.971</th>
<th>2.582</th>
<th>2.307</th>
<th>1.588</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>R²</td>
<td>0.838</td>
<td>0.345</td>
<td>0.328</td>
<td>0.393</td>
</tr>
</tbody>
</table>

* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.
7 Discussion

In this chapter, the following topics are covered: 1) main findings, 2) methodologies, 3) connections to the theories, and 4) suggestions for further studies. In the first part, main findings are discussed and then linked with the research questions. The second part examines the characteristics, pros and cons of the methodologies, such as the approaches, statistical methods, and variables that the study employed. Third, the connections between the findings and the theories are discussed. Finally, suggestions for further studies are reflected.

First of all, the purpose of the study was to analyse and reveal the effects of value-adding strategy and cost levels on financial performance of Finnish sawmills on industry wide and strategic group scales. According to regression analysis, the value-adding strategy enhances the financial performance whereas higher cost levels such as high employment and material cost hamper performance the whole industry level. Investments either in the current or the previous years seem irrelevant to value-added and the financial figures. In comparison, the results on cluster analysis revealed that those sawmills with high value-added have high employment cost, yet seem to outperform other firms, suggesting that higher employment cost may not necessarily damage performance. Also, these sawmills with high value-added component have high level of investments especially in the previous year. Unfortunately, not much information on strategic group scale was obtained due to limitation of data.

These results from the regression analysis generally confirm the findings made in earlier studies. As suggested by many scholars (e.g. Bush and Sinclair 1991, Cohen 1992, Cohen and Sinclair 1992, Idassi et al. 1994, Hansen and Juslin 2011, Toivonen et al. 2005) and empirically shown by Roos et al. (2001, 2002) in Sweden, Hansen et al. (2006) in USA, and Lähtinen and Toppinen (2008) in Finland, this study also finds that value-added certainly affects the performance positively for sawmills in Finland. As for cost levels, the results evidently indicate that both employment and material cost negatively influence performances at the industry scale.

The results of this study indicate that value-added affects all the performance figures positively although no statistically significant evidence is found on turnover growth. The lack
of evidence of the effect on growth suggests two possible implications of value-adding strategy as well as just a lack of sufficient data. One is that a firm cannot expect a quick improvement in performance by value-adding strategy since turnover growth signifies an immediate response to a company’s activities from a market, and thus, a firm should implement value-adding strategy as a long-term aim.

Lähtinen and Toppinen (2008) also suggested this implication that value-adding strategy affects performance in the long term, but the reasoning is different. Their results show that value-added affects profitability (ROI), solvency (Equity Ratio), and turnover growth but not liquidity (Current Ratio). They consider profitability as longer-term financial performance, growth as indication of future competitiveness, and liquidity as short-term financial performance, and thus conclude the effect of value-added is relatively longer term. Although the base of the idea in this study and the previous one differs, the message is essentially the same.

Another possibility deduced from the results is that value-added can improve performance without increasing turnover because value-adding strategy does not affect growth. The results suggest that a firm can materialize higher profit and enhance the performance without increasing the total revenue, if value-adding strategy is successfully implemented.

As for the cost side, employment cost is found to affect all the performance figures with high statistical significance and their effect is generally larger than impacts of material cost. Thus, salary is a very important factor for the sawmill firms. Material cost explains profitability (ROI), Growth, and liquidity (Quick Ratio) well whereas its effect on solvency (Equity Ratio) was not found. This suggests that the level of material cost is critical for direct and immediate market performance and cash flow rather than the internal control of finance in a firm, namely solvency.

Considering the results from step 2, cluster analysis revealed an interesting reality in the industry. Figure 6-2, 6-3, and 6-4 depict a strong linear relationship between unit price and the share of value-added for the majority of firms. The higher the price is, the more value-added a firm achieves. In the dataset “2005”, each group appears to have different slopes for the linear relationships, suggesting a clear segmentation in the industry exists, for instance, for different products.
It is worth noting that a fitted line by regression analysis for the data in Figure 6-3 would have the negative slope without the information of clusters, although unit price and the share of value-added clearly have a positive correlation inside each cluster. In short, the regression analysis could find the opposite effects in aggregated data from the effects that were found in smaller groups. This is known as Simpson paradox, which is named after Simpson (1951). The paradox refers to a phenomenon where an apparent effect of a variable in small groups in data can appear reversed in aggregate data. The paradox disappears if a model includes a necessary variable. In the case of Figure 6-3, the necessary information is that of strategic groups.

As for the results of cluster analysis made in this study, it is fair to consider these clusters as strategic groups. A strategic group in an industry shares similar business models or strategy combinations, and the criteria used in the analysis can identify strategic groups. As discussed in Chapter 3, identifying strategic groups should not rely on the performance of companies. Value-added share is defined as the sum of operating margin and personnel expenses. Hence, the criterion includes performance, or a result of business operation by definition. Nonetheless, the criterion is essentially an indicator of value-adding strategy. In addition, it seems value-added is more influenced by salary than the operating margin. Therefore, the share of value-added is a valid criterion for the analysis and clusters identified by the analysis can be considered as strategic groups.

Comparing each cluster in Step 3 clarifies their characteristics. Among six variables as profile of clusters assessed: the number of employees, value-adding efficiency, material, salary, investment, and lagged investment. The upper right groups are generally higher in the number of employees, value-adding efficiency, salary, and investments, and lower in material cost. Considering the definition of value-added, which is the sum of operational margin and employment cost in principle, it is reasonable to assume higher value-added coincides with higher salary.

The number of employees is larger in the upper right groups, suggesting larger firms tend to choose more value-adding activities, although no evidence is found that the number differs among all the clusters. At least the firms in Group 1 are significantly larger in terms of the number of employees compared to firms in Group 2 and 3.
Investments are always found to be the highest in Group 1 among groups that comprise the majority, although the differences among groups are statistically significant only in the dataset “2011”. Compared with firms in Group 2 and 3, those in Group 1 invest significantly more, especially investments in the previous year. Because an investment is one manifestation of value-adding strategy, the results support the earlier finding from comparing performances of different cluster. In short, value-added can enhance the performance and affect the long term.

In the previous studies, there have been conflicting results regarding whether larger firms invest more in value adding activity. Niemalä and Smith (1997) in North America and Lähtinen and Toppinen (2008) in Finland confirmed it whereas Roos et al. (2001, 2002) and Brege et al. (2010) in Sweden denied it. Confirming the suggestion of Lähtinen and Toppinen (2008), the results of the current study weakly support that larger firms implement more value-adding activity in Finland. Regional differences might explain why this is the case as Niemelä and Smith (1996) found that regional differences affect what strategies a firm chose on a collective level. It might be the case that some factors exist that prevent large firms from choosing value-adding strategy in Sweden.

As for performances, Group 1 (i.e., the ones with higher unit price and the value-added component) generally outperformed other groups that constitute the majority of the datasets in all performances but liquidity, although no statistical evidence is found that performance differ among groups. The variables in which Group 1 is the highest are the number of employees, value-adding efficiency, salary, investment, ROI, Equity Ratio and Growth. Meanwhile, material cost is always the lowest in Group 1.

It is worth noticing that liquidity in Group 1 is not very high in any datasets whereas other performance measures tend to be the highest in the group. The higher value-added may require constant investments in resources, which might cause the relatively lower liquidity compared to other groups.

Due to the limited population, the regression analysis with information of strategic group in Step 4 was unable to provide much meaningful information regarding the effects of value-added and cost levels contingent to strategic groups. Nonetheless, the correlation
analysis as a preliminary test for the regression analysis revealed that the dummy variable for Group 1 is strongly correlated with employment cost and lagged investment positively and with material negatively. This suggests that the group with high value-added pays more salaries to their employees, invest more, and the proportion of their material cost to its unit price is very low, which confirms the findings from Step 3.

The purpose of executing both regression and cluster analysis was to shed light on the different effects of variables at the whole industry and at strategic groups levels. Some results indicated that the effects of strategies are similar in both cases. One of the strongest effects found in both analyses is the effect of value-added. The regression analysis found that value-added strongly impacts financial performances positively. Comparing the performances of clusters also indicate value-added enhances performance. Its longer time scale in which to affect performances is also acknowledged in both analyses.

Effects that are found to be different between regression analysis and cluster analysis are employment cost and investments. Employment cost is found to strongly damage performance in the regression analysis, whereas clusters with higher employment cost generally outperformed others. The effects of investments are only found on liquidity and solvency, but not on profitability and growth. Nevertheless, groups with higher profitability often invest significantly more than firms in other groups.

Both employment cost and investment consist of two components which in nature are supposed to have opposite impacts on performance. Basic costs and necessary spending, such as simple labour cost in employment cost or machine repair and maintenance costs in investment, is one part which has a negative effect on performance. Unnecessarily high basic costs hamper performance. Another part with positive effect is an extra cost or additional spending to enhance the performance, typically spent to add value. Examples of this part include training and welfare for employee in employment cost and spending in the state of art technology and machinery or additional processes in investments. These two components are mixed up in the financial figures and it is impossible to distinguish the individual proportions for each of these.

Cluster analysis revealed the positive effects of salary and investment on performance that regression analysis did not find. The suggestions from Step 2 and Step 3 are less reliable
especially on performance due to the limitation of data availability and the structure of methodology. However, it is still worth discussing the different suggestions that two analyses revealed. At least, it is safe to conclude that salary is mainly composed of the “basic cost” because of the overall negative effect on the performances and that the effect of investment is subtle.

These three explanations discussed below might account for why cluster analysis and comparing clusters find positive effects of salary and of investment, of which the third explanation seems most plausible. Firstly, the regression analysis is trapped by Simpson’s paradox. However, this is not the case because comparing clusters in Step 3 is merely comparing the averages of clusters instead of comparing the effects of variables among member companies in each cluster. In short, Step 3 does not assess the effects of variables in small groups, and therefore, Simpson’s paradox is irrelevant.

Secondly, the trimming process in cluster analysis omits factors that disturb regression analysis. The way of identifying outliers in the second-phase cluster analysis is unique because it takes into account the relative position in two variables, compared to that of regression analysis, which simply omits cases with extraordinary values. Nonetheless, this explanation is not plausible. This is because outliers identified in the second-phase cluster analysis are few compared to the population. Regression analysis finds very strong evidence that salary negatively influences performance, which means these few outliers should not matter much, and the second explanation is implausible.

Finally, the third explanation is that cluster analysis separated those two components of costs in the process of forming clusters. In other words, companies with relatively more negative components of costs were filtered out from Group 1 and those with positive components of costs were concentrated in Group 1. A firm with high employment or investment cost can be either spending extra cost intentionally or suffering from high basic cost due to inefficiency. Regression analysis ignores the nature behind the costs and treats them alike. On the contrary, cluster analysis can take into account the differences by grouping firms based on a certain set of criteria. In this study, the high cost with mixed underlying factors are separated by classifying firms on its level of value-added and unit price, and thus, the positive effect of employment and investment cost on performance is revealed in Group 1.
To sum up the findings, the research questions presented in Chapter 2 shall be addressed. The first half of the answer to the question 1) is obvious. The results evidently indicate that value-adding strategy does impact the performance and its effect is positive. In addition, the effect of value-adding strategy is in relatively the long run. Cost levels influence performances negatively in general, but the value-creating component of salary seems to improve performances. More detailed data is required to distinguish the two opposing effects of salary on performances.

The last question remains unanswered due to lack of data. In order to answer the question, a model of regression analysis should include information about to which strategic group a firm belongs. Nonetheless, the availability of production information limits the population and necessary analysis cannot be performed.

Second, the characteristics, pros and cons of the methodology that the study employed need to be discussed. The datasets employed in this study were quantitative with extensive financial data as well as information on the production of Finnish sawmills companies. Data from financial statements and balance sheets are extremely useful. Because these quantitative data measure many aspects of firms in an objective way, comparison of firms is reliable. In contrast, quantitative data such as answers to interviews necessarily involve subjective perspectives. In addition, the data are compatible with any other firms in other countries and industries, although differences in the environment in which a firm operates should be taken into account.

One major drawback of financial data is that it cannot assess any characteristics that are not in financial statements or balance sheets such as intangible assets, e.g. know-how, and operational information, e.g. production amount, although approximation is not impossible. In addition, it is worth noticing that the financial figures and market share are “hard”, meaning accurate and precise, but historical whereas customer surveys such as customer satisfaction and loyalty are future oriented but “soft” as West et al. (2010) discuss.

It would be beneficial to combine both quantitative and qualitative data in the further studies. For example, comparing results of interview with those quantitative data that is used in the study would reveal new facts and suggest new advice to managers in the industry. The interview can involve companies, customers, and other stakeholders. For example, active
enrolment in CSR and detailed description of resources can be obtained from companies, customer perception about companies from customers, and more from other stakeholders. It is very beneficial because these data is strongly required to assess effects of resources based on RBV.

In this study, both multiple regression and cluster analysis were employed and it turned out that they could complement each other when executed properly. Detailed statistical implications are beyond the scope of this thesis. Hence, the discussion of each analysis in this section focuses on their usage and implication upon analysing the effect of strategies on performance in an industry.

Regression analysis is an appropriate statistical tool to reveal relationships between independent and dependent variables. However, regression analysis can fail when the assumptions are violated. For instance, regression analysis may identify a trend to be positive even though actual trend does not exist, which is known as a spurious relationship. In the case of Simpson’s paradox, the model finds the opposite trend from the real one.

We can avoid Simpson’s paradox and the problem of spurious relationships that is caused by the existence of small different groups by identifying the groups hidden in the aggregate data. It is rational to assume that different groups such as strategic groups exist in an industry and the effect of a variable such as employment cost varies among them. Conversely, these differences among groups have not been emphasized in the previous studies. This study successfully acknowledges the different groups and suggests different effects of variables though regression analysis and cluster analysis.

In this study, performances of a firm were measured from four dimensions of financial performances. ROI is adopted as a profitability measure instead of ROE for the reasons discussed in Chapter 5. It is worth noting that Return on Assets (ROA) might be as good an indicator of profitability as ROI. ROA is the proportion of net income to the average total assets. ROA, thus, includes total capitals that are not included in ROI such as non-interest-bearing external capital. In short, ROA represents efficiency of whole resource usage in a firm whereas ROI indicates the investment efficiency. In addition, ROA is suitable for the sawmill industry because sawmill business does not require many resources that are not counted on balance sheets such as brand value. A negative side of using ROA is that it is
not used in the earlier study by Lähnten and Toppinen (2008) and might impair comparability. Nevertheless, it is worth checking which variable better indicates profitability in further studies.

As for the time scale of performance indicators, it is unclear whether these financial figures describe the success of a firm in different time scale as Lähnten and Toppinen (2008) explained, except for turnover growth which is surely an immediate response from a market which in turn can impact profitability. For instance, liquidity is certainly an important indicator of a firm in a short period, but high liquidity sustained for long term does not necessarily increase Equity Ratio nor ROI in the long run. Thus, discussion on effects of value-added and costs in a different time scale based on significances of effects on these financial figures is refrained from in the study.

In the study, new variables were used to indicate several important characteristics of sawmills. Variables for value-added and unit price are unique and worth discussion. Value-added in this study is “gross value-added” meaning all the value a firm created by transforming raw materials to products, and not “additional value-added” which is extra value a firm creates on top of a commodity product. In principle, “additional value-added” is preferred for assessing value-adding strategy to “gross value-added”. Nonetheless, financial figures cannot indicate “additional value-added”, and this study employs “gross value-added”. It seems “gross value-added” is sufficient approximation for the value-adding strategy, because the clusters with higher value-added indicator have higher salary and investments and lower material cost, all of which indicate these companies in the clusters implement value-adding strategy.

Value-adding efficiency is the proportion of “gross value-added” to the resources that production requires such as factories and machines. This variable worked extremely well. It is good enough to indicate value-adding strategy, but it does not have strong correlation with material cost. Since a variable for material cost has a perfect linear relationship with the proportion of value-added to turnover by definition, value-adding efficiency was indispensable for the study.

Unit price is approximated by dividing turnover, i.e. net sales, by production, either actual production or the production capacity. The figure is essentially the weighted average of all the products of a firm. Since the turnover in Rankingraportti excludes operating income outside
the main sawmill business such as capital gains and lease income, the figure indicates the unit price of products that belong to ordinal business operations. The figure would get close to the real value if products of firms have similar prices. In other words, the figure would be distorted and cannot indicate the unit price correctly if a firm sells variety of products with different prices or even products other than sawnwood such as papers and furniture.

The majority of unit prices are within the range of 150 to 300 €/m$^3$, which seems reasonable compared to the unit price of Finnish exported sawnwood (Figure 1-5). The unit price in 2011 might be underestimated because the production capacity is always larger than the actual production. Although the unit price estimated in this way is not quite accurate, the approximation was adequate since the focus is the relative price in order to classify firms.

The major drawback of this figure is information about the production of a firm is not easily accessible, leaving the total population to be far less. Another is that the figure is only a weighted average of all the products and cannot indicate the real unit price when a firm sells variety of products. Especially if a firm produces products other than sawnwood that have very different price range, the figure might become useless.

In this study, value-adding strategy and cost levels of Finnish sawmills were approached both at the levels of sawmill industry and strategic groups of companies within the industry. In the discussion above, the emphasis is put on clusters with more value-added groups, or Group 1. This implies that the study focuses on those companies with more value-added creation and higher performance. As a result, it reveals new important findings and suggestions. In short, value-added creation enhances the performances and so do some parts of costs.

Nonetheless, these suggestions from the results are limited mainly due to the narrow perspective and the data availability. Firstly, the narrow perspective limits applicability of suggestions. They are vague and not practical enough for managers as a reference for decision-making. As is often the case with research in business and management, the study focuses on what worked well, or what a successful firm did. The study does not pay much attention to those firms that are struggling: why they are struggling, what they can do to improve their performance, and how to implement it. Instead, this study provides an obvious message: adding more value helps in the long run.
Secondly, the data might be biased and restrict the possibility of what analysis can be performed. It seemed the assumptions of multiple linear regression were mostly fulfilled in Step 1, although variables used in Step 4 have strong linear relationship each other, indicating the presence of multicollinearity. Information about production is very limited and restricted the whole population in Step 2, 3 and 4. For example, Step 4 did not reveal the effects of variables inside a strategic group because the population is too small. It compares strategic groups, not firms inside a strategic group. With enough population, regression analysis at each strategic group level would be possible. Besides, the data that represent the whole Finnish sawmill industry would be beneficial as the data in the study may be biased.

Third, although these methodological limitations as presented above, the study provided new findings as discussed in the first part of this chapter and their connection to the theories shall be discussed. As mentioned in chapter 4, larger firms tend to choose cost leadership because they can take advantage of the economy of scales in theory and Niemelä and Smith (1997) supported the idea empirically. Value-added measured in this study include both differentiation and focus strategies in Porter’s language and high level of material cost is an indication of cost leadership. Oppose to the Niemelä and Smith (1997), the results suggest that larger firms, typically grouped in Group 1, choose differentiation and/or focus strategies instead of cost leadership.

Considering the fact that sawmills cannot focus on one generic strategy, large firms combine some of the generic strategies including cost leadership in reality. In this study, material cost is an indication of cost leadership, which must become smaller as the share of value-added increases. Hence, production with cost leadership in a large sawmill was not apparent in the study although they must produce commodity products for a certain degree.

As for small sawmills, the results illustrated two interesting types of sawmills: one with very high value-added and low material cost, typically grouped in Group 4 and Group 5, and another with lower value-added and high material cost, typically grouped in Group 3. Small firms of the former kind are often mapped far from the majority of firms in figures. It appears that these small firms invest more than others do. Although the large firms are concluded to adopt value-adding strategy the most, it might be the case that those small sawmills actually adopt value-adding strategy and invest more than or as much as those firms in Group 1. Since the number of these small firms is low, no statistically significant evident was found that
some small sawmills adopt value-adding strategy. These facts imply that some firms are actively investing in value-added whereas others are not very active in value-added production. The former kind performs well above the average.

Considering the connection with RBV, it seems that value-adding strategy intermediates investment and performance. In other words, investment, which is a representation of resources such as capital and know-how, contribute to implement value-adding strategy, which in turn strengthen performance. Investment, thus, does not improve performance directly as found in Step 1. Other than this finding, little can be discussed in connection with RBV, due to the limitations of the RBV and the quantitative nature of the study. The definition of resources in RBV is tautological and all-inclusive (Priem and Butler 2001), and intangible resources are often very difficult, if not impossible, to assess. Furthermore, RBV assumes that each company has own set of resources and is unique, and thus, meaningful results across the sample can be rarely obtained as Luckett et al. (2009) discussed.

In addition, the quantitative nature of this study made it even more difficult to assess resources in sawmills empirically. Financial figures cannot measure intangible resources. One of a few exceptions is the efficiency measure such as value-added or operation margin per employee. Nevertheless, these efficiency measures gauge merely how much output an employee produces, in other words, an aggregate result of many resources. These efficiency indicators miss so many important resources that employees need to produce output such as art-of-state facilities and good access to materials. Therefore, quantitative research like this study does not provide direct implications for the RBV.

The RBV should be approached qualitatively or both quantitatively and qualitatively, not merely by analysing financial performance unless the focus is financial resources or unless elaborate techniques to gauge resources are found.

Some parts of the study can be applied to either similar or different studies. The methodology that the study employs, especially the combination of regression analysis and cluster analysis, can be applied to other industries too. Some industries are more suitable for the methodology than others for two aspects.

First, the resources required in an industry should be apparent in the balance sheet. In other
words, industries that do not require many intangible resources such as company brand, high
technologies, and skills of sales persons are suitable for analysis with financial data. Second,
the variety and price of products in the industry and a firm should be relatively limited and
homogeneous for the sake of comparison. If the products vary much in kind and price, it
implies that firms must have different sets of resources, which hampers comparability. In
addition, if products of a firm differ significantly in prices, the unit price estimated by
dividing turnover by production cannot be accurate.

The sawmill industry satisfies the both requirements, and therefore, is very suitable for the
methodology. Other such industries tend to be in the upper stream in the value chain and B2B
business such as raw material industries.

Finally, the major suggestion from this study is that two approaches can advance further
studies: more data and careful selection of the focus. First, more data can improve the studies
in two ways. One is that more quantitative data, especially the product amount in the study,
can increase the population of firms analysed and enable us to assess the effects of strategies
at three levels; the whole industry, among strategic groups, and within strategic groups by
including the results of cluster analysis in multiple regression. In this study, the first is done
successfully with multiple linear regression, but not the rest due to limited population of data.

With enough data, the combination of regression analysis and cluster analysis could avoid
Simpson’s paradox and find different effects of strategies depending on strategic groups in
which a firm operates. For example, salary might influence performances positively in a
group with high value-added, but negatively in a group with low value-added which implies
the existence of cost leadership.

Another is that additional qualitative data obtained from interviews can broaden the scope of
the study. As discussed above, these qualitative data includes customer perceptions, CSR and
information about resources.

This study emphasizes value-adding strategy because it seems to be a critical issue in the
industry as discussed in Chapter 1. Either by narrowing its scope or by focusing on different
issues, the study could have provided more meaningful and practical information. On one
hand, focusing on more specific topics in value-adding strategy could be more practical than
the suggestions that this study provides. The narrower topics include what kind of
value-adding strategy is adopted, which type of value-added can improve the performance more, and how a company should implement them. On the other hand, focusing on another topic instead of value-adding strategy could provide new sets of information that have not been studied much earlier. For example, investigating what the main causes of low performance are and how a firm can avoid these causes could shed light on the industry with a new perspective and its message could be very meaningful for managers.
8 Conclusion

The Finnish sawmill industry constitutes an important part of the forest sector which then plays a vital role in Finnish economy and society. Nonetheless, the sawmill industry has been suffering from low performance and loss of shares in world markets. Therefore, this study examined the effects of cost levels and value-adding strategy of which importance has been strongly emphasized in academia around the world.

The study used financial and production data of Finnish sawmills and employed cluster analysis as well as multiple linear regression. Cluster analysis revealed strategic groups in the industry. Together with multiple linear regression that found general effects of the value-adding activity and cost levels at the industry scale, the information of strategic groups revealed positive and yet subtle effects of salary and investment in a certain situation.

The study found that value-adding activity positively impacts performance, especially in the longer term. To implement value-adding strategy, investment is a major method in general. Although investment does not directly improve performance directly, those companies that achieve high value-added and outperform other firms invested significantly more in the previous year. Thus, investment that is meant for value-adding activity, or perhaps together with higher salary which is one component of value-added, can enhance the performance of a firm.

As for the costs side, higher material cost and salary generally hamper performance in the short term as found in previous studies. However, the study found a positive side of salary that improves performance. Although it is impossible to tell which components of salary contribute to performance due to the nature of the data that the study used, the importance of investing in human resource should be acknowledged.

Although the findings discussed above are new and contribute to the academia, the essence of the main findings may appear insignificant for scholars and obvious for managers of firms.
Value-adding strategy has long been emphasized and studied by many scholars as discussed in Chapter 4. Therefore, new perspectives are required to move forward either by focusing on more specific issues or by changing its perspective.
References


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