

Absorptive Capacity in a Board Context

A Quantitative Analysis

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Abstract

A recent strand of literature has investigated the 'black box' of actual board processes, behaviors and task performance in order to advance knowledge on the behavioral and human side of corporate governance and develop recommendations to improve board effectiveness. Our analysis contributes to this literature by theoretically investigating the link between board task performance and absorptive capacity.

Boards of directors and their role in directing and governing organizations have long been the subject of research (Daily, Dalton, & Cannella Jr, 2003), and new knowledge on how boards behave, function and perform has attracted much interest by practitioners especially in the light of corporate scandals. Yet, despite the impressive advances made by scholars, our knowledge of boards and board performance is not complete. One particular gap relates to our understanding of how boards behave dynamically and the extent to which they are capable of learning and adapting over time. Hence, insights generated by the literature on dynamic capabilities and learning and knowledge transfer may advance our understanding of board processes and board effectiveness.

In our project the mediating effect of absorptive capacity on board task performance is discussed, tested and analyzed. The concept 'absorptive capacity' originally goes back to learning theory. Since the concept was introduced by Cohen and Levinthal in 1989, the theory has been further developed (Zahra & George, 2001, 2002, Jansen et al, 2005, Lane et al, 2006, Todorova and Durisin, 2007). Absorptive capacity is one of several dynamic capabilities and describes the effectiveness with which organizations identify, assimilate and use new knowledge. Several empirical studies have been conducted related to firms, but absorptive capacity has just rarely been associated to board task performance. Building on process models of board performance, we apply absorptive capacity to boards and argue that absorptive capacity mediates the relationship between board knowledge levels and board task performance.

Related to the theory above and a model derived by Lane (defining absorptive capacity by exploratory, transformative and exploitative learning) (Lane et al, 2006), we derive the hypothesizes. Since absorptive capacity has not earlier been measured in a board context, measurements for absorptive capacity are discussed and developed. Since earlier presentations have met the argument that the measurements of absorptive capacity in a board context are complicated and hard, not saying impossible to develop, we choose to include the whole description of this part of the study. Based on a sample from the Norwegian research program "The Value Creating Board" (2003-2006), the hypothesizes are tested. By using statistical theories we find significant support for our hypothesizes, which indicates a mediating effect of absorptive capacity on board task performance with the antecedent "presence of knowledge and skills".

These results should be of great interest in an academic as well as in a practical context, since the challenges of boards of today often is related to innovations, dynamic behavior and utilizing of new knowledge. In one and the same country we find some companies which succeed in their further development, while others do not find their way into the new world having exactly the same availability of information and knowledge. The absorptive capacity might be one of several crucial factors explaining the difference between this success and crisis.

Key words: *Absorptive capacity, board task performance, knowledge, measurements*

Introduction

During the last years boards, board behaviour and board task performance have been focused by several researchers. Within the boards and governance literature, there have been two distinct streams of research. One stream of literature has investigated how board structures and composition affect corporate performance. Dominated by agency theory and using archival data and quantitative methods, this research generated 'best practice' prescriptions on structure and composition of boards that informed the development and content of governance codes of practice (Zattoni & Cuomo, 2009). Yet, many of these prescriptions failed to prevent board and governance failures, and the theoretical hegemony of agency theory, the simplistic conceptualization of input-out models, as well as the methodological limitations of archival research were increasingly questioned by scholars. A second stream of research emerged that opened the 'black box' of boards by studying actual board behaviours, processes and board task performance (Zahra & Pearce, 1989; Forbes & Milliken, 1999; Huse, 2007; Huse 2009). New knowledge was created that helped us understand a) what tasks board perform, how effectively and under what conditions (Zahra & Pearce, 1989; Judge and Zeithaml, 1992; Huse, 2007; Minichilli *et al.*, 2009), b) how board processes such as conflict, trust, effort norms and use of knowledge and skills impact on effective task performance (Forbes & Milliken, 1999; Zona & Zattoni, 2007; van Ees *et al.*, 2008) and c) what behaviours characterize interactions in the boardroom (Huse, 2007) (Westphal & Khanna, 2003; Westphal & Stern, 2007). Yet, despite the impressive advances made by scholars, our knowledge of boards and board performance is not complete. One particular gap relates to our understanding of how boards behave dynamically, and the extent to which they are capable of learning and adapting over time. Hence, insights generated by the literature on dynamic capabilities, learning and knowledge transfer may advance our understanding of board processes.

Further; during the last twenty years the concept absorptive capacity has been increasingly focused. Absorptive capacity was first introduced and defined by Cohen and Levinthal (1989, 1990) as the 'ability to recognise the value of new information, assimilate it, and apply it to commercial ends' (Cohen and Levinthal, 1990: 128). With a theoretical background in cognitive and behavioural learning theory, Cohen and Levinthal (1990) proposed that the level of prior related knowledge as well the type of knowledge source, are antecedents to absorptive capacity. Because levels of absorptive capacity are associated with levels of knowledge acquisition, assimilation and new knowledge creation, firms' innovation performance will be affected.

A further contribution to the theoretical and conceptual development of absorptive capacity was published by Zahra and George (2002). They proposed that the research in the area had culminated and gone into a certain track. Absorptive capacity was defined as one of several dynamic capabilities, and they underlined strongly the dynamic aspect of the absorptive capacity. This view was later supported by several other researchers (Lane *et al.*, 2006, Todorova and Durisin, 2007). During the last years several empirical researches have been conducted (Jansen *et al.*, 2005, Lane *et al.*, 2006, Lichtenthaler, 2009, 2010, Cadiz, Sawyer & Griffith (2009)), moving the concept absorptive capacity in front as an relevant explanatory factor - mainly related to innovations in a firm context. The concept has, however, just rarely been associated to boards and board task performance.

This paper contributes to the literature by testing a model which incorporates presence of knowledge and skills, absorptive capacity and board task performance as variables. As suggested by Forbes and Milliken (1999) we study possible relationships between presence of knowledge and skills and board task performance. More specific, we take into account the gap between available knowledge resources and actual board task performance. The main hypothesis is that the effect of knowledge and skills on board task performance is mediated by absorptive capacity. We specially focus on the role absorptive capacity might play in this context.

The rest of this paper is structured as follows: The next section holds a short discussion of previous research studying board theories as well as the concept absorptive capacity. Then the model is derived and four hypotheses built up. The next part presents the methods used to test the hypotheses. This includes a description of the sample and variables used, and measurements of absorptive capacity in a board context are derived. The description of how to measure absorptive capacity in a board context is more detailed than the descriptions of the other measurements, since these ones have to be developed especially. Data analysis and results are shown in the fourth part. Part five covers results, discussion and conclusions.

Previous research

Boards and board tasks

Early research was based on so-called input-output models that investigated how, and to what extent, board structure and composition affected corporate performance (Dalton, Daily, Ellstrand, & Johnson, 1998; Johnson, Daily, & Ellstrand, 1996). Theoretically, these studies were informed pre-dominantly by agency theory, though scholars also drew on stewardship, resource-dependency and stakeholder theory to investigate the link between variables such as board size, outside directors and CEO-chairman duality and firm performance (Dalton et al., 1998; Donaldson & Davis, 1991; Hillman & Dalziel, 2003; Hillman, Keim, & Luce, 2001; Muth & Donaldson, 1998; Pfeffer, 1972). However, this focus on the ‘usual suspects’ (Finkelstein & Mooney, 2003) provided only limited insights into board performance and effectiveness, and failed to shed light on how, theoretically and in practice, boards contribute to organizational value creation (Huse 2007). A new stream of research emerged which sought to open the ‘black box’ of boards by deploying new theoretical, conceptual and methodological approaches (Huse, 2007). New knowledge was created on processes, behaviors and interactions in and around the boardroom, on contingencies under which boards operate, and on the antecedents and outcomes of board task performance.

Zahra & Pearce (1989) addressed some of the limitations of previous input-output studies by theoretically deriving an integrated model of board and firm performance. Building on resource-dependency and agency theory, Zahra & Pearce (1989) theoretically derived three board roles – service, strategy and control. The performance of these roles, they argued, was determined by board structural and demographic variables (board attributes) and influenced by firms’ external and internal contingencies. The article was an important milestone in board research. However, a number of questions remained. Although Zahra & Pearce included board processes as one category of board attributes, they did not specifically investigate the link of such processes to board tasks. As the authors themselves pointed out, further empirical evidence was needed to test the proposed linkages.

Drawing on research on team performance and cognitive processes, Forbes & Milliken (1999) provided a further important theoretical breakthrough in our understanding of what boards actually do. The key contribution made was their explication of board processes as a link between board demography and board task performance of control and service. These insights started a new process-oriented research agenda. A number of studies empirically tested the Forbes & Milliken model and generated important new knowledge. In the process variables the view of the board as a team is directly and indirectly included. Forbes and Milliken are arguing that the board considered as a group has particular attributes. In their model Forbes and Milliken define a difference between ‘functional area knowledge and skills’ and ‘firm-specific knowledge and skills’ (Forbes and Milliken, 1999, p.495). With the aim of high quality board work both these attributes need to be presented. The board members as strategic working groups will need to hold essential parts of these skills, as well as belonging to other groups or networks where additional knowledge is available. Knowledge related to market and competitors and knowledge related to the specific firm are both critical for the quality of board work.

In a framework presented by Huse, his focus went in the same direction as the former behavioural oriented researchers. His main new contribution was his detailed analysis of actual board task performance and the strong focus on human, social and cultural aspects of board work. The introduction of board expectations as one of the board tasks, underlines the essence of human aspects developed by board work (Huse 2007).

Absorptive capacity

Absorptive capacity was introduced and defined by Cohen and Levinthal (1989, 1990). Cohen and Levinthal (1990) further proposed that the level of prior related knowledge as well the type of knowledge source, are antecedents to absorptive capacity. They further put resource and development at the center of firms' innovative processes by linking it to both learning and innovation. Further, because levels of absorptive capacity are associated with levels of knowledge acquisition, assimilation and new knowledge creation, firms' innovation performance will be affected. The idea behind these models was founded on the fact that a learning organization normally will be an organization in development (Cohen & Levinthal, 1989, 1990).

Zahra and George contributed with a further development a few years later. They underlined strongly the dynamic aspect of the absorptive capacity by splitting the concept into two variables in the analysis. Zahra and George defined a difference between potential and realized absorptive capacity, with an efficient factor describing the difference between these two variables. The dynamicity was thus defined as the degree to which the firms develop their absorptive capacity by transforming potential capacity to realized capacity (Zahra and George, 2002). Zahra and George further proposed: 'A firm's transformative capacity reduces the gap between potential and realized absorptive capacity, thereby improving its efficiency factor' (Zahra and George, 2002, p.196). The transformative capacity thus defines to which degree the firm succeed in transferring and exploiting potential absorptive capacity. While Cohen and Levinthal defined absorptive capacity as a process, their conclusion of applying research and development (RD) spending as the predictor of innovative activity, turns the attention to a resource definition, Zahra and George moved the theory a step forward by their consistent focus on absorptive capacity as a dynamic process.

The third theoretical contribution to the concept of absorptive capacity was conducted by Todorova and Durisin in 2007. Todorova and Durisin criticised Zahra and George for omitting some of the dynamic aspects of absorptive capacity, even though the concept itself was defined as a dynamic capability. According to Todorova and Durisin the dynamic factors will work in different phases, via different explanatory variables and at different periods of time during a process or a project. Todorova and Durisin turned back to 'recognizing the value' being the first component as in Cohen and Levinthal's (1990) conceptualization.

Lane et al. (2006) developed both an extended definition, as well as a process model specifying the antecedents and outcomes of absorptive capacity. A recent process based definition is that a firm's absorptive capacity is 'the ability to utilize external knowledge through the processes of exploratory, transformative and exploitative learning' (Lane et al, 2006). Exploratory learning refers to recognizing and understanding external knowledge in correspondence with the concept potential absorptive capacity (Zahra & George, 2002). Exploitative learning is related to applying acquired knowledge for creating new knowledge, and it reflects the concept of realized absorptive capacity (Zahra and George, 2002). Transformative learning is the assimilation of external knowledge to new valuable knowledge in the firm, linking the two processes, as a contribution of maintaining knowledge over time. These three processes are collecting a dynamic description of absorptive capacity, synthesising the theories from Cohen & Levinthal and Zahra and George (Lane et al, 2006). This way of defining and analyzing absorptive capacity is used in this quantitative study.

In their recommendations for future research, Lane et al. (2006) urge scholars not only to build theory in relation to absorptive capacity but to also explore and test the construct in non-R&D contexts. A fertile context for such research is corporate governance and boards of directors. The insights from the dynamic capabilities literature, and specifically absorptive capacity, may enhance the value-adding board literature by a) explicitly modelling learning and knowledge transfer as variables in board processes and b) using absorptive capacity to understand the processes. Despite its relevance to board research, very few studies have thus far analysed absorptive capacity as a dynamic capability of boards. There is still a gap in exerting absorptive capacity in an analysis of the work of the single board member and the board as group, focusing on the contribution absorptive capacity can present in this context.

The measurements and hypotheses

The absorptive capacity presents, as mentioned, a new and nearly unexplored concept in a board context. Processes related to and analyzed by absorptive capacity might shed light to the way and manner knowledge is managed. When testing the focus will thus be on the relationship between "presence of knowledge and skills" and the dependent variables of the model, with absorptive capacity as a mediator.

The management of knowledge is covering individual knowledge as well knowledge on boards as a group. Absorptive capacity might contribute to knowledge management with regard to board task performance as well as to strategic and organizational development initiated in boards, but executed on TMT or firm level of the company. The model does not analyze all different aspects of knowledge management related to absorptive capacity. Further developments might compensate this.

Antecedent

The main antecedent in this study will be “the presence of knowledge and skills”. Forbes and Milliken describe to different dimensions of knowledge and skills; firm-specific knowledge and skills and functional area knowledge and skills. While the firm-specific knowledge and skills refer to the activities and operations by the firm as well as management issues, the functional area knowledge and skills refer to the general business as accounting, finance, marketing and the firm’s relationship to the environment.

Consequences

With regard to the consequences related to a model analyzing possible effects of absorptive capacity on boards, several different output variables will be in question. Cohen and Levinthal (1989) used innovation as the dependent variable, while Zahra and George (2002) as well Todorova and Durisin (2007) argued for competitive advantage (flexibility, innovation and performance) as the dependent variables. Lane et al defined firm performances as the consequences.

When deriving a model for absorptive capacity in boards, the equivalent variable will be board performance.

The mediator

The three processes from Lane et al (2006) are collecting a dynamic and well covering description of absorptive capacity, synthesising the theories from Cohen & Levinthal and Zahra and George (Lane et al, 2006). This specified definition and sub grouping will be used when deriving the mediating effect instead of choosing one particular theoretical direction.

Further; based on the antecedent, the consequences and the mediator(s), the following hypotheses are derived:

Hypothesis 1: Absorptive capacity mediates the relationship between the presence of knowledge and skills and board task performance.

Hypothesis 1a: Exploratory learning mediates the relationship between the presence of knowledge and skills and board task performance.

Hypothesis 1b: Transformative learning mediates the relationship between the presence of knowledge and skills and board task performance.

Hypothesis 1c: Exploitative learning mediates the relationship between the presence of knowledge and skills and board task performance.

These hypotheses will be tested in correspondence with methods derived in the literature, based on existing measurements when possible, and new measurements when existing ones are missing.

Methods

The value creating board survey

The quantitative analysis presented in this article is based on a survey among Norwegian companies. Data were collected at two points in time, responses were collected from CEO's and chairpersons in the same firms, and various dyadic analyses were conducted. Our data are collected from two researches related the value creating board survey. These studies apply data from the Innovation survey in 2003/2004 (with the board chairpersons as the respondents) and from a follow up survey in 2005 with the CEO as the respondents. Another follow up survey sent to the board members was conducted during fall 2005/spring 2006, but numbers from this survey are not included in the study. The results are based on 6-8 pages questionnaires related to the value creating of boards.

The survey covered the displayed items:

- a. Firm demography and industry
- b. Age, gender, tenure, experience and background of the CEO and chairperson (and respondent)
- c. Ownership
- d. The board members and board composition

- e. Board working structures and board leadership
- f. Board decision-making culture
- g. Board task involvement
- h. Innovation and value creation

The survey has during the latest year been the source of several studies and articles. Similar studies have been conducted in Sweden in 1998, 1999 and 2000 and in several other European countries from 2004 and later (The Netherlands, Belgium, Italy, Germany, Turkey and Finland) (Huse, 2007, Sellevoll, Huse & Hansen, 2007).

Measurements

When conducting surveys and analysis with a model, the measurements of the variables are an important issue. All the variables in this study have been built and measured through items using a seven-point Likert-type scale where 1 one was "strongly disagree" and 5 "was strongly agree".

The variables in the model are built up as follows:

The antecedent

Knowledge was defined as an antecedent in the article by Forbes and Milliken in 1999. In the following analysis this variable includes seven dimensions: Knowledge of main activities/knowledge of critical technology and critical competency/knowledge of weak points in the firms/knowledge of critical technology/knowledge of HMS (Health, Environment and Safety) and knowledge of customers' needs. The knowledge variable is thus covering the usual items associated with presence of knowledge and skills. The Cronbach alpha for the knowledge variable is 0.84.

Absorptive capacity

The research related to absorptive capacity has mainly been associated to firm activities. Measurements for absorptive capacity in boards will thus have to be developed. The selected items are based on earlier research in a firm context (Szulanski (1996) and Szulanski, Capetta & Jensen (2004), Jansen et al (2005), Cadiz, Sawyer & Griffith (2009), Lichtenthaler (2009, 2009)). All the quotations below are described in table 1.

Table 1 about here

Absorptive capacity is defined by three different variables - exploratory learning, transformative learning and exploitative learning (Lane et al, 2006, Lichtenthaler, 2009, .2009).

Exploratory learning:

The items covering the *exploratory part* in this analysis are:

1. Board members available if needed
2. Fast info flow between board members
3. Board members explores info before meetings
4. Board actively seeks own information in addition to management reports

The first item is based on the acquisition part from Jansen et al:

" Our unit has frequent interactions with corporate headquarters to acquire new knowledge / Employees of our unit regularly visit other branches / We collect industry information through informal means / Other divisions of our company are hardly visited. (reverse-coded) / Our unit periodically organizes special meetings with customers or third parties to acquire new knowledge",

and the recognition part from Lichtenthaler (Jansen et al, 2005, Lichtenthaler 2009, 2009):

" We frequently scan the environment for new technologies / We thoroughly observe technological trends / x3: We observe in detail external sources of new technologies / We thoroughly collect industry information / We have information on the state-of-the-art of external technologies".

Availability of board members will entail new and unknown knowledge to be present between board meetings as well as at the meetings. The board members themselves and their networks represent knowledge sources for the board.

With a fast info flow between board members the exploratory effect will increase. This flow will entail exchange and development of new and unknown knowledge. This item (2) is based on two items in the assimilation part of the article by Cadiz, Sawyer & Griffith:

"The shared knowledge within my team makes it easy to understand new material presented within our technical areas/ It is easy to see the connections among the pieces of knowledge held jointly within our team", and on this reverse coded item from Jansen et al: Other "divisions of our company are hardly visited". (reverse-coded). The flow of info between board members is important for securing shared and common knowledge, and for improving the overview of knowledge available for every single board member."

The third and fourth items secure that board members individually are checking out and collecting new knowledge which is later made available to the board. These items are based on parallel items in the firm context from these articles with the following items: Jansen et al:

"We collect industry information through informal means (e.g. lunch with industry friends, talks with trade partners)/Our unit periodically organizes special meetings with customers or third parties to acquire new knowledge".

The assessment part of Cadiz, Sawyer & Griffith:

"People in my team are able to decipher the knowledge that will be most valuable to us/It is easy to decide what information will be most useful in meeting our customer's needs/ We know enough about the technology we use to determine what new information is credible and trustworthy".

Parts of the exploratory learning by Lichtenthaler :

" Recognize: We frequently scan the environment for new technologies/We thoroughly observe technological trends/ We thoroughly collect industry information. Assimilate: We frequently acquire technologies from external sources/ We periodically organize special meetings with external partners to acquire new technologies".

In a board context the board members will play a role collecting and presenting information as described in the studies. Even if some of the items above are more detailed than the ones used in this analysis, the exploratory learning variable is closely related to similar items in a firm context, which might show that the items in the variable are covering well.

The Cronbach alpha for the exploratory learning variable is 0.73.

Transformative learning

With regard to the *transformative learning variable* seven items are included:

1. All board members are active during the meetings
2. Board members fully use knowledge and skills
3. Board members give sufficient priority to the board tasks
4. Board asks critical questions to proposals initiated by management
5. Board asks critical questions to info from management
6. Board members present creative and innovative proposals
7. Board members present creative and innovative solutions

The first three items include the activity, the priority and the actual use of knowledge and skills presented by the board members at the meetings. The next four ones represent the utilization of board members knowledge which is used for asking critical question and present innovative suggestions. The knowledge is thus transformed from individual knowledge to common knowledge in the actual board. These seven items have parallel items in the firm context: Jansen et al:

"Transformation: Our unit regularly considers the consequences of changing market demands in terms of new products and services/Employees' record and store newly acquired knowledge for future reference/Our unit quickly recognizes the usefulness of new external knowledge to existing knowledge/Employees hardly share practical experiences. (reverse coded)/We laboriously grasp the opportunities for our unit from new external knowledge. (reverse-coded)/Our unit periodically meets to discuss consequences of market trends and new product development.

Cadiz, Sawyer & Griffith:

"The shared knowledge within my team makes it easy to understand new material presented within our technical areas/ It is easy to see the connections among the pieces of knowledge held jointly within our team.

Lichtenthaler:

"We communicate relevant knowledge across the units of our firm. Knowledge management is functioning well in our company."

All the items listed above are describing the flow of knowledge and information in the actual group. Some of the items presented from the firm context are more detailed than the ones included in transformative learning in this study. In a firm, however, the meeting frequency will be higher and the exchange and transformation of knowledge and skills will often be executed quicker, easier and more detailed.

The Cronbach alpha for the transformative learning variable is 0.79.

Exploitative learning

The difference between transformative learning and exploitative learning might be marginal and hard to define. This issue is the same as described by Todorova and Durisin, who propose that there is no direct process from the time when knowledge is transformed to the same knowledge is exploited, but rather a process where the transformative learning and the exploratory learning might "circle" for a while until the knowledge eventually is exploited (Todorova and Durisin, 2007). When selecting items to the *exploitative learning variable* this fact has been considered. The second issue is to define the correct limit between exploitation of knowledge and innovation. In this study use of knowledge and skills is considered as exploitation of knowledge as far as real, new innovative activities are not initiated. Huse is underlining this point in his definition of innovation, (Huse, 2004, p.44). The items covering the exploitative variable are the following eight ones:

1. Changing the organization structure in significant ways to promote innovation
2. Introducing innovative human resource programs to spur creativity and innovation
3. Financing domestic start-up activities
4. Entering new foreign markets
5. Expanding international operations
6. Supporting start-up business activities dedicated to international operations
7. Financing start-up business activities dedicated to international operations
8. Utilizing the potential in gender differences

These items are matching well, especially with the items described by Lichtenthaler in a firm context. All the different items cover exploiting of general and firm specific knowledge and skills. Compared with earlier defined variables in a firm context Jansen et al, Cadiz, Sawyer & Griffith and Lichtenthaler are including these similar items

Jansen et al:

"Our unit has a clear division of roles and responsibilities/We constantly consider how to better exploit knowledge/Our unit has difficulty implementing new products and services. (reverse-coded).

Cadiz, Sawyer & Griffith:

"It is easy to adapt our work to make use of the new technical knowledge made available to us/new technical knowledge can be quickly applied to our work/My customers can immediately benefit from new technical knowledge learned in the team"

Lichtenthaler;

"Transmute: We are proficient in transforming technological knowledge into new products/We regularly match new technologies with ideas for new products/We quickly recognize the usefulness of new technological knowledge for existing knowledge/Our employees are capable of sharing their expertise to develop new products.

Apply: We regularly apply technologies in new products/We constantly consider how to better exploit technologies/We easily implement technologies in new products".

The three authors all define the exploitative variable by items related to application of expertise, technologies and the way this knowledge is utilized for innovative actions - without covering innovation itself. This selection of items is parallel to the choice of items in this study. The Cronbach alpha for the exploitative variable is 0.83.

Exploratory learning, transformative learning and exploitative learning are adding up to the description of the absorptive capacity process. By calculating one value for absorptive capacity as the mean of these three variables, the validity fails (Cronbach alpha 0.6). Values of Cronbach alpha with smaller values than 0.7, might, however, be acceptable when dealing with a comprehensive diversity of the constructs being measured (Kline, 1999). In the analysis we will conduct the testing for absorptive capacity and for the three items of the absorptive capacity variable individually.

The consequences

The dependent variables in this analysis will be board task performance, measured by the strategy task, the service task and the control task. With a long research tradition in enhancing these variables in articles related to board performance, well constructed measures have been developed. Existing scales will thus be used (Forbes and Milliken, 1999, Huse, 2005, Minichilli, 2009). The measurements applied are listed in appendix I. The Cronbach's alpha is 0,8 for the strategy and service task and 0,7 for the control task.

Data analysis

First all the variables were entered and the standard descriptive statistic (table 2) as well as correlation coefficients were calculated.

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Table 2 about here

The results showed some internal correlation (all the coefficients were significant), but no multicollinearity was found (none of the predictor variables had a correlation > 0.8-0.9) (Field, 2009, p.224). Actual control variables are included in the analyzes. CEO-duality could have been included, but the descriptive statistic showed a mean at 0,08 (dummy variable), which means that less than 10 companies in the survey actually have got a CEO-duality. This explanation is to be found in Norwegian laws, which deny companies a CEO-duality when the registered share value is higher than NOK 3 mill (about £300.000), and in practice CEO-duality is not common even in small companies with lower share values.

Testing of the hypotheses

For testing for the mediating effects the following procedure was executed:

1. Testing if the antecedent (independent) variables have effects on the mediating variables; 2. Testing if the antecedents (independent) variables have effects on the consequences (depending variables); 3. testing if the mediators have effects on the consequences (depending variables).

If the effects of the antecedents are weaker when a mediator is entered into the equation, a mediating effect is supported (Simon, Pelled and Smith, 1999, Baron and Kenny, 1986). Table 3-5 show the multiple regression for the testing of the strategy task, service and control task.

[Table 3-5 about here](#)

Results and discussion

Based on the linear regression conducted according to the first step of testing as described by Baron and Kenny, presence of knowledge and skills showed significant positive influence on all the mediating variables - ($p < 0.01$ for explorative learning, transformative learning and absorptive capacity, and $p < 0.05$ for exploitative learning). For absorptive capacity beta was 0.49 (H1), while the values were 0.45 for explorative learning (H1a), 0.41 for transformative learning (H1b) and 0.10 for exploitative learning (H1c). The adjusted R^2 and F-values had significant values. Presence of knowledge and skills is thus relevant as a predictor of absorptive capacity with the three explanatory factors: Explorative learning, transformative learning and exploitative learning. These results fit well in with earlier studies and research. Cohen and Levinthal and Todorova and Durisin derived "knowledge source" and "prior knowledge" as the main antecedents of absorptive capacity (Cohen and Levinthal, 1990, Todorova and Durisin, 2007), while Zahra and George extended with the concept "knowledge complementarity" - the degree to which the knowledge fits in with the actual needs of the company (Zahra & George, 2002).

The further testing of the model shows that there are significant correlations between the presence of knowledge and skills and board task performance (table 3-5). Presence of knowledge and skills has a stronger correlation to the service and the control task, compared with the strategy task.

In the rows (table 3-5) showing the mediators on the consequences (Baron and Kenny, 1986, part 3) the correlation between knowledge and skills and board task performance is checked out when absorptive capacity (as a whole and splitted) is taken into account. For exploratory learning, transformative learning and for exploitative learning as well as for absorptive capacity the correlations are significant for all variables, and the all over results confirm the mediating effect (details below). The significance is lower for the exploitative learning when testing with the control task as the dependent variable.

The conclusion is thus that all the hypotheses are supported. In general exploitative learning seems to be the weakest mediator.

This study is thus supporting the hypotheses, defining absorptive capacity as a significant mediator on board task performance (the strategy, service and control task) with presence of knowledge and skills as the independent variable. This result is further statistically connecting absorptive capacity to a board context; board task performance and presence of knowledge and skills in boards.

Another result is that the effect of presence of knowledge and skills is strong towards the dependent variables as well as on the mediators, This means that the contribution from the board members with regard to knowledge, and the ability of board members of presenting, sharing and conveying their prior and new knowledge with the other member of the board at the meetings and between meetings, is suggested to be especially important. This analysis of the mediating effect of absorptive capacity in a board context thus gave further insights in board processes and the knowledge management of boards.

These findings are of interest in an academic as well as in a practical context. With the challenges met by boards of today, the processes in boards are becoming even more important than earlier. The focus on knowledge, including all kinds of the concept will be another important contribution to practical board performance in the future. Academically the relationship between boards and absorptive capacity has not been derived earlier. Focusing on absorptive capacity as a mediator in this context, should turn the focus towards board processes and group dynamicity in board in general and towards knowledge management related to board task performance in special.

Further research on the role of absorptive capacity in board contexts should be conducted, and the measurements of absorptive capacity should be further developed. Based on this study and studies including and analyzing other variables, these results and other similar results should be derived and analyzed.

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Tables

Table 1 Measurements and methods - absorptive capacity in a firm context

Researcher(s)	Definition	Methods	Operationalization and/or Measurements
Szulanski (1996) and Szulanski, Capetta & Jensen (2004)	Ability of the recipient unit to identify, value and apply new knowledge	The transfer of best practices (O'Dell et al. 1998) provides a propitious setting to observe intrafirm knowledge transfer. Data were collected through a two-step questionnaire survey.	Members of [recipient] have a common language to deal with the [practice]; [recipient] had a vision of what it was trying to achieve through the transfer; [recipient] had information on the state of the art of the [practice]; [recipient] had a clear division of roles and responsibilities to implement the [practice]; [recipient] had the necessary skills to implement the [practice]; [recipient] had the technical competence to absorb the [practice]; [recipient] had the managerial competence to absorb the [practice]; it is well known who can best exploit new information about the [practice] within [recipient]; it is well known who can help solve problems associated with the [practice].
Jansen et al (2005)	Exploring how organizational antecedents affect potential and realized absorptive capacity, this study identifies differing effects for both components of absorptive capacity.	Based on the article by Zahra & George (2002) they are testing 7 hypotheses with regard to absorptive capacity	Potential and realized absorptive capacity were used in the study. Potential absorptive capacity consists of acquisition and assimilation of new external knowledge. Six items assessed the intensity and direction of efforts expended in knowledge <i>acquisition</i> . In addition, Three items measured <i>assimilation</i> and gauged the extent to which units were able to analyze and understand new external knowledge. Measurements: Potential Absorptive Capacity <i>Acquisition</i> Our unit has frequent interactions with corporate headquarters to acquire new knowledge. Employees of our unit regularly visit other branches. We collect industry information through informal means (e.g. lunch with industry friends, talks with trade partners).

			Other divisions of our company are hardly visited. (reverse-coded) Our unit periodically organizes special meetings with customers or third parties to acquire new knowledge. Employees regularly approach third parties such as accountants, consultants, or tax consultants. <i>Assimilation</i> We are slow to recognize shifts in our market (e.g. competition, regulation, demography). (reverse-coded) New opportunities to serve our clients are quickly understood. We quickly analyze and interpret changing market demands. Realized Absorptive Capacity <i>Transformation</i> Our unit regularly considers the consequences of changing market demands in terms of new products and services. Employees' record and store newly acquired knowledge for future reference. Our unit quickly recognizes the usefulness of new external knowledge to existing knowledge. Employees hardly share practical experiences. (reverse coded) We laboriously grasp the opportunities for our unit from new external knowledge. (reverse-coded) Our unit periodically meets to discuss consequences of market trends and new product development. <i>Exploitation</i> It is clearly known how activities within our unit should be performed. Client complaints fall on deaf ears in our unit (reverse coded) Our unit has a clear division of roles and responsibilities. We constantly consider how to better exploit knowledge. Our unit has difficulty implementing new products and services. (reverse-coded) Employees have a common language regarding our products and services.
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			<i>All items were measured on a seven-point scale on which 1</i> <i>Was “strongly disagree” and 7 was “strongly agree.”</i>
Lane et al (2006)	Absorptive capacity refers to one of a firm’s fundamental learning processes: its ability to identify, assimilate, and exploit knowledge from the environment.	Reconceptualisation: Absorptive capacity is a firm’s ability to utilize externally held knowledge through three sequential processes: (1) recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning, (2) assimilating valuable new knowledge through transformative learning, and (3) using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning.	Develop a process model for absorptive capacity in a firm with three factors directly related to the concept: 1. Recognize and understand new external knowledge (exploratory learning) 2. Assimilate valuable external knowledge (transformative learning) 3. apply assimilated external knowledge (exploitative learning)
Cadiz, Sawyer & Griffith (2009)	Absorptive capacity is the ability to transform new knowledge into usable knowledge through the processes of assessment (identification and	They reintegrated a component of value identification that was originally proposed by Cohen and Levinthal (1990) and most recently recommended by Todorova and Durisin	<i>Assessment</i> acap.1: People in my team are able to decipher the knowledge that will be most valuable to us. acap.2: It is easy to decide what information will be most useful in meeting our customer’s needs. acap.3: We know enough about the technology we use to determine what new information is credible and trustworthy.

	filtering of valuable information), assimilation (conversion of new knowledge into usable knowledge), and application (using the knowledge).	(2007).	<i>Assimilation</i> acap.4: The shared knowledge within my team makes it easy to understand new material presented within our technical areas. acap.5: It is easy to see the connections among the pieces of knowledge held jointly within our team. acap.6: Many of the new technological developments coming to the team fit well into the current technology. <i>Application</i> acap.7: It is easy to adapt our work to make use of the new technical knowledge made available to us. acap.8: New technical knowledge can be quickly applied to our work. acap.9: My customers can immediately benefit from new technical knowledge learned in the team.
Lichtenthaler (2009)	The definition and the model proposed by Lane et al (2006) are used	Data from a multi-informant survey conducted in 175 industrial firms show that exploratory, transformative, and exploitative learning have complementary effects on innovation and performance. The results emphasize the multidimensional nature of absorptive capacity, and they help to explain interfirm discrepancies in profiting from external knowledge.	Exploratory Learning <i>Recognize</i> x1: We frequently scan the environment for new technologies. x2: We thoroughly observe technological trends. x3: We observe in detail external sources of new technologies. x4: We thoroughly collect industry information. x5: We have information on the state-of-the-art of external technologies. <i>Assimilate</i> x6: We frequently acquire technologies from external sources. x7: We periodically organize special meetings with external partners to acquire new technologies. x8: Employees regularly approach external institutions to acquire technological knowledge. x9: We often transfer technological knowledge to our firm in response to technology acquisition opportunities.

			Transformative Learning <i>Maintain</i> x10: We thoroughly maintain relevant knowledge over time. x11: Employees store technological knowledge for future reference. x12: We communicate relevant knowledge across the units of our firm. x13: Knowledge management is functioning well in our company. <i>Reactivate</i> x14: When recognizing a business opportunity, we can quickly rely on our existing knowledge. x15: We are proficient in reactivating existing knowledge for new uses. x16: We quickly analyze and interpret changing market demands for our technologies. x17: New opportunities to serve our customers with existing technologies are quickly understood. Exploitative Learning <i>Transmute</i> x18: We are proficient in transforming technological knowledge into new products. x19: We regularly match new technologies with ideas for new products. x20: We quickly recognize the usefulness of new technological knowledge for existing knowledge. x21: Our employees are capable of sharing their expertise to develop new products. <i>Apply</i> x22: We regularly apply technologies in new products. x23: We constantly consider how to better exploit technologies. x24: We easily implement technologies in new products. x25: It is well known who can best exploit new technologies inside our firm.
Huse (2005)	The value creating board	A big survey covering approximately 300 board chairpersons in firms with between 50 and 5000 employees	6 models were tested based on long and detailed questionnaires, which cover most of the variables defined in the framework: The value creating board

**Table 2 Descriptive Statistics - control variables, independent variable, mediators
and independent variables**

Variable	Minimum	Maximum	Mean	Std. Deviation
High-tech firm	0	1	0,08	0,27
Firm size (ln employees)	0	10,37	4,01	1,67
Chair ownership	0	100	25,94	33,58
Number of board members	0	12	4,48	2,00
Insider ratio	0	1	0,39	0,26
Ceo ownership, TMT and respective families	0	100	44,21	43,60
Ceo duality	0	1	0,9	0,21
Presence of knowledge and skills	1,67	5	3,95	0,63
Explorative learning	1	5	3,55	0,77
Transformative learning	1	5	3,63	0,74
Exploitative learning	1	5	2,66	0,86
Absorptive Capacity	1	5	3,49	0,75
The strategy task	1	5	3,42	0,94
The service task	1	5	3,23	0,79
The control task	1	5	3,62	0,77

Table 3 Regression analyses - the Strategy Task

Standardized Beta Coefficients	Model 1	Model II	Model III	Model IV	Model V	Model VI
Control variables						
High-tech firm	0,03	0,04	0,03	0,09	0,02	0,01
Firm size (ln employees)	-0,01	0,00	0,05	0,04	0,01	0,04
Chair ownership	0,04	-0,02	-0,38	-0,02	-0,03	-0,02
Number of board members	0,02	0,04	0,75***	0,08+	0,08+	0,08+
Insider ratio	0,03	-0,08	-0,89***	-0,07*	-0,07	-0,07*
Ceo ownership, TMT and respective families	0,17***	-0,04	-0,06**	-0,02	-0,03	-0,06
Independent variable						
Presence of knowledge and skills		0,35***	0,22***	0,21***	0,34***	0,19***
Mediators						
Explorative learning			0,33***			
Transformative learning				0,34***		
Exploitative learning					0,13***	
Absorptive Capacity						0,36***

R	0,18	0,34	0,45	0,47	0,37	0,47
Adj.R2	0,31	0,17	0,20	0,21	0,13	0,21
F (sign)	32,16**	65,12***	83,33***	89,63***	50,00***	89,71***
F change	32,16**	124,00***	105,76***	122,43***	17,53***	0,321
N	978	978	978	978	978	978

+ = 0,10-level, * = 0,05-level, ** = 0,01-level, *** = 0,001-level.

Table 4 Regression analyses - the Service Task

Standardized Beta Coefficients	Model 1	Model II	Model III	Model IV	Model V	Model VI
Control variables						
High-tech firm	0,05*	0,04	0,03	0,03	0,02	0,01
Firm size (ln employees)	0,02*	0,03	0,02	0,03	0,02	0,03
Chair ownership	0,02*	-0,07*	-0,08+	-0,01	-0,03	-0,05+
Number of board members	-0,10	-0,04	0,00	-0,03	-0,05	0,00
Insider ratio	-0,06	-0,08+	-0,09***	-0,06*	-0,08+	-0,06*
Ceo ownership, TMT and respective families	0,08	-0,07*	-0,08**	-0,06*	-0,06+	-0,08+
Independent variable						
Presence of knowledge and skills		0,42***	0,26***	0,27***	0,41***	0,23***
Mediators						
Explorative learning			0,38***			
Transformative learning				0,37***		
Exploitative learning					0,12***	
Absorptive Capacity						0,41***

R	0,14	0,42	0,54	0,54	0,44	0,55
Adj.R2	0,14	0,18	0,30	0,29	0,19	0,31
F (sign)	3,39***	107,03***	136,15***	134,18***	38,05***	143,10***
F change	3,39***	201,62***	159,60***	154,74***	16,34***	176,70***
N	978	978	978	978	978	978

+ = 0,10-level, * = 0,05-level, ** = 0,01-level, *** = 0,001-level.

Table 5 Regression analyses - the Control Task

Standardized Beta Coefficients	Model 1	Model II	Model III	Model IV	Model V	Model VI
Control variables						

High-tech firm	0,03	0,07	0,00	0,00	-0,01	-0,02
Firm size (ln employees)	-0,03	0,01	0,01	0,01	0,01	0,02
Chair ownership	0,04	0,01	-0,01	0,02	0,01	0,01
Number of board members	0,01	0,03	0,07*	0,05+	0,03	0,07*
Insider ratio	0,03	0,01	0,00	0,02	0,01	0,02
Ceo ownership, TMT and respective families	0,18***	0,02	-0,01	0,03	0,02	-0,03
Independent variable						
Presence of knowledge and skills		0,50***	0,37***	0,37***	0,50***	0,36***
Mediators						
Explorative learning			0,33***			
Transformative learning				0,32***		
Exploitative learning					0,08*	
Absorptive Capacity						0,32***

R	0,18	0,51	0,59	0,59	0,51	0,58
Adj.R2	0,04	0,26	0,34	0,34	0,26	0,34
F (sign)	32,16***	169,86***	171,76***	169,69***	116,95***	166,03***
F change	32,16***	297,79***	130,49***	125,86***	8,52*	117,73***
N	978	978	978	978	978	978

+ = 0,10-level, * = 0,05-level, ** = 0,01-level, *** = 0,001-level.

Figures

Figure 1: The model and the hypotheses

