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# **Predictive Crowding as a Concept to Support the Assessment of Disruptive Ideas: A Conceptual Framework**

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## **Abstract**

**Purpose** – *The purpose of this paper, is to develop a conceptual framework for a holistic view on how to use crowd intelligence to identify the logic of sequences to fully address the potential of crowds, and contest the common assumption that one crowd fits all challenges.*

**Design/methodology/approach** – *This conceptual development is based on both deductive and inductive reasoning and is the result of interdisciplinary collaboration of partner universities and research institutions.*

**Findings** – *A number of research postulations are presented, opening a future research stream to provide a new perspective on application possibilities of crowdsourcing in SMEs, and encourage further discussion on crowd definition and crowd selection for varying applications.*

**Research limitations/implications** – *Subsequent empirical work is called for to test various research postulations.*

**Practical Implications** – *The conceptual framework demonstrates the applicability of crowd intelligence for predictive assessment of disruptive ideas, and adds to the literature on how SMEs could use Predictive Crowding (Expert Crowds) to assess disruptive ideas.*

**Keywords:** *Crowdsourcing; crowd-sourced innovation; disruptive innovation; innovation assessment; Delphi methodology, predictive crowding.*

**JEL Classifications:** *M10; M30*

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## Introduction

The innovation process is changing, and extensive research has been published on the need to innovate (Chesbrough, 2003; Gassmann, 2006; Sawhney, Prandelli and Verona, 2003; Von Hippel 1988); the search for new ideas (Laursen, 2012); the impact of new technologies, the changing dynamics of digital/social networks, the need to collaborate and draw intelligence from outside experts (Chiesa and Manzini, 1998; Chesbrough, 2003; Laursen and Salter, 2014); the requirement to look at the innovation process in a more open, distributed, and democratic way (Von Hippel, 1988, 2005; Chesbrough, 2003; Chesbrough, Vanhaverbeke and West, 2006). In addition, the innovation process is currently undergoing significant disruption in many organizations (Bücheler and Sieg, 2011). Due to the speed of technological innovations and product lifecycle times becoming shorter and shorter, companies are facing the need to speed up their innovation process (Dahlander and Gann, 2010; Gassmann, Enkel and Chesbrough, 2010).

The open innovation concept has been widely discussed in both practice and academia over the past decade (Huizingh, 2011; Diener and Piller, 2013). Open innovation implies the usage of a wide range of internal and external actors in order to ensure efficient innovation, and has prompted organizations to adapt their innovation process from being an internal process that is mainly performed within organizational boundaries, to opening up this process and incorporate acquiring external knowledge and exploiting internal knowledge externally (Chesbrough, 2003).

In recent years, digital networks have created a virtual world of collective intelligence and have facilitated large groups of people to connect, contribute and collaborate (Bücheler and Sieg, 2011). As a result competitive pressure has increased, product life cycles have become shorter, and the need to innovate has augmented. At the same time, companies have been faced with reduced internal R&D budgets and cost increases (Chesbrough, 2003; Tidd and Bessant, 2013). In particular, technology centered organizations have been forced to launch new products and processes faster than their competitors, with technologies being in constant flux presenting unique innovation challenges (Tidd and Bessant, 2013).

Many companies nowadays start to apply crowdsourcing to obtain ideas, feedback, and solutions to develop and initiate corporate activities (Diener and Piller, 2013; Gartner, 2013; Fuller 2006, 2010). The crowdsourced innovation market volume is expected to double from 2.7 billion Euros in 2013 to 5.5 billion Euros in 2015 (Diener and Piller, 2013). However, today about 80% of the open innovation market is driven by ideation contests (Diener and Piller, 2013; Van Delden, 2014), involving potential customers in incremental innovation processes. While there is no extensive body of literature or theoretical frameworks beyond front-end innovation metrics (Ferrier, 2014), Chiu, Liang and Turban (2014) note that, aside from publicly promoted success stories of crowdsourcing, examples abound of unsuccessful projects and adoption problems resulting in cost overruns and poor quality decisions. Keupp and Gassmann (2009) highlight transaction costs and intellectual property considerations as factors that may negatively affect the feasibility of crowdsourcing in open innovation.

As such, while crowdsourcing has its contributions and challenges in facilitating open innovation in terms of incremental innovation, the assessment of disruptive ideas using crowd intelligence remains largely unanswered. This research aims to address this gap in the literature by providing a more holistic approach to crowdsourcing that requires a shift from traditional process and tool applications, such as social media marketing as an extension of the marketing tool kit, to understanding the value of crowd-intelligence from both a fuzzy front-end (search) and back-end perspective (capture), to selection of crowd participants and implementation of sourced information.

This paper contributes to the literature in several ways. First, the conceptual framework furthers our understanding of the shifting nature of work. Predictive crowding uses the intelligence of a pre-determined, that is “predictive crowd”, to democratize or challenge work ethics globally, by enabling anyone in principle to contribute to an innovation portfolio. Having people all across the world collaborate in this way will not only disrupt industries, but may also change societies into “value ecologies” (Ben Letaifa, 2014). Secondly, this research advances the understanding of crowdsourcing from a stage gate focus - ideation in the fuzzy front-end and social marketing crowding in the back-end - to a meta-level understanding of how to utilize crowd intelligence. Thirdly, the conceptual framework that is presented proposes a different view in screening ideas, i.e. assessing ideas, and moves our perspective on innovation from a firm perspective to innovation in a value ecology. Our research also contributes to practice by developing a unique framework for SMEs to support them through crowd-sourced experts when evaluating disruptive ideas outside their existing business model.

This paper is organized as follows. First, the concept of predictive crowding is elaborated on, in particular how it captures crowd intelligence to facilitate disruptive open innovation, and how it may apply to SMEs in particular. From this discussion a number of research propositions are postulated that form a future research agenda for empirical investigation. Next, a conceptual framework is developed that outlines the process of how crowd intelligence may be used to advance innovation capability of organizations and networks. Finally, areas for future research are identified.

## Predictive Crowding and research postulations

Dahlander and Gann (2010) identified a range of definitions of crowdsourcing when reviewing more than 100 papers on the subject. Blohm, Leimeister and Krcmar (2013) state the basic idea of crowd sourced innovation as a company or institution proposing to an undefined group of contributors to either collaborate or take part in an idea contest.

While disruptive innovation has been recognized as an important phenomenon in competitive strategy (Christensen, 1997; Christensen and Raynor, 2003; Burgelman, Christensen and Wheelwright, 2003; Wan, Williamson and Yin, 20014) only little research has been conducted on how crowd intelligence can be used in this context (Füller, Lemmer and Hutter, 2014; Piezinka and Dahlander, 2014). Moreover, SMEs are not necessarily concerned about their idea pipeline, but rather express a need to get expertise to assess and evaluate disruptive ideas outside their existing business model. In addition, more studies argue that it is important to attract highly motivated and highly capable individuals to the crowd (Frey, Lüthje and Haag, 2011). In several of the reported success stories, solutions were actually derived by small groups or by a few experts, i.e. Delphi Crowds, and not by large crowds (Bogers, Afuah and Bastian, 2010; Chiu, Liang and Turban, 2014; Piezunka and Dahlander, 2014).

In order to manage and lead an efficient innovation process, most companies have implemented an idea-to-launch system, such as the Stage-Gate Model, which contains all phases of an innovation process (Cooper, Edgett and Kleinschmidt 2002). Cooper (1994) developed a multidimensional integrative innovation model, which explains the different kinds of innovation: administrative, technological, process, product, radical, and incremental innovation. In this context, technological innovations can be products or processes, and can be further classified as either incremental or radical. Traditionally, researchers and managers conducted their technology and innovation efforts within their internal R&D department. The internal innovation results were shared sporadically with external parties (Gassmann, 2006; Gassmann and Enkel, 2006). The stage-gate process model has become a standard model in innovation management in organizations, with the latest version striving to be more adaptive, agile, and accelerated (Cooper, 2014), but fails to include crowd intelligence.

Van Delden (2014) states that most executives are currently unable to understand the entire scope of the crowd concept and all its implications. Chiu, Liang and Turban (2014) add that there is a need to examine how crowdsourcing can be applied properly to benefit organizations, at minimal risk.

Our research contribution and discussion is based on the four-stage innovation process proposed by Tidd and Bessant (2013): search, select, implement, and capture. In addition we will combine the inside-out and outside-in open innovation philosophy initially addressed by Chesbrough, 2003. The conceptual foundation of our research is the innovation process introduced by Cooper, Edgett and Kleinschmidt (2002), and Tidd and Bessant (2013).

Our research focuses on the use of crowds for the assessment of disruptive ideas, and is related back to the four-stage innovation process proposed by Tidd and Bessant (2013): *search, select, implement, and capture*. Next we develop research postulations for future empirical research around the search- and select- stages of this innovation process:

### **“Search” process in innovation management: research postulations P1-P4**

Chesbrough, Vanhaverbeke and West (2006) argue that a lack of knowledge force firms to use external sources in order to fill knowledge gaps that cannot be addressed internally. Organizations can seek new ideas by considering collective wisdom of a heterogenic group of actors, i.e. individuals or organizations, designated as crowds. Hence crowdsourcing can take place by assessing an innovation intermediate, organize an external idea contest or innovation workshop (Simula and Ahola, 2014).

In their search for innovation, organizations often invite external contributors to make suggestions (Von Hippel, 2005). Soliciting suggestions is a form of distant search, since it allows organizations to tap into knowledge that may not reside within their organizational boundaries. Organizations engaging in distant search often face a large pool of suggestions, an outcome we refer to as crowding. When crowding occurs, organizations, whose attention is limited, can pay attention to only a subset of suggestions. Firms usually have sufficient resources and capabilities to continuously assess incremental, sustainable ideas in line with their respective business design.

***P1: It is postulated that organizations, and in particular SMEs, do not lack disruptive ideas; but rather the assessment capabilities, e.g. time, competence, to fully understand the impact of ideas outside their existing business design.***

Adding to the research of Herstatt, Verworn and Nagahira (2004, 2008) Gassmann and Schweitzer (2014) claim that the cornerstone for innovation is its early stage, the ‘fuzzy front end’ (Baldwin, Hienerth and Von Hippel, 2006). However, as proposed by Howe (2006, 2008) applications of crowdsourcing can occur along the whole innovation process. Applications of crowdsourcing are clustered into four categories, three of which can be used for crowd-sourced innovation. The first application, the “collective intelligence or wisdom of the crowd” aims to provide further insights or new ideas to assist a company introduce new products and services. In the second application, “crowd-creation”, people can create different types of content, accessible to other people or companies at a small fee or even for free. The third and last application is “crowd-voting”, where people simply vote, rate, or filter ideas for products or services.

These different applications cover different stages in the innovation process, allowing crowdsourcing to provide support for decision-making, problem solving, and opportunity exploitation. Yet, most of these applications of crowd-sourced innovations require big data volumes to be assessed. This can be very resource intensive and costly, especially if companies lack capabilities and processes for making sense of crowd sourced

data (Aitamurto, Leiponen and Tee, 2011). Sheng, Provost and Iperotis (2008) confirm the high costs of data processing when accessing agile knowledge. Blohm, Leimeister and Krmar (2013) refer to the example of IBM where development of an effective absorptive capacity to generate knowledge and value from crowd-sourced data required 50 senior executives working for several weeks. This would not be feasible in most SME business contexts.

Contrary to the popular assumption that organizations need ‘outside-in’ innovation, this research moves the focus to ‘inside-out’ open innovation (Chesbrough, 2003; Chesbrough and Appleyard, 2007; Laursen, 2012), facilitated through predictive crowding.

***P2: It is postulated that the need for crowd-intelligence at SMEs is not the fuzzy front end, i.e. idea generation, but rather idea assessment. Tapping on the unlimited knowledge within organizations, such an approach shifts the need to move the internal improvement process to a new, disruptive, dimension.***

Innovation leaders need to make various choices, when and how to get involved in innovation crowd sourcing (Huizingh, 2011), in particular at what stage of the innovation process a crowd should be addressed and what kind of application is called for (Lüthje, Herstatt and Von Hippel, 2005). The literature reports cases of crowd feedback and voting, yet these cases focus more on an extension of the marketing tool kit, i.e. social media marketing, and show limited use of crowd intelligence (Diener and Piller, 2013; Gartner 2013).

***P3: It is postulated that, in order to maximize value for a firm, crowd intelligence needs to be addressed and used in all stages of the innovation process.***

Tidd and Bessant (2014) state that managing innovation requires a holistic view across all steps in the innovation process. Hence, when moving the process into the crowd the same principles apply. Felin and Zenger (2014) add problem solving and governance choice to the decision to pursue open or closed innovation processes.

***P4: It is postulated that the approach to disruptive innovation requires crowdsourcing, moving from ‘fuzzy front-end’ and consumer driven back-end applications, to value creation and capture using crowd intelligence, i.e. predictive crowding, and by doing so question the existing business design. In particular SMEs are not necessarily concerned about evaluating their idea pipeline, but rather need expertise to assess and evaluate disruptive ideas outside their existing business model.***

#### **“Select” process in innovation management: research postulations P5-P7**

Innovation leaders must decide what method to apply and which external sources are appropriate when internal capabilities are not up to the task. Organizations need a level of control in the selection process of experts to ensure the defined crowd can act in a predictive capacity. External sources can be (un-)defined crowds (Dahlander and Gann, 2010; Van Delden, 2014), or strategic partners (Narula and Hagedoorn, 1999; Cooper, Edgett and Kleinschmidt, 2002). Fey and Birkinshaw, 2005 introduce governance modes, like idea contests, alliances, joint ventures, licensing and open source platforms. Yet more and more studies argue that it is important to attract highly motivated and highly capable individuals externally (Laursen and Salter, 2014). In several of the reported success stories, solutions were actually derived by small groups or by a few experts, i.e. Delphi crowds, and not by major crowds (Chiu, Liang and Turban, 2014; Diener and Piller, 2013).

***P5: It is postulated that external Delphi workshops, using a predictive expert crowd, are an effective way to assess disruptive ideas and select the innovation portfolio of an organization.***

Recent research by (Diener and Piller, 2013) showed that in many ideation projects pre-defined groups were targeted that may not always be heterogeneous. Piezunka and Dahlander (2014) argue that “...crowding narrows organizations' attention; that is, despite organizations' efforts to reach out to external contributors to access suggestions that capture distant knowledge, they are more likely to pay attention to suggestions that are familiar, not distant.” As such, the selection process is critical for the predictive and successful use of crowdsourcing and crowd intelligence. External experts can be suppliers, customers, competitors and universities (Laursen and Salter, 2014). This step requires in-depth stakeholder assessment, early buy-in, as well as an extended stakeholder perspective. Innovation leaders need to add new dimensions of thinking in crowd intelligence, including and considering how employees and the ‘extended workforce’ connect, share, and build relationships (Gartside et. al., 2013).

Earlier research in crowdsourcing suggests that key success factors in the selection of an appropriate crowd were a large crowd size and heterogeneity of knowledge of the crowd (Rosenkopf and Nerkar (2001), Kozinets, Hemetsberger and Schau (2008). However, Frey, Lüthje and Haag (2011) found only some degree of empirical evidence that larger size and heterogeneity really resulted in improved results. Van Delden (2014) argues that crowd sourced innovation is only possible when tapping the right crowd that consists of people with the relevant knowledge and skills required for the respective innovation process. Ertekin, Hirsch and Rudin (2012) addressed the need to define who are the most representative people in a crowd, who represent the interests of the majority in order to make the process more effective. Additionally, Cusumano (2010), for example, states that Apple’s or Amazon’s open innovation platforms are controlled very tightly in terms of selecting which people can actually access these platforms. Hence, he concludes, that many firms so called “openness” is not really open. Yet, Brabham (2008) states that the digital platform used in crowdsourcing can enable the crowd as an external resource for working on a topic is usually performed internally by employees or suppliers. In principle, the crowd can generally include everyone who has thoughts or solutions that may expand or improve a firm’s innovation capability (Huizingh, 2011; Ebner, Leimeister, Krcmar, 2009; Howe, 2008; Kozinets, Hemetsberger and Schau, 2008).

Another aspect is how the crowd can be attracted and motivated (Osterloh and Frey, 2000). Gartside et. al. (2013) suggest to include expert crowd as an “extended workforce”. Afuah (2003) redefines firm boundaries due to new digital technologies. Van Delden (2014) found that monetary compensation was not a primary concern, and that other rewards, such as recognition, the sense of accomplishment, prizes or fame, featured as more important incentives. Personal profiles could include aggregated ratings of the overall quality of a participant’s contributions to reduce problems of free-riding and signaling apparent high involvement, but non-substantial contributions, to a solution thread. Frey, Lüthje and Haag (2011) found a positive correlation between the aspiration for monetary rewards and non-substantial contributions, concluding that enjoyment has a tendency to produce more important contributions instead. Additionally, Kogut and Metiu (2001) propose that the actual question is not as much about motivating, but rather attracting highly motivated and highly capable individuals. Furthermore, an external idea contest, by hosting an ideation contest and inviting external experts to submit ideas, can be conducted. Incentives for experts are encapsulated in a contest price. Such an approach involves added cost and time, because the contest has to be prepared towards rules, administration and awarding prizes (Cooper and Edgett, 2008). To tackle the data volume problem and the problem of participant bias, Dekel and Shamir (2009) suggested an algorithm for cutting the votes of less reliable participants. Nonetheless, Gassman, Enkel and Chesbrough (2010) state that

internal processes of managing crowd-sourced innovation are still more trial and error, than a professionally managed process.

***P6: It is postulated that, for the effective creation of predictive crowding, further research insights are needed as to:***

- ***How organizations find, attract and select experts in the crowd,***
- ***How to size the expert crowd,***
- ***How to create desire for experts to participate in idea evaluation, and***
- ***How to build crowd assets, i.e. long-term access to crowd intelligence.***

In the increasing complexity of innovation management and processes, many firms and organizations have focused on providing services and products to perform various roles in other organizations' innovation process. Such companies are considered being so called intermediaries (Howells, 2006). Open innovation intermediaries are on the rise and are significantly changing the technology market. According to Hossain (2012), particularly in the last decade intermediaries have rapidly emerged. Furthermore, he found that many corporations utilize intermediaries to search and solve innovation problems, but that only few studies go beyond their general role in the technology market.

In their open innovation market study, Diener and Piller (2013) investigated 160 intermediaries with regard to their business models, projects, services provided and characteristics of their participant pool. They found, that in general open innovation intermediaries can be clustered into two groups. The first group runs an open innovation project on behalf of their clients and the second group helps their clients in building own open innovation competences. Reasons for companies to involve an intermediaries are to help facilitating internal and external technology, to connect innovation seekers and innovation providers, to support corporations to screen external markets, to ease searching tasks, to reduce search cost, and to in-license, co-develop and acquire external intellectual properties or technologies (Hossain, 2012; Lichtenthaler et al., 2009)

Diener and Piller (2013) furthermore found, that open innovation platform or service providers services differ significantly regarding their community composition. Intermediaries that offer technical offering technical search services have access to high level expert communities. On the other hand, intermediaries focusing on ideation and concept generation often have a broad, very heterogeneous community.

However, Diener and Piller (2013) also conclude that compared to their 2010 study, 20 of the intermediaries did not exist anymore or were acquired by other player. Additionally they expect, that this wave of mergers and acquisitions in the market is getting even stronger in the next few years, which indicates, that the market, the players and the services provided are currently rapidly changing.

***P7: It is postulated that for effective predictive crowding, the role of innovation intermediaries needs to be further investigated as to how they can facilitate crowd selection, and expert participation.***

## Conceptual Framework for Predictive Crowding

In this section, a conceptual framework is developed for organizations, in particular SMEs, that explains how to use predictive crowding (expert crowds) to assess disruptive ideas outside the organization's existing business model, and thereby extend today's

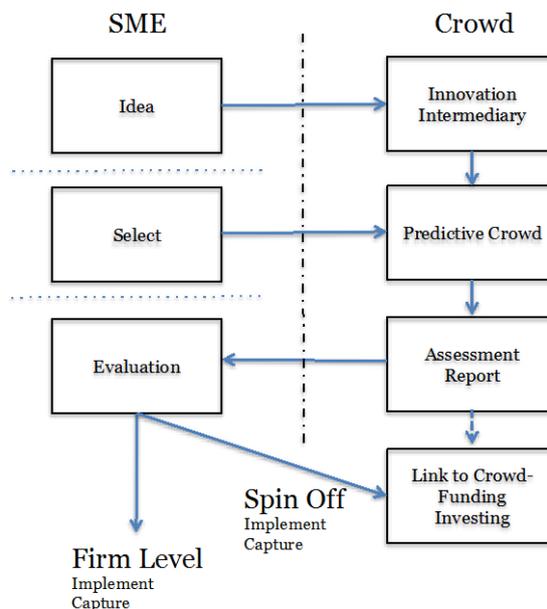
common applications of crowdsourcing. In addition, the framework assists SMEs through crowd-sourced expert evaluation, incorporating strategic as well as operational perspectives.

This framework development is based on both a deductive methodology, using theories and findings that already exist in the research area, as well as an inductive stage in the development of a new framework (Saunders, Lewis and Thornhill, 2009; Yin, 2009). Yet, as the literature and theoretical basis of predictive crowding, and crowdsourcing in general, has only developed recently and has not yet progressed to availability of varying viewpoints and reliable theories, future empirical research may also use features of interpretivism to solicit information on what some experts think about the suitability of predictive crowding in different situations, and how they tackle problems that occur in their projects when using the crowd for idea assessment.

Based on the earlier research postulations grounded in the literature, a conceptual framework is presented on how to use crowd intelligence for advancing innovation capability of organizations.

The starting point is an SME or any organization facing the evaluation of a disruptive idea outside the current business design. The innovation process leader contacts an innovation intermediary he trusts for tapping on the expert crowd database and selecting the crowd based on competence profiles believed to deliver an assessment report supporting the strategic decision making process at firm level, i.e. a predictive result. Based on this information and subsequent decisions, the idea is taken through the innovation process inside the organization, or as a spin-off to a crowd-investing or crowd-funding platform, the latter potentially suggested as well by the expert crowd. The proposed framework for predictive crowding is shown in Figure 1 below.

**Figure 1:**  
Conceptual Framework for Predictive Crowding



Innovation Intermediaries such as Atizo, NineSigma, Lumenogic or InnoCentive already offer a starting point for firms to access crowd intelligence for value creation at the front end of innovation. The proposed conceptual framework in this research lays out a foundation for assessing disruptive ideas, considering critical factors like trust, IP protection, and the option to (pre-)define the ideal crowd. In particular, the following actions are suggested in this process:

- Provide the organization (SME) with a new perspective on the application possibilities of crowdsourcing using predictive crowding;
- Focus on the extending ideation to “idea assessment”;
- Promote participation of experts in selected crowd-sourcing projects;
- Encourage discussion of crowd definition and selection for different purposes, as well as the impact of innovation diffusion;
- Transfer findings to stakeholders, leaders, decision makers and open innovation accelerators.

## Areas for future research

This research presented a number of research postulations, as well as a conceptual framework, in relation to the use of predictive crowding as a novel extension to crowd sourcing in fostering disruptive innovation in organizations, in particular SMEs. Future research needs to empirically investigate the proposed research postulations, as well as the validity and reliability of the proposed conceptual framework steps in regard to the implementation of predictive crowding.

More research is needed to study several success factors identified in earlier research, in particular expert motivation, to answer the question on how to attract intrinsically motivated users with diverse knowledge bases, and how to create a desirable environment to assess and share knowledge and reasoning. Other success factors to be investigated may include ease of use (i.e. autonomous processes), integrated processes, and immediate/constant feedback both from other contributors and from the seeker firm (Füller, Lemmer and Hutter, 2014). Future research may also investigate how to transform sporadic expert participation into a crowd asset for the platform (i.e. the innovation ecosystem).

The predictive crowd proposition encourages firms and potential platform operators to invite potential knowledge contributors from both inside and outside the innovation ecosystem, who may have critical complementary knowledge, including wildcards. Future research may extend the detailed personal profiling, similar to those on various social networks to search for specific experience and expertise, to include psychological factors such as bias (Fey, Lüthje and Haag, 2011).

Finally, the conceptual framework proposed in this research opens up application opportunities that transcends firm specific value into network value on a value ecology-level (Ben Letaifa, 2014). Hearn, Roodhouse, and Blakey (2007) define “value ecology” as a dynamic constellation of firms where the value flow is multi-directional and works through clusters of networks. In the “value ecology”, value is created within a paradigm that:

- Emphasizes the idea of networks or webs of relationships;
- Suggests a holistic dynamic view rather than a static linear view;
- Suggests that the generation of value does not just reside in the product itself;

- Argues both competitive and cooperative processes are in interaction with each other;
- Encompasses the idea of an environment of factors that engender and create value without necessarily being part of the first order factors of productivity; and
- Opens the door to evolutionary metaphors to analyze change and development of the context of businesses (Hearn and Pace, 2006, p. 57).

This paradigm shift creates a shift in thinking from:

- Consumers to co-creators of value;
- Value chains to value networks;
- Product value to network value;
- Co-operation or competition to thinking about complex co-opetition; and
- Individual firm strategy to thinking about strategy in relation to the value ecology as a whole (Hearn and Pace, 2006, p. 55).

While Ferrier (2014) confirms the need to understand the ecosystem of innovation-centric activities, his research is limited to firm boundaries. Future research may extend the use of predictive crowding as a facilitator of disruptive innovation on a value ecology scale, opening up wider dimensions of sociology and human behavior, including the integration of game theory (Dix and Nalebuff, 2008) and a holistic stakeholder analysis.

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