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Climate for Innovation and Innovation Strategy as Drivers for Success in the Wood Industry: Moderation Effects of Firm Size, Industry Sector, and Country of Operation

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This study examines the relationships between firm financial performance and a) the climate for innovation and b) innovation strategy in the wood products industry. The focus is on the moderator effects of firm size, country of operation, and industry sector. Using a sample of 460 responses from chief executive officers and top managers of Norwegian and US firms, we conducted a regression analysis to probe for interaction effects. The sample included primary and secondary manufacturers of various sizes. Consistent with previous studies, we found a positive impact for both a climate for innovation and an innovation strategy on firm performance. In terms of moderation, only one interaction was found to be significant, representing a moderator effect of industry × size on the climate-performance relationship. Further testing showed that secondary, large manufacturers exhibited a weaker, yet still positive, relationship between climate for innovation and performance. This low level of significant interactions suggests stability of the relationship among the main factors depicted in the model, with important implications for managers and future research. These findings indicate that a positive climate for innovation and a management committed to innovation through an innovation strategy have a positive effect on the bottom line of wood products firms. This effect holds true regardless of industry, size, or country, so most firms can benefit from the implementation of these pro-innovation practices.

Keywords comparative management, innovations, organisational culture, strategy, wood industry, working climate
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1 Introduction

Recent decades have seen an increased focus on innovation and performance (Damanpour 1987, Garcia 2002, Rogers 2003, Tidd and Bessant 2009). Much of the extant work focuses on the manufacturing wood industry and forest sector (Bull and Ferguson 2006, Crespell et al. 2006, Hansen et al. 2006, Schaan and Anderson 2002, Stendahl 2009, Tykkä et al. 2010). The literature is consistent with respect to both the forest sector and the general industry, showing that enhanced levels of innovation or innovativeness positively impact performance (Calantone et al. 2002, Han et al. 1998, Hult et al. 2004, Wheelwright and Clark 1992), even in small firms (Nybakk 2009, Nybakk et al. 2008).

Less attention has been directed in the forest products marketing and economic literature towards innovation strategy, with a priority given to innovation and a climate conducive to innovation. However, several studies have been conducted in other industries on innovation strategy (Akman and Yilmaz 2008, Fruhling and Siau 2007, Jenssen and Randøy 2006) and the climate for innovation (Amabile et al. 1996, Deshpandé and Farley 2004, Ekvall 1996). A relationship has been found between innovation strategy and the climate for innovation with respect to the wood products industry (Crespell and Hansen 2008b, Crespell and Hansen 2009, Nybakk and Jenssen 2011). However, most research to date has been conducted in very different settings than, for example, the small-scale primary wood products industry in Scandinavia (e.g. Fruhling and Siau 2007, Jenssen and Randøy 2006). To the authors' knowledge, research that applies to primary, small-scale industry is absent.

Lee et al. (2000) compared Korea and the US to study differences in organisational characteristics in new product development. They emphasised the importance of country-specific factors that influence the success of innovation, and stressed that research results from one country should be applied to other countries with caution. In this study, we investigate how the relationships between innovation strategy, the climate for innovation and firm performance are affected by country of operation (here, Norway and the US), size (small and large firms) and industry type (primary and secondary wood products industries). Based on the following objectives, we present findings with managerial implications. We aimed to Identify the moderating roles of firm size, country, and industry sector on firm financial performance with respect to climate for innovation and innovation strategy. By doing so, we seek to validate the consistency of the impact of climate for innovation and innovation strategy on firm financial performance.

We sought to evaluate whether the theoretical model developed for 1) the US, 2) large firms and 3) secondary industry related to innovation strategy and climate for innovation may be generalised to, for example, the small, primary wood products industry in Scandinavia.

2 Theoretical Background

2.1 Theoretical Framework of the Study

Schumpeter (1934) understood technological innovation as a new product/service or a new production process and the strategic advantages and increased performance this created for a firm. Soon after a new product, service or production process was invented, the entrepreneur had a strategic advantage that lasted until someone else adopted it or developed something newer and better. This process cycles as yet another innovation enters the market to gain a strategic advantage. Something new is created, which renders the other product or process obsolete, a process Schumpeter called 'creative destruction'. In this fashion, innovative wood products firms are constantly striving for new and better products, processes, and ways to manage their business processes.

Climate for innovation and innovation strategy are two key components of an innovative firm. The constant search for new and better products, services, and management processes is not merely for adventure's sake. Instead, it is done because managers believe, and the literature shows, that innovative firms are superior performers (Han et al. 1998, Hult et al. 2004). An innovation is a new or improved product, process or business

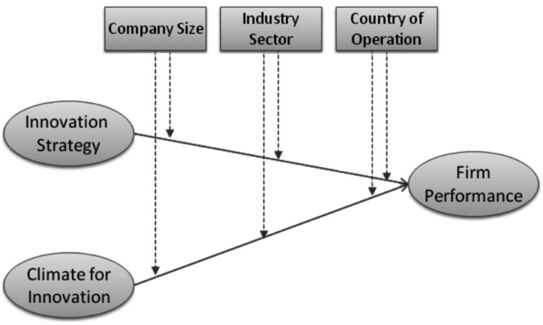

Fig. 1. Theoretical framework of the study.

system while innovativeness is described as the propensity to create and/or adopt new products, processes, and or business systems (Knowles et al. 2008). Innovativeness can be seen as a cultural attribute that captures the openness to new ideas and, hence, an organization's orientation towards innovation (Hurley and Hult 1998). Climate for innovation is the observable manifestation of a pro-innovation culture and has a positive impact on innovation as does innovation strategy (Crespell and Hansen (2008b). Wood products industry firms tend to be oriented towards production (Nord 2005) and many firms find it difficult to shift gears from a focus on operational effectiveness to the pursuit of other types of innovation (Anthony et al. 2008).

In this paper, we hypothesized that *innovation strategy* and *climate for innovation* have a positive impact on *firm performance* and that *firm size*, *industry sector* and *country of operation* moderate this relationship (Fig. 1).

2.2 Climate for Innovation

Climate for innovation refers to the organisational climate that fosters innovation. Climate consists of the "behaviours, attitudes and feelings which are characteristic of life in the organisation" (Ekvall 1996). Climate is less stable than culture and can be seen as the manifestation of culture at a specific point in time. Climate can have a positive effect on creativity in an organisation (Amabile et al. 1996, Cooper et al. 2004). An organisation's creativity comes from employees, and climate is important for their motivation. Crespell and Hansen (2008a) conducted a case study on work climate and its relation to innovativeness in a small secondary wood product firm in the US. They found six factors associated with pro-active innovation: supervisor encouragement, team cohesion, challenge, autonomy, openness to innovation and availability of resources. The scale was further refined and validated in a quantitative study (Crespell and Hansen 2008b). Several scholars have documented a positive relationship between an innovative climate and performance (e.g. Deshpandé and Farley 1999, Deshpandé and Farley 2004, Deshpandé et al. 1993).

2.3 Innovation Strategy

There are several definitions of *innovation strategy* in the literature (Akman and Yilmaz 2008, Fruhling and Siau 2007, Jenssen and Randøy 2002). In the most generic sense, *innovation strategy* means creating clear targets and tactics that guide personnel (Anthony et al. 2008). Zahra and Das (1993) studied manufacturing firms and distinguished among four dimensions: an orientation of the firm towards innovation leadership, types of innovation, sources of innovation and level of investment in innovation. Durmusoglu et al. (2008) referred to new product-development strategy simply as product innovation. Similarly, we use the term *innovation strategy* as the priority given within a firm to various forms of innovation (Crespell and Hansen 2008b). Therefore, we use four dimensions: 1) leadership priority for product innovation, 2) leadership priority for process innovation, 3) leadership priority for business-systems innovation and 4) resource commitment to research and development (R&D) to gain competitive advantage. Previous studies have shown that firms with an *innovation strategy* perform better (Fruhling and Siau 2007, Jenssen and Randøy 2006, Zahra and Das 1993), however, some studies have reported mixed results (Jenssen and Åsheim 2010). We include *innovation strategy* to account for those managerial actions relevant to the effective implementation of innovations (Klein and Knight 2005).

2.4 Country, Industry Sector and Firm Size

Despite a large body of literature on the *climate for innovation* and its effect on innovation and economic performance, little research has been done relating to the wood products industry. Accordingly, there are no studies known to the authors examining how the effects of the *climate for innovation* and *innovation strategy* on *firm performance* are moderated by *country of operation*, *industry type*, and *firm size*.

Firm Size: Large firms are endowed with resources that their smaller counterparts cannot afford (Acs and Audretsch 1988), and they can tolerate more unsuccessful attempts at innovation (Damanpour 1987). Most important are slack resources, those extra resources that can be applied to, for example, creativity and innovative projects (Armojur and Teece 1980, Kimberly and Evanisko 1981). Slack resources primarily consist of time or money. Some of the firms most noted for innovation (e.g., 3M and Google) have a policy that a certain amount of time for each employee should be set aside for creativity. This is something that large firms are better situated to do than small firms. Large firms, because of their extended employee base, are also better placed for innovation because of the higher probability of the presence of specialised and diverse knowledge and expertise. McDade et al. (2002) argued that there is a U-shaped relationship between innovation adoption and firm size, with a higher probability of the early adoption of incremental and semi-radical product innovation among large firms. However, this effect of size is reduced with respect to radical innovations. With strategy implementation, larger firms may be better positioned because they are likely to have specialists in strategic planning and have the firm structure necessary for the efficient implementation of strategies. Because they have more people and more specialists, a large firm can employ a large and diverse network (Forte et al. 2000).

Conversely, large firms also have size liabilities that can discourage creativity and innovation. A commonly cited challenge with large firms is the tendency to create a bureaucracy that stifles innovation. Large firms are not nimble and can be difficult to navigate or slow to exact change. Smaller firms are less bureaucratic (Mohr 1960, Thompson 1967) and can quickly implement new strategies. Furthermore, there will often be a shorter distance from top management to employees, which makes supervisory encouragement and autonomy more realistically achievable (Husso and Nybakk 2010). Small firms also tend to facilitate the upward flow of information.

While small firms do not have the resource endowments of their larger counterparts (Acs and Audretsch 1988, Jenssen 2001, Jenssen and Koenig 2002), they also are not saddled with many of the hurdles to innovation faced by large firms (Pavitt et al. 1987). Larger firms and more capital-intensive firms have a larger potential to implant an ambitious innovation project that will lead to performance. To implement an innovation strategy, smaller firms need to invest in networking to gain some hierarchy, which can imply transaction costs; they may also need a larger network to access sufficient knowledge.

Country of Operation: According to innovation systems theory, the success of an innovation is dependent not only on technology but also on social and cultural factors (Lundvall 2007). Political economy and the national culture are expected to affect how organisations are managed. The culture of the *country of operation* also influences the employees' commitment to an organisation (Andolsek and Stebe 2004). This external, environmental factor can be investigated by examining two different regions with respect to both political economy and national cultures, e.g., the US and Scandinavia (Selnes et al. 1996). There are several reasons for comparing Scandinavia to the US. Despite similarities in, for example, historical economic development and democratic traditions, the political economies of the US and Scandinavia are considerably different. The level of government involvement is much higher in Scandinavia than in the US (Souder and Jenssen 1999). The Scandinavian labour unions are stronger than in the US, and Scandinavia has higher taxes and a stronger social system, with free hospitals and universities (Souder and Jenssen 1999).

Hult and Svallfors (2002) studied work orientation in Norway, Sweden, Germany, Britain, New Zealand and the US and found that the level of employment commitment was highest in Scandinavia and lowest in liberal market economies. Further, they found that organisational commitment was highest in the US and lowest in Sweden. Employment commitment was defined as individuals' non-financial commitment to paid work in general, and organisational commitment was defined as individuals' commitment and loyalty to a particular job or organisation.

The domestic market for wood products is much larger in the US than in Scandinavia. There are also significantly more wood products industry firms in the US. In Norway, only two corporations (Moelven AS and Bergene Holm AS) dominate the sawmill industry. This may affect the innovation strategies and climates for innovation in the firms in the two countries. The Scandinavian countries are also known to have a higher quality of work tasks and better opportunities for participation in firms compared to other countries in the European Union (Gallie 2003).

Scandinavian countries have a long tradition of cooperation, which may give them an inherent advantage for innovation (Lundvall 2007). This cooperation-oriented culture contrasts with the more individual-oriented culture associated with the US. Consequently, one might assume that Scandinavian firms are prone to follow team-based innovation development efforts. In the specific case of Norway, this may be reinforced by the fact that females represent a large proportion of the workforce (Nielsen et al. 2009). All the above-mentioned similarities and differences may have important managerial implications for the relationships between *firm performance* and both *innovation strategy* and *climate for innovation*. However, the literature does not indicate a clear direction for these causal relationships.

Industry Sector: The culture of organisations differs among nations. Reynolds (1986) found that the industry sector was one of the factors most strongly correlated with perceived work context, work values, and work beliefs. After studying different industry sectors, Reynolds (1986) emphasised that statements about organisational cultures that did not take the industry sector into account would likely be inaccurate. Nevertheless, few studies have reflected on the ways in which organisational culture and, more specifically, *climate for innovation* and *innovation strategy* may differ in these countries.

This research also compares primary manufacturers with value-added manufacturers. These two types of firms are generally referred to as primary and secondary. There is very little information regarding the differences in *innovation strategy* or *climate for innovation* between these sectors. The few prior studies have typically focused on the primary industry, and their findings suggest that the focus within the industry culture is on operational effectiveness (Nord 2005), and there are few slack resources with respect to personnel (Hansen et al. 2007, Korhonen 2006). Given the recent (low) profitability record of the primary industry (PriceWaterhouseCoopers 2009), there are likely few financial resources available to dedicate to innovation and creativity.

Traditionally, primary producers have focused on commodity products. However, current trends towards relationship-based practices suggest that firms are moving beyond this focus (Juslin and Hansen 2003, Niemelä and Smith 1996). Studies of Swedish sawmills have found that firms are working to establish new product-marketing strategies (Nord 2005). It may be that the commodity view of the sector no longer holds true (Hugosson and McCluskey 2009). If this is the case, having an *innovation strategy* in place with a positive *climate for innovation* becomes more relevant.

In contrast, the secondary industry is known for a wide variety of products and less for a focus on commodity categories. Regardless, there may be fewer possibilities for product innovation in the primary wood industry. However, process and organisational innovation will likely be important for both primary and secondary industry. Based on this discussion, one can speculate that the secondary industry would benefit more from an *innovation strategy* and a *climate for innovation* than the primary industry.

3 Materials and Methods

3.1 Questionnaire Development

Drawing from previous research, a theoretical model was constructed to evaluate the moderator roles of *firm size*, *country of operation* and *industry sector* on *firm performance* via *climate for innovation* and *innovation strategy*. A ques-

Table 1. Overview of data collection in the US and Norway.

UNITED STATES (See Crespell and Hansen (2008) for more details)
- 1550 wood products firms were selected.
  List bought from a private company.
  Randomly selected (single plants with 50–499 employees)
- Mail survey with an optional internet survey solution
- Three reminders (one of them a full questionnaire package)
- 219 completed responses (15% adjusted response rate)
- Data collected in 2006

NORWAY(See Nybakk and Jenssen (2011) for more details)
- 492 wood products firms were selected from the four relevant interest organisations (70–90% of the population)
- E-mail survey followed by a postal survey
- E-mail survey with three e-mail reminders
- Full mail survey with full questionnaire and return envelope.
- One of them a full questionnaire package and one reminder letter.
- 241 usable responses (49% adjusted response rate)
- Data collected in 2009

tionnaire was developed consisting of three major sections: *innovation strategy*, *climate for innovation* and *firm performance*. Additionally, descriptive data such as the number of employees, total sales and industry type were obtained. The first version of the questionnaire was pretested on 22 wood products industry managers and reviewed by experts in academia and industry (See Crespell and Hansen 2008b). The questionnaire was first written and pretested in English and then translated into Norwegian. To ensure that the translation was accurate, it was translated back into English by a second person. Only small changes were made after this step. For more information regarding details, see Nybakk and Jenssen (2011).

3.2 Measurement

The scales were partly based on previous studies and partly developed for this study. The following discussion outlines the measurement scheme for the three main constructs: *innovation strategy*, *climate for innovation* and *firm performance* (See Appendix A).

Innovation strategy was measured with respect to the focus given by a firm to the following four dimensions developed by Crespell and Hansen (2008b). A seven-point Likert scale was used (1 = totally disagree, 7 = totally agree) to rate the following dimensions: 1) Priority of product innovation, 2) Priority of innovation in manufacturing processes, 3) Priority of business systems innovation, and 4) Priority of research and development.

Climate for innovation was measured with a scale refined with 20 items, drawing from work by Amabile et al. (1996). The measurement of the *climate for innovation* in this study was based on this instrument, but composite indicators were used in which four items per climate dimension were combined and ranked on a seven-point scale (1 = totally disagree, 7 = totally agree) including the following dimensions: 1) team cohesion 2) supervisory encouragement, 3) resources, 4) autonomy and 5) openness to innovation.

Firm performance was measured using a five-point scale where respondents compared their firm to their nearest competitors for the previous calendar year (see Table 1). Respondents rated their firm based on how it compared to competitors in their industry, where 1–5 corresponded to the lowest to highest quintiles. The items included the following: 1) Return on sales, 2) Sales growth rate, 3) After-tax return on assets and 4) Overall competitiveness (Dess and Robinson Jr 1984, Knowles et al. 2008).

Firm size was measured by total number of employees. Both the Norwegian and US datasets were categorised as "small" or "large" firms according to the number of employees. This procedure resulted in samples approximately split in half within each country. The within-country approach avoided problems due to scale; for instance, US small firms are slightly smaller on average than the size of the large Norwegian firms (Table 3). Firm size was treated as a dichotomous variable.

Industry sector was measured by asking what types of products the companies produced. According to this answer, the respondent firms were categorised as primary or secondary manufacturers. Primary industry included firms with processing such as sawmills. Secondary industry included all those products involving further transformation of the primary product, e.g., furniture. Industry sector was treated as a dichotomous variable.

3.3 Sampling and Data Collection

This study included sawmills, planing mills, laminated-wood factories, furnishings and various value added wood products manufacturers. Parts of the industry were excluded from the study for practical reasons. For the larger actors, this concerned house construction and intermediate stages, such as wholesaling and retailing.

Sampling and data collection in the US and Norway, described in Tables 1, 2 and 3, resulted in 219 valid responses in the US (15% response rate) and 241 valid responses in Norway (49%), for a total of 460 valid responses. The data has been utilised and previously reported in Crespell and Hansen (2008b) and Nybakk and Jenssen (2011). The work reported here includes and focuses on the moderator effects of *firm size*, *industry sector* and *country of operation*. By combining the datasets and running new analyses, we gained new insights with important implications for theory and practice.

A non-response bias test was conducted on both the Norwegian and US dataset using the method suggested by Armstrong and Overton (1977). Early and late respondents were compared with a *t*-test regarding differences in *climate for innovation*, *innovation strategy*, *firm performance* and *size*. No differences were found ($p > 0.05$), suggesting no non-response bias.

Table 2. Number of valid responses by country of operation, industry sector and firm size.

Sample size (n)	US	Norway	Total
INDUSTRY			
Primary	118	46	164
Secondary	101	195	296
SIZE-INDUSTRY			
Small-primary	60	29	89
Small-secondary	59	110	169
Large-primary	58	17	75
Large-secondary	42	85	127
TOTAL	219	241	460

3.4 Analyses and Measurement Model

Data screening was performed and imputation was done using the expectation-maximization (EM) algorithm (Byrne 2006). Using listwise deletion would have led to the loss of more than 15% of the observations. Some non-normality suggested using maximum likelihood and the 'Robust' option in the structural equation modelling software EQS (Bentler 2006). First, the model was fit for each country. We then tested for invariance of the parameters (loadings, covariances and

Table 3. Average number of employees categorised by country of operation, industry sector and firm size.

Country	Small			Large			Full sample
	2ary	1ary	1ary & 2ary	2ary	1ary	1ary and 2ary	
US	57	57	57	181	163	170	109
NO	11	44	15	69	64	67	40
Grand total	27	54	35	107	129	116	73

All numbers are average number of employees
1ary = primary sector
2ary = secondary sector

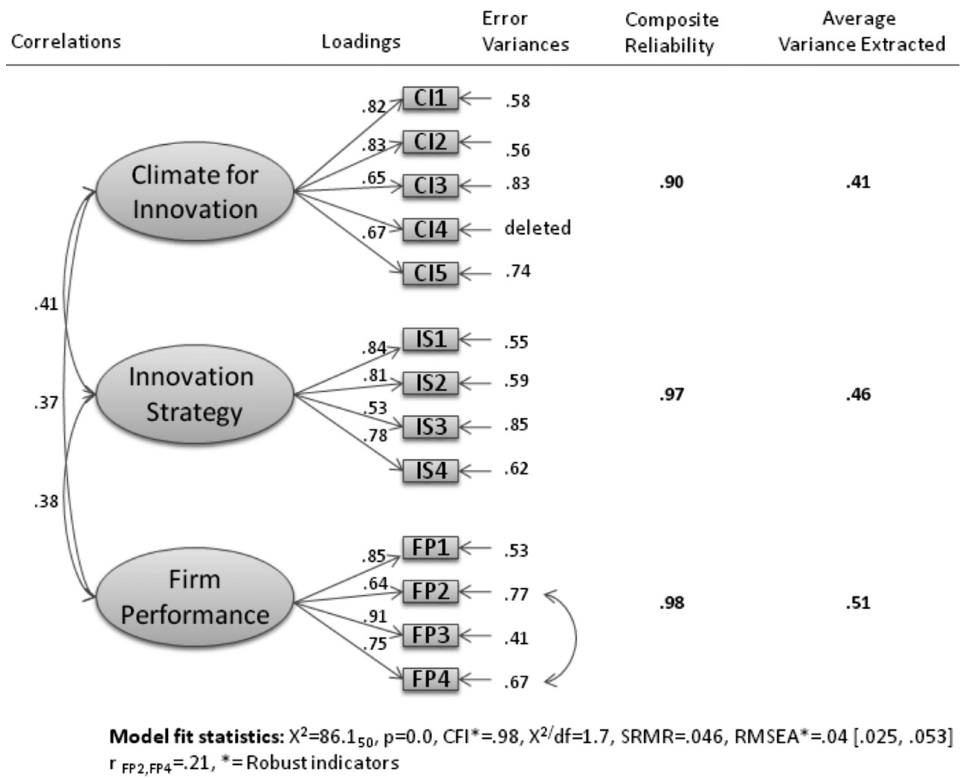

Fig. 2. Parameter estimates for measurement relationships in the measurement model and fit values.

structural coefficients) between samples. Minimal non-invariance was found; therefore, both samples were pooled into one dataset.

The next step was evaluating the measurement model to ensure that all items and dimensions were loading as expected from previous work with the same scales. The measurement model consisted of three constructs: *innovation strategy*, *climate for innovation* and *firm performance*. As a result, one of the dimensions for *climate for innovation* was dropped due to low *t*-values for the loading coefficients and high error variance. All constructs showed appropriate reliability and validity (Fig. 1). Note that composite reliability is an indicator of reliability similar to Cronbach's Alpha.

Note: For details on the scales see Appendix A and/or Crespell and Hansen 2008b. The correlation among the constructs is also presented in Fig. 2. Additionally, a discriminant validity test was conducted, as suggested by Fornell and Larker (1981). All pairs of constructs passed the discriminant validity test, hence the constructs were deemed different from each other.

4 Results

4.1 Moderator Effects

The results chapter includes two main parts. First, we present the moderator effects of *firm size*, *industry sector*, and *country of operation* and their interactions with *climate for innovation* and *innovation strategy* on *firm performance*. Second, we present the results from the examination of the four-way interactions: (*industry sector* × *country of operation* × *firm size)* × (*climate for innovation* or *innovation strategy*) on *firm performance*.

The current limitations of structural equation modelling led us to choose multiple regression to

Table 4. Reduced model including the dependent variables: climate for innovation (CI), innovation strategy (IS) and the three-way interaction industry sector (I) × firm size (S) × climate for innovation.

		Rediced model							
	R^2_{adj}	Intercept		IS		CI		IxSxCI	
		Estimate	P	Estimate	P	Estimate	p	Estimate	P
Firm performance	0.158	–0.008	.85	0.180	<.001*	0.233	<.001*	0.406	.04*

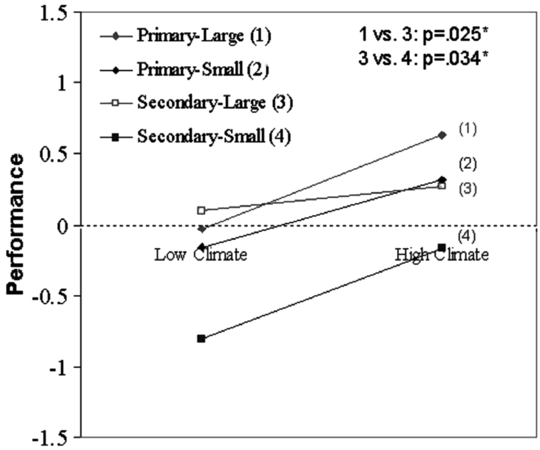

Fig. 3. Interaction testing.

test for higher-order interactions (up to four-way) and their impact on *firm performance*. Following the recommendations of Hair et al. (2010) and Bentler (2006), Barlett's factor scores were calculated for each construct. These scores are weighted means (continuous variables) that reflect the structure of the constructs while reducing them to a more manageable set of variables for use in regression analysis. The scores correlated well with the composites (r > 0.9). The moderator variables (*country of operation*, *industry sector*, and *firm size*) were converted into dichotomous variables, taking values of 0 or 1.

Multiple regression analysis was performed using simultaneous least squares and validated using a stepwise approach; both yielded similar results. To perform the analysis, a partial Gram-Schmidt orthogonalisation procedure was followed to avoid multicollinearity issues between the product variables (e.g., *industry sector* × *firm size* × *climate for innovation*) and the simple component variables (Burrill 1998). The orthogonalisation procedure yielded similar results as using the raw data (factor scores). The final model explained nearly 16% of the variance with three significant effects: *climate for innovation*, *innovation strategy* and the three-way interaction *industry sector* × *firm size* × *climate for innovation*. The full model included the two main effects and their interaction plus all the two-way, three-way, and four-way interactions with the moderator variables, with 20 terms in total. None of the four-way interactions was found to be significant; however, *country of operation* × *industry sector* × *firm size* × *climate for innovation* came close, at p = 0.081.

The full model explained 15.2% of the variance, whereas the reduced model resulted in an $R^2_{adj.}$ = 0.158, which is higher and more parsimonious, and therefore was selected. The reduced model is shown in Table 4.

$$FP = .008 + .180IS + .233CI + .406I \times S \times CI$$

Where,
FP = Firm performance
IS = Innovation strategy
CI = Climate for innovation
I = Industry sector
S = Firm size

Furthermore, a slope-testing analysis was performed on the only significant interaction using a tool developed by Dawson (http://www.jeremydawson.co.uk/slopes.htm – Accessed in May 2011) based on the methods by Aiken and West (1991) and Dawson and Richter (2006) (Fig. 3).

Slope testing yielded significant differences between curves 3 and 4 (p = 0.034) and between Curves 1 and 3 (p = 0.025). The positive relationship between climate for innovation and firm performance held in all situations. Secondary-large firms (3) had a lower impact, although still

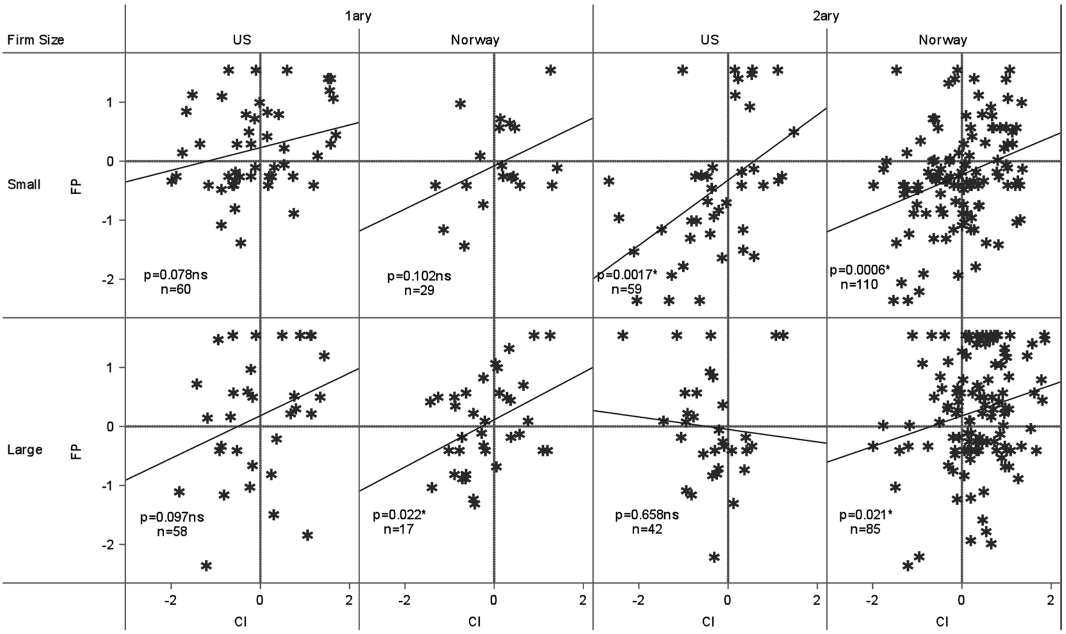

Fig. 4. The interaction effects of country of operation × industry sector × firm size on the relationship between climate for innovation and firm performance (factor scores).

positive, on firm performance at higher levels of climate for innovation, whereas secondary-small firms (4) were able to create more positive firm performance with higher levels of climate for innovation (3 vs. 4, p = 0.034*). A similar relationship was observed for primary-large (1) vs. secondary-large firms (3), where primary-large firms were able to create better firm performance through higher levels of climate for innovation than secondary-large firms (1 vs. 3, p = 0.025*).

4.2 Examination of the Four-Way Interactions

Even though none of the four-way interactions proved to be significant, we provide Fig. 4 and 5 to illustrate the observed relationships between *climate for innovation* and *firm performance* and the moderator effects of *firm size*, *country of operation*, and *industry sector*. As suggested by the regression analysis, the figures showed a stable and positive relationship between *climate for innovation* and *firm performance* and *innovation strategy* and *firm performance* that was consistent across *country of operation*, *firm size*, and *industry sector*.

Fig. 4 shows that six of the regressions indicated a positive, significant relationship between *climate for innovation* and *firm performance* (p < 0.1). However, note that the reported significance levels are only referential, as they do not incorporate all main effects into the regression. None of the regressions for the individual quadrants had a significant negative effect (p < 0.1). Fig. 5 shows that five of the regressions indicated a positive significant impact of *climate for innovation* on *firm performance* (p < 0.1).

5 Discussion

Overall, the findings of this study reinforce and build upon previous findings using cross-validation between *country of operation*, *firm size* and *industry sector*. In that regard, both Norway and the US showed model invariance, suggesting that the relationships between *firm performance* and both *innovation strategy* and *climate*

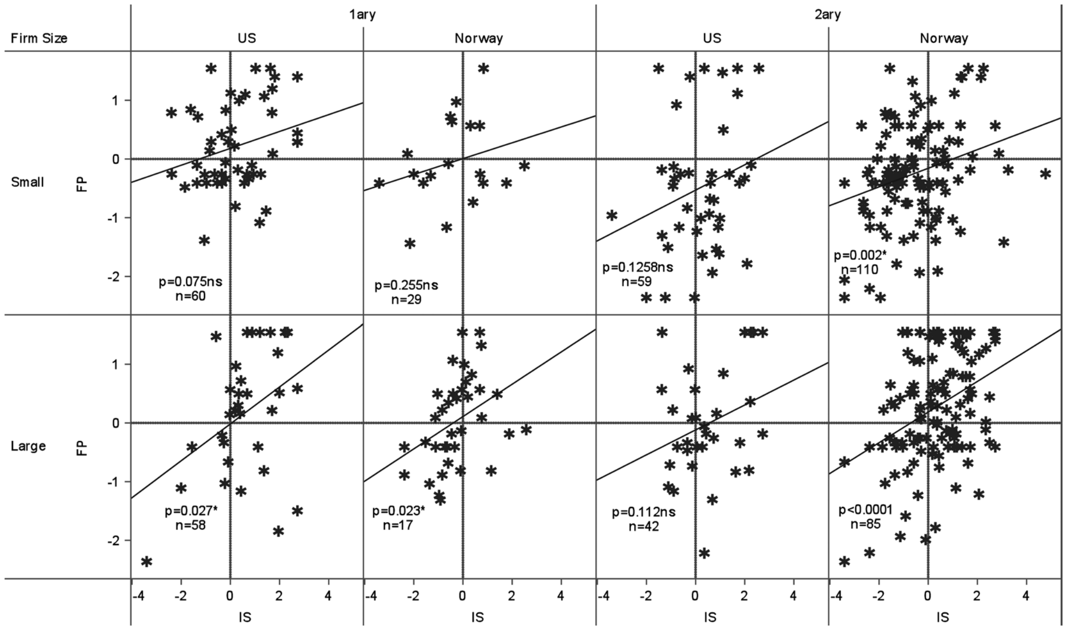

Fig. 5. The interaction effects of country of operation × industry sector × firm size on the relationship between innovation strategy and firm performance (factor scores).

for innovation are consistent despite different cultural and organisational settings. Likewise, this applies to both small and large firms and the primary and secondary wood products industries. This link between *innovation strategy* and *firm performance* is also consistent with findings in other industries and countries (see e.g. Cooper et al. 2004, Fruhling and Siau 2007, Jenssen and Randøy 2006) and between *climate for innovation and firm performance* (see e.g. Amabile et al. 1996, Deshpandé and Farley 2004 and Ekvall 1996).

The fact that the model accounts for only 16% of the variation in *firm performance* may be explained by acknowledging that *climate for innovation* and *innovation strategy* are only antecedents that are likely moderated or mediated by other factors, such as knowledge-integration mechanisms and good business practices (De Luca and Atuahene-Gima 2007). Furthermore, this study focused on intra-organisational phenomena. The addition of extra-organisational variables such as networking would likely result in higher levels of explained variance (Jenssen and Nybakk 2009, Nybakk et al. 2009).

Rather than focusing on the one significant interaction found, we believe the most relevant finding of this study is the low degree of interactions. In other words, the positive effects of *climate for innovation* and *innovation strategy* on *firm performance* are significant regardless of *firm size*, *country of operation* (in the Western world) and *industry sector* and their combinations. This is relevant to researchers and policy makers because the commonly held idea is that these topics are relevant only for large firms or for some types of industries, such as the more market-oriented secondary industry.

The stability of these relationships has significant implications for both theory and practice. There have been several studies applied to other industries with larger firms. One example is Jenssen and Randøy (2006), who found a positive effect of an innovation strategy among Norwegian shipping firms on performance. Given the results of this study, it is logical to assume that the findings are valid for smaller firms in other industries and western countries, for example. Likewise, managers and practitioners in the wood products industry should invest in an *innovation* *strategy* and a *climate for innovation* regardless of *firm size*, *country of operation* (in the Western world) and value-chain location to promote *firm performance*. Accordingly, all managers can likely benefit from these findings by having an *innovation strategy* in place and by promoting those factors that create a positive *climate for innovation*, such as management support, availability of resources and teamwork. Some means to achieve this include holding workshops and assessing the work climate for the dimensions of interest. Incentive and performance-assessment mechanisms should incorporate these criteria both at the employee level (*climate for innovation*) and at the senior-management level (*innovation strategy*).

The results suggest that *all the studied industry sectors and company sizes can benefit economically from a climate for innovation, with a weaker observed effect for large secondary manufacturers*. The quantitative nature of the study and the scales used make it difficult to interpret this particular finding; however, some observations can be pointed out. As shown in Fig. 4, it was the US large secondary manufacturers who did not benefit from a higher climate for innovation ($p = 0.66$). Looking deeper into this group one observes that there was less variation in reported performance, with the smallest sample size among secondary manufacturers for both countries. Although this is consistent with the nearly significant 4-way interaction: *country of operation* × *industry sector* × *firm size* × *climate for innovation* ($p = 0.081$), it is difficult to draw conclusions from it. This finding is interesting given the current focus on production efficiencies, in which less attention is usually given to 'soft' issues such as work climate. In addition to a favourable climate, the *innovation strategy* should target all types of innovations, namely products, processes and business systems. This study shows a positive significant correlation between *innovation strategy* and *climate for innovation*, suggesting that these phenomena are not the result of chance but rather the outcome of deliberate management actions.

Further research could help validate these findings by using the same and/or new samples and/or populations and different scales to measure the constructs. Longitudinal studies would be very helpful to study the causal relationships among these constructs. It is also important to note that in this study we focused on the relationships between performance and innovation strategy and climate. The prior literature has shown that several important factors (e.g., management skills, management's motivation ability, authority and project champions) constitute a global formula for innovation success; however, other factors can have different impacts on the success of innovation (Lee et al. 2000).

Despite the differences between the US and Scandinavia described previously, both are representatives of the Western world. The similarities in the results may originate from a common Western culture and wealth status (Nielsen et al. 2009). To generalise these findings to less similar, non-Western (e.g., Asian) cultures could lead to faulty inferences. Perhaps a more hierarchical culture results in more rigid work climates, with less variation and different dimensions. For instance, supervisor encouragement may play a weaker role than team cohesion or alignment. This issue should be investigated.

The US study was conducted prior to the global recession, and data from Norway were collected after the recession had begun. We have no way of evaluating if there was any impact of this difference on our findings; the analyses comparing the countries should be considered in this regard. Finally, non-response bias was tested by comparing early and late respondents, as suggested by Armstrong and Overton (1977). However, nonresponders were not surveyed and could have provided additional insights. Finally, the response rate in the US sample was low. Therefore, any possible bias would be of larger concern for the US than in the Norwegian dataset.

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Appendix A. Scales used in the study.

CLIMATE FOR INNOVATION
- Team cohesion
  - Teams are committed to their work
  - People feel they cannot trust their coworkers
  - Communication is free and open within teams
  - Employees lack a shared vision of where we are going and what we are trying to do
- Supervisory encouragement
  - People ignore what their superiors expect from them
  - People do not feel encouraged by their superiors to do creative work
  - People feel that top management is enthusiastic and confident about their work
  - Supervisors support their teams within the organization
- Resources
  - If people need information to do their work, it is readily accessible within the organization
  - Generally, people can get the resources they need for their work
  - It is difficult for people to get the resources they need to do their work
  - People have too much work to accomplish in the allotted time
- Autonomy
  - People feel like they do not have control over their own work
  - Employees have the freedom to decide how they are going to do their work
  - Employees determine their own work
  - People do not have a say in the way their job is performed
- Openness to innovation
  - People are encouraged to take risks even if it results in failure
  - New ideas are generally resisted
  - It is often difficult to carry out organizational changes
  - Innovation is rewarded

INNOVATION STRATEGY
  - We give high priority to product innovation
  - We give high priority to innovation in manufacturing process
  - We give high priority to innovation in business systems
  - We give high priority to Research and Development to gain a competitive advantage

FIRM PERFORMANCE
  - Return on sales (ROS)
  - Sales Growth Rate
  - After tax return on assets (ROA)
  - Overall Competitiveness