Searching Wide and Deep for Business Model Innovation

Angelshaug, Magne S.; Saebi, Tina; Lien, Lasse B.; Foss, Nicolai J.

Document Version
Final published version

Published in:
Innovation: Organization & Management

DOI:
10.1080/14479338.2023.2252789

Publication date:
2023

Routledge
Taylor & Francis Group

Innovation
Organization & Management

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rimp20

Searching wide and deep for business model innovation

Magne S. Angelshaug, Tina Saebi, Lasse Lien & Nicolai J. Foss

To cite this article: Magne S. Angelshaug, Tina Saebi, Lasse Lien & Nicolai J. Foss (2023): Searching wide and deep for business model innovation, Innovation, DOI: 10.1080/14479338.2023.2252789

To link to this article: https://doi.org/10.1080/14479338.2023.2252789

Published online: 03 Sep 2023.

INNOVATION: ORGANIZATION & MANAGEMENT
https://doi.org/10.1080/14479338.2023.2252789

Routledge
Taylor & Francis Group

Searching wide and deep for business model innovation

Magne S. Angelshaug[a], Tina Saebi[a], Lasse Lien[a] and Nicolai J. Foss[b]

[a]Department of Strategy and Management, Norwegian School of Economics, Bergen, Norway; [b]Department of Strategy and Innovation, Copenhagen Business School, Frederiksberg, Denmark

ABSTRACT

To remain competitive, firms must innovate their business models (BMs) to meet the demands of the external environment. Given the severity of external threats or opportunities, managers need to determine the scope of BM innovation (BMI) – how many elements of a BM need to be changed – and the degree of novelty required. However, internal firm knowledge may not be sufficient to conceive of and implement new BMIs. Seeking external knowledge can offer managers diverse perspectives and expertise that should foster BMI, a topic that has been insufficiently addressed in the literature. To address this gap, we investigate whether firms that engage in external knowledge search are more likely to engage in BMI and whether different external knowledge sourcing strategies are associated with different BMI types. Analysing Norwegian firm-level data, we find a close association between a firm's choice of external knowledge search activity in terms of breadth and depth and the scope and novelty of a BMI. The wider a firm's search, the wider its BMI scope, and the deeper that search, the more novel its BMI. Our findings contribute new, empirically supported insights on external knowledge search as an important antecedent to BMI. For practitioners, our findings illustrate how different search strategies help firms initiate and implement different types of BMI.

ARTICLE HISTORY
Received 11 September 2022
Accepted 23 August 2023

KEYWORDS
Business model; business model innovation; external knowledge search; open innovation; absorptive capacity

Introduction

New forms of competition, technologies, and demands for sustainability are challenging firms' existing business models (BMs): how firms create, deliver, and capture value (Amit & Zott, 2012; Bocken & Geradts, 2020; Foss & Saebi, 2018). Business model innovation (BMI) allows firms to replace outdated BMs with newer ones to improve or maintain their competitive fitness (Cucculelli & Bettinelli, 2015; Massa & Tucci, 2014; Zott & Amit, 2008).

Given the severity of external threats or opportunities, managers need to determine the *scope* of a BMI – how many BM elements need to change – and its *degree of novelty* (Foss & Saebi, 2017, 2018). While minor changes in an industry may require a firm to adapt specific elements of its BM, more profound changes in the environment may require a firm to introduce an entirely new BM. However, what that new BM should be is often not readily visible to managers, who are likely to be cognitively constrained by previous mental maps, choices, resource commitments, and a firm's internal knowledge repository (Coombs & Hull, 1998; Levinthal & March, 1993).

CONTACT Magne S. Angelshaug magne.angelshaug@nhh.no

How, then, can managers effectively search for and find a suitable BM? An emerging research stream offers promising but still limited insights into how boundary-spanning search can help firms overcome organisational inertia and increase the propensity to engage in BMI (e.g., Huang et al., 2013; Snihur & Wiklund, 2019; Yu et al., 2020; Zhu et al., 2022). Although these studies suggest a correlation between external knowledge sourcing and BMI, they generally do not consider the variety of external knowledge sourcing approaches and how each might affect BMI outcomes. External knowledge search can vary in *breadth* (the number of different external knowledge sources used) and *depth* (the intensity with which those sources are used) (Laursen & Salter, 2006). This leads to two key questions. Are firms that engage in external knowledge search also more likely to engage in BMI? Are different external knowledge sourcing strategies in terms of breadth and depth associated with different BMI types?

To address these questions, we link insights from NK modelling (Levinthal, 1997) to research on BMI (Desyllas et al., 2022; Foss & Saebi, 2018; Snihur & Wiklund, 2019) and external knowledge search (Cohen & Levinthal, 1990; Laursen & Salter, 2006). We hypothesise that different forms of BMI are likely to pose different information and knowledge challenges (Foss & Saebi, 2017, 2018) and thus require different sources of knowledge and search behaviour (Cohen & Levinthal, 1990; Saebi & Foss, 2015; Trantopoulos et al., 2017).

Analysing Norwegian firm-level data, we find a close association between a firm's choice of external knowledge search activity (search breadth and depth) and its BMI outcomes (scope and novelty). The wider a firm's search, the wider its BMI scope, and the deeper that search, the more novel its BMI. Firms that search both widely and deeply tend to implement BMIs of wider scope and novelty.

We make three contributions to the BMI literature. First, we provide clear evidence that firms undertaking external knowledge search are more likely to engage in BMI. This finding helps answer the call for more research on the antecedents of BMI (Andreini et al., 2022; Bouncken et al., 2021; Foss & Saebi, 2017; Schneckenberg et al., 2021). For scholars, this implies that the use of external knowledge sources is not only critical in the search for new products (Laursen & Salter, 2006; Leiponen & Helfat, 2010), services (Mina et al., 2014), and processes (Mol & Birkinshaw, 2009; Terjesen & Patel, 2017; Trantopoulos et al., 2017); it can also aid managers seeking new BMs. Second, we offer a more finely grained understanding of BMI as a boundary-spanning activity where managers search broadly and deeply for new BM configurations. Linking our understanding of BMs as complex systems to NK modelling (Baumann et al., 2019; Levinthal, 1997) allows us to produce a coherent theoretical account of how different BMIs are associated with different search behaviours. Hereby, our findings can spur more research on BMI as a multidimensional construct. Third, for practitioners, our findings illustrate how using different search strategies helps firms initiate and implement different BMI types. This can aid a firm in picking the best search strategy to identify the BMI most suitable to the demands of its external environment.

Theoretical background and hypotheses

Business models as complex systems

BMs are complex systems of interconnected elements that firms deploy to create, deliver, and capture value (Foss & Saebi, 2017, 2018; Teece, 2010). BMs need to be designed to

produce 'fit'; that is, internal congruence where individual elements work well together (Christensen et al., 2016; Desyllas et al., 2022; Leppänen et al., 2023; Snihur & Zott, 2020; Tidhar & Eisenhardt, 2020), and external congruence, with the new BM addressing market requirements (Casadesus-Masanell & Ricart, 2010; Casadesus-Masanell & Zhu, 2013). Viewed through the lens of NK model theory (Kauffman, 1993; Levinthal, 1997; Simon, 1962; Wright, 1932), each possible BM configuration in a business environment can be ranked by its fitness according to a performance criterion like profitability or sales volume. However, as new opportunities and threats arise, what was once an attractive BM in the fitness landscape may soon face declining performance as other models rise to take its place. Consequently, managers must engage in BMI, 'a firm-level activity in which managers search for opportunities to change elements of their current business model to improve firm performance' (Desyllas et al., 2022, p. 237).

Based on the extent of interdependencies between the elements of the BM, we differentiate BMI with regard to the scope of change (modular versus architectural) and degree of novelty (known versus new to the industry). 'Innovating a BM where the value creation, delivery, and appropriation mechanisms are tightly interdependent implies architectural change; conversely, a more loosely coupled business model will entail less architectural change, but potentially more modular change' (Foss & Saebi, 2017, p. 216). Thus, in modular BMI, the innovation is contained in one element of the BM; for example, Netflix innovated its value capture mechanism to deal with customers sharing login details while keeping its other BM elements intact. In architectural BMI, change is comprehensive and far-reaching, since it affects the BM's interconnected activities and linkages; for example, the Netflix transition from a postal-based DVD rental service to a subscription-based streaming platform required a fundamental change in its BM. Further, BMIs can be differentiated with respect to their degree of novelty. A firm can emulate a competitor's BM and so change its existing model while remaining within the familiar forms of its industry (known to the industry) or introduce a BM significantly different from the industry's established practices (new to the industry). Netflix's transition to a subscription-based streaming platform represented a completely new BM. Below, we argue how these different forms of BMI are likely to pose different informational and knowledge challenges (Foss & Saebi, 2017, 2018) and thus require different sources of knowledge and search behaviour (Cohen & Levinthal, 1990; Saebi & Foss, 2015; Trantopoulos et al., 2017).

The search for BMI over a fitness landscape

Drawing on the metaphor of firms searching on a rugged performance landscape, Desyllas et al. (2022) conceive of BMI as 'firms trying to identify which business model elements and configurations thereof can elevate firms to higher performance levels' (p. 238). When searching for a new BM, the 'large number of choices gives rise to a large number of possible combinations, which creates a multidimensional search space' in which the 'interdependencies among choices imply that the different combinations vary in terms of their performance or viability' (Baumann et al., 2019, p. 288).

For managers, the complexity of these interdependency effects on performance means that a new optimum BM – that is, the one associated with the creation of the most value over time – will often lie beyond their current field of vision. Thus, searching for a new BM

configuration requires managers to gather new knowledge that helps them identify the most attractive path and overcome the cognitive and structural constraints that hold a firm to its existing BM (Ethiraj & Levinthal, 2004; Levinthal, 1997; Nickerson & Zenger, 2004; Rindova & Martins, 2021).

We argue that firms that strive for a BM change that is limited in both scope and novelty do so through local adaptation; that is, the continued exploitation of known BM forms through small or large steps towards a local optimum in the fitness landscape. Because these are changes towards BM forms in the 'immediate neighbourhood of the existing organisation' (Levinthal, 1997, p. 937), we expect them to be based on a local search for knowledge (Nickerson & Zenger, 2004) and to use easily accessible knowledge close to what is familiar, such as seeking knowledge about new customer preferences related to a firm's existing products and services.

By contrast, firms that engage in architectural and novel change aim for a BM form that deviates significantly from known industry practice and is attained through *radical reorientation* (Billinger et al., 2013; Ganco, 2017) or *long jumps* in the fitness landscape (Kauffman, 1993). These are exploratory changes to BM forms 'far removed from the organisation's current mode of operation' (Levinthal, 1997, p. 938), and we expect them to be based on a more distant search for knowledge, such as seeking emerging technologies not yet tested in the industry (Nickerson & Zenger, 2004). Below, we argue that the use of external knowledge search can facilitate both local and distant searches for knowledge and thus different types of BMI. We further point to the role of absorptive capacity in strengthening this relationship.

The role of external knowledge search and absorptive capacity in BMI

External knowledge search can be characterised by its level of breadth and depth (Laursen & Salter, 2006). *Search breadth* refers to the number of different external sources or search channels a firm uses in its innovative activities. Increasing search breadth ensures access to a wider range of knowledge but may not facilitate ready access to tacit knowledge (Lowik et al., 2012; Zaheer et al., 2010). Digikala, one of the Middle East's largest online stores, is an example of a business that regularly employs broad crowdsourcing contests to generate new BM ideas (Bagheri et al., 2020). By contrast, *search depth* refers to the intensity with which external sources or search channels are used in the innovation process. Intensifying the search depth – for example, through close collaborations – creates a strong relationship of trust and reciprocity between the focal firm and its external knowledge source and hence a more favourable learning environment (Phelps, 2010). For example, in its efforts to transition to a new digital BM, the Spanish bank BBVA collaborated closely with fintech startups (*The Economist*, 2017).

Search breadth and scope of BMI

As noted above, the scope of BMI can vary from modular to architectural change. As modular BMI involves changing a single BM component, it does not rely on interactions among dispersed knowledge sets (Nickerson & Zenger, 2004). By contrast, architectural BMI requires managers to grasp which BM components require simultaneous innovation to obtain the desired effect (Desyllas et al., 2022; Ennen & Richter, 2010; Foss & Saebi, 2017). Thus, the wider the BMI scope, the less likely there will be an adequate pool of

knowledge in only one or a few knowledge sources (Oerlemans & Knoben, 2010). Thus, to facilitate architectural BMI, a firm needs to combine widely dispersed knowledge sets (Nickerson & Zenger, 2004; Savino et al., 2017).

Firms that perform a broad external search are more likely to increase their access to such dispersed sources of knowledge (e.g., through access to customers, users, and suppliers) and thus their chances of identifying combinations of BM components that reinforce one another in architectural BMI. For example, Enel, an Italian multinational electricity and gas manufacturer, relied on knowledge input from startups, universities, innovation hubs, venture capitalists, and environmental organisations to transition from a fossil fuel-based to a more sustainable BM (Chesbrough, 2019).

Search depth and novelty of BMI

The degree of BMI novelty can vary from those largely known and familiar to the industry to those essentially unknown. As the former relies on knowledge close to the current inventory of the firm, relevant knowledge from external sources is easily codified (Hansen, 1999; Saviotti, 1998). This type of knowledge can then be effectively transferred even if the external relationships are infrequent and distant (i.e., weak ties) (Hansen, 1999). Contrasting this, novel BMI requires knowledge combinations on the frontier of knowledge development and is much further removed from the existing inventory of firms (Bierly et al., 2009; Cohen & Levinthal, 1990; Saviotti, 1998). The transfer of this type of knowledge is more likely to be challenging, as it is non-codified and highly tacit and requires external relationships with a higher frequency of interactions, shared language, and trust (i.e., strong ties) (Bierly et al., 2009; Oerlemans & Knoben, 2010).

Firms that search deeply seek to intensify their relationship with external knowledge partners and thus establish a foundation for trust and a common language (Fey & Birkinshaw, 2005; Oerlemans & Knoben, 2010; Saviotti, 1998). This allows for greater knowledge assimilation (Cohen & Levinthal, 1990), especially when non-codified and tacit knowledge is transferred (Bierly et al., 2009; Hansen, 1999; Oerlemans & Knoben, 2010). Hence, prolonged and deep exposure to a particular knowledge source can lead to the new knowledge combinations needed for novel BMI. This can take the form of strategic alliances and partnerships, such as the one established between retail giant Carrefour and Google to jointly develop new value creation mechanisms to take advantage of artificial intelligence, which led to a new and improved BM for Carrefour (Mancuso et al., 2023).

The role of absorptive capacity

The mere availability of external knowledge sources is not sufficient; an organisational ability to exploit these sources is required (Cohen & Levinthal, 1990). A key facilitator for the effective use of external knowledge sources is a firm's absorptive capacity, which is defined as its ability to identify, assimilate, and exploit the knowledge gained from external sources (Cohen & Levinthal, 1990; Monteiro et al., 2017; Pihlajamaa, 2021; Zahra & George, 2002). Hence, while connecting to external knowledge sources enables the acquisition of knowledge, firms must be able to apply this knowledge in innovations (Bierly et al., 2009; Savino et al., 2017). Absorptive capacity has been shown to be essential in the application of external knowledge to facilitate product innovation (Zobel, 2017), service innovation (Xie et al., 2021), and strategic

innovation (Gebauer et al., 2012). Recent studies show that absorptive capacity can play a role in aiding firms in reconfiguring BM components (Bhatti et al., 2021; Miroshnychenko et al., 2021; Müller et al., 2021; Ritter & Lettl, 2018). Below, we hypothesise the interaction effects between a firm's external knowledge sourcing strategy (depth and breadth of search), the level of absorptive capacity, and the type of BMI (scope and novelty).

Hypotheses: interactions between search depth, breadth, absorptive capacity, and BMI

Drawing on the above insights, increasing the breadth of knowledge search without increasing its depth allows managers to gather more extensive insights into existing BMs in an industry and thus identify well-known and tested combinations of BM components. We thus posit the following:

Hypothesis 1: *Increasing the breadth of search activity is positively associated with an increase in BMI scope but not BMI novelty.*

A firm that dedicates itself to closer collaborations and draws on a large variety of external sources is more likely to gather diverse and novel insights. Increasing the breadth and depth of knowledge search allows managers to seek both near and distant knowledge and thus find possible paths to more distant and attractive BMs. In terms of NK models, this kind of BMI moves the firm's BM away from known industry practice and is attained through radical reorientation (Levinthal, 1997) or long jumps in the fitness landscape (Kauffman, 1993). Thus, firms that increase the depth and breadth of knowledge search are more likely to engage in BMIs that are architectural and new to the industry, and we posit the following:

Hypothesis 2: *Increasing the depth and breadth of search activity is positively associated with increases in both BMI scope and BMI novelty.*

Increasing the breadth of external knowledge search increases the complexity of handling diverse knowledge from various sources (Leiponen & Helfat, 2010), while a deeper search introduces the company to non-codified and tacit knowledge (Hansen, 1999). In both cases, the firm's absorptive capacity plays a crucial role in its ability to assimilate and apply the knowledge gained through its search activity (cf. Spithoven et al., 2011; West & Bogers, 2017). We argue that the higher the level of absorptive capacity, the more able a firm is to apply external knowledge in the reconfiguration and innovation of its BM components:

Hypothesis 3: *The associations between types of search activity and types of BMI (Hypotheses 1 and 2) are stronger with higher levels of absorptive capacity.*

Data and methods

Sample and data

Data on BMI and external knowledge sourcing were collected through an online survey sent to 4,000 CEOs of Norwegian firms in fall 2014 by the Centre for Service Innovation at the Norwegian School of Economics (NHH). The survey method was chosen to generate a sample of sufficient sample size and variety in search behaviours and BM changes and because information about these topics cannot be reliably extracted from other public sources. The targeted firms were randomly chosen from the population of Norwegian firms with more than 30 employees to ensure the generalisability of our findings. We excluded the smallest firms to avoid those with no true operations and because, in very small firms, the BM tends to be more fluid and less distinct from normal operations. CEOs were targeted because they have the best overall view of a firm's knowledge search and BMI efforts. The remaining data were collected by accessing official accounting data covering all Norwegian firms from 1992 through 2016, which provided control variables for our analysis, such as company size and age.

The survey provided 286 responses, a 7.2% response rate. Excluding those with missing answers or missing control variables yielded a final sample of 256 responses (6.4%). Although this response rate may seem low, it is not uncommon in organisational research, particularly when the target respondent is the CEO (Baruch, 1999; Baruch & Holtom, 2008). To ensure the representativeness of the final sample, we tested for non-response bias. These tests did not indicate any significant differences (based on chi-square and *t*-test statistics) between firms that responded early as opposed to late with respect to the independent, dependent, and control variables. When considering how the sample firms compare to the relevant total population, tests did not indicate significant differences for any control variable except for firm age. For this control, our test showed the sample to have a slight over-representation of older firms. Overall, we believe that our sample is sufficiently representative.

Except for the control variables, all variables were from the same survey collected in the same time period and based on CEO self-reports. This means that common method variance (CMV) may bias our data and coefficient estimates (Williams & Brown, 1994). Procedural remedies included in the survey design were anonymisation of the respondents and methodical separation of the items related to the independent and dependent variables. Post hoc statistical tests were used to identify potential CMV issues and did not indicate any red flags. The tests included Harman's one-factor test and the common latent factor test (Podsakoff et al., 2003). Although we cannot conclusively rule out a CMV threat, we interpret these post hoc tests as indicating a limited impact on our data and analyses. Below, internal consistency tests using Cronbach's alpha are provided for each variable. Moreover, tests for discriminant validity were carried out with satisfactory results.

Independent variables

External knowledge sourcing

Two independent variables represent external knowledge sourcing, search breadth and search depth. These variables are based on questions from the Eurostat Community

Innovation Survey and were captured by 11 items representing knowledge sources relevant to innovation (Appendix, question 1), and are in alignment with Laursen and Salter's (2006) operationalisation of external knowledge sourcing. The use of each external knowledge source was measured using a four-point scale (1 = *not used* to 4 = *highly used*). Our composite independent variables were constructed from all 11 knowledge sources, with no discrimination between the different types. The survey responses for these source items show a relatively high degree of internal consistency (Cronbach's alpha = 0.81). The independent variable *Search_breadth* was constructed as the total number of different sources a firm uses to some degree and excluding those not used. Within the sample, the number of knowledge sources used by firms ranges between 0 and 11 (i.e., firms received a score of 0 when no knowledge sources were used and a maximum score of 11 when all knowledge sources were used). The independent variable *Search_depth* was defined as the extent to which a firm draws intensively from different external knowledge sources; that is, the number of sources a firm cited as highly used. Within the sample of firms, the number of knowledge sources used to a high degree varied between 0 and 7.

To test the robustness of the results for search depth, an alternative *Search_depth_collab* measure was included. This measure was drawn from seven survey items (Cronbach's alpha = 0.64) based on the Eurostat Community Innovation Survey. It captured whether a firm had formal innovation collaboration with different external sources (Appendix, questions 2 and 3). As with the other independent variables, this variable was constructed as the total number of collaborations a firm uses in its innovation activities. A firm received a score of 0 when no collaborations were in place and the maximum score of 7 when all types of sources were used.

Absorptive capacity

To operationalise absorptive capacity, we target a firm's ability to apply external knowledge in its innovation processes. In line with Bierly et al. (2009), we draw on a measure that covers a firm's strategic orientation towards innovation and development rather than more conservative postures. This goes beyond more narrowly focused proxies, such as those covering R&D personnel or R&D spending (Flatten et al., 2011). A measure that covers a wider set of strategic indicators is important because the knowledge and learning processes required to achieve BMI can be quite diverse and require a long-term perspective. This contrasts with purely technology-driven innovations, where R&D personnel and R&D spending are more likely to be satisfactory measures. Consequently, in the present study, we rely on a measure of absorptive capacity drawn from nine survey items targeting the firm's strategic orientation (Appendix A, question 4), using a seven-point scale (1 = *not important* to 7 = *very important*) (Cronbach's alpha = 0.70). The items representing absorptive capacity were drawn from a factor analysis in which the resulting factor covered the firm's orientation towards such areas as innovation and R&D, creating new patents and trademarks, and launching new products and services.

Dependent variables

To operationalise the type of BMI undertaken by the firm, we used 11 survey items (Appendix, questions 5–7). The items are based on the four main components of a BM:

target market, value proposition, value capture, and value delivery. We mapped whether elements within the BM components had been subjected to change during the three years prior to 2014 using yes/no questions. We further distinguished whether these changes were already known to the industry ('new to firm, known to industry') or new to the industry ('new to firm, new to industry'). Among responding firms, we found the number of BM elements that changed varied between 0 and 11 for configurations known to industry and between 0 and 10 for configurations new to industry. The responses also showed that the survey items had a relatively high degree of internal consistency (Cronbach's alpha = 0.75). The dependent variable *BMI_low_novelty* is based on the 'new to firm, known to industry' responses and represents BMI scope that is already familiar in the industry. The dependent variable *BMI_high_novelty* is based on the 'new to firm, new to industry' responses and represents BMI scope that is new to the industry. Continuous factor scores were generated from the basic binary items using factor analysis based on polychoric correlations.

Control variables

Firms of different sizes and ages may have different challenges and capabilities related to BMI. Larger and older firms may have access to greater financial, human, and other resources that could help facilitate change while also being more prone to biases, rigidity, prior commitments, and overall path dependency in the face of BM change (Leiponen & Helfat, 2010). We controlled for size (measured as the log of number of employees) and age (years since incorporation), both of which were collected through official accounting data.

Financial performance compared to industry peers can serve as an important predictor of changes in an existing BM (Greve, 1998, 2003). We therefore include industry-adjusted return on assets as a control variable. Industry association generally affects a broad spectrum of firm characteristics (Vittori et al., 2022), so we include measures of industry growth, volatility, and capital intensity to control for general demand growth, level of uncertainty, and path dependency, respectively. For these controls, industry associations were based on four-digit NACE industry codes. The sample distribution across industries is shown in Table 1 using two-digit NACE industry codes. A test for non-independence of observations originating in these industry associations was also

Table 1. Sample distribution across industries.

Industry	Number of companies	Mean breadth	Mean depth
Accommodation and food services	15	7.47	0.87
Professional, scientific, and technical services	41	8.12	1.59
Primary industries	20	7.35	1.80
Construction	30	8.17	1.17
Electrical supply, water supply, and renovation	10	8.50	1.10
Financial, insurance, and real estate	8	7.63	0.89
Human health, social, and cultural work	29	8.38	1.76
Information and communication	12	8.17	1.67
Manufacturing	55	8.13	1.24
Transportation and storage	8	7.63	0.88
Wholesale and retail	28	7.07	1.43
Average		**7.88**	**1.38**

performed.[6] Because our sample represented population diversity in terms of ownership structures, we controlled for different propensities to innovate across such structures. Ownership was represented by a single control variable that distinguishes limited liability firms from less common ownership structures.

Analysis and results

Table 2 presents the descriptive statistics and pairwise correlations between the main variables. These results do not indicate that multicollinearity is an actionable concern. Moreover, in line with the motivation to study the effects of external search on the propensity for BMI, Table 2 shows how *Search_breadth* and *Search_depth* are positively correlated with *BMI_low_novelty* and *BMI_high_novelty* and that *Absorptive_capacity* is positively correlated with the BMI variables. Moreover, we find a positive correlation between *Search_breadth* and *Search_depth*, which was expected because high-intensity use of external sources can only occur within the sources with which a firm is engaged. The direction of correlations among other variables is within what can be expected based on the motivation for their inclusion.

We used hierarchical linear regressions for our dependent variables, as presented in Tables 3 and 4. Variables were sequentially entered, starting with control variables covering basic firm and industry attributes (Model 1) and independent variables (Model 2). Next, we performed a robustness test for search depth using the alternative *Search_depth_collab* measure (Model 3). We then included the interaction term between *Search_breadth* and *Search_depth* (Model 4) and finally included the interaction term for *Absorptive_capacity* (Model 5).

For *BMI_low_novelty* (Table 3), Model 2 shows the control for size and ownership to be significant, indicating that firms of larger size and firms with other than limited liability ownership may have a somewhat lower propensity for BMI known to the industry. Moreover, the industry controls of growth and volatility are significant, indicating a lower propensity for BMI known to the industry for firms in industries experiencing strong growth and low levels of volatility. Model 2 shows a positive and significant ($p < 0.05$) coefficient for *Search_breadth*, providing the first indication of how the increased use of external knowledge sources may increase the propensity for a wider BMI scope within the current industry landscape. With respect to the role of *Absorptive-capacity*, Model 2 does not show any significant relationship with *BMI_low_novelty*.

For *BMI_high_novelty* (Table 4), Model 2 shows that the industry control for growth is significant, indicating a greater propensity for BMI high in novelty for firms in industries experiencing strong growth. Model 2 also shows a positive and significant ($p < 0.01$) coefficient for *Search_depth*, providing the first indication of how increased use of deep collaborations may increase the propensity for a wider BMI scope outside the current industry landscape. Moreover, Model 2 shows a significant positive relationship ($p < 0.01$) between *Absorptive_capacity* and *BMI_high_novelty*. This indicates that absorptive capacity is more important for BMI requiring knowledge that is unfamiliar and distant from the current knowledge inventory.

The results are bolstered by a robustness check using the alterative measure for external search depth (*Search_depth_collab*). These results are shown in Model 3 for both BMI variables, and we find *Search_depth_collab* to have coefficients largely in line with those found in Model 2 (Tables 3 and 4).

Table 2. Descriptive statistics and pairwise correlations.

Variable	Mean	S.D	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) *BMI_low_novelty*	0.355	0.333	1.000										
(2) *BMI_high_novelty*	0.127	0.219	−0.169***	1.000									
(3) *Company_size*	4.311	1.380	−0.095	0.101	1.000								
(4) *Company_age*	25.195	25.927	−0.064	−0.074	0.105*	1.000							
(5) *Performance*	0.007	0.138	−0.053	−0.002	0.086	0.051	1.000						
(6) *Industry growth*	0.018	0.659	−0.156***	0.106*	−0.024	−0.204***	−0.130**	1.000					
(7) *Industry volatility*	0.074	1.467	0.019	−0.050	0.041	0.461***	−0.030	0.026	1.000				
(8) *Industry capital intensity*	0.440	3.203	−0.001	−0.086	0.011	0.510***	0.007	−0.097	0.908***	1.000			
(9) *Search_breadth*	7.875	2.890	0.187***	0.140**	0.189***	−0.112*	−0.057	−0.003	0.010	−0.002	1.000		
(10) *Search_depth*	1.379	1.323	0.112*	0.291***	0.146**	−0.116*	0.074	0.003	−0.062	−0.066	0.316***	1.000	
(11) *Absorptive_capacity*	0.011	0.997	0.144**	0.328***	0.098	−0.062	0.080	−0.047	−0.007	−0.028	0.267***	0.242***	1.000

*$p < 0.1$ **$p < 0.05$ ***$p < 0.01$.

Table 3. Hierarchical ordinary least squares regression for *BMI_low_novelty*.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Company_size	−0.02 (0.02)	−0.03** (0.02)	−0.03* (0.02)	−0.03* (0.02)	−0.03* (0.02)
Company_age	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)
Company ownership	−0.12* (0.06)	−0.13* (0.07)	−0.14** (0.07)	−0.12* (0.07)	−0.11* (0.07)
Performance	−0.01 (0.01)	−0.01 (0.01)	−0.01 (0.01)	−0.01 (0.01)	−0.01 (0.01)
Industry growth	−0.10*** (0.03)	−0.11*** (0.03)	−0.11*** (0.03)	−0.12*** (0.03)	−0.12*** (0.03)
Industry volatility	0.06** (0.03)	0.07** (0.03)	0.07** (0.03)	0.07** (0.03)	0.07** (0.03)
Industry capital intensity	−0.02 (0.01)	−0.02 (0.01)	−0.02 (0.01)	−0.03 (0.02)	−0.03 (0.02)
Search_breadth		0.02** (0.01)	0.02** (0.01)	0.03*** (0.01)	0.04*** (0.01)
Search_depth		0.02 (0.02)		0.21*** (0.06)	0.23*** (0.07)
Absorptive_capacity		0.01 (0.02)	0.01 (0.02)	0.02 (0.02)	−0.08 (0.08)
Search_depth_collab			0.01 (0.01)		
Search_breadth x *Search_depth*				−0.02*** (0.01)	−0.02*** (0.01)
Search_breadth x *Absorptive_capacity*					0.01 (0.01)
Search_depth x *Absorptive_capacity*					0.01 (0.05)
Search_breadth x *Search_depth* x *Absorptive_capacity*					−0.00 (0.01)
R^2	0.07	0.12	0.11	0.16	0.16
Adjusted R^2	0.05	0.09	0.08	0.12	0.12
F for change in R^2	2.81***	4.05***		10.48***	0.10

*$p < 0.1$ **$p < 0.05$ ***$p < 0.01$.

Table 4. Hierarchical ordinary least squares regression for *BMI_high_novelty*.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Company_size	0.02 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	−0.00 (0.01)
Company_age	−0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Company ownership	−0.01 (0.05)	0.01 (0.04)	0.01 (0.04)	0.00 (0.04)	0.00 (0.04)
Performance	−0.00 (0.01)	−0.00 (0.01)	−0.00 (0.01)	−0.00 (0.01)	0.00 (0.01)
Industry growth	0.03 (0.02)	0.04* (0.02)	0.04* (0.02)	0.04* (0.02)	0.05** (0.02)
Industry volatility	0.02 (0.02)	0.01 (0.02)	0.01 (0.02)	0.01 (0.02)	0.00 (0.02)
Industry capital intensity	−0.01 (0.01)	−0.01 (0.01)	−0.01 (0.01)	−0.01 (0.01)	−0.01 (0.01)
Search_breadth		−0.00 (0.01)	−0.00 (0.01)	−0.01** (0.01)	−0.01** (0.01)
Search_depth		0.04*** (0.01)		−0.06* (0.04)	−0.07* (0.05)
Absorptive_capacity		0.07*** (0.01)	0.05*** (0.01)	0.06*** (0.01)	0.10** (0.05)
Search_depth_collab			0.01** (0.01)		
Search_breadth x Search_depth				0.01*** (0.00)	0.01** (0.01)
Search_breadth x Absorptive_capacity					−0.01 (0.01)
Search_depth x Absorptive_capacity					−0.06** (0.03)
Search_breadth x Search_depth x Absorptive_capacity					0.01** (0.00)
R^2	0.03	0.18	0.15	0.21	0.23
Adjusted R^2	-	0.15	0.12	0.17	0.18
F for change in R^2	1.16	15.41***		7.32***	4.82**

*$p < 0.1$ **$p < 0.05$ ***$p < 0.01$.

The conditional association between search activity and BMI

Through Model 4 in Table 3, the interaction effect between *Search_depth* and *Search_breadth* on *BMI_low_novelty* can be interpreted. The coefficient of the interaction term is negative and significant. However, if we examine the influence of increasing *Search_breadth* at different levels of *Search_depth*, we find that a positive relationship exists at low levels of *Search_depth*. In other words, when *Search_depth* is kept constant at a low level, increasing *Search_breadth* results in an increased propensity for a wider BMI scope within the current industry landscape. This is illustrated by the positively sloped curve in Figure 1, which shows the

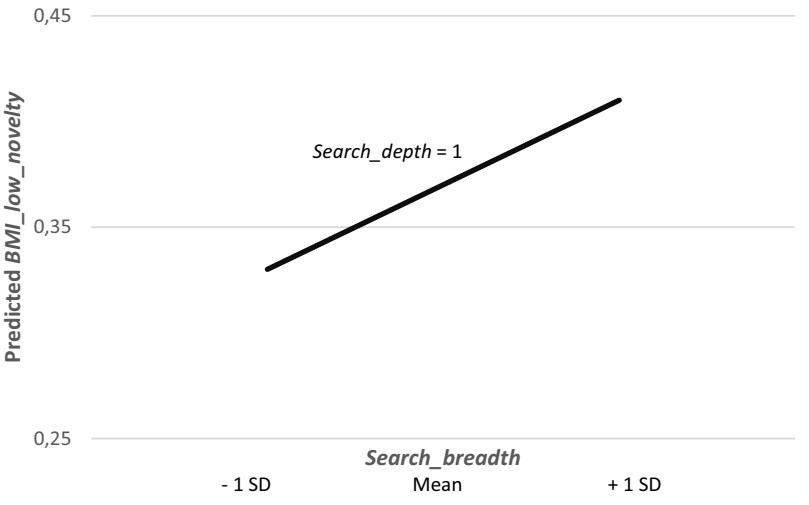

Figure 1. Predicted *BMI_low_novelty* when increasing *Search_breadth* while keeping *Search_depth* low and constant.

relationship when *Search_depth* is kept constant at one. The positive association is found to be significant at depth levels of zero and one ($p < 0.10$), and at depth level zero ($p < 0.05$).

These relationships show support for Hypothesis 1. The scope of low-novelty BMI increases when *Search_depth* is kept low while *Search_breadth* is increased (as illustrated in Figure 1). This implies that using the easily accessible and codified knowledge typically obtained through low-intensity connections is associated with BM changes that are known to the industry.

Regarding *BMI_high_novelty*, the interaction effect between *Search_depth* and *Search_breadth* can be interpreted using Model 4, which is presented in Table 4. We now maintain *Search_breadth* constant at different levels while changing *Search_depth*. The interaction term in Model 4 is positive, and while a negative relationship does exist at low levels of *Search_breadth*, we find that a positive conditional relationship exists at high levels of *Search_breadth*. In Figure 2, *Search_breadth* is kept constant at nine while allowing *Search_depth* to vary. The slope is positive, which means that increasing *Search_depth* results in a greater propensity for a wider BMI scope that is outside the current industry landscape. The positive association is found to be significant ($p < 0.05$) at breadth levels above seven.

These relationships show support for Hypothesis 2. The scope of novel BMI increases when *Search_breadth* is kept high while *Search_depth* is increased (as illustrated in Figure 2). Thus, using external, unfamiliar knowledge that is accessible through high-intensity connections increases the propensity to engage in BMIs that are new to the industry.

The conditional association between absorptive capacity, search activity, and BMI

Hypothesis 3 is based on arguments regarding the role of absorptive capacity when linking external search to BMIs of low and high novelty. Through Model 5 as shown in

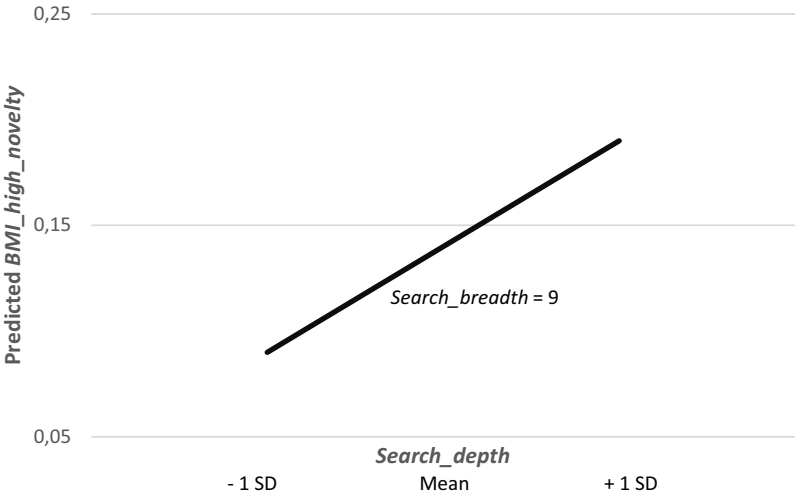

Figure 2. Predicted *BMI_high_novelty* when increasing *Search_depth* while keeping *Search_breadth* high and constant.

Table 3, the interaction effect between *Absorptive_capacity*, *Search_depth*, and *Search_breadth* on *BMI_low_novelty* can be interpreted. Here we find that the coefficient of the interaction term is not significant. Contrasting this, through Model 5 as shown in Table 4, we find significant interaction results between *Absorptive_capacity*, *Search_depth*, and *Search_breadth* on *BMI_high_novelty*. In Figure 3, we keep *Search_breadth* and *Search_depth* constant at high and low levels (i.e., with a mean value ± 1 standard deviations, respectively) while allowing *Absorptive_capacity* to vary. The slopes are found to be positive for all four search activity combinations and

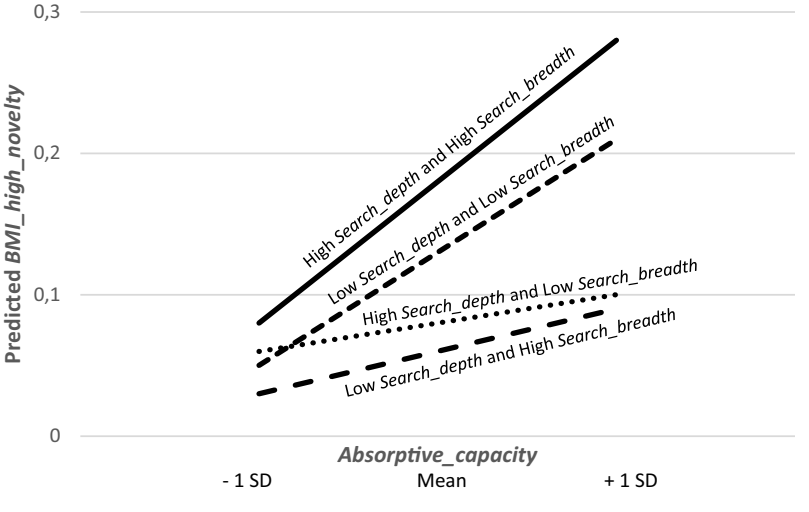

Figure 3. Predicted *BMI_high_novelty* when increasing *Absorptive_capacity* while keeping *Search_breadth* and *Search_depth* constant at high and low levels.

significant ($p < 0.01$) for the two steepest slopes: low depth and low breadth, and high depth and high breadth. These results indicate that a firm increases its propensity for a novel BMI scope by increasing its *Absorptive_capacity* in combination with external search activities. Hence, as we do not have significant results for *BMI_low_novelty*, we find only partial support for Hypothesis 3. This indicates that absorptive capacity plays a more significant role when a firm needs to engage deeply with external knowledge sources (as argued in Hypothesis 2) and thus needs to rely on absorptive capacity to facilitate the transfer and use of non-codified and tacit knowledge.

Discussion and implications

BMI is an essential innovation tool for firms seeking to improve or maintain their competitive fitness in increasingly dynamic environments (Cucculelli & Bettinelli, 2015; Massa & Tucci, 2014; Zott & Amit, 2008). While our analysis cannot demonstrate causation, we cautiously interpret our findings to indicate that (1) firms relying on the use of external knowledge sources are more likely to engage in BMI and that (2) different search strategies increase the propensity for different forms of BMI. We discuss the theoretical and managerial implications of these two findings below.

The use of external knowledge sources can spur BMI

Although prior studies found that the use of external knowledge sources plays a critical role in the search for new products (Katila & Ahuja, 2002; Laursen & Salter, 2006; Leiponen & Helfat, 2010; Li et al., 2013), services (Mina et al., 2014), and processes (Mol & Birkinshaw, 2009; Terjesen & Patel, 2017; Trantopoulos et al., 2017), it has not been 'obvious how these findings can be extrapolated to business model innovation' (Snihur & Wiklund, 2019, p. 306). BMI has emerged as a new unit of analysis that 'complements the traditional subjects of process, product, and organisational innovation' (Zott et al., 2011, p. 1032) and that 'needs to be conceptualised and theorised on its own' (Foss & Saebi, 2017, p. 201).

Drawing on the metaphor of firms searching over a rugged performance landscape (Desyllas et al., 2022), our data shows that managers can search broadly and deeply for new BM configurations. As internal firm knowledge may not be sufficient to conceive of and implement new BMIs, seeking external knowledge can offer managers diverse perspectives and expertise that can foster BMI, a topic that has been insufficiently addressed in the BMI literature to date. By combining our findings with insights from NK model theory (Levinthal, 1997) and the knowledge-based theory of innovation (Cohen & Levinthal, 1990), we contribute to a better theoretical understanding of external knowledge search as an important antecedent to BMI (Andreini et al., 2022; Foss & Saebi, 2017; Schneckenberg et al., 2021).

Different external knowledge search strategies can lead to different BMI outcomes

Prior studies linking external knowledge search to new BMs (Dell'era et al., 2020; Huang et al., 2013; Snihur & Wiklund, 2019; Yu et al., 2020; Zhu et al., 2022) often measure BMI along a single dimension (e.g., the presence or absence of a new BM). This approach

neglects the multidimensional nature of BMI and leads to an oversimplified conceptualisation and operationalisation of the BMI construct. In contrast, by conceptualising BMI as changes to a complex system of interconnected elements characterised by the scope of change and degree of novelty, we contribute new empirical insights into a multidimensional-outcome view of BMI. We contend that this view enables a more nuanced understanding of how external knowledge search strategies can lead to different types of BMI. Adopting this multidimensional-outcome view on BMI can help scholars move away from the one-dimensional understanding of BMI that has dominated the BMI literature and instead take into account the heterogeneity of BMI types that firms aspire to implement.

Based on the data, we find that the broader a firm's search, the larger its BMI scope, and the deeper a firm's search, the more novel its BMI. More specifically, we find that firms that search both widely *and* deeply tend to implement BMIs of wider scope and novelty. This conditional association aligns with previous research that points to the benefits of combining deep with broad searches when targeting exploratory innovations (Hansen, 1999; Leiponen & Helfat, 2010; Oerlemans & Knoben, 2010). When applied to the BMI context, this may explain why some firms struggle to innovate their BMs when their search efforts are directed only at deep external cooperation. We hereby contribute novel, empirically supported insight into the conditional association between different external knowledge search strategies and BMI outcomes.

Moreover, we add to the emerging literature on the role of absorptive capacity in aiding firms in reconfiguring their BM components (Bhatti et al., 2021; Miroshnychenko et al., 2021; Müller et al., 2021; Ritter & Lettl, 2018). While we find only partial support for our arguments in this respect, we contribute to this research stream by providing a nuanced view of the interaction between absorptive capacity and search strategies in the BMI context. Firms that search only broadly but not deeply, such as using crowdsourcing, can achieve a wider BMI scope within what is known in their industry *without* high levels of absorptive capacity. However, sufficient levels of absorptive capacity are necessary for firms that search broadly and deeply and who strive for more complex BMI forms – that is, BMI of wider scope and novelty. This implies that firms that have to respond to changes in their external environment with more complex forms of BMI need to increase their absorptive capacity levels first before they can expect to reap the full benefits of engaging in external knowledge search. These findings open up new avenues for empirically driven research on the conditional association between absorptive capacity, search activity, and BMI.

Managerial implications

Dynamic changes in the business environment of a firm may require radical transformations of the firm's existing BM; that is, the way the firm creates, delivers, and captures value. Connecting to external sources of knowledge can be essential in enabling such innovations. However, for managers, engaging in external knowledge sourcing is costly and time-consuming. We therefore offer more finely grained insights into how the choice of search strategy needs to be aligned with the desired BMI outcome. This can aid firms in picking the right search strategy to conceive the most suitable type of BMI for the specific demands of its external environment.

Our findings illustrate how the use of codified knowledge easily accessible in the environment is associated with BMIs within the known landscape of the industry. By contrast, we find that unfamiliar knowledge accessible only through high-intensity connections with external knowledge sources is necessary to engage in BMIs that take the focal firm outside the known industry landscape. This implies that the focal firm also engages in a few close collaborations (e.g., innovation partnerships and alliances) to create new knowledge about BM combinations not previously seen in the industry.

In sum, our study may constitute a valuable tool for managers to understand how to leverage different external knowledge search strategies for the purpose of BMI.

Limitations and future research directions

The research design of the present study has certain limitations that can also serve as opportunities for further research. First, the findings are based on cross-sectional data collected in 2014; therefore, our analysis cannot establish causality (Frankfort-Nachmias & Nachmias, 1996). We argue that using external knowledge sources is positively associated with the scope and novelty of BMI. However, alternative interpretations of our findings are possible. A BMI initiated by a firm may trigger a requirement for establishing a greater number, or more intense use, of external sources. Thus, additional research using longitudinal or experimental designs may help clarify the direction of causality among the independent and dependent variables studied here. Second, self-reported data in surveys may be subject to social desirability bias (Podsakoff & Organ, 1986); social desirability 'refers to the need for social approval and acceptance and the belief that it can be attained by means of culturally acceptable and appropriate behaviours' (Crowne & Marlowe, 1964, p. 109). This is problematic in surveys because it can bias the answers of respondents towards certain levels and thus mask the true relationships between variables measured through the same source (Ganster et al., 1983; Moorman & Podsakoff, 1992). Such biases can then influence our findings on the relationship between external search and BMI. While we do not find a firm's external knowledge search and changes to BM elements to be particularly sensitive to social desirability, certain procedural methods can further reduce the risk that biases will influence the results (Ozer & Zhang, 2015; Podsakoff et al., 2003). In the present study, several such procedures have been applied. The respondents were provided with an assurance of anonymity, which can reduce social desirability bias even in cases of socially sensitive topics. The questions were also worded to minimise the likelihood of responses being affected by social desirability bias, as they were all closed-ended (e.g., yes/no, Likert scales) and subject to adjustments based on feedback from pilot testing. Moreover, there was a psychological separation between the questions for search and BMI in the survey design. Third, our research design does not allow for the analysis of search breadth and depth within each type of knowledge source. This means that we are not able to discern, for instance, whether a given firm was collaborating with one or several universities. Future research could develop more finely grained items for each type of knowledge source, so that insights regarding the impact of different knowledge sources on BMI could be enhanced. Fourth, further limitations related to endogeneity may exist. One source of such a limitation could be the omitted variable bias, where an unobserved variable (e.g., development trajectory within the industry) (Frankfort-Nachmias & Nachmias, 1996; Vittori et al., 2022) causes the association between external knowledge

search and BMI. In the absence of strong and valid instrumental variables, we control for several firm characteristics and industry conditions. Even with these controls, the hypothesised associations were still supported by our results. Finally, the sample includes only Norwegian firms in established industries, which raises the question of how widely the findings can be generalisable to other settings. This might, for instance, limit the applicability of our findings to firms in emerging industries (e.g., Vittori et al., 2022). Both cross-national studies and replications in other settings are therefore warranted.

Disclosure statement

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

Funding

The Norwegian School of Economics is the only organisation that funded this research.

References

Amit, R., & Zott, C. (2012, March 20). Creating value through business model innovation. *MIT Sloan Management Review*, *53*(Spring), 41–49. https://sloanreview.mit.edu/article/creating-value-through-business-model-innovation/

Andreini, D., Bettinelli, C., Foss, N. J., & Mismetti, M. (2022). Business model innovation: A review of the process-based literature. *Journal of Management & Governance*, *26*(4), 1089–1121. https://doi.org/10.1007/s10997-021-09590-w

Bagheri, S. K., Raoufi, P., Samandar Ali Eshtehardi, M., Shaverdy, S., Ramezani Akbarabad, B., Moghaddam, B., & Mardani, A. (2020). Using the crowd for business model innovation: The case of Digikala. *R&D Management*, *50*(1), 3–17. https://doi.org/10.1111/radm.12353

Baruch, Y. (1999). Response rate in academic studies: A comparative analysis. *Human Relations*, *52*(4), 421–438. https://doi.org/10.1177/001872679905200401

Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizational research. *Human Relations*, *61*(8), 1139–1160. https://doi.org/10.1177/0018726708094863

Baumann, O., Schmidt, J., & Stieglitz, N. (2019). Effective search in rugged performance landscapes: A review and outlook. *Journal of Management*, *45*(1), 285–318. https://doi.org/10.1177/0149206318808594

Bhatti, S. H., Santoro, G., Khan, J., & Rizzato, F. (2021). Antecedents and consequences of business model innovation in the IT industry. *Journal of Business Research*, *123*, 389–400. https://doi.org/10.1016/j.jbusres.2020.10.003

Bierly, P. E., Damanpour, F., & Santoro, M. D. (2009). The application of external knowledge: Organizational conditions for exploration and exploitation. *Journal of Management Studies*, *46*(3), 481–509. https://doi.org/10.1111/j.1467-6486.2009.00829.x

Billinger, S., Stieglitz, N., & Schumacher, T. R. (2013). Search on rugged landscapes: An experimental study. *Organization Science*, *25*(1), 93–108. https://doi.org/10.1287/orsc.2013.0829

Bocken, N. M., & Geradts, T. H. (2020). Barriers and drivers to sustainable business model innovation: Organization design and dynamic capabilities. *Long Range Planning*, *53*(4), 101950. Article 101950. https://doi.org/10.1016/j.lrp.2019.101950

Bouncken, R. B., Kraus, S., & Roig-Tierno, N. (2021). Knowledge-and innovation-based business models for future growth: Digitalized business models and portfolio considerations. *Review of Managerial Science*, *15*(1), 1–14. https://doi.org/10.1007/s11846-019-00366-z

Casadesus-Masanell, R., & Zhu, F. (2013). Business model innovation and competitive imitation: The case of sponsor-based business models. *Strategic Management Journal*, *34*(4), 464–482. https://doi.org/10.1002/smj.2022

Casadesus-Masanell, R., & Ricart, J. E. (2010). From strategy to business models and onto tactics. *Long Range Planning*, *43*(2–3), 195–215. https://doi.org/10.1016/j.lrp.2010.01.004

Chesbrough, H. (2019). *Open innovation results: Going beyond the hype and getting down to business*. Oxford University Press.

Christensen, C. M., Bartman, T., & Van Bever, D. (2016, September 13). The hard truth about business model innovation. *MIT Sloan Management Review*, (Fall), *58*(1), 30–40.

Cohen, W., & Levinthal, D. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(1), 128–152. https://doi.org/10.2307/2393553

Coombs, R., & Hull, R. (1998). 'Knowledge management practices' and path-dependency in innovation. *Research Policy*, *27*(3), 237–253. https://doi.org/10.1016/S0048-7333(98)00036-5

Crowne, D., & Marlowe, D. (1964). *The approval motive: Studies in evaluative dependence*. Wiley.

Cucculelli, M., & Bettinelli, C. (2015). Business models, intangibles and firm performance: Evidence on corporate entrepreneurship from Italian manufacturing SMEs. *Small Business Economics*, *45*(2), 329–350. https://doi.org/10.1007/s11187-015-9631-7

Dell'era, C., DiMinin, A., Ferrigno, G., Frattini, F., Landoni, P., & Verganti, R. (2020). Value capture in open innovation processes with radical circles: A qualitative analysis of firms' collaborations with Slow Food, Memphis, and Free Software Foundation. *Technological Forecasting and Social Change 158*, 120128. Article 120128. https://doi.org/10.1016/j.techfore.2020.120128

Desyllas, P., Salter, A., & Alexy, O. (2022). The breadth of business model reconfiguration and firm performance. *Strategic Organization*, *20*(2), 231–269. https://doi.org/10.1177/1476127020955138

The Economist. (2017, October 14). BBVA, a Spanish bank, reinvents itself. https://www.economist.com/finance-and-economics/2017/10/14/bbva-a-spanish-bank-reinvents-itself-as-a-digital-business

Ennen, E., & Richter, A. (2010). The whole is more than the sum of its parts-or is it? A review of the empirical literature on complementarities in organizations. *Journal of Management*, *36*(1), 207–233. https://doi.org/10.1177/0149206309350083

Ethiraj, S. K., & Levinthal, D. (2004). Bounded rationality and the search for organizational architecture: An evolutionary perspective on the design of organizations and their evolvability. *Administrative Science Quarterly*, *49*(3), 404–437. https://doi.org/10.2307/4131441

Fey, C. F., & Birkinshaw, J. (2005). External sources of knowledge, governance mode, and R&D performance. *Journal of Management*, *31*(4), 597–621. https://doi.org/10.1177/0149206304272346

Flatten, T. C., Engelen, A., Zahra, S. A., & Brettel, M. (2011). A measure of absorptive capacity: Scale development and validation. *European Management Journal*, *29*(2), 98–116. https://doi.org/10.1016/j.emj.2010.11.002

Foss, N. J., & Saebi, T. (2017). Fifteen years of research on business model innovation: How far have we come, and where should we go? *Journal of Management*, *43*(1), 200–227. https://doi.org/10.1177/0149206316675927

Foss, N. J., & Saebi, T. (2018). Business models and business model innovation: Between wicked and paradigmatic problems. *Long Range Planning*, *51*(1), 9–21. https://doi.org/10.1016/j.lrp.2017.07.006

Frankfort-Nachmias, C., & Nachmias, D. (1996). *Research methods in the social sciences*. St. Martin's Press.

Ganco, M. (2017). NK model as a representation of innovative search. *Research Policy*, *46*(10), 1783–1800. https://doi.org/10.1016/j.respol.2017.08.009

Ganster, D. C., Hennessey, H. W., & Luthans, F. (1983). Social desirability response effects: Three alternative models. *Academy of Management Journal*, *26*(2), 321–331. https://doi.org/10.2307/255979

Gebauer, H., Worch, H., & Truffer, B. (2012). Absorptive capacity, learning processes and combinative capabilities as determinants of strategic innovation. *European Management Journal*, *30*(1), 57–73. https://doi.org/10.1016/j.emj.2011.10.004

Greve, H. R. (1998). Performance, aspirations, and risky organizational change. *Administrative Science Quarterly*, *43*(1), 58–86. https://doi.org/10.2307/2393591

Greve, H. R. (2003). *Organizational learning from performance feedback: A behavioral perspective on innovation and change*. Cambridge University Press.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly*, *44*(1), 82–111. https://doi.org/10.2307/2667032

Huang, H. C., Lai, M. C., Lin, L. H., & Chen, C. T. (2013). Overcoming organizational inertia to strengthen business model innovation. *Journal of Organizational Change Management*, *26*(6), 977–1002. https://doi.org/10.1108/JOCM-04-2012-0047

Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal*, *45*(8), 1183–1194. https://doi.org/10.2307/3069433

Kauffman, S. A. (1993). *The origins of order: Self-organization and selection in evolution*. Oxford University Press. https://doi.org/10.1007/978-94-015-8054-0_8

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, *27*(2), 131–150. https://doi.org/10.1002/smj.507

Leiponen, A., & Helfat, C. E. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, *31*(2), 224–236. https://doi.org/10.1002/smj.807

Leppänen, P., George, G., & Alexy, O. (2023). When do novel business models lead to high performance? A configurational approach to value drivers, competitive strategy, and firm environment. *Academy of Management Journal*, *66*(1), 164–194. https://doi.org/10.5465/amj.2020.0969

Levinthal, D. A. (1997). Adaptation on rugged landscapes. *Management Science*, *43*(7), 934–950. https://doi.org/10.1287/mnsc.43.7.934

Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, *14*(S2), 95–112. https://doi.org/10.1002/smj.4250141009

Li, Q., Maggitti, P. G., Smith, K. G., Tesluk, P. E., & Katila, R. (2013). Top management attention to innovation: The role of search selection and intensity in new product introductions. *Academy of Management Journal*, *56*(3), 893–916. https://doi.org/10.5465/amj.2010.0844

Lowik, S., Van Rossum, D., Kraaijenbrink, J., & Groen, A. (2012). Strong ties as sources of new knowledge: How small firms innovate through bridging capabilities. *Journal of Small Business Management*, *50*(2), 239–256. https://doi.org/10.1111/j.1540-627X.2012.00352.x

Mancuso, I., Petruzzelli, A. M., & Panniello, U. (2023). Innovating agri-food business models after the Covid-19 pandemic: The impact of digital technologies on the value creation and value capture mechanisms. *Technological Forecasting and Social Change 190*, 122404. Article 122404. https://doi.org/10.1016/j.techfore.2023.122404

Massa, L., & Tucci, C. L. (2014). Business model innovation. In M. Dodgson, D. M. Gann, & N. Phillips (Eds.), *The Oxford handbook of innovation management* (pp. 420–441). Oxford University Press.

Mina, A., Bascavusoglu-Moreau, E., & Hughes, A. (2014). Open service innovation and the firm's search for external knowledge. *Research Policy*, *43*(5), 853–866. https://doi.org/10.1016/j.respol.2013.07.004

Miroshnychenko, I., Strobl, A., Matzler, K., & De Massis, A. (2021). Absorptive capacity, strategic flexibility, and business model innovation: Empirical evidence from Italian SMEs. *Journal of Business Research*, *130*, 670–682. https://doi.org/10.1016/j.jbusres.2020.02.015

Mol, M., & Birkinshaw, J. M. (2009). The sources of management innovation: When firms introduce new management practices. *Journal of Business Research*, *62*(12), 1269–1280. https://doi.org/10.1016/j.jbusres.2009.01.001

Monteiro, F., Mol, M., & Birkinshaw, J. (2017). Ready to be open? Explaining the firm level barriers to benefiting from openness to external knowledge. *Long Range Planning*, *50*(2), 282–295. https://doi.org/10.1016/j.lrp.2015.12.008

Moorman, R. H., & Podsakoff, P. M. (1992). A meta-analytic review and empirical test of the potential confounding effects of social desirability response sets in organizational behaviour research. *Journal of Occupational and Organizational Psychology*, *65*(2), 131–149. https://doi.org/10.1111/j.2044-8325.1992.tb00490.x

Müller, J. M., Buliga, O., & Voigt, K. I. (2021). The role of absorptive capacity and innovation strategy in the design of industry 4.0 business models: A comparison between SMEs and large enterprises. *European Management Journal*, *39*(3), 333–343. https://doi.org/10.1016/j.emj.2020.01.002

Nickerson, J. A., & Zenger, T. R. (2004). A knowledge-based theory of the firm—The problem-solving perspective. *Organization Science*, *15*(6), 617–632. https://doi.org/10.1287/orsc.1040.0093

Oerlemans, L. A. G., & Knoben, J. (2010). Configurations of knowledge transfer relations: An empirically based taxonomy and its determinants. *Journal of Engineering and Technology Management*, *27*(1–2), 33–51. https://doi.org/10.1016/j.jengtecman.2010.03.002

Ozer, M., & Zhang, W. (2015). The effects of geographic and network ties on exploitative and exploratory product innovation. *Strategic Management Journal*, *36*(7), 1105–1114. https://doi.org/10.1002/smj.2263

Phelps, C. C. (2010). A longitudinal study of the influence of alliance network structure and composition on firm exploratory innovation. *Academy of Management Journal*, *53*(4), 890–913. https://doi.org/10.5465/amj.2010.52814627

Pihlajamaa, M. (2021). What does it mean to be open? A typology of inbound open innovation strategies and their dynamic capability requirements. *The Innovation*, *25*(1), 1–24. https://doi.org/10.1080/14479338.2021.1907192

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management*, *12*(4), 69–82. https://doi.org/10.1177/014920638601200408

Rindova, V. P., & Martins, L. L. (2021). Shaping possibilities: A design science approach to developing novel strategies. *Academy of Management Review*, *46*(4), 800–822. https://doi.org/10.5465/amr.2019.0289

Ritter, T., & Lettl, C. (2018). The wider implications of business-model research. *Long Range Planning*, *51*(1), 1–8. https://doi.org/10.1016/j.lrp.2017.07.005

Saebi, T., & Foss, N. J. (2015). Business models for open innovation: Matching heterogeneous open innovation strategies with business model dimensions. *European Management Journal*, *33*(3), 201–213. https://doi.org/10.1016/j.emj.2014.11.002

Savino, T., Messeni Petruzzelli, A., & Albino, V. (2017). Search and recombination process to innovate: A review of the empirical evidence and a research agenda. *International Journal of Management Reviews*, *19*(1), 54–75. https://doi.org/10.1111/ijmr.12081

Saviotti, P. P. (1998). On the dynamics of appropriability, of tacit and of codified knowledge. *Research Policy*, *26*(7–8), 843–856. https://doi.org/10.1016/S0048-7333(97)00066-8

Schneckenberg, D., Matzler, K., & Spieth, P. (2021). Theorizing business model innovation: An organizing framework of research dimensions and future perspectives. *R&D Management*, *52*(3), 593–594. https://doi.org/10.1111/radm.12506

Simon, H. A. (1962). The architecture of complexity. *Proceedings of the American Philosophical Society*, *106*, 467–482. https://doi.org/10.1109/MCS.2007.384127

Snihur, Y., & Wiklund, J. (2019). Searching for innovation: Product, process, and business model innovations and search behavior in established firms. *Long Range Planning*, *52*(3), 305–325. https://doi.org/10.1016/j.lrp.2018.05.003

Snihur, Y., & Zott, C. (2020). The genesis and metamorphosis of novelty imprints: How business model innovation emerges in young ventures. *Academy of Management Journal*, *63*(2), 554–583. https://doi.org/10.5465/amj.2017.0706

Spithoven, A., Clarysse, B., & Knockaert, M. (2011). Building absorptive capacity to organise inbound open innovation in traditional industries. *Technovation*, *31*(1), 10–21. https://doi.org/10.1016/j.technovation.2010.10.003

Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, *43*(2–3), 172–194. https://doi.org/10.1016/j.lrp.2009.07.003

Terjesen, S., & Patel, P. C. (2017). In search of process innovations: The role of search depth, search breadth, and the industry environment. *Journal of Management*, *43*(5), 1421–1446. https://doi.org/10.1177/0149206315575710

Tidhar, R., & Eisenhardt, K. M. (2020). Get rich or die trying . . . Finding revenue model fit using machine learning and multiple cases. *Strategic Management Journal*, *41*(7), 1245–1273. https://doi.org/10.1002/smj.3142

Trantopoulos, K., von Krogh, G., Wallin, M. W., & Woerter, M. (2017). External knowledge and information technology: Implications for process innovation performance. *MIS Quarterly*, *41*(1), 287–300. https://doi.org/10.25300/MISQ/2017/41.1.15

Vittori, D., Natalicchio, A., Panniello, U., Petruzzelli, A. M., & Cupertino, F. (2022). Business model innovation between the embryonic and growth stages of industry lifecycle. *Technovation 117*, 102592. Article 102592. https://doi.org/10.1016/j.technovation.2022.102592

West, J., & Bogers, M. (2017). Open innovation: Current status and research opportunities. *The Innovation*, *19*(1), 43–50. https://doi.org/10.1080/14479338.2016.1258995

Williams, L. J., & Brown, B. K. (1994). Method variance in organizational behavior and human resources research: Effects on correlations, path coefficients, and hypothesis testing. *Organizational Behavior and Human Decision Processes*, *57*(2), 185–209. https://doi.org/10.1006/obhd.1994.1011

Wright, S. (1932). The role of mutation, inbreeding, crossbreeding and selection in evolution. In *Proceedings of the Sixth International Congress of Genetics*, Cornell University, Ithaca, New York, (Vol. 1, pp. 356–366). Brooklyn Botanic Garden.

Xie, X., Wang, H., & García, J. S. (2021). How does customer involvement in service innovation motivate service innovation performance? The roles of relationship learning and knowledge absorptive capacity. *Journal of Business Research*, *136*, 630–643. https://doi.org/10.1016/j.jbusres.2021.08.009

Yu, B., Hao, S., & Wang, Y. (2020). Organizational search and business model innovation: The moderating role of knowledge inertia. *Journal of Knowledge Management*, *24*(7), 1705–1718. https://doi.org/10.1108/JKM-02-2020-0100

Zaheer, A., Gözübüyük, R., & Milanov, H. (2010). It's the connections: The network perspective in interorganizational research. *Academy of Management Perspectives*, *24*(1), 62–77. https://doi.org/10.5465/amp.24.1.62

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, *27*(2), 185–203. https://doi.org/10.2307/4134351

Zhu, P., Miao, X., & Jin, S. (2022). Boundary-spanning search and business model innovation: The joint moderating effects of innovative cognitive imprinting and environmental dynamics. *European Journal of Innovation Management*. Advance online publication. https://doi.org/10.1108/EJIM-12-2021-0605

Zobel, A. K. (2017). Benefiting from open innovation: A multidimensional model of absorptive capacity. *Journal of Product Innovation Management*, *34*(3), 269–288. https://doi.org/10.1111/jpim.12361

Zott, C., & Amit, R. (2008). The fit between product market strategy and business model: Implications for firm performance. *Strategic Management Journal*, *29*(1), 1–26. https://doi.org/10.1002/smj.642

Zott, C., Amit, R., & Massa, L. (2011). The business model: Recent developments and future research. *Journal of Management*, *37*(4), 1019–1042. https://doi.org/10.1177/0149206311406265

Appendix

A: Survey Questions

1. Sources of information and co-operation for innovation

How important were each of the following information sources for your firm's innovation activities during the last three years (1 =*Not used*,4 =*Highly used*)?

1.1. Other firms within your group
1.2. Suppliers of equipment, materials, services, or software
1.3. Clients or customers
1.4. Competitors or other firms in your industry
1.5. Consultants, commercial laboratories, or private R&D institutes
1.6. Universities or other higher education institutions
1.7. Government or public research institutes
1.8. Conferences, trade fairs, and exhibitions
1.9. Scientific journals and trade or technical publications
1.10. Professional and industry associations
1.11. Technical, industry, or service standards

2. Did your firm co-operate in any of your innovation activities with other firms or institutes during the last three-year period (*Yes/no*)?

3. Which types of co-operation partners did you use, and where were they located?

3.1. Other firms within your firm group
  3.1.1. Inside Norway
  3.1.2. Outside Norway
3.2. Suppliers of equipment, materials, services, or software
  3.2.1. Inside Norway
  3.2.2. Outside Norway
3.3. Clients or customers
  3.3.1. Inside Norway
  3.3.2. Outside Norway
3.4. Competitors or other firms in your industry
  3.4.1. Inside Norway
  3.4.2. Outside Norway
3.5. Consultants, commercial laboratories, or private R&D institutes
  3.5.1. Inside Norway
  3.5.2. Outside Norway
3.6. Universities or other higher education institutions
  3.6.1. Inside Norway
  3.6.2. Outside Norway
3.7. Government or public research institutes
  3.7.1. Inside Norway
  3.7.2. Outside Norway

4. Strategic orientation

How important are the following for your firm in the competition with your closest competitors (1 =*Not important*, 7 =*Very important*)?

4.1. Excellent customer service
4.2. Wide product/service range
4.3. Low prices
4.4. Customization/tailoring for customers
4.5. Patents/trademarks
4.6. Launch of new products/services
4.7. Innovation/R&D
4.8. Creation of high switching costs for customers
4.9. Reduction of costs (marketing and sales costs, transaction processing costs)

5. BM dimension: change in target customer/new market.

Which of the following changes to its target market(s) has your firm undertaken in the last three years? During the last three years, did your firm. . .

5.1. . . . target a new customer segment?
5.2. . . . enter a new market it had not previously targeted?
5.3. . . . target customers that competitors ignored?

6. BM dimension: change in value proposition and value capture

Which of the following changes to its value proposition and value capture has your firm undertaken in the last three years? During the last three years, did your firm. . .
(*Yes/no*; and if yes, was it '*new to firm, known to industry*' or '*new to firm, new to industry*').

6.1. . . . introduce a significant new bundle of products and services to its existing customers?
6.2. . . . introduce a significant new bundle of products and services to new customers?
6.3. . . . introduce any significant changes in its pricing scheme?
6.4. . . . change its main source of revenue?
6.5. . . . implement any new or significant changes to its use of trademarks, patents, or copyrights?

7. BM dimension: change in value chain.

Which of the following changes to its value chain has your firm undertaken in the last three years? During the last three years, did your firm . . .

7.1. . . . collaboratein a novel way with parties in its supply chain, such as suppliers and customers?
7.2. . . . collaboratein a novel way with parties outside its supply chain?
7.3. . . . significantlychange the traditional roles and power relationships in its industry?