

Emerging interstices in communities of innovation

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Online communities are an important source of distributed intelligence and novelty for any firm. Their evolving independence exhibits purpose and progress of the individuals in them. However, research on community innovation is disparate, with literature enshrouded in macroperspectives of a firm's largest external source of innovation. Utilizing critical interpretive synthesis, we uncover three dominant perspectives in literature on community innovation—namely, outside-in, epistemic and competitive. We then propose a multilevel perspective of communities to explore three levels of innovation context. In closing, we examine a missing mesoperspective in literature and present four dynamic stages of exchange in communities—(i) convergence and design, (ii) interaction, (iii) interchange and (iv) productive synergy. With this final and main contribution, we apply a conceptual multilevel perspective to the same sample of 132 articles, previously used to demonstrate the three dominant macroperspectives. In doing so, we reconceptualize diversified knowledge in community literature and acknowledge the innovation context of independent individuals and groups in the community. We hope that scholars of open innovation use variations of the multilevel perspective for further theory construction as a lens into the context of innovation for individual, group and community innovation outcomes. The interconnectivity brought by these levels also creates challenges and opportunities for practitioners, wishing to engage with or design online communities to influence individual, group and community outcomes and motivations.

KEYWORDS

communities of innovation, community dynamics, community innovation, meso processes

1 | INTRODUCTION

Research has increasingly emphasized the importance of firms' networks and linkages with external sources of knowledge as a driver of innovation performance (Chatterji & Fabrizio, 2014; Cillo et al., 2010; Laursen & Salter, 2006; Sánchez-González et al., 2009). Tapping into external sources of knowledge allows a firm to acquire resources and information, which would have been difficult or even impossible to

generate internally (Becker & Dietz, 2004). One increasingly important type of these external sources of innovation are online communities (Dahlander et al., 2008; Füller et al., 2007; von Krogh & von Hippel, 2006), and some firms even go as far as building their business models around the innovation potential of such communities.

Literature implicitly introduces a void between the innovation potential that firms need (Jaworski & Kohli, 1993; Prause & Thurner, 2014) and the portrayal of community innovation, where individual motivations are an abstruse part of the collective (Janzik & Herstatt, 2008). Various literature reviews cover common linkages between communities and open innovation (Antikainen et al., 2010; Bretschneider et al., 2008; Bullinger &

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Möslein, 2010; West & Bogers, 2014); however, literature is missing a construct that untangles the labyrinth of diffusion innovation factors present in large innovating groups.

According to Schröder and Hölzle (2010), part of the void between firm's innovation needs and community research lies in not knowing how both need to collaborate to be successful. Frey et al. (2012) argue that motivations to innovate in communities are independent of the context of firms and for-profit interest. Firms are offered sufficient research in organizational behaviour and innovation (Lam, 2004; Gopalakrishnan & Damanpour, 1994; O'Reilly et al., 1998), and less is known about community dynamics such as fluidity (Gryszkiewicz & Friederici, 2014) and autonomy (Bullinger et al., 2010) that result in innovation outcomes.

This paper uses critical interpretive synthesis to analyse open innovation literature specific to communities. Our contributions are threefold: first, we demonstrate the macro portrayal of communities by classifying literature into three categories. Then, we introduce a multilevel perspective including the presence of a meso level. Lastly, as our main contribution, we uncover four dynamic (meso) stages of exchange to highlight the context of innovation for individuals convening, interacting and productively innovating. The resynthesis of literature is illustrative of the multilevel perspective's applicability.

The remainder of this article is structured as follows. In the next section, we summarize the research design used to review literature on online communities. Section 3 describes the multilevel perspective and its significance to the context of individuals, groups and community innovation. Section 4 presents the main contribution of the article with reclassified literature according to dynamic stages of exchange. In conclusion, we discuss the applicability of the multilevel perspective to bridge the gap between the macrobenefits for firms and their individual innovation context.

2 | RESEARCH DESIGN

2.1 | Acquiring and classifying literature

Keyword searches included combinations of the following search terms: *motivations*, *innovation outcomes*, *online community*, *open innovation* and *innovation community*. These keyword searches accounted for mild variations as the definition of community is fragmented in marketing, business and information management literature. Variations of the search term *community* included abbreviations such as Community of Innovation (CoI), Community Innovation (ComInv), Communities of Practice (CoP) and even Collaborative Innovation Networks or COINs (Gloor, 2006). In these descriptions, the term *community* is used interchangeably with brand or online community (Füller et al., 2008), communities of practice (Brown & Duguid, 1991) and collective or consumer-driven innovation (Kozinets et al., 2008)

This paper presents the results of an interpretive review (Noblit & Hare, 1983) of literature on communities and open innovation. We inspected each paper, identified recurring themes and first developed three categories of research to divulge a gap in the perception of literature (Cooper, 1988) on communities. As the purpose of our analysis

and synthesis concerns itself with the development of concepts and their interpretation of extant research (Dixon-Woods et al., 2005), we presented a multilevel perspective that describes a structure of relationships and innovation contexts between the individual groups and the community. The critique of the literature was demonstrated by reclassifying the same sample just as interpretively. Wherever possible, we cross-checked our categorization using word counts of certain phrases in the articles (see Appendix A).

In pursuit of completeness, 132 articles were shortlisted from about 72 diverse journals spanning the years 1997 to 2018 (Appendix B). *The New Task of R&D Management: Creating Goal-Directed Communities for Innovation* by Judge et al. (1997) marked the first reference to an outlook of community innovation for firm's R&D departments. The sample contains articles from open innovation literature, where the subject of innovation was connected to outcomes and influences in communities. While scanning literature, we also paid peripheral attention to implicit and explicit commercial motives between firms and online communities. The sample did not contain articles, where communities focused on social development as the exchange relationship between parties such as the community and government, where geographical, sociopolitical and macroeconomic influences clearly impacted indispensable needs to the participants' personal lives.

2.2 | Increasing interest in community innovation research over time

Both syntheses of literature reveal a comparably growing interest in research on community innovation. In fact, the majority of the sample of articles has a normative focus on the composition of online communities, and less focus is given respectively to how participants interact, interchange or achieve productive synergy when innovating in groups in the community. Articles that include interchange and interaction between community participants peaked in 2017 at four and five, respectively (Figure 1).

3 | FINDINGS

3.1 | Prior research on communities of innovation

Various researchers have considered the nexus of communities and innovation. Research quickly identified them as another important source of knowledge alongside markets and hierarchies (Adler, 2001; Powell, 2003). We uncover three bodies of literature, where research focuses on communities as an external source of innovation, as new knowledge creation and as a competitive forum for ideation (Table 1).

3.1.1 | Outside-in

The outside-in perspective positions online communities as an avenue for external ideas and technologies into a company's own innovation

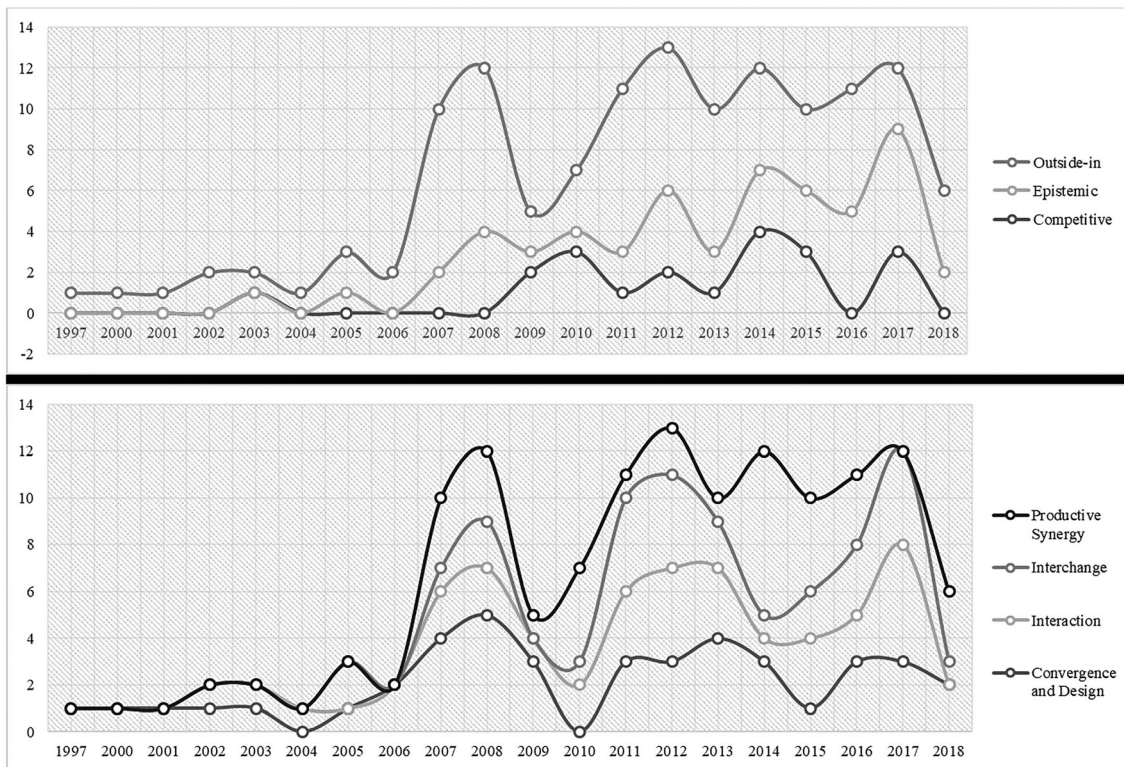


FIGURE 1 Three dominant macro perspectives and meso stages of exchange, over time

TABLE 1 Dominant macroperspectives of community innovation in literature

Bodies of research	Description
Outside-in	<p>Papers with an outside-in perspective present online communities as external sources of innovation, predominantly tied to firms that exchange resources for innovations.</p> <p>Classically divided into internal or external sources, open innovation proposes the joining of forces on both fronts (Chesbrough & Crowther, 2006).</p>
Epistemic (knowledge sharing)	<p>Epistemic literature in online community indicates that the community has innovative methods to create knowledge and share it. Innovation in this context contributes to acquiring new knowledge and/or sharing information in new ways.</p>
Competitive (crowdsourcing and contests)	<p>The competing perspective focuses on the role that the community plays as crowdsourcing forums, facilitating contests to encourage diversity in innovation.</p> <p>Typically, firms pose a problem online and a large group of contestants compete to solve it for reward (Howe, 2006).</p>

process (Chesbrough & Brunswicker, 2014), giving advice on how firms should design communities to source ideas and promote innovations (Judge et al., 1997; Weiss, 2017). In fact, some researchers

present advancement in community design, if continuous delivery of innovations is practiced (Corso et al., 2008). Most literature recognizes that innovations often reside outside the established boundaries of firms (Baron & Shane, 2007; Christensen, 1997), shifting the focus of innovation and interaction onto the outside. As a result, this literature recommends firms to source innovations from independent, consumer (user-led) communities; however, it provides little detail about deeper connections and interactions that nurture these very communities to generate ideas (Jeppesen & Molin, 2003). As such, the outside-in perspective is often limited to viewing the exchange relationship between communities and firms primarily as an exchange of resources for innovation (Sims, 2014). In fact, the outside-in literature treats communities as an entity and hardly considers the collection of individuals, technology and interactions that the community consists of. Similarly, firms are treated as entities and consequently, relations are considered on an aggregate level and summarized in constructs such as ‘Community-Company Interaction Quality’ (Schröder & Hölzle, 2010).

3.1.2 | Epistemic

Another body of literature examines how creating new knowledge or sharing knowledge in new ways can take place in communities (Murray & O’Mahony, 2007). These innovation outcomes are seen as an end to a means, where knowledge collaboration helps develop further innovations (Stanko, 2016). Notably, this perspective acknowledges research in communities in educational institutes, where

creation of new knowledge and or innovative learning is viewed as the locus of innovation performance (Gloor et al., 2008). By valuing knowledge as a product and even a catalyst for innovation (Hung et al., 2010), the epistemic perspective retains a stronger focus on knowledge and less on continuously integrating knowledge of community participants. Particularly, the value of the community is often illustrated as a system, where the collective creates new and innovative knowledge such as co-authorship and social network analysis (Santonen & Ritala, 2014).

3.1.3 | Competitive

Other research has focused on communities as a setting for innovation contests and competitions (Füller et al., 2015). In contrast to the first subset of literature, its main premise is of user-group contributions that compete for reward or to be selected by firms to commercialize their innovations. Correspondingly, current literature suggests bridging opposing interests between firms and communities, through the facilitation of contests (Lauritzen, 2017). In fact, contest communities are portrayed as tools or forums to integrate the 'best' external knowledge into a firm's innovation processes (Kathan et al., 2015). The competing perspective includes 'crowdsourcing', implying low cost or free access to a variety of ideas and innovative solutions from multiple sources, within the boundaries of a contest (Howe, 2006). This perspective diverges into two subspecialties. One stream elaborates the need to engineer online communities and intensify competition virtually (Ebner et al., 2009), and another observes community-based competitions that are directed at cocreation or

'communitation' (Hutter et al., 2011). Until this recent split in competitive literature, the competing perspective differs from previous bodies of literature, where it also considers cooperation between individuals in the community with the outcome of the best innovation.

Not only does this classification of community innovation literature diverge into three broad themes, it also represents extant research's perspective of communities as equitable systems of innovation creation and diffusion. As a result, influences on innovation outcomes disintegrated across articles on individual motivations to innovate. Complex mechanisms such as decision making, peer feedback and problem solving (Yi et al., 2012) are either researched as an integrated part of the whole community or fragmented on the individual level.

3.2 | The multilevel perspective of communities as social systems of innovation

In social science, groups and networks are largely distinguishable by boundaries, where networks, for instance, have none (Forsyth, 2018). Particularly, online communities are in between networks and groups (Ospina, 2017)—as a boundary blend with the personality of a group and the ambiguity of a network. Hence, to study the community as a system of innovation, it is imperative to represent the interchange of influences such as *trends* (Sakamoto et al., 2008) or *feedback* (Zhu et al., 2013) along with *innovation outcomes* such as *ideas* or *new products*.

The multilevel perspective presents a view of communities first as social systems of innovation. Second, it introduces a new meso level of analysis to trace influences of innovation diffusion, where

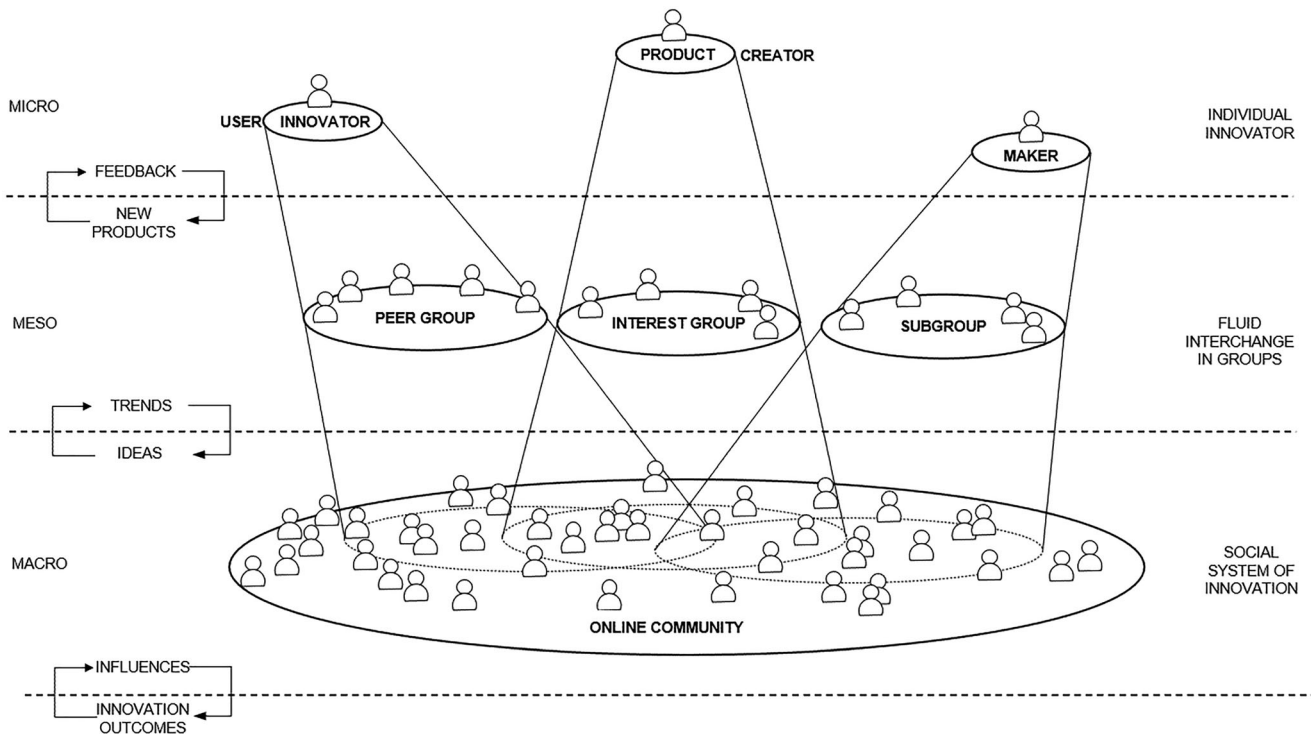


FIGURE 2 A multilevel perspective of communities as social systems of innovation

alternately extant research represents micro processes and macro level outcomes (Mühlhaus et al., 2012). Lastly, it demonstrates interchange between levels in a community with open boundaries and resulting fluid interaction in groups. As a result, the three levels expose innovation context combining relationships between individuals, groups and their influences and outcomes.

Figure 2 illustrates the microlevel with three familiar roles in current literature, namely, *user innovator*, *maker or product innovator/creator* (Colombelli et al., 2013; Martin, 2015; Tanenbaum et al., 2013; von Hippel, 2005). The innovator is represented as an independent actor surrounded by interaction, influences and innovation outcomes in the community.

While group sizes vary, the meso level is characterized by the individual's participation in fluid subgroups of smaller sizes than the community. For instance, a woodworker (*maker*) in a community like Facebook might be influenced by *feedback* from others in a subgroup. Correspondingly, the same woodworker's outcomes such as *new products* are likely to be shared in other subgroups in the community. Subgroup categories can be classified as peer or interest groups. *Peer groups*, for instance, are determined by influences and outcomes among individuals with common skills, as observed in user and maker communities (Moilanen & Vadén, 2013). Similarly, *interest groups* (Hasenauer, 2009) exemplify innovation outcomes such as *new products* and influences such as *trends* from individuals with common interests.

On the whole, the multilevel perspective of communities as social systems of innovation manifests a structure of relationships between the innovating individual, subgroups and the larger collective. Its significance lies in interposing a mesolevel to trace linkages between diffusion innovation factors such as individual innovation outcomes and group or community influences (Rogers, 1983). Equally important, the mesolevel presents itself as a driver of innovation creation due to the fluid nature of its support to the independent innovator and the community.

4 | DYNAMIC STAGES OF EXCHANGE ON A MESOLEVEL

Groups perform better or worse given the capabilities of the individuals in them (Forsyth, 2014). By the same token, research in organizational behaviour and social sciences have investigated boundaries between individuals, groups and larger collectives to evaluate

performance of complex microprocesses such as ideating in groups (Heslin, 2009). However, the openness of innovation in communities relies on a different kind of complexity and includes processes, where individual participants, ideas and resources interchange freely (Laursen & Salter, 2006) but rarely as a large visible collective. Thus, an intermediate level helps represent the context of individual innovation as they contribute to the sum.

We present four dynamic stages of exchange to illustrate a reciprocal interchange of information or resources between participants and the community. Furthermore, the four stages symbolize relationships between participants, subgroups and between the whole—for the purpose of innovation. These stages are convergence and design, interaction, interchange and productive synergy.

With communities distinguishing themselves in egalitarianism and peer-production from the rigidity of hierarchy in classical organizations (Arazy et al., 2014), it was important for us to represent dynamic stages of exchange as less of an ascending view, where one stage helps elevate the other. Moreover, polycentric governance between individual interchanges is depicted as progressing towards independence in outcome for the individual and intensity in purpose for the collective (Frey et al., 2012). We represent this interconnection in the arrangement of the four stages (Figure 3) and in their definition (Table 2).

Convergence and design is a strong initiating stage, where participants represent a common purpose or the community is designed for a specific need (Elayne & Peter, 2007; Fuller et al., 2006; Hienerth, 2006; Kozinets et al., 2008). Correspondingly, the next stages of interaction, interchange and productive synergy share more structure in interoperability between individual participants and the community. In fact, in independent communities such as open-source communities, rules of engagement are meant to formalize the transition from one stage of interchange to another (Goldman & Gabriel, 2005). In addition, they have frequent affiliation with resources exchanged (Robinson & Stubberud, 2012) between participants and with other organizations, thereby influencing the intensity and motivation with which participants will switch between stages of exchange.

4.1 | Stage I: Convergence and design

Subgroups converge when participants convene with similar albeit unclear intent and when norms emerge as they progress in the group

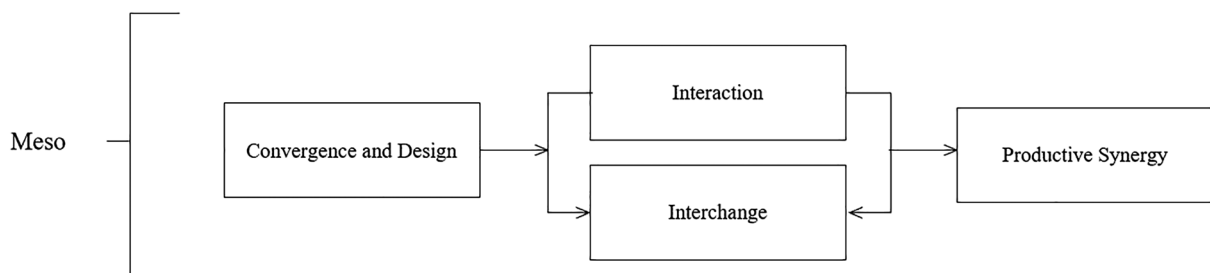


FIGURE 3 Four dynamic stages of exchange in community innovation

TABLE 2 Descriptions of the stages of exchange

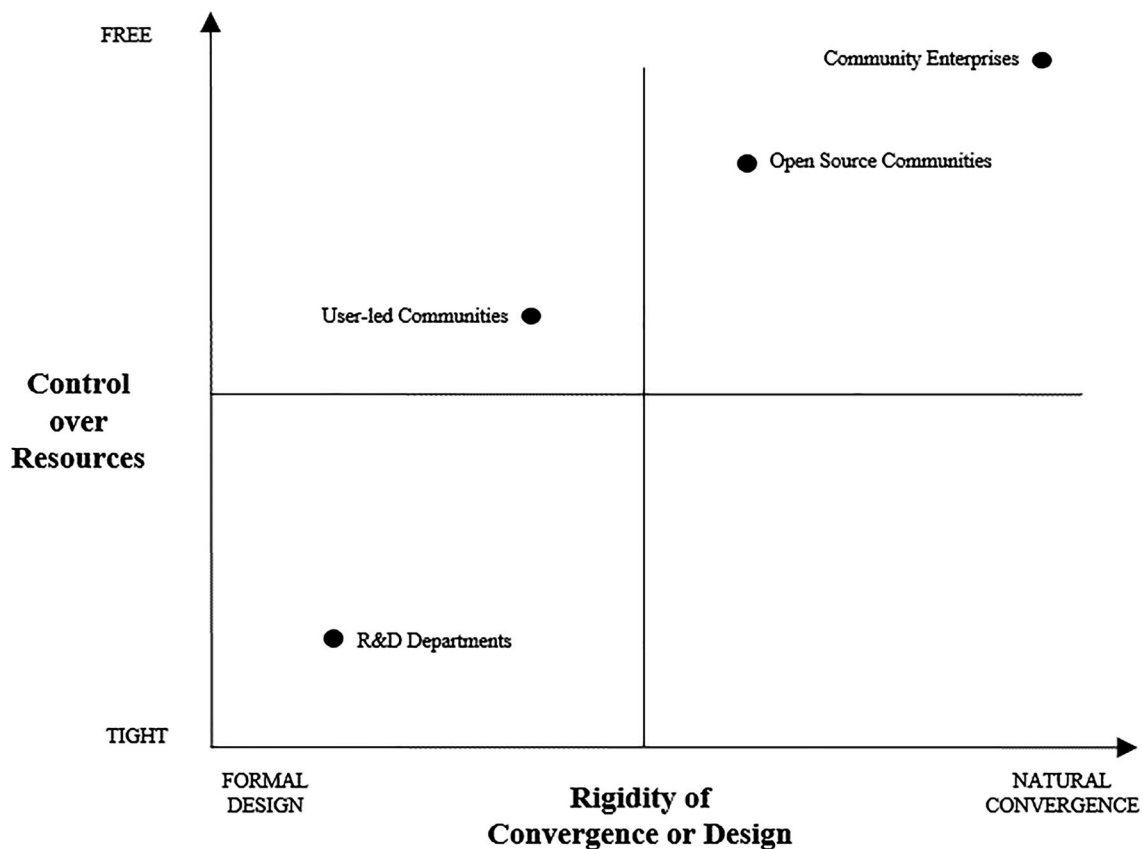
Stages of exchange	Description
Convergence and design	The literature contributes to a community's inclination to innovate based on normative designs. Communities are tied by a common purpose and are stimulated to do more than interact or communicate.
Interaction	Participants have access to the community and can respond and react with each other. Interactions in communities include both competitive and collaborative actions such as likes, downvotes or shares.
Interchange	Interchange among participants and possibly cooperative efforts with other participants and the community. The implicit or explicit intention to innovate or to contribute towards an innovation outcome mostly involves exchanging resources, ideas and information.
Productive synergy	Participants achieve a heightened level of synergy, where individuals and subgroups cofunction with disparate or shared inner workings on a new or different method or product.

(Turner & Killian, 1957). In user-led innovation, the aspiration that creates communities is the inability of the market to fulfil specific needs, whereas the community offers them access to useful structures,

user-to-user cooperation and benefit from innovation distribution (von Hippel, 2005). Markedly, a subcategorization unfolds at this stage—one that is demonstrated by the progress of communities and their relationship towards control over resources and flexibility in structure (Figure 4).

Firms often struggle with balancing rigidity of convergence or design and control over resources. Judge et al. (1997) describe how corporate R&D departments were created with a closed design despite a communal culture, where decisions were made in the collective and where participants took each other's views into perspective. Once a person became a member, the group took care of them (Robert & Wasti, 2002). However, for these R&D departments to thrive as innovation communities, operational and strategic autonomy of researchers and managers are needed along with continuous slack in resources. Equally important is the high level of a goal-directed community within the boundaries of firms, which also encourages the spirit that leads users to form communities outside of companies (Judge et al., 1997).

Comparatively, user-led communities have more freedom with resources available in designed cooperation with markets or firms. The nature of requirements in user-led online communities is based on peer collaboration, access to tools and structure that commands organized convergence. Communication rituals, promoting transparency and encouraging etiquette are strongly recommended while designing such communities (Kim, 2000). Easy access to skills and resources is most evident in software development, where users

**FIGURE 4** Evolution of communities by rigidity of their design and control over their resources

match innovation needs to their own assets, making innovations in distributed control (von Hippel, 2005).

Particular to their informal nature, open-source communities converge like a network, where there are almost no barriers to joining. A mild distinction is found between open-source communities that are sponsored by a single firm over more autonomous communities. Firmed communities offer more transparency but less accessibility compared with their counterparts, making them more controlled and designed in form (West & O'Mahony, 2008).

Community enterprises such as Wikipedia are barrier-free networks that produce free resources. They have even less member affiliation and self-organization than innovation networks. They almost have no design characteristics and in fact, challenge orthodox economics. Although their products are public with no planning or control of their resources, community enterprises converge based on self-defined rules; control of resources is prevented at all costs even by the community itself (Frey et al., 2012).

4.2 | Stage II: Interaction

The stage interaction facilitates idea generation and is linked to brainstorming, where it triggers multiple creative stimuli including some exchange between participants for an effective process (Osborn, 1957). In community innovation literature, both stages of interaction and interchange are strongly at par (Figure 4) owing to the influence of technology and space. In fact, informal collectives are liberated in interaction by technology—that is easy to use and publicly accessible (Scacchi, 2007).

In the interaction stage, participants establish free contact to group entities (Fichter, 2009) based on specific (functional) interests and circles of value and within the boundaries of the community. In contrast, research on crowdsourcing (previously classified as competitive literature) demonstrates input and interaction by participants that excludes the necessity to exchange with other subgroups or with the community to produce innovation outcomes (Janzik & Raasch, 2011; Kim et al., 2008; Kosonen et al., 2013).

Although community spaces include active and passive participation, where active participants interact and communicate more and passive participants lurk or only acquire information (Blanchard & Markus, 2002), participants interact with each other and familiarize themselves with the community environment, ideas and assess their involvement at this stage. For this type of exchange, technology is an indispensable enabler that transfers interactions into interchanging, knowledge-intensive processes. These processes lead back to change in interaction within a social culture, where people develop ways of working and relationships to collaborate (Hawryszkiewicz, 2005). Literature starts to focus on the meso level in communities by classifying actors by their contribution such as core and cosmopolitan (Dahlander & Frederiksen, 2012), by their commercial level of adoption and advocacy (Alexy & Henkel, 2007) and by their level of activity (Leshed, 2005).

4.3 | Stage III: Interchange

We distinguish between interaction and interchange as the former being a reactionary relationship of a participant with the community and the latter a more engaging one although not necessarily harmoniously collaborative. The distinction underlines the dynamism of individual outcomes in the innovation context of the collective, where individuals can innovate independently or in competing/collaborative response to other participants.

Individual participants also interchange within community environments of physical or online setting and eventually influence their exchange and innovation outcomes. In reference to open innovation, these environments have been defined as a position in the market (Bessant & von Stamm, 2013), a virtual area of influence (Faraj et al., 2011) and as interactions, conversations and shared tasks (Gratton, 2013).

Interchange has also included ideation and creativity to the dimension of environments, where interaction between participants takes place at a given space and time and by sharing the same experience (Girotra et al., 2010). Participants' creativity surfaces on the boundaries of specialisms and in the flexible construct of online communities that encourages open collaboration across other organizations and groups (Coakes et al., 2011). We also remind ourselves of laboratory research in human psychology that has repeatedly resulted in individuals being more creative than those working in groups. While the individual is more creative, groups are better at turning creative ideas into innovative practices (Nijstad & De Dreu, 2002).

A similar context of interchange is observed with problem solving, where simple problems are easily solved in the group; however, innovation (needs-based) problems are likened to a complex system with interdependent elements, choices and knowledge sets that are recombined allowing problem solving to compose valuable solutions (Füller et al., 2015).

4.4 | Stage IV: Productive synergy

When active participants achieve productive synergy in communities, their cohesion brings about a balance between innovative contributions and community outcomes. Groups or individual participants achieve a stage of productive synergy when firms and markets can use this productivity to accelerate change and rely on the success of its innovation activities (Chow et al., 2007). A group of active participants was investigated after they had innovated together. The results were positively linked to their willingness to share ideas and their identity with the community, including loyalty to the brand (Norskov et al., 2016). In addition, literature recognizes that fluidity contributes to a dynamic environment that fosters productive synergy in online communities, where a dynamic flow of resources can be designed for enhanced collaboration and productivity (Fayard et al., 2015).

Community literature is flooded with the benefits of competition (Hutter et al., 2011) and research includes results, where intergroup

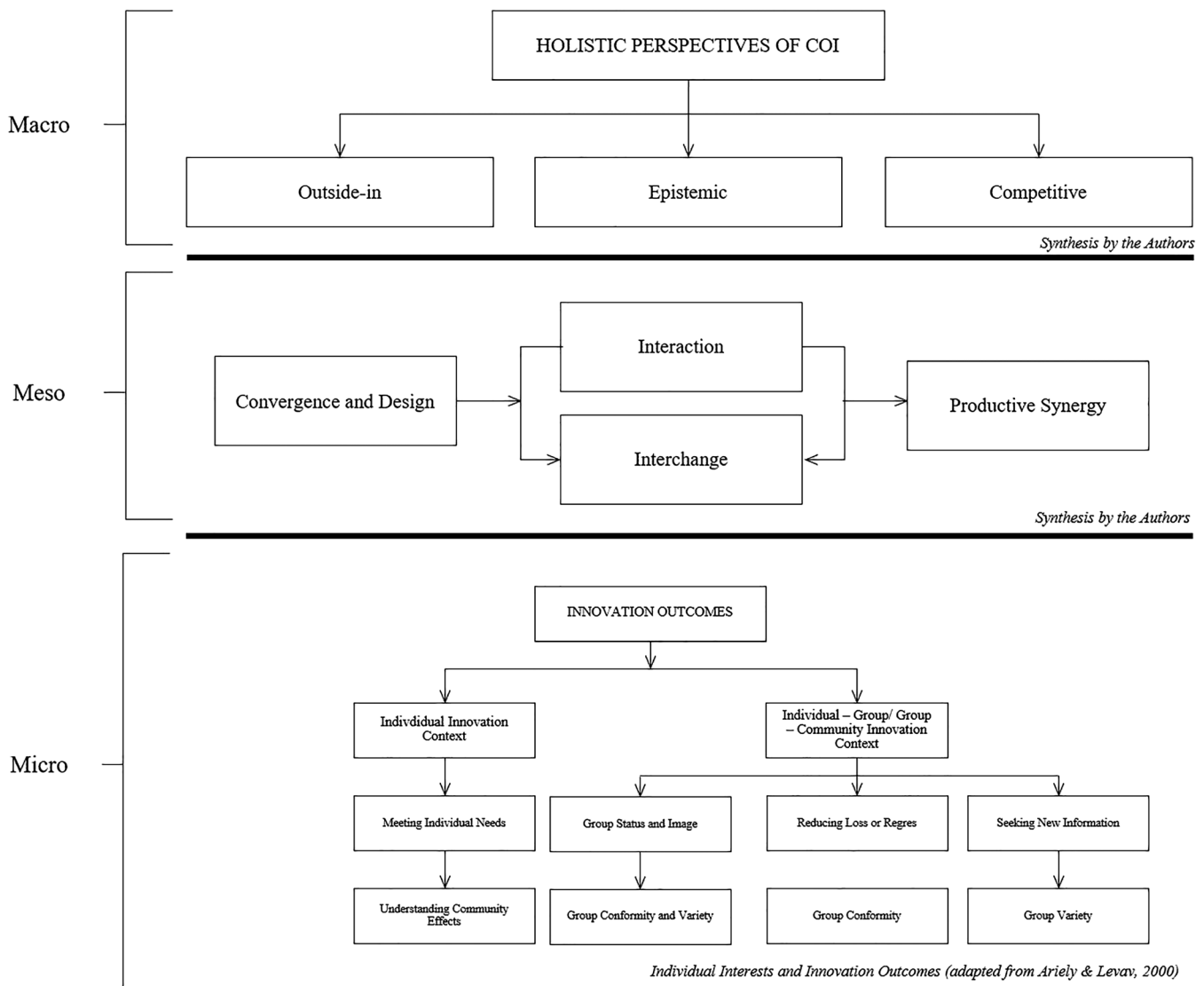


FIGURE 5 The multilevel perspective applied illustratively for future research in community innovation

competition, interpersonal competition and individualist goal structures show that cooperation is significantly more effective than interpersonal competition (Johnson et al., 1981). In fact, more recent literature accepts the importance of productive synergy and has determined that pure contest communities lead to resistant behaviour among participants such as nondisclosure of ideas. Community behaviour is suggested to inevitably surface owing to an outcome of communal culture (Hutter et al., 2015).

Online communities are large collectives consisting of smaller groups that are driven towards productivity by varying interests and functions. Despite being active in different ways, cohesion-performance relationships are not only always positive but also stronger in smaller groups (such as active, functional interest groups), with almost no observable difference with heightened interaction (Mullen & Copper, 1994). Nevertheless, cohesion and synergy is essential for productivity, 'minimizing friction due to human "grit" in the system' (Mullen & Copper, 1994).

5 | CONCLUSION

5.1 | Summary and limitations

Scholars of open innovation agree about disjointed research in community innovation. For instance, Dahlander et al. (2008) attribute this disparity to scholars from 'different backgrounds using different theoretical perspectives to how online communities work'. Faraj and Johnson (2011) recognize the gap in literature through the 'diversity of motivations of individuals' (Flanagin, 2007) over their own findings and allude to a macro (firm recognized) versus meso (peer recognition and reciprocity by peers) perspective (Jeppesen & Frederiksen, 2006).

However, the disparity continues on a macro level, where management implications are linked to homogeneous views of how individuals in communities engage with firms, such as community participants as virtual co-workers for companies to 'institutionalize communities of innovation' and 'gain feedback concerning different innovations'

(Füller et al., 2004). According to Brandtzæg et al. (2009), the distinction on a macro level lies between user versus community centric approaches (individual versus the collective) and smaller group actions are a suggested direction to offer 'opportunities of innovation'. As a result, the gap in literature includes a less acknowledged meso perspective despite its critical influence on the larger community.

We study this gap by first exposing dominant macro perspectives of the community. Then, utilizing critical interpretive synthesis, we explain why a multilevel model can help researchers connect the context of innovation to individuals, groups and the community. As an illustration of its applicability, we resynthesized research and unveil four dynamic mesostages of exchange in innovation communities.

By the nature of a literature review, we draw significantly from extant, secondary information that is focused on a specific scope of research. The multilevel perspective also assumes the three levels (Figure 2) are somewhat distinguishable in group clusters either by participation, role or interest. However, we find there is no analysis of interactions and influences among these levels (Mühlhaus et al., 2012). With this understanding, we suggest that our colleagues and scholars reflect on whether lack of multilevel distinction presents more opportunity or less relevance to their research.

5.2 | Research implications and future avenues

This review furthers the construction of diffusion of innovations theory in community innovation by applying a multilevel perspective of communities as social systems of innovation. To this end, we structure research in micro processes that shape innovation contributions of open collectives. Scholars can utilize a multilevel perspective to categorize interstices emerging from community spaces (Faraj et al., 2011) and to distinguish between group and community factors that influence an individual's innovation outcomes. We believe that studying the interplay between these levels offers valuable insights to better understand how individual level and context-level factors shape the degree of novelty in innovation contributions.

Future theory construction in innovation diffusion benefits from the linkages between all the three levels. Importantly, diffusion factors vary based on the interchange between individuals, the relationship to the meso level (e.g., stages of interchange and involvement in subgroups) and the influence of the larger community (Korhonen et al., 2013). Accordingly, Figure 5 presents a construct to enable research in community innovation contexts, where the levels demonstrate corresponding research perspectives, motivations or outcomes. Specifically, the adaptation of individual motivations (Ariely & Levav, 2000) illustrates potential to identify patterns among individuals, peer groups and the collective.

5.3 | Managerial implications

Our research also offers important insights for managers and practitioners working with online communities. For one thing, the multilevel

perspective extends a vantage point for open and independent innovating systems. Correspondingly, we recommend it as essential practice for community design choices with the following guidance.

Practitioners can evaluate the impact of community design decisions for individuals, subgroups and the community—so as to avoid misalignment of design choices and desired community contributions. This is particularly true for firm-sponsored communities. For instance, incentive programmes could result in low responsiveness or copying without crediting the originator when they reward unique (individual) innovations in a community that celebrates credited copying for learning. Relatedly, managers may also be able to identify self-reinforcing mechanisms that boost innovation performance. For example, easy-to-use feedback mechanisms, virtual playgrounds or limited access areas may provide a flexible infrastructure that accommodate community members' needs at various different levels of expertise.

Although group phenomena are consistent with the belief that the collective is more than the sum of its participants, firms must pay close attention to the sum of independent innovators continually interacting, problem solving and radicalizing innovation in a free community.

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APPENDIX A.

Key journals featuring community innovation literature

- IBM Systems Journal
- INSEAD Working Papers Collection
- Journal of Economic Behavior & Organization
- Journal of Knowledge Management
- Journal of Product Innovation Management
- Academy of Management Annual Meeting Proceedings
- AI Practitioner
- American Behavioral Scientist
- Behaviour & Information Technology
- Bulletin of the Association For Information Science & Technology
- Business Horizons
- Business People
- Business Process Management Journal
- Business Source Premier
- California Management Review
- Creativity & Innovation Management
- Creativity and Innovation Management
- Economic Development Quarterly
- Electronic Commerce Research
- Electronic Commerce Research & Applications
- European Conference Proceedings
- Gestion 2000
- Global Journal of Flexible Systems Management
- Government Information Quarterly
- Handel Wewnêtrzny
- IEEE Transactions on Engineering Management
- Industry & Innovation
- Informatica Economica
- Information & Organization
- Information Systems Management
- Information Systems Research
- Innovation & Organization
- Innovation Journal
- International Journal of Entrepreneurship & Innovation Management
- International Journal of Innovation Management
- International Journal of Production Research
- International Journal of Public Sector Management
- International Journal of Technology Management
- Journal of Business & Industrial Marketing
- Journal of Business Research
- Journal of Engineering & Technology Management
- Journal of High Technology Management Research
- Journal of Knowledge Management
- Journal of Macromarketing
- Journal of Management Information Systems
- Journal of Product Innovation Management
- Learning Organization
- Long Range Planning
- Management
- Management Learning
- Managerial and Decision Economics
- Marketing Education Review
- MIS Quarterly
- MIT Sloan Management Review
- Organization Science
- Perspectives on Global Development & Technology
- Politiques et Management Public
- Proceedings of ISPIIM Conferences
- Proceedings of the European Conference on Innovation & Entrepreneurship
- Production Planning & Control
- R&D Management
- Research Policy
- Research Technology Management
- Revue Française de Gestion
- Routledge
- Strategic Direction
- Strategy & Leadership
- Technology Analysis & Strategic Management
- Technovation
- Total Quality Management
- Total Quality Management & Business Excellence
- Venture Capital

APPENDIX B.

Key journals featuring community innovation literature

- IBM Systems Journal
- INSEAD Working Papers Collection
- Journal of Economic Behavior & Organization
- Journal of Knowledge Management
- Journal of Product Innovation Management
- Academy of Management Annual Meeting Proceedings
- AI Practitioner
- American Behavioral Scientist
- Behaviour & Information Technology
- Bulletin of the Association For Information Science & Technology
- Business Horizons
- Business People
- Business Process Management Journal
- Business Source Premier
- California Management Review
- Creativity & Innovation Management
- Creativity and Innovation Management
- Economic Development Quarterly
- Electronic Commerce Research
- Electronic Commerce Research & Applications
- European Conference Proceedings
- Gestion 2000
- Global Journal of Flexible Systems Management
- Government Information Quarterly
- Handel Wewnêtrzny
- IEEE Transactions on Engineering Management
- Industry & Innovation
- Informatica Economica
- Information & Organization
- Information Systems Management
- Information Systems Research
- Innovation & Organization
- Innovation Journal
- International Journal of Entrepreneurship & Innovation Management
- International Journal of Innovation Management
- International Journal of Production Research
- International Journal of Public Sector Management
- International Journal of Technology Management
- Journal of Business & Industrial Marketing
- Journal of Business Research
- Journal of Engineering & Technology Management
- Journal of High Technology Management Research
- Journal of Knowledge Management
- Journal of Macromarketing
- Journal of Management Information Systems
- Journal of Product Innovation Management
- Learning Organization
- Long Range Planning
- Management
- Management Learning
- Managerial and Decision Economics
- Marketing Education Review
- MIS Quarterly
- MIT Sloan Management Review
- Organization Science
- Perspectives on Global Development & Technology
- Politiques et Management Public
- Proceedings of ISPIM Conferences
- Proceedings of the European Conference on Innovation & Entrepreneurship
- Production Planning & Control
- R&D Management
- Research Policy
- Research Technology Management
- Revue Française de Gestion
- Routledge
- Strategic Direction
- Strategy & Leadership
- Technology Analysis & Strategic Management
- Technovation
- Total Quality Management
- Total Quality Management & Business Excellence
- Venture Capital

APPENDIX C.

Stage of exchange	Authors and article titles	Word counts in the article for interact, interaction and interactive
Interaction	Faullant, R., & Dolfus, G. (2017). Everything community? Destructive processes in communities of crowdsourcing competitions.	69
Interaction	Schröder, A., & Hölzle, K. (2010). Virtual communities for innovation: Influence factors and impact on company innovation.	67
Interaction	Dahlander, L., & Frederiksen, L. (2012). The core and cosmopolitans: A relational view of innovation in user communities.	35
Interaction	Mühlhaus, D., Weiber, R., Kim, J. S., & Hyun, J. H. (2012). A conceptual approach to modelling the success of communities of innovation.	27
Interaction	Hsiu-fen, L. (2009). Examination of cognitive absorption influencing the intention to use a virtual community.	18
Interaction	Bullinger, A., Neyer, A., Rass, M., & Moeslein, K. (2010). Community-based innovation contests: Where competition meets cooperation.	17
Interaction	Lauritzen, G. (2017). The role of innovation intermediaries in firm-innovation community collaboration: Navigating the participanship paradox.	16
Interaction	Kosonen, M., Gan, C., Olander, H., & Blomqvist, K. (2013). My idea is our idea! Supporting user-driven innovation activities in crowdsourcing communities.	15
Interaction	Angehrn, A. A., Maxwell, K., Luccini, A. M., & Rajola, F. (2008). Designing collaborative learning and innovation systems for education professionals.	11
Interaction	Chou, C., Yang, K., & Jhan, J. (2015). Empowerment strategies for ideation through online communities.	11
Interaction	Füller, J., Hutter, K., Hautz, J., & Matzler, K. (2017). The role of professionalism in innovation contest communities.	11
Interaction	Hiennerth, C., & Lettl, C. (2011). Exploring how peer communities enable lead user innovations to become standard equipment in the industry: Community pull effects.	10

Note: Demonstrates the validation approach used to classify articles into the interact stage of exchange. Validation is done based on the number of references to the term 'interact' in articles.