Journal of Business Research 116 (2020) 1–12

Contents lists available at ScienceDirect

Journal of Business Research

journal homepage: www.elsevier.com/locate/jbusres

How important is alignment of social media use and R&D–Marketing cooperation for innovation success?

Edwin J. Nijssen[a,*], Andrea Ordanini[b]

[a] Eindhoven University of Technology, Department of Industrial Engineering & Innovation Sciences, Innovation Technology Entrepreneurship & Marketing Group, P.O. Box 513, 5600 MB Eindhoven, the Netherlands

[b] BNP Paribas Professor of Marketing & Service Analytics at Bocconi University, Department of Marketing, Milan, Italy

ARTICLE INFO

Keywords:
Social media strategy
Product innovation
Contingency theory
Information processing theory
R&D-marketing cooperation
Polynomial regression
fsQCA

ABSTRACT

Efforts to use social media as a network tool for open innovations have not met expectations, or utilized its potential adequately. Recent research on identifying firms' social media skill has not addressed the complex underlying mechanisms and calibration of social media capabilities. We explore how, why, and which resources an organization should integrate. Social media in NPD should be accompanied by carefully aligned R&D – marketing cooperation. Alignment results in efficient knowledge integration, but dis-alignment fails to tap enough ideas, or can lack information processing capacity. The alignment and disalignment hypotheses are tested using survey data of a sample of 101 innovative SMEs. In a second, configurational study we extend findings from Study 1 to determine micro level social media capabilities required. Results show that social media can be used for both radical and incremental innovation, but are more useful for service than for product innovation.

1. Introduction

Despite claims that results of using social media in new product development (NPD) look promising (Nishikawa, Schreier, Fuchs, & Ogawa, 2017; Poetz & Schreier, 2012), empirical results suggest that expected benefits are often not fully realized (Marion, Barczak, & Hultink, 2014; Roberts & Candi, 2014). "What's more, some companies have seen their innovation performance negatively affected." (Roberts & Piller, 2016, p.41). Many of these firms simply do not know how to use social media for innovation and, as a result, fail to make the necessary organizational changes.

Against this background, recent research began to pay attention to various organizational capabilities necessary to exploit the potential of social media and leverage the firm's network for open innovation (Bashir, Papamichail, & Malik, 2017; Muninger, Hammedi, & Mahr, 2019; Roberts & Piller, 2016). At the same time, other scholars explored a linear adoption process of social media tools, with different maturity levels and related organizational characteristics (Chirumalla, Oghazi, & Parida, 2018; Mount & Garcia Martinez, 2014). However, despite their fundamental contribution, these recent efforts heavily relied on qualitative methods and mainly focused on general characteristics of adoption. Attention for *underlying mechanisms of integration* of the newly generated ideas and feedback, as well as the generalizability of findings across contexts (services vs. products, radical vs. incremental innovations) have remained limited. Also, the question whether the impact of social media usage on the organization and outcomes is simple and linear, or involves complex nonlinear effects has remained unaddressed.

Based on these observations, we conduct two studies using different methods, with the aim of helping managers properly use their social media in NPD and focusing their attention on the underlying mechanism of knowledge integration. By combining a quantitative predictive study (Study 1) and a qualitative comparative analysis (Study 2), we respond to a longstanding call in the literature for more multimethod research in marketing and management research to enhance the robustness, scope, and impact of empirical research findings (Davis, Golicic, & Boerstler, 2011).

In Study 1 we address the *how* and *why* questions. The former focuses on how social media activities need to be aligned with R&D-marketing cooperation to ensure integration of the firm's newly attracted external and internal resources. The latter refers to the identification of knowledge integration as an important mediator towards successful innovation outcomes. Drawing on Service Dominant Logic (SDL) theoretical principles (Vargo & Lusch, 2004), we suggest that new institutional arrangements will be necessary to accomplish this integration. It will require careful alignment between the firm's externally- and internally-oriented activities. We develop and test this alignment hypothesis using the polynomial regression approach

* Corresponding author.
E-mail addresses: e.j.nijssen@tue.nl (E.J. Nijssen), andrea.ordanini@unibocconi.it (A. Ordanini).

https://doi.org/10.1016/j.jbusres.2020.04.056
Received 31 May 2019; Received in revised form 23 April 2020; Accepted 25 April 2020

(Edwards & Parry, 1993), which allows us to estimate linear and non-linear complex effects between these internal and external activities. We also account for possible differences in level of alignment necessary for the successful development of products vs. services. We anticipate that, since services are intangible and complex, alignment is more critical for use of social media in a service than product context.

In study 2 we investigate *what* capabilities companies need to develop. We focus on the role played by specific micro capabilities of social media usage in the innovation process. Specifically, we use fuzzy set Qualitative Comparative Analysis (fsQCA) (Ragin, 2000) to identify the configurations of capabilities regarding use of social media for innovation that are associated with successful radical and incremental new product outputs, respectively. We show that using social media to leverage external resources can benefit a firm's innovation outcomes, but when using the crowd to help develop radical (vs. incremental) new products, capabilities for evaluating the value of the external contribution become a critical ingredient that should complement other capabilities, such as the ability to select and motivate the right, i.e. relevant people.

Our research makes three important contributions. First, we add to the growing number of innovation studies focusing on social media using a firm rather than customer perspective (e.g., Bashir et al., 2017; Chirumalla et al., 2018; Muninger et al., 2019) and on R&D-marketing interface management (Calantone & Rubera, 2012; Chirumalla et al., 2018; Iansiti, 1995). Drawing on SDL we focus on the knowledge integration process and develop an *alignment hypothesis*. Alignment refers to a theoretically defined *match* between two related variables. It explains *how* firms can be successful using social media in their NPD. If inputs from social media are carefully matched with adequate internal cooperation between R&D and marketing knowledge, integration will occur, but if such alignment is absent, firms will experience serious drawbacks because they will be unable to integrate their external and internal resources. We provide evidence that (mis)alignment involves important non-linear effects, and is more important for firms operating in service than product innovation context. We show that R&D–marketing collaboration is not a 'silver bullet', but will only generate positive innovation outcomes if combined and carefully aligned with the firm's level of social media efforts.

Second, and related to the previous point, we introduce efficient knowledge integration (EKI) as an important, mediating construct. Drawing on SDL we define EKI as the smart utilization of new knowledge generated from customers using social media in a firm's new product planning and development. Our results show that EKI indeed drives product innovation outcomes. Driven by the above-mentioned alignment mechanism, EKI explains *why* some firms are more successful than others. It extends, for example, Chirumalla et al. (2018) work by demonstrating the effect size of alignment of internal and external resources (how) on EKI (why).

Finally, we provide detailed insight into micro level capabilities for using social media and demonstrate that the benefits are not limited to radical but also extend to incremental innovation, albeit in a slightly different way. By identifying the unique 'recipes' that are associated with the different innovation outcomes, we add to the understanding of *what* capabilities firms need to develop to successfully use social media in NPD for either type of innovation strategy. The results extend prior qualitative work (e.g., Bashir et al., 2017; Mount & Garcia Martinez, 2014) by more systematically accounting for and comparing these two new product development settings. We begin by discussing the theoretical background of our study before we present our model and develop the hypotheses of Study 1.

2. Theoretical background

Social media are a way for firms to connect to and leverage their customer network. It comprises, for instance, Blogs, Online forums, LinkedIn, and Facebook (Kaplan & Haenlein, 2010). To conceptualize and understand the various challenges organizations face regarding the use of social media and bringing the customer voice into their NPD process, we draw on the theoretical perspective of Service Dominant Logic (SDL) (Vargo & Lusch, 2004). SDL aims to understand human value co-creation by offering an alternative to traditional product-centered logics of exchange. SDL is well-suited to our purposes because it provides a perspective on social and economic exchanges that is able to capture the key distinguishing factors of social media use for NPD.

First, the use of social media for innovation purposes implies a series of close interactions between different players, e.g., crowds of customers, innovation managers, social media platforms. This circumstance reflects a key assumption of SDL, according to which economic value is always co-created in the networks of interactions among economic actors. In fact, SDL views all social and economic actors as resource integrators (Sharma & Conduit, 2016). According to SDL, co-creation is indeed the outcome of the integration of a provider's and a customer's resources and processes. When using social media, a firm should carefully consider the level and scope of involvement of its customer network.

Second, the interactions between customers and companies in the context of social media and innovation are mostly based on the exchange of information and knowledge. This feature is consistent with SDL's core proposition that considers knowledge as the most important resource for a company, and defines the co-creation process as a series of close interaction and collaboration efforts between different actors to ensure conversation and mutual exchange of knowledge vs. mere "knowledge [or data] import" (Sharma & Conduit, 2016; Sawhney, Verona, & Prandelli, 2005).

Third, customer knowledge from social media aims to improve innovation quality by augmenting (vs. substituting) the knowledge that resides in a firm's marketing and R&D units, i.e. departments typically involved in a firm's NPD process. It means that social media give way to a complex 'co-development' process, in which actors try to combine knowledge from internal and external sources (Chirumalla et al., 2018; Sharma & Conduit, 2016). This is in line with the meaning SDL associates with co-creation and knowledge integration principles: any resource an actor obtains can never be used in isolation, but its usefulness depends on *how* it is combined or bundled with other resources (Vargo & Lusch, 2008). Internal and external knowledge (resources) need to be properly *aligned* in configurations that a firm offers the market in the form of value propositions to ensure knowledge integration that contributions to new products' or services' value-in-use (Hartmann, Wieland, & Vargo, 2018; Macdonald, Kleinaltenkamp, & Wilson, 2016).

The above discussion suggests that to fully understand the role of social media in NPD we need to go beyond the current prescriptions accumulated in the literature on product innovation, and that SDL principles can be highly informative in this regard. First, it draws attention to the fact that while social media may initially be used for ideation, these media should also be used for co-design. If a firm wants to systematically create better competitive advantage it will need to adjust its internal organization and align it with its social media usage. Any investments in using social media to increase external resources (e.g. ideas), require development of a more iterative and collaborative in-house process to ensure integrating these resources in the firm's product or service solutions. By using social media not only for obtaining new ideas, but also for refining and fine-tuning these ideas together with the crowd, better results can be achieved (Allen, Chandrasekaran, & Basuroy, 2018).

However, because members of the "crowd" are neither familiar specialists nor a part of the internal team, there is also a need for closer monitoring and internal involvement to develop solutions. It will require R&D and marketing to develop new institutional arrangements, i.e. new norms and routines, to make it work (e.g., Vargo & Lusch, 2016). It is only by developing such new institutions that a firm can better connect, monitor, and coordinate with its stakeholders, and

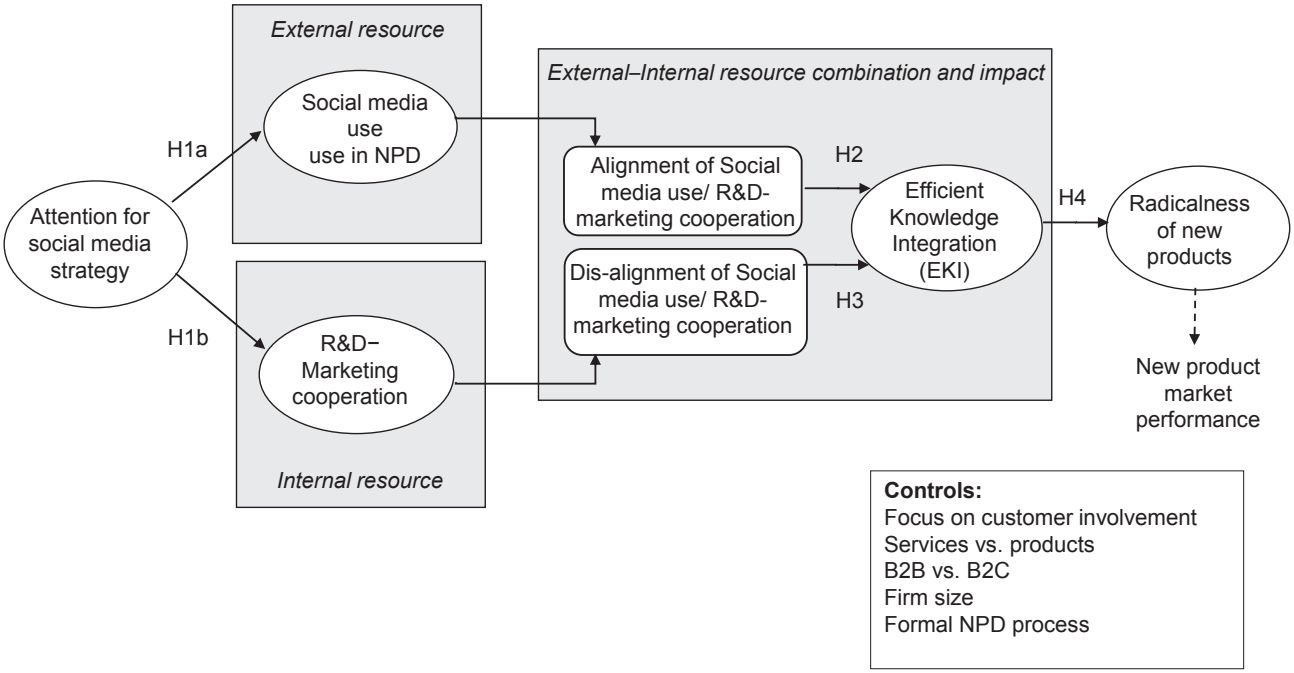

Fig. 1. A model of social media firm strategy and resource integration mechanisms.

integrate the new knowledge efficiently. With traditional research on R&D-marketing interaction focusing on structural and communication elements, less attention has been allocated to the need for developing such new institutional arrangements as well as potential non-linear interaction effects between social media use and R&D-marketing co-operation that may be associated with it. Moreover, effects may be more pronounced in services as compared to product innovation context. Due to the intangibility of services, knowledge regarding service solutions is stickier and thus both harder to convey and absorb (Homburg & Kuehnl, 2014), explaining why investments in internal and external resources alignment, based on these new institutional arrangements, will be more critical.

Based on the above, we propose a novel conceptual framework to predict innovation success (see Fig. 1). Central in this framework is EKI that combines external and internal resources to drive positive innovation, i.e., more radical new products and services. EKI depends on complex and non-linear alignment mechanisms involving R&D-marketing collaboration and social media for involving the firm's customer network. The firm's social media strategy drives this process.

We develop our hypotheses for the model in the next section. Given that SDL operates at a high-order conceptual level, we will complement it with Information Processing Theory and Contingency Theory as specific middle-range theories (Brodie, Hollebeek, Juric, & Ilic, 2011) to detail arguments at the (NPD) process level. The former argues that data or information is collected but needs to be processed to become knowledge that can be used in a firm's business processes and products. The latter suggests that the effectiveness of an organization is depend on certain conditions, i.e. contingencies that can make a process more or less effective.

3. Study 1

3.1. Model and hypotheses development

A firm's attention for a strategic approach to social media drives its level of use of social media in NPD, and affects its degree of R&D–marketing cooperation. Because strategic attention to social media acts as a contingency mechanism it helps ensure that increased efforts to stimulate input from outside are complemented with adequate internal resources to ensure knowledge integration.

Nambisan (2002) was among the first to stress the importance of such a strategic response to social media. He stressed the simultaneous need for developing social relationships with the firm's (virtual) network community *and* increasing processing/integration capabilities of the firm. There should be "significant focus on capturing customers' tacit knowledge about a product and the application context and making such knowledge explicit so that it can be used by the internal NPD team." (Nambisan, 2002, p. 403). The former concerned a call to managers to switch from seeing customers as a target to considering them as a resource – a notion completely in line with SDL prescription (Vargo & Lusch, 2008). The latter particularly referred to inter-functional cooperation, such as the collaboration between R&D and marketing (De Luca & Atuahene-Gima, 2007; Li & Calantone, 1999). It facilitates the integration of a firm's market and technical knowledge in product or service applications, and has proven in many studies a key driver of new product advantage (e.g., Calantone & Rubera, 2012; Li & Calantone, 1999).

Results of, for example, Bashir et al. (2017), Chirumalla et al. (2018), and Muninger et al. (2019) provide evidence that a formal, deliberate strategy for capability development benefits a firm's successful use of social media for innovation and increase inter-functional cooperation. Formal strategic attention ensures that top management is involved and attention and resources are allocated to warrant integration of this knowledge in the firm's innovation processes. It stimulates seeing customer information and co-design as a means rather than as a goal, which fosters knowledge integration and thus new product advantage (Moorman, 1995; Sinkula, 1994). It helps connect with external stakeholders but also brings together internal stakeholders to ensure adequate data processing and integration by considering the user context (Chirumalla et al., 2018).

H1. Attention for social media strategy has a positive relationship with (a) the level of NPD social media use, and (b) the level of R&D − marketing cooperation.

Although social media usage (for NPD) and R&D–marketing co-operation will facilitate generation of insights and integration of this knowledge respectively, both processes should be *aligned* to achieve positive results (Chirumalla et al., 2018; Roberts & Grover, 2012). If

both processes are only used to *limited extent*, few new customer data will be acquired and usage of the crowd may focus on simple ideation and not the more complex co-design. Low R&D–marketing cooperation then will suffice to process the incoming data, and use it in the firm's NPD process. So, for small amounts and less complex new information, limited processing capacity and existing routines between R&D and marketing will be suffice to achieve EKI. In contrast, if *both* processes are *used extensively*, the firm leverages its customer network to great extent. It will acquire many new ideas and may also involve customers for co-design. Consequently, it will need to complement the effort with serious investments in internal resources to be able to process and integrate the external input and deal with the interactions of co-design. High R&D–marketing collaboration then will be required to ensure that the rich but ambiguous information collected is properly structured and used in the firm's innovation process (Allen et al., 2018; Poetz & Schreier, 2012). This investment in internal resources will have to include the development of new institutional arrangements to connect customers for co-design. As Zietsma and McKnight (2009) explain, institutional change always involves multiple actors who, iteratively and nonlinearly, bring about imperfect alignments in their institutional arrangements, which affects enactment of new value co-creation practices (cf. Hartmann et al., 2018). It stresses the need for alignment and anticipating nonlinear effects.

Although the effectiveness of alignment (moving from low/low to high/high) may be linear, we anticipate *diminishing returns*. First, although the number of insights that can be collected from a large group of customers may be endless, we expect that the quality of ideas a group of customers can come up with to first increase and then decrease. Customers need some time to consider a problem and become creative, i.e. think out of the box, but then will soon run out of ideas. However, internal limitation will play a role too. Involving the crowd for refining and fine-tuning design will require developing joint language and meaning, i.e. new institutional arrangements (Allen et al., 2018). Because there is a maximum of mental capacity of the actors involved, with increased levels of customer participation employee stress and inefficiency effects will grow also (Homburg & Kuehnl, 2014). As a result, these actors may be less motivated and able to filter ideas carefully, which may make high/high alignment-combination less effective.

Based on the combination of these two reasons, we hypothesize a positive slope but negative curvature effect for the level of alignment between social media use and R&D–marketing cooperation on EKI:

H2. EKI (a) increases with rising levels of alignment of NPD social media use and R&D–marketing cooperation (positive slope), but with (b) decreasing marginal value (negative curvature).

In contrast to alignment, dis-alignment of levels of social media use and R&D–marketing cooperation will hamper EKI (Muninger et al., 2019; Roberts & Piller, 2016). The reason is straightforward: In case of *high* social media use and *low* internal cooperation between R&D and marketing, the organization will have serious difficulty dealing with all customer interaction and digesting the large number of ideas and suggestions for improvement generated by its customer resource. As a result, the integration of newly generated knowledge will decrease. Drawn from a large group of people the information will be rich, but also vary widely and be poorly structured, giving way to ambiguity (Poetz & Schreier, 2012). "Because members of the "crowd" are neither familiar specialists nor a part of the internal team, there is a need for closer monitoring and internal involvement to move toward a solution." (Allen et al., 2018, p.110). It may cause frustration of employees, which decreases the firm's chance of EKI. This will be particularly the case when too little internal resources are available to complement the high level of external involvement and co-design. The result will be a rapid, nonlinear deterioration of innovation outcomes.

A similar effect is expected for dis-alignment of the kind where internal cooperation is *high* and social media efforts towards the firm's external customer network is *low*. The high internal cooperation between R&D and marketing will make the few insights collected easy to integrate. However, very strong internal ties may cause ingroup-outgroup thinking that can stimulate "not invented here"- tendencies, which result in a negative evaluation bias of the ideas and thus rejection rather than assimilation of the information. Under these conditions the internal resource sees customers as target rather than as a viable resource, which explains why both R&D and marketing will quickly reject input from the crowd. Due to their strong relationship and culture the two departments will prevent and even frustrate the development of new institutions to involve the customer network. As a result, negative nonlinear impact on innovation outcomes will occur, particularly if the firm becomes inward looking and inert.

Therefore, we expect both types of dis-alignment to generate suboptimal outcomes. Moving away from alignment –in either direction—results in suboptimal outcomes. Results are limited by the weakest link in the firm's information processing network: weak internal or external resources determines the outcome. In accordance with SDL logic we anticipate the negative effects to be modest in case of small dis-alignment but detrimental when imbalance increases. However, we do not anticipate one type of dis-alignment to be more problematic than the other; we assume that collecting many ideas/co-design suggestions without a mechanism to process them is probably just as bad as a few ideas with excessive processing capacity. Therefore, we propose a hypothesis for the curvature but not the slope effect. Hence,

H3. EKI decreases with rising levels of dis-alignment of social media use and R&D–marketing cooperation (negative curvature).

Compared to traditional market research, social media allow a firm to involve many more (existing and potential) customers for ideation and co-design. Extending the external resource increases the likelihood of tapping heterogeneous knowledge and increases the chance of obtaining new, fresh ideas for radically new products (Afuah & Tucci, 2012; Bonner & Walker, 2004). EKI ensures that these innovative ideas are transformed into knowledge that can be implemented in the firm's NPD. This smooth integration will benefit the quality of the firm's innovation output, and lead to more radically new products being developed by the firm. The efficiency emerges from and reflects new institutional arrangements developed by the firm that give way to alignment of external and internal resources. The better this alignment, the better the EKI, and the higher the chance that high quality, and radical innovation is achieved. Therefore, we propose:

H4. EKI has a positive relationship with radicalness of new products.

While many prior studies have focused on manufacturing firms and their use of social media for innovation (e.g, Bashir et al., 2017; Chirumalla et al., 2018; Sawhney et al., 2005) attention for service firms has been rather limited. Consequently, there is limited knowledge regarding potential differences across these contexts. Given that services are inherently more complex and require extensive coproduction, the impact of social media engagement on generation and implementation of customer knowledge can be anticipated to be higher for services than for physical products (Homburg & Kuehnl, 2014). Consistent with this, we expect that the joint role of social media usage and R&D—marketing collaboration will be more important in the context of service innovation than product innovation. Instead of developing an extra hypothesis for this complex three-way effect, we simply will explore the difference between services vs. products empirically.[1]

[1] We thank one of the reviewers of our paper for this suggestion.

3.2. Methodology

3.2.1. Data collection procedure

To test our hypotheses, we collected data from a set of innovative SMEs using social media. The sampling frame consisted of a list of 251 firms generated using public lists of 'The 100 Most Innovative Firms' in The Netherlands from three consecutive years[2], and complemented with the list of two regional networks of 65 additional innovative SMEs. We first approached these organizations by telephone to establish their suitability, willingness to cooperate, and to be able to identify the person most knowledgeable on the topic. As incentive, we included a donation of €5 to a charity upon completion of the questionnaire. It yielded 104 valid responses. Three responses were removed because of missing values, leaving 101 observations for the analysis.

The majority organizations in our sample concerned manufacturing (71.1%) and business to business firms (69.7%). Consistent with our focus on SMEs the annual sales of most firms did not exceed 1 million euros (44.9%). In roughly 60% of cases the key respondent most knowledgeable to fill out the questionnaire on the topic of social media use for innovation turned out to be the firm's CEO.

Most firms used 2 or 3 types of social media (66.7%), i.e. LinkedIn, Facebook, Twitter, and/or special user forums. Examples of new products developed by the firms in our sample were: a gaming engine, a 'floating' office chair, a worldwide method for evaluation quality of endoscopes, a cattle feed robot, a liquid bread enhancer, and a hearing aid.

3.2.2. Questionnaire development

Based on pilot interviews, academic literature, and the business press, we developed a draft survey. Several measures are grounded in existing literature (see Appendix A). Because social media is a rather new, evolving area (with most research qualitative, i.e. case-based) the items for NPD social media use and EKI are new measures for new constructs. For social media use we focused on behavior as proxy for the firm's level of activities and underlying capabilities.[3] Specifically we focused on the firm's level, intensity, and percentage of use of social media. The measure for EKI mainly draws on Afuah and Tucci (2012) and focuses on how difficult it is to use new information from social media in the firm's NPD process.

The survey was pre-tested using 4 managers and an industry consultant, which only lead to minor modifications.

3.2.3. Measurement validation

The data were analyzed in two principal stages using SPSS 23 and SmartPLS software. In step one we focused on measurement validation. Because our measures were perceptual, we conducted a confirmatory factor analysis (CFA) to determine the reliability and validity of the multi-item scales. The CFA model for the multi-item constructs confirmed that items loaded on their respective constructs with factor loadings exceeding > 0.5. We also assessed the scale (composite) reliabilities, all of which were greater than > 0.70 threshold (see Table 1). The average variance extracted for both constructs exceeded 0.50, and each one is larger than the squared correlation between them, in support of discriminant validity (Fornell & Larcker, 1981). Discriminant validity through average variance extracted also signals that multicollinearity in the presence of measurement error is not a threat to statistical inference (Grewal, Cote, & Baumgartner, 2004).

Because common method bias is a concern when utilizing a survey instrument to measure both independent and dependent variables, different measures were implemented. First, when designing our questionnaire, we followed the procedural steps mentioned by Podsakoff, MacKenzie, Lee, and Podsakoff (2003). Particularly, we assured complete confidentiality, varied scale formats and separated predictor and criterion variables in our survey instrument. Second, post-hoc tests were performed (Lindell & Brandt, 2000). If common method bias is present, partialling out the smallest observed correlation in the data can make results more robust. However, since in our data the smallest correlation is 0.00 common method bias should not be a problem when interpreting the findings (see Table 1).

3.2.4. Model estimation

In Step 2 we adopted a two-stage analysis approach to estimate our full model (Mullins, Ahearne, Lam, Hall, & Boichuk, 2014). In the first stage, we modeled the antecedent of attention to social media firm strategy's impact on NPD social media use and R&D–marketing cooperation using a multivariate hierarchical regression. To strengthen the robustness of results we controlled for: type of firm, firm size, formality of the firm's NPD process, number of social media used, the firm's focus on customers involvement in NPD, the level of formality of the NPD process and respondent functional background.[4] In the second stage, we model the outcomes of social media use and R&D–marketing cooperation (dis)alignment using response surface analysis (Box & Draper, 1987; Edwards & Parry, 1993; Roberts & Grover, 2012). Such analysis provides a nuanced view of relationships between combinations of two predictor variables and an outcome variable by graphing the results of polynomial regression analyses in a three-dimensional space, and as a result has more explanatory potential than difference scores or traditional moderated regression analyses (Edwards & Parry, 1993). Recently the technique has been used in marketing in several studies to explore complex relationships between variables (for an example see Web appendix of Mullins et al. (2014) Online Supplement: https://doi.org/10.1509/jm.13.0300). In our case, the polynomial regression equation used was:

$$EKI = b_0 + b_1(A) + b_2(B) + b_3(A^2) + b_4(A \times B) + b_5(B^2) + e_1,$$

where A and B refer to social media usage and R&D–marketing cooperation, respectively. The above-mentioned controls were included in this analysis, too. To test the results regarding the significance of linear and curvature along the (dis)alignment lines we applied the approach of and software provided by Shanock, Baran, Gentry, Clever Pattison, and Heggestad (2010).

3.3. Results

Table 2 shows the results regarding the regression estimates of the front part of our model that focuses on social media firm strategy's impact on social media use by the organizations. The antecedent and controls explain a fair amount of variance of the two dependent variables: 46% of NPD social media usage and 16% of R&D–marketing cooperation. The detailed results confirm the anticipated effects: the firm management's attention for social media strategy positively and significantly impacts NPD social media usage ($\beta = 0.54$, $p < .01$) and fosters R&D–marketing cooperation ($\beta = 0.31$, $p < .01$). This lends support to H1a and b, respectively. The results also show significant effects for several control variables that thus were correctly included: Firm size is negatively correlated with NPD social media use and with R&D–marketing cooperation respectively ($\beta = -0.23$ and -0.21, both $p < .05$). Smaller firms probably have to be more creative and thus use social media more than large firms, while larger firms' higher level of departmentalization probably negatively affects their level of collaboration between R&D and marketing. Service firms seem to use more social media than product-oriented counterparts ($\beta = 0.29$, $p < .01$), and having a formal NPD process seems to benefit social media use in

[2] These lists showed overlap explaining the number of 300–65 = 186 firms.

[3] Unaware of the level of social media capabilities of other firms in their industry, managers generally find it difficult to benchmark their own firm's capabilities in comparison to competitors or industry average.

[4] Based on lack of impact two controls (the number of social media used and respondent's functional background) were removed from the analysis.

Table 1
Correlations and DESCRIPTIVES.

	Mean	SD	Composite reliability	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. NPD social media use	2.78	1.10	0.90	0.76										
2. R&D– Marketing coop'n	3.87	0.99	0.95	0.15	0.85									
3. EKI	3.06	1.12	0.89	0.59	0.33	0.89								
4. Radicalness	4.21	0.91	0.76	0.11	0.32	0.22	0.52							
5. Att'n social media strategy	3.93	1.59	0.92	0.57	0.33	0.51	0.00	0.85						
6. Focus on customer involvement	5.40	1.33	0.78	0.16	0.27	0.09	0.26	0.11	0.78					
7. Services	0.27	0.47	1.0	0.32	−0.01	0.28	0.09	0.12	−0.03	1				
8. B2B (Reverse coded)	0.29	0.46	1.0	0.02	−0.14	−0.04	−0.02	0.13	−0.12	0.04	1			
9. Size (fte, categorical)	2.91	1.53	1.0	−0.10	−0.14	0.16	−0.20	0.08	−0.00	0.05	−0.11	1		
10. Formal NPD process	3.68	1.82	0.94	0.22	0.08	0.24	−0.11	0.21	0.03	−0.05	0.07	0.25	0.88	
11. New product market performance	4.95	1.43	0.94	−0.12	0.32	0.22	0.28	0.03	0.08	−0.06	−0.03	0.05	−0.07	0.84

Correlations > 0.20 are sign p < 0.05 (2-tailed); Average variance extracted underlined on the diagonal.

Table 2
PLS results of estimated coefficients social media strategy.

	NPD social media use			R&D–Marketing coop'n		
	Path coef.	St.Err	t-Value	Path coef.	St.Err	t-Value
Independent vars						
Att'n for social media strategy	0.54	(0.07)	8.14***	0.31	(0.09)	3.27***
Controls						
Focus on customer involvement	0.10	(0.06)	1.61	0.20	(0.09)	2.32**
Services	0.29	(0.08)	3.50***	−0.01	(0.06)	0.17
B2B (Reverse coded)	−0.07	(0.06)	1.29	−0.17	(0.09)	1.85*
Firm size	−0.23	(0.08)	2.95***	−0.21	(0.10)	2.05**
Formal NPD process	0.19	(0.07)	2.58**	0.08	(0.08)	1.01
Adj.R^2		0.46			0.16	

***$p < .01$; **$p < .05$; *$p < .1$ (2-tailed).

NPD ($\beta = 0.19$, $p < .05$).

Table 3 shows the results of the estimation of the second part of our model and focuses on the (dis)alignment hypotheses of H2 and H3. Results for both the main effects- and the full model are included. The statistics regarding overall model fit indicates that the hypothesized model again fits the data well. Comparing the full and main effects models we note that the quadratics and interaction of NPD social media usage and R&D–marketing cooperation are all significant and provide a tangible contribution to the variance explained in EKI of the full model ($\Delta R^2 = 0.07$, $p < .01$). It suggests the existence of a complex interrelationship between our variables as anticipated. For the interpretation and confirmation, we use a surface plot and related significance tests (Shanock et al., 2010).

Fig. 2 shows the three-dimensional surface plot between the variables of NPD social media use (x), R&D–marketing cooperation (y), and EKI (z). The solid line on the floor of the graph represents x = y (as related to z) and thus refers to *perfect alignment*, while the dashed line represents x = −y (as related to z) and thus indicates *dis-alignment*. The final test results regarding significant differences are shown in Table 4. These findings indicate a significant positive slope coefficient ($b1 + b2 = 0.60$, $p < .01$), but a non-significant curvature ($b3 + b4 + b5 = 0.13$, $p > .10$) along the line of *alignment*. Fig. 2, illustrates this effect, showing a linear upward sloping line along the solid line that reaches a maximum level of EKI when social media use and R&D–marketing cooperation are both high. It supports H2a regarding the need of alignment between social media usage and R&D–marketing cooperation, but not H2b regarding the curvilinear effects of this relationship. There thus is a significant positive effect of alignment on EKI.

Second, the results ($b3 - b4 + b5 = -0.35$, $p < .10$) do confirm a significant negative curvature along the dashed line of *dis-alignment*, which implies a concave surface. It means that knowledge integration decreases more sharply as the degree of discrepancy (between social media usage and R&D–marketing cooperation) increases. It lends

Table 3
PLS results of estimated coefficients of social media use consequences.

	Main effects model								Full effects model							
	EKI				Radicalness				EKI				Radicalness			
	Path coef	St.Err.	t-Value		Path coef	St.Err	t-Value		Path coef.	St.Err	t-Value		Path coef.	St.Err	t-Value	
Independent vars.																
NPD social media use	0.56	(0.08)	6.72	***					0.44	(0.09)	4.81	***				
R&D Marketing coop'n	0.29	(0.08)	3.59	***					0.19	(0.09)	2.06	**				
NPD social media use^2									0.15	(0.09)	1.75	*				
Marketing–R&D coop'n ^{2}									−0.25	(0.09)	2.84	***				
NPD social media use × R&D–Marketing coop'n									0.15	(0.06)	2.37	**				
EKI					0.29	(0.11)	2.65	**					0.28	(0.11)	2.58	**
Controls																
Focus on customer involvement	−0.08	(0.07)	1.22		0.22	(0.09)	2.54	**	−0.08	(0.06)	1.37		0.21	(0.10)	2.15	**
Services	0.09	(0.08)	1.18		0.03	(0.06)	0.48		0.06	(0.07)	0.90		0.02	(0.07)	0.28	
B2B (Reverse coded)	0.00	(0.06)	0.04		0.01	(0.06)	0.24		0.03	(0.05)	0.58		0.02	(0.06)	0.24	
Firm size	0.23	(0.07)	3.10	***	−0.16	(0.09)	1.75	*	0.19	(0.07)	2.85	***	−0.17	(0.09)	1.86	**
Formal NPD process	0.06	(0.05)	1.17		−0.17	(0.10)	1.70	*	0.02	(0.04)	0.37		−0.15	(0.10)	1.59	
Adj.R^2		0.47				0.11				0.52				0.11		

***$p < .01$; **$p < .05$; *$p < .1$ (2-tailed): $\Delta AdjR^2$ ($EKI_{Full} - EKI_{main}$) = 0.07, F-change = 4.52, $p < .01$.

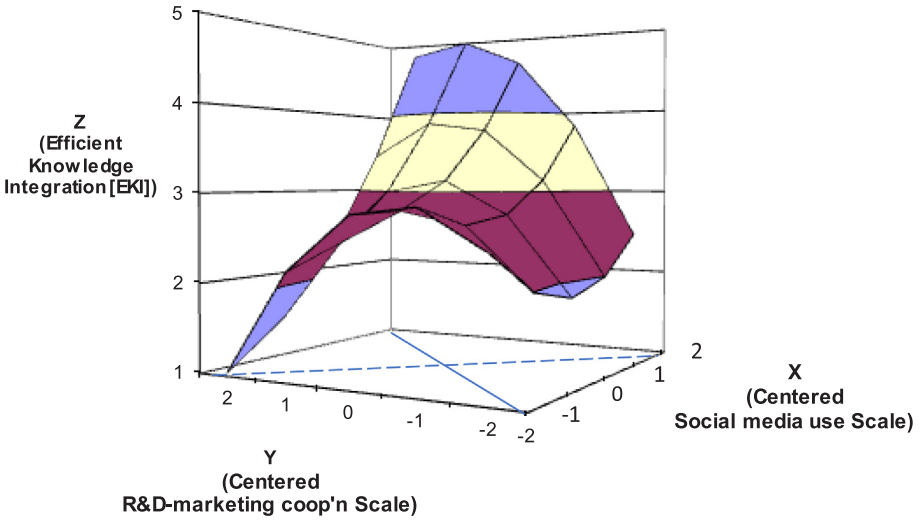

Fig. 2. EKI as predicted by social media use and R&D-marketing cooperation.

support to H3.

An unanticipated significant slope effect along the dashed discrepancy line (b1 - b2 = 0.35, p < .05) is detected also (see Table 4). It refers to the fact that EKI is higher when the discrepancy is such that social media use is higher than R&D–marketing cooperation than vice versa.

Finally, we find a significant and positive relationship between EKI and radicalness of the new products the firm develops (β = 0.28, $p < .05$) (Table 3), which supports H4. Several controls are significant too, e.g., large firms are better able to accomplish efficient knowledge integration but produce fewer radical new products than smaller counterparts (β = 0.19, $p < .05$ and −0.17, $p < .01$ respectively). Furthermore, there appears some borderline negative effect of formal NPD processes on radicalness of the new products the firm develops (β = −0.17, $p < .10$ only in main effects model), and a positive effect of focus on customer involvement (β = 0.21, $p < .05$).

Post hoc we explored a potential differential effect for products vs. services. For this purpose, we added service as a moderator of the analysis to the back-end of our model. To ensure correct model estimation of moderation effect on the curvilinear relationship regarding R&D—marketing on EKI we implemented the stepwise approach suggested by Haans, Pieters, and He (2016). The procedure accounts for (i) a potential shift in turning point, and (ii) steepening or flattening of the curve under influence of the moderator. Because social media use's effect on EKI was only linear here a simple moderation analysis sufficed.

The results showed that service context positively moderates the impact of social media usage on EKI. The effect is shown in Fig. 3, Panel A. The results also confirm moderation of R&D—marketing cooperation on EKI. While the turning point of the curve was unaffected, there was a significant moderation of the squared term, i.e. R&D—marketing^2 * service (β = 0.15, t-value = 1.86, $p < .10$). As Fig. 3, Panel B shows, this refers to a *steeper inverted U* for services than products. It means that for social media use in new service development there is a 'sweet spot', or optimum in R&D—marketing cooperation than for new product development. This interesting finding suggests that services managers should pursue a moderate level of collaboration between R&D and marketing to ensure that ideas are processed and carefully considered, but not dismissed due to a too- close collaboration and knowledge exchange between the marketers and engineers of the firm. We also explored the ultimate effect of our moderator on the impact of our two mechanisms on EKI along the line of alignment. These plots showed a steeper and more accentuated curve for services than products too.

Finally, for matters of completeness we tested the relationship between radicalness of the new products developed and the firm's new product market performance. Our performance measure focused on extra sales growth and growth of market share due to the firm's newly developed products. The results show a positive and significant relationship between level of radicalness of the new products and this performance measure, as expected: β = 0.30, t-value = 2.57, $p < .05$. It suggests that social media use helps these firms create more novel products.

3.4. Discussion

We briefly discuss the results of Study 1 before continuing with Study 2. In Fig. 2, the highest level of EKI is at the back corner of the graph, where NPD social media usage and R&D–marketing cooperation are both high. They are lowest at the front of the graph, where both are low. These findings indicate a complex additive model, wherein EKI for innovation is enhanced by both forms of organizational activity in combination: social media use and R&D–marketing cooperation thus are *complementary* activities for EKI. Because the information generated from the firm's customer network is often ambiguous and fragmented it needs to be carefully interpreted and evaluated before implementation in the firm's NPD process. A matching level of cooperation between R&D and marketing and the social media effort makes this possible.

Interestingly, while there is a positive slope effect (b1 + b2 = 0.60,

Table 4
Response surface analysis test results.

Effect	Coefficient	St. Err.	t-Value
Alignment slope (b1 + b2) *[Slope along x = y as related to z]*	0.60	0.14	4.37***
Alignment curvature (b3 + b4 + b5) *[Curvature on x = y as related to z]*	0.13	0.09	1.48
Dis-alignment slope (b1 − b2) *[Slope along x = -y as related to z]*	0.35	0.14	2.56**
Dis-alignment curvature (b3 − b4 + b5) *[Curvature on x = -y as related to z]*	-0.35	0.15	−2.23**

***$p < .01$; **$p < .05$; *$p < .1$

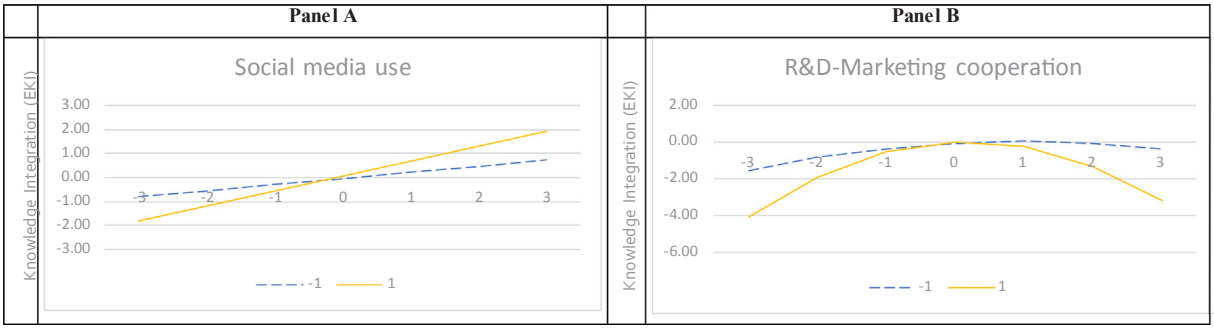

Fig. 3. Moderating impact of service of the relationship of predictors with EKI.

$p < .01$) we do not find evidence for a curvature effect (b3 + b4 + b5 = 0.13, *ns*), i.e. a decreasing marginal value of these two mechanisms on EKI along the line of alignment. A possible explanation is that the maximum level of use social media by SMEs may not yet have been reached, which explains why no diminishing returns are observed. However, it could also mean that the anticipated negative effects simply do not occur.

Dis-alignment of our two mechanisms results in low EKI and thus disappointing results of using social media for innovation, as anticipated. If the discrepancy increases, EKI strongly decreases at accelerating pace (see Fig. 2 curvature effect along the dashed line, $b3 - b4 + b5 = -0.35, p < .05$). So, management that decides to use social media should be aware and allocate resources and attention to enhance the interface between marketing and R&D when investing in relational capabilities of social media and vice versa. The slope effect detected along the discrepancy line ($b1 - b2 = 0.35, p < .05$) (see Table 4) indicates that EKI is higher when the discrepancy is such that social media use is higher than R&D–marketing cooperation than vice versa. Two possible explanations come to mind. First, social media use acts as a prerequisite, that is, only if new insights emerge can the organization leverage the information. Second, with high levels of social media usage a firm gains experience which can, at least to some extent compensate for lower levels of internal cooperation between R&D and marketing. The efficiency may stem from new routines and norms the organization develops along the way. For instance, possibly high levels of social media use come with the ability to deconstructing a research problem into smaller chunks, which results in less ambiguous new information, which can be more easily and rapidly integrated.

These results extend and qualify prior results of, for example, Muninger et al. (2019) and Roberts and Piller (2016) showing that only careful alignment and, particularly, avoidance of dis-alignment between the two resources/capabilities can help guarantee a successful use of social media for NPD. Alignment helps ensure EKI of the customer insights acquired from the firm's network. Firms with a strategic approach are better at accomplishing such alignment. Service firms benefit more from social media engagement than product firms, but do need to pay closer attention to striking the right level of R&D-marketing collaboration. This more positive effect of social media use for services is explained by SDL principles; the more intangible the service, the more critical customer co-creation is for creating and safeguarding the new offer's value-in-use. The simultaneous production and consumption of services, which generally results in greater customization, suggests that an extensive customer involvement in a firm's new service development may increase the likelihood of the new services becoming too customized and thus unsuitable for its entire customer base. As a result, the development of new institutional arrangements and thus organizational practices to use social media for innovation is more critical in new service than product development context. The evidence of diminishing returns also extends, in the context of social media use, the findings of Homburg and Kuehnl (2014), who found an inverted U shape between customer involvement and innovation success in the context of services.

4. Study 2

4.1. Conceptualization and identification of capabilities

To learn more about the specific social media capabilities required for innovation, we conducted Study 2. Our aim was twofold: (i) to detail the social media capabilities involved, and (ii) to provide preliminary quantitative evidence that also these detailed capabilities should be complemented by strong inter-functional cooperation to ensure EKI. Such results would help provide further support for the findings of Study 1, but also help managers take the appropriate measures to enjoy the benefits of social media to grow their firms' NPD success.

In prior studies, several tasks have been identified as critical in the utilization of social media for involving customers in a firm's NPD (e.g., Gebauer, Füller, & Pezzei, 2013; Afuah & Tucci, 2012; Poetz & Schreier, 2012; Lettl, 2007; Sawhney et al., 2005; Nambisan, 2002). Drawing on this work, three facets were identified as particularly salient: (i) the ability to select the right customers, (ii) the ability to motivate the participants of the social network, and (iii) the ability to internally evaluate the pieces of information generated through social media. Prior work (Sawhney et al., 2005) stresses the complementarity of these capabilities: social media can only be used successfully for innovation if the firm can identify *and* activate users who are willing and able to come up with new product ideas that might appeal to the market, *and* has staff that can effectively evaluate the acquired information with an open mind.

However, like in Study 1 we again argue that it is not the information of customers per se but rather its integration that affects the innovation outcome and thus the firm's competitive advantage. So, again we draw on the premises of the SDL perspective (Vargo & Lusch, 2004) and its key principles of resource integration and co-development. Consequently, we also again account for the collaboration between marketing and R&D.

Based on this, we set out to identify the "recipes" (Ordanini, Parasuraman, & Rubera, 2014) of our three specific social media capabilities and R&D–marketing cooperation. Consistent with the findings of Study 1 we anticipate that all social media capabilities as well as R&D–marketing cooperation will be necessary ingredients for the outcome, i.e. EKI. Because results could be contingent on whether a firm aims for improved or radically new products we also included this dimension in our research design. Since loyal, existing customers are probably well-represented in the firm's social network, mobilizing and motivating customers to co-create incremental new products is easier than co-creating radically new products. The latter requires involving a more heterogeneous group of potential customers (Bonner & Walker, 2004).

Because the anticipated patterns of capabilities are complex, with multiple forms of interactions, we chose fuzzy-set qualitative comparative analysis (fsQCA) as method to analyze the data. This set theoretical approach is useful to empirically investigate the causal

Table 5
fsQCA results of configurations with high EKI.

	Solutions Generated	
	Solution 1	Solution 2
1. Capability to identify	●	●
2. Capability to motivate	●	●
3. Capability to evaluate	●	
4. R&D–marketing cooperation	●	●
5. Radicalness of products developed		×
Consistency	0.923	0.916
Raw coverage	0.656	0.629
Unique coverage	0.075	0.047
Overall consistency	0.923	
Overall coverage	0.703	

Notes: The ● symbol indicates the presence, and the × symbol indicates the absence of a condition. Blank spaces indicate neutral, i.e. that the condition does not matter for a particular solution.

complexity of management and organizational phenomena (Misangyi et al., 2017). We discuss the methodology of Study 2 in more detail below.

4.2. Methodology

4.2.1. Data collection.

To explore the impact of the identified social media capabilities in firms' innovation success, we collected extra data from the sample of Study 1. Thirty-two of the firms cooperated and offered the extra data we requested.

4.2.2. Measures.

The three constructs of social media capability mentioned above were operationalized with 3 new items each (see Appendix A) that were based on Afuah and Tucci (2012) and Lettl (2007). In a principal component analysis, all items loaded on their respective factor with loadings exceeding 0.5. Moreover, all measures had Cronbach αs exceeding 0.7 and AVE exceeding 0.5, in support of internal reliability and discriminant validity, respectively (Fornell & Larcker, 1981). The measures and data for R&D–marketing cooperation and radicalness of new products were taken from Study 1. This was also true for our dependent variable, EKI.

4.2.3. Method of analysis

To find out more about the *sufficient* capabilities in combination with the need for R&D –marketing cooperation and level of radicalness of the new products involved, we used fuzzy-set qualitative comparative analysis (fsQCA) (Ragin, 2000) and fs/QCA 2.5 software (Ragin, 2008). The fsQCA approach is a set-theoretic method for studying organizational configurations using a comparison of cases to differentiate attributes that are related (or unrelated) to an outcome of interest (in our case high EKI). It identifies cases as sufficient configurations that consistently lead to the outcome using Boolean algebra (Fiss, 2007). This technique, in essence a qualitative technique, has been recently used in marketing/innovation to study complex interactions of variables, for example, in service innovation (Ordanini et al., 2014), market orientation and performance measurement systems (Frösén, Jaakkola, Tikkanen, & Aspara, 2016), and marketing strategy (Zacharias, Nijssen, & Stock, 2016).

The QCA procedure conceptualizes the outcome of interest as a set to which each case either does or does not belong. Next, each case is characterized by its degree of membership of each of the conditions and configurations of conditions that explain the outcome—here, the three social media dimensions and R&D–Marketing cooperation plus the level radicalness of the new product. Membership of both the outcome and each of the causal conditions vary between full (i.e., 1.00) vs. no (i.e., 0.00) membership. These memberships are collected into a matrix or "truth table", which distinguishes configurations associated with the outcome of interest from all possible configurations of the conditions under study. The number of configurations is then reduced to the most parsimonious, or simple, logical expression that encompasses all the configurations that meet the frequency threshold (number of empirical instances of the configuration) and consistency threshold (which is computed for each configuration). Consistency concerns an index of sufficiency that determines whether a configuration uniformly leads to the outcome of interest, while coverage is an index of relevance indicating the level to which a configuration is necessary for the outcome to occur. In our study we set the minimum acceptable consistency for configurations at 0.90, well above the 0.75 criterion generally suggested (Ragin, 2008).

Given the absence of theoretical guidance, the different measures were calibrated for the fsQCA procedure as follows: the extremes of the 7-point Likert scales were selected for full non-membership (1 = floor) and full membership (7 = ceiling), respectively, using the midpoint of the scale (4) as cross-over point between fully in and out. A similar approach was used regarding R&D–marketing cooperation, and radicalness of the new products. For calibrating the outcome of EKI, we used a different approach. Because we were interested in best practices of the 25% highest performers, we used 5 as the crossover point for EKI.

4.3. Results

The fsQCA results are shown in Table 5. Two effective combinations of capabilities to involve customers using social media and achieve excellent EKI were detected.

At 92% the level of consistency of our solutions with the outcome is very high. The coverage is 70% suggesting that when combined, the two configurations identified account for approximately 70% of membership in the outcome, i.e. high EKI.

In the two solutions black circles (●) indicate the presence of a condition, (×) refers to absence, while blank spaces indicate neutrality of the condition (see Table 5). The first solution is that all detailed social media capabilities and R&D–marketing cooperation should be present; all capabilities are *complementary* ingredients. This configuration works both for radical and incremental solutions (blank space for 'radicalness').

The second solution is unique to incremental innovations (× for 'radicalness'). It involves combining customer identification capability with the capability to motivate customers of the social network and R&D–marketing cooperation. The capability to evaluate ideas generated using social media is neutral (blank space); apparently insights generated for incremental new products are relatively easy to judge, which makes the evaluation capability a less important ingredient. Given its exclusive focus on incremental new products the unique coverage of Solution 2 is lower than that of the more general Solution 1 (0.047 versus 0.075).

4.4. Discussion

The results of Study 2 provide managers with a detailed list of specific social media capabilities their organizations need to develop: (i) select the right customers, (ii) motivate them to help the firm and do their best, and (iii) internally evaluate the ideas/information generated. The recipes for success confirmed that in general all these capabilities need to be present simultaneously. Only if the right customers are approached and involved, knowledge will be extracted that can be efficiently used and ultimately lead to new product advantage. Interfunctional collaboration again proved to be an important facilitator to leverage the external customer network through social media for EKI. These results corroborate SDL logic, which argues that resource integration stresses the importance of involving customers in co-creation.

The repertoire for using social media in innovation is larger for incremental than for radical innovations. For incremental compared to radical innovations, the judgement of ideas is easier and thus the capability to evaluate them less critical. For radical innovations the customer value and technical feasibility of ideas will generally be both less obvious and clear, and thus harder.

5. General discussion and theoretical implications

Our analysis shows that increased use of social media exposes firms to important new challenges in their innovation processes. First, the use of social media introduces inputs of a different (external) nature into a complex process where internal inputs (i.e., R&D and Marketing) already operate in combination. Our study shows that the contribution from using social media in NPD cannot be assessed independently; its effectiveness depends on how such external inputs are *effectively integrated* with traditional internal ones. Our results identify EKI as a fundamental 'carryover' mechanism that largely explains the faith of social media use to improve NPD outcomes. It extends the mostly qualitative literature on the use of social media-related inputs for product innovation (Chirumalla et al., 2018; Mount & Garcia Martinez, 2014; Sawhney et al., 2005) by offering empirical evidence of *why* internal and external types of knowledge should be both present in the process, and *what* purpose their joint use serves: EKI.

Second, and central to our argument, our study reveals that achieving EKI is not possible by simply combining internal and external inputs in an additive fashion, but requires firms to carefully *align* the levels of both sources of knowledge. Our results show that EKI is the outcome of a non-linear and complex interaction effect between social media use and R&D–marketing cooperation; when internal and external inputs are aligned (i.e., both high or both low) their combination exhibits a positive additive effect on EKI; when instead, the two sources of knowledge are mis-aligned, there is a penalty on EKI of increased misalignment (i.e., a negative curvilinear effect). This effect is asymmetrical in that it is better to have more, excessive social media input than more inter-functional cooperation. This set of findings extends current knowledge on the use of internal and external resources for product innovation by empirically showing *how* they should be present in the process, and what the consequences are of their alignment/mis-alignment on NPD outcomes. New institutional arrangement will have to be developed with EKI as the end-goal.

If a firm is not able to develop new institutional arrangements and routines to ensure alignment between the use of internal and external inputs (and thus resources) for innovation, it is better to refrain from using the social media external sources at all, because the cost of misalignment offsets the potential benefits. In this light, our study sheds new light on the literature studying open innovation using social media (e.g., Chirumalla et al., 2018; Mount & Garcia Martinez, 2014) but also prior work on R&D-marketing interfaces (Calantone & Rubera, 2012; Li & Calantone, 1999) that have not been so detailed and outspoken.

Third, we note that the above described (asymmetric) effects of alignment are more pronounced in the case of service (vs. product) innovation. It extends current literature (e.g., Chang & Taylor, 2016; Homburg & Kuehnl, 2014) by offering evidence that the use of social media inputs for innovation may generate greater benefits for service firms (in the case of alignment), but also involves bigger risk (in the case of mis-alignment). Interestingly, for services there appears to be a sweet spot of R&D—marketing collaboration. This result suggests that service settings are more complex and require the development of very specific institutional arrangements and thus norms and routines for using social media to involve many customers, which seems consistent with the SDL perspective (Vargo & Lusch, 2016). It involves a learning process in which R&D-marketing collaboration affects the way social media is used, but social media use probably also informs the organization how to improve the collaboration between the two departments for this particular networking context (Chirumalla et al., 2018). Over time firms may learn to better manage these social media related processes and become more proficient in aligning external and internal resources. As a result of such learning the curvilinear relationship between R&D-marketing collaboration and EKI (see Fig. 3, panel B) might shift the left.

Fourth, we found that complex combinations of micro capabilities are necessary to exploit the potential of social media both in the case of radical and incremental innovation efforts. In general, all three capabilities are required together: (i) select the right customers, (ii) motivate participants, and (iii) internally evaluate the ideas/information generated. However, in case of incremental new products the importance of evaluation capabilities is not critical/essential. This mix of micro capabilities should always be complemented with adequate R&D-marketing collaboration. The additional evidence of Study 2 improves our current understanding of the use of internal and external inputs for product innovation, by empirically showing which social media capabilities are required and in which combination.

Summing up, we contribute to existing literature by showing *why* social media inputs should be combined in the internal NPD process to be beneficial (i.e., to achieve EKI), *how* such a complex combination should occur and which are its nuanced consequences (i.e., alignment/mis-alignment), *when* the careful combination is more important (i.e., service vs. product; radical vs. incremental), and *what* it implies for its execution (i.e., social media innovation capabilities). From a theoretical standpoint, such contributions were largely possible thanks to the use of SDL's key principles (i.e., resource integration, co-creation, actor-to-actor interaction), which allowed to take a different and more insightful conceptual angle to the investigation of the NPD process and promising but challenging role of social media inputs.

6. Limitations, future research and practical implications

Like all research this study has several limitations that are opportunities for future research. First, the sample is small and focused on SMEs in the business-to-business domain. Although we controlled for many characteristics, additional research using a broader sample could help enhance the generalizability of the results. Comparing the size of benefits for large versus small or medium-sized firms would be interesting too. Second, the cross-sectional nature of the data implies that inference regarding direct influence of social media on innovation outcomes needs to be interpreted with caution. Longitudinal research would be useful in this regard. Third, we relied on a general measure of usage of social media. Although we controlled for the number of social media used, exploring the impact of each type of social media on firm innovation outcomes could be interesting. It would, of course, require a larger sample to involve enough users of each type of social media for innovation. Future research could also better distinguish between use of social media for e.g., ideation and co-design. This would allow to research the impact on levels and nature of new institutional arrangements. Finally, identifying additional contingencies (e.g., the general social media literacy of firms in an industry, better control for the type of business) might be useful.

We close by identifying several important implications for managers. First, our results suggest that developing and implementing a social media strategy pays off. Attention to such a strategy will help ensure the development of complementary processes and capabilities; social media processes are important for acquiring new information, while R&D–marketing collaboration is important to process this information and integrate it efficiently in the firm's new product development output together with actors from the external network. Second, managers should account for the micro-dimensions of social media use, i.e. the ability to identify the right people, the ability to motivate them, and also the ability to carefully evaluate the results of the social media outreach. All three dimensions are critical for successful social media usage in NPD. However, the repertoire for using social media in innovation is larger for incremental than for radical innovations; for

incremental customer ideas scrutiny is easier and thus the capability to evaluate them less critical. Third, and most importantly, managers should pay attention to the careful alignment of the social media capabilities with R&D–marketing cooperation; the more a firm invests in bridging with its customer networks, the more it will need to enhance bonds inside to ensure necessary EKI. Dis-alignment should be prevented or resolved. Whereas alignment leads to EKI, dis-alignment hinders or even prevents it. The use of social media for innovation is a balancing act, and should aim for information generation *and* knowledge implementation, a challenge which is more rewarding but also more challenging for a service context than for product innovation. Making EKI a goal in social media use for innovation and paying careful attention to routines to facilitate this resource integration will make achieving innovation success easier.

Acknowledgement

The authors thank the RAAK-mkb program (project MKB. 2.0, 2011-19-22 M) for funding of the project.

Appendix A. Measures used for the Study Constructs*

Independent Variables
NPD social media use (new, 5pt. semantic differential scale) To what extent does your firm use social media to generate new knowledge from the firm's social/customer network for your new product development? Very little/Very much Not intensively/Intensively Percentage use in NPD projects (< 20, 20 < 40, 40 < 60, 60–80, > 80%)
R&D-Marketing cooperation (adapted from De Luca, Verona, & Vicari, 2010; Li & Calantone, 1998) In our company R&D and marketing… Frequently interact Openly communicate Fully collaborate in establishing innovation projects' goals and priorities. Share similar views and finalities.
Efficient Knowledge Integration (new, based on Afuah & Tucci, 2012) How difficult was it to use the knowledge your organization acquired through social media from its social network in the organization's innovation process? The knowledge integration was… Very slow/very quick Very complex/very easy Very laborious/very effortless
Attention for social media strategy (adapted from Menor & Roth, 2007) We use social media for clearly defined goals and purposes We consciously/systematically allocate resources to social media use We train our staff on how to use social media We have a deliberate social media strategy
Extra measures of social media (follow up study)
Capability to identify (based on Afuah & Tucci, 2012; Lettl, 2007). How good is your organization at using social media to involve a customer group or crowd… Determining the knowledge the crowd should have Determining the specific characteristics the group should have Involving the right group of people
Capability to motivate (new, based on Afuah & Tucci, 2012; Lettl, 2007). Motivate the crowd/customer group to participate Identify ways to motivate the group to participate; Keep those involved motivated during the NPD process; Stimulate the crowd to do its best.
Capability to evaluate (new, based on Afuah & Tucci, 2012). Evaluate the generated ideas on their merit; Formulate evaluation criteria prior to collecting the ideas from crowd; Involving the right set of people in the evaluation process.
Dependent variables
Radicalness of new products (based on Atuahene-Gima, 2005; Im & Workman, 2004, 5pt. semantic differential scale). Please characterize the new products your firm recently developed; Small improvements/Major improvements; Incrementally new for customer/Radically new for customers; Addressed existing market/Opened up whole new market.
New product market performance (based on Pelham & Wilson, 1995). The new products …helped to increase our market share; …enabled sales growth from new product-market combinations; …resulted in sales growth from new customers.

*All 7pt. Likert scales (Strongly Disagree-Strongly Agree) unless mentioned otherwise.

References

Afuah, A., & Tucci, C. L. (2012). Crowdsourcing as a solution to distant search. *Academy of Management Review, 37*(3), 355–375.

Allen, B. J., Chandrasekaran, D., & Basuroy, S. (2018). Design crowdsourcing: The impact on new product performance of sourcing design solutions from the "Crowd". *Journal of Marketing, 82*(2), 106–123.

Atuahene-Gima, K. (2005). Resolving the capability–rigidity paradox in new product innovation. *Journal of Marketing, 69*(3), 61–83.

Bashir, N., Papamichail, K. N. N., & Malik, K. (2017). Use of social media applications for supporting new product development processes in multinational corporations. *Technological Forecasting and Social Change, 120*, 176–183.

Bonner, J. M., & Walker, O. C., Jr. (2004). Selecting influential business-to-business customers in new product development: Relational embeddedness and knowledge heterogeneity considerations. *Journal of Product Innovation Management, 21*(3), 155–169.

Box, G. E. P., & Draper, N. R. (1987). *Empirical model-building and response surfaces.* New York: Wiley.

Brodie, R. J., Hollebeek, L. D., Juric, B., & Ilic, A. (2011). Customer engagement: Conceptual domain, fundamental propositions, and implications for research. *Journal of Service Research, 14*(3), 252–271.

Calantone, R., & Rubera, G. (2012). When should RD&E and marketing collaborate? The moderating role of exploration-exploitation and environmental uncertainty. *Journal of Product Innovation Management, 29*(1), 144–157.

Chang, W., & Taylor, S. A. (2016). The effectiveness of customer participation in new product development: A meta-analysis. *Journal of Marketing, 80*(1), 47–64.

Chirumalla, K., Oghazi, P., & Parida, V. (2018). Social media engagement strategy: Investigation of marketing and R&D interfaces in manufacturing industry. *Industrial Marketing Management, 74*, 138–149.

Davis, D. F., Golicic, S. L., & Boerstler, C. N. (2011). Benefits and challenges of conducting multiple methods research in marketing. *Journal of the Academy of Marketing Science, 39*(3), 467–479.

De Luca, L. M., & Atuahene-Gima, K. (2007). Market knowledge dimensions and cross-functional collaboration: Examining the different routes to product innovation performance. *Journal of Marketing, 71*(1), 95–112.

De Luca, L. M., Verona, G., & Vicari, S. (2010). Market orientation and R&D effectiveness in High Technology firms: An empirical investigation in the biotechnology industry. *Journal of Product Innovation Management, 27*(3), 299–320.

Edwards, J. R., & Parry, M. E. (1993). On the use of polynomial regression equations as an alternative to difference scores in organizational research. *Academy of Management Journal, 36*(6), 1577–1613.

Fiss, P. C. (2007). A set-theoretic approach to organizational configurations. *Academy of Management Review, 32*(4), 1180–1198.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.

Frösén, J. L., Jaakkola, M., Tikkanen, H., & Aspara, J. (2016). What counts versus what can be counted: The complex interplay of market orientation and marketing performance measurement. *Journal of Marketing, 80*(3), 60–78.

Gebauer, J., Füller, J., & Pezzei, R. (2013). The dark and the bright side of co-creation: Triggers of member behavior in online innovation communities. *Journal of Business Research, 66*(9), 1516–1527.

Grewal, R., Cote, J. A., & Baumgartner, H. (2004). Multicollinearity and measurement error in structural equation models: Implications for theory testing. *Marketing Science, 23*(Fall), 519–529.

Haans, R. F. J., Pieters, C., & He, Z. L. (2016). Thinking about U: Theorizing U- and inverted U-shaped relationships in strategy research. *Strategic Management Journal, 37*, 1177–1195.

Hartmann, N. N., Wieland, H., & Vargo, S. L. (2018). Converging on a new theoretical foundation for selling. *Journal of Marketing, 82*(March), 1–18.

Homburg, C., & Kuehnl, C. (2014). Is the more always better? A comparative study of internal and external integration practices in new product and new service development. *Journal of Business Research, 67*, 1360–1367.

Iansiti, M. (1995). Technology integration: Managing technological evolution in a complex environment. *Research Policy, 24*, 521–542.

Im, S., & Workman, J. P., Jr. (2004). Market orientation, creativity, and new product performance in high-technology firms. *Journal of Marketing, 68*(2), 114–132.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons, 53*(1), 59–68.

Lettl, C. (2007). User involvement competence for radical innovation. *Journal of Engineering Technology Management, 24*(1–2), 53–75.

Li, T., & Calantone, R. J. (1998). The impact of market knowledge competence on new product advantage: Conceptualization and empirical examination. *Journal of Marketing, 62*(4), 13–29.

Lindell, M. K., & Brandt, C. J. (2000). Climate quality and climate consensus as mediators of the relationship between organizational antecedents and outcomes. *Journal of Applied Psychology, 85*(3), 331–348.

Macdonald, M. K., Kleinaltenkamp, M., & Wilson, H. N. (2016). How business customers judge solutions: Solution quality and value in use. *Journal of Marketing, 80*(May), 96–120.

Marion, T. J., Barczak, G., & Hultink, E. J. (2014). Do social media tools impact the development phase? An exploratory study. *Journal of Product Innovation Management, 31*(S1), 18–29.

Menor, L. J., & Roth, A. V. (2007). New service development competence in retail banking: Construct development and measurement validation. *Journal of Operations Management, 25*, 825–846.

Misangyi, V. F., Greckhamer, T., Furnari, S., Fiss, P. C., Crilly, D., & Aguilera, R. (2017). Embracing causal complexity: The emergence of a neo-configurational perspective. *Journal of Management, 43*(1), 255–282.

Moorman, C. (1995). Organizational market information processes: Cultural antecedents and new product outcomes. *Journal of Marketing Research, 32*(3), 318–335.

Mount, M., & Garcia Martinez, M. (2014). Social Media: A tool for open innovation. *California Management Review, 56*(4), 124–143.

Mullins, R. R., Ahearne, M., Lam, S. K., Hall, Z. R., & Boichuk, J. P. (2014). Know your customer: How salesperson perceptions of customer relationship quality form and influence account profitability. *Journal of Marketing, 78*, 38–58.

Muninger, M., Hammedi, W., & Mahr, D. (2019). The value of social media for innovation: A capability perspective. *Journal of Business Research, 95*(February), 116–127.

Nambisan, S. (2002). Designing virtual customer environments for new product development, toward a theory. *Academy of Management Review, 27*(3), 392–413.

Nishikawa, H., Schreier, M., Fuchs, C., & Ogawa, S. (2017). The value of marketing crowdsourced new products as such: evidence from two randomized field experiments. *Journal of Marketing Research, LIV, 3*, 525–539.

Ordanini, A., Parasuraman, A., & Rubera, G. (2014). When the recipe is more important than the ingredients: A qualitative comparative analysis (QCA) of service innovation configurations. *Journal of Service Research, 17*(2), 134–149.

Pelham, A. M., & Wilson, D. T. (1995). A longitudinal study of the impact of market structure, firm structure, strategy, and market orientation culture on dimensions of small-firm performance. *Journal of the Academy of Marketing Science, 24*(1), 27–43.

Podsakoff, P. M., MacKenzie, S. B., Lee, J., & 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.

Poetz, M. K., & Schreier, M. (2012). The value of crowdsourcing: Can users really compete with professionals in generating new product ideas? *Journal of Product Innovation Management, 29*(2), 245–256.

Ragin, C. C. (2000). *Fuzzy-set social science.* Chicago: Univ. of Chicago Press.

Ragin, C. C. (2008). *Redesigning social inquiry: Fuzzy sets and beyond.* Chicago: University of Chicago Press.

Roberts, D. L., & Candi, M. (2014). Leveraging social network sites in new product development: Opportunity or hype? *Journal of Product Innovation Management, 31*(S1), 105–117.

Roberts, N., & Grover, V. (2012). Investigating firm's customer agility and firm performance: The importance of aligning sense-and-respond capabilities. *Journal of Business Research, 65*(5), 579–585.

Roberts, D. L., & Piller, F. T. (2016). Finding the right role for social media in innovation. *MIT Sloan Management Review, 57*(3), 41–47.

Sawhney, M., Verona, G., & Prandelli, E. (2005). Collaborating to create: The internet as a platform for customer engagement in product innovation. *Journal of Interactive Marketing, 19*(4), 4–17.

Shanock, L. R., Baran, B. E., Gentry, W. A., Clever Pattison, S., & Heggestad, E. D. (2010). Polynomial regression with response surface analysis: A powerful approach for examining moderation and overcoming limitations of difference scores. *Journal of Business Psychology, 25*, 543–554.

Sharma, S., & Conduit, J. (2016). Cocreation culture in health care organizations. *Journal of Service Research, 19*(4), 438–457.

Sinkula, J. M. (1994). Market information processing and organizational learning. *Journal of Marketing, 58*(1), 35–45.

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic in Marketing. *Journal of Marketing, 68*(1), 1–17.

Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: Continuing the evolution. *Journal of the Academy of Marketing Science, 36*(1), 1–10.

Zacharias, N. A., Nijssen, E. J., & Stock, R. M. (2016). Effective configurations of value creation and capture capabilities: Extending Treacy and Wiersema's value disciplines. *Journal of Business Research, 69*, 4121–4131.

Zietsma, C., & McKnight, B. (2009). Building the iron cage: Institutional creation work in the context of competing proto-institutions. In T. B. Lawrence, R. Suddaby, & B. Leca (Eds.). *Institutional work: Actors and agency in institutional studies of organizations*. Cambridge, UK: Cambridge University Press.

Edwin J. Nijssen is a Full Professor of Technology Marketing at Eindhoven University of Technology and holds a PhD from Tilburg University (The Netherlands). His research interest focuses on marketing and innovation, sales and service research (e.g., innovation in the front line, servitization) and commercialization by entrepreneurial firms. He published in e.g., International JAMS, IJRM, JPIM, JIM, JIBS, IMM. He is on the review boards of IMM and JPIM.

Andrea Ordanini is THE the the BNP Paribas Professor of Marketing & Service Analytics at Bocconi University, Department of Marketing. He visited the London School of Economics and Political Sciences in 1997 and the University of California at Irvine in 2003 and 2006. His research interests include service marketing, consumption of cultural goods (e.g., music) service innovation, new product development. He published in JM, JCR, JSR, JAMS, IJRM and JIBS among others. He is on the review boards of several journals and an associate associate editor of JSR and JPIM.