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Insights

Welcome to the September 2014 issue of the *Technology Innovation Management Review*. We welcome your comments on the articles in this issue as well as suggestions for future article topics and issue themes.

Editorial <i>Chris McPhee</i>	3
Conceptualizing Innovation in Born-Global Firms <i>Erik Zijdemans and Stoyan Tanev</i>	5
Developing a Social Network as a Means of Obtaining Entrepreneurial Knowledge Needed for Internationalization <i>Chen Han and Adeleye Afolabi</i>	11
Down the Rabbit Hole: How Structural Holes in Entrepreneurs' Social Networks Impact Early Venture Growth <i>Mackenzie Adams, Maged Makramalla, and Walter Miron</i>	19
Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil <i>Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon</i>	28
Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance for Strategic Advantage <i>Derek Smith</i>	36
Author Guidelines	45



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Overview

The *Technology Innovation Management Review* (TIM Review) provides insights about the issues and emerging trends relevant to launching and growing technology businesses. The TIM Review focuses on the theories, strategies, and tools that help small and large technology companies succeed.

Our readers are looking for practical ideas they can apply within their own organizations. The TIM Review brings together diverse viewpoints – from academics, entrepreneurs, companies of all sizes, the public sector, the community sector, and others – to bridge the gap between theory and practice. In particular, we focus on the topics of technology and global entrepreneurship in small and large companies.

We welcome input from readers into upcoming themes. Please visit timreview.ca to suggest themes and nominate authors and guest editors.

Contribute

Contribute to the TIM Review in the following ways:

- Read and comment on articles.
- Review the upcoming themes and tell us what topics you would like to see covered.
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Editorial: Insights

Chris McPhee, Editor-in-Chief

Welcome to the September 2014 issue of the *Technology Innovation Management Review*. In this issue, our authors present insights about internationalization, entrepreneurship, social networks, crowdsourcing, and patent evaluation.

In the first article, **Erik Zijdemans** and **Stoyan Tanev** review the literature that addresses the challenges of innovation in firms that seek global markets from inception, meaning they are "born global". Their findings indicate that the early internationalization of new ventures should be considered as an innovation process in itself, and they emphasize that innovation and internationalization have a positive effect on each other. They also draw a link between the innovation management needed to reach global markets early in a technology company's lifecycle and the use of a lean startup approach to bring a technology product to market as early as possible.

Next, **Chen Han** and **Adeleye Afolabi** examine the knowledge needs of startups seeking to internationalize. They point to the role of social networks as a means of obtaining the different types of knowledge required through the phases of the internationalization process. Following a review of relevant literature on knowledge-based resources, the internationalization process, and the value of networks for new ventures, they provide a strategy guide to help entrepreneurs leverage their social capital for internationalization.

Mackenzie Adams, **Maged Makramalla**, and **Walter Miron** explore the effects of structural holes in an entrepreneur's social network on growth in the early years of a venture's development. They argue that structural holes play an important role in the growth and profitability of a new venture and affect its vulnerability to exploitation. Their article captures lessons learned and provides recommendations for entrepreneurs and managers of formal institutions in support of successful entrepreneurship.

Fabio Prado Saldanha, **Patrick Cohendet**, and **Marlei Pozzebon** present a case study of the Fiat Mio, a concept car developed in Brazil through a collaborative crowdsourcing process with Internet users. Their analysis of the case leads them to propose a new approach – the accordion model – which challenges the typical stage-gate approach to crowdsourcing. In the accordion model, a succession of broadening and narrowing periods allows ideas to be refined and explored in an iterative and collaborative manner. The article includes lessons learned by the executives of Fiat Brazil, which can be applied to other crowdsourcing projects.

Finally, **Derek Smith** introduces a new framework to help executives and managers determine the value of a patent by filtering out the "noise" in patent citation data. By focusing only on relevant citations, more reliable insights can be gleaned from the knowledge, technology, and invention properties of a patent, thereby increasing opportunities for strategic advantage. The article includes scenarios that illustrate how the proposed framework can be applied.

We hope you enjoy this issue of the TIM Review and will share your comments online.

In October and November, we will revisit the theme of **Cybersecurity**, and our guest editor will be **Tony Bailetti**, Director of the Technology Innovation Management (TIM; timprogram.ca) at Carleton University in Ottawa, Canada.

For future issues, we welcome submissions of articles on technology entrepreneurship, innovation management, and other topics relevant to launching and growing technology companies. Please contact us (timreview.ca/contact) with article topics and submissions, suggestions for future themes, and any other feedback.

Chris McPhee
Editor-in-Chief

Editorial: Insights

Chris McPhee

About the Editor

Chris McPhee is Editor-in-Chief of the *Technology Innovation Management Review*. Chris holds an MASc degree in Technology Innovation Management from Carleton University in Ottawa and BScH and MSc degrees in Biology from Queen's University in Kingston. He has over 15 years of management, design, and content-development experience in Canada and Scotland, primarily in the science, health, and education sectors. As an advisor and editor, he helps entrepreneurs, executives, and researchers develop and express their ideas.

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Conceptualizing Innovation in Born-Global Firms

Erik Zijdemans and Stoyan Tanev

“It has been said that arguing against globalization is like arguing against the laws of gravity.”

Kofi Annan
Diplomat and Nobel Laureate

This article summarizes the insights from a systematic study of the research literature focusing on the innovation aspects of born global firms – ventures that were launched to exploit a global niche from the earliest days of their operations. The authors provide a snapshot of opinions on the different aspects of innovation in the way they were conceptualized in the academic literature. The insights are based on a selection of 32 peer-reviewed journal articles addressing the different challenges associated with early internationalization and innovation in such ventures. The article emphasizes that the early internationalization of new ventures should be considered as an innovation process in itself and that innovation and internationalization have a positive effect on each other. In addition, it points out the role of knowledge acquisition and networking capabilities as key innovation enablers and refers to the emergence of the lean startup perspective on the innovation processes in born global firms. The suggested insights will be relevant to researchers and practitioners interested in the relationship between early internationalization and innovation in international new ventures and lean global startups.

Introduction

According to Knight and Cavusgil (2004), the early internationalization of a firm and its potential success in a foreign market are functions of its internal capabilities. The superior ability of certain firms to sustain innovation leads to new knowledge creation, which enables the development of organizational capabilities that result in superior performance, particularly in highly competitive environments. On the other hand, innovation results from various sources, such as internal R&D and imitation of the innovations of other firms. R&D in particular supports the opening of new markets and the re-invention of firm's operations in a way that enables the firm to better serve those new markets. The innovativeness of such firms includes the masterful leveraging of knowledge and organizational capabilities despite scarce financial, human, and tangible resources. Knight and Cavusgil (2004) provide evidence that born-global firms are inherently entrepreneurial and innovative firms, displaying a specific pattern of knowledge and capability management that engenders early internationalization and sustainable, superior performance in foreign markets.

In what follows, we will focus on the different aspects of innovation in the way it was conceptualized within the context of international new ventures and born-global firms. We used the Web of Knowledge academic research database to identify 32 peer-reviewed journal articles in the fields of business and management that discuss the challenges associated with early internationalization and innovation in such firms. The articles were selected by looking simultaneously for two keywords: “born-global firm” and “innovation”. The underlying assumption is that the distinctive characteristics of such firms affect the way innovation is being conceptualized within their specific context. We start with the realization that the act of internationalization, and especially early internationalization, is an innovative act in itself. The next point focuses on the interrelation between internationalization and other types of innovation where particular attention is paid to the innovativeness of firms as a prerequisite for their commitment to a born-global way of internationalization. The next step in the discussion emphasizes the importance of two key innovation resources for born-global firms: knowledge and networking capabilities. Finally, we refer to the lean startup approach as one of the ways

Conceptualizing Innovation in Born-Global Firms

Erik Zijdemans and Stoyan Tanev

that could accelerate the early internationalization of startups.

Internationalization as an Innovative Act

While a large number of researchers have shown interest in the innovativeness of born-global firms or international new ventures, Jones and Coviello (2005) suggest that even the establishment of an existing business mode in a country new to the firm is a clear evidence for the existence of special innovative capabilities. Born-global firms are particularly innovative in this regard (Knight & Cavusgil, 2004). The early internationalization is stimulated by a strong innovation culture and interest to pursue international markets.

According to Afuah (2003), an innovation could be classified as incremental or radical depending on the extent to which it impacts a firm's capabilities. This is usually referred to as the organizational view of classifying innovations. In this view, an innovation is said to be radical if the knowledge required to exploit it is very different from knowledge that is available within the firm. In incremental innovations the knowledge required to develop a product builds on existing knowledge. Jones and Coviello (2005) suggest that internationalization as an innovative process can be also characterized as either radical or incremental depending on the geographic and cultural proximity to the domestic market. Internationalization as an incremental innovation is defined as the expansion to neighbouring countries or markets with only slight differences, which is in line with the traditional Uppsala model (Johanson & Vahlne, 1977), where firms acquire market knowledge of the domestic market before gradually moving to foreign markets that are culturally or geographically close. Internationalization as a radical innovation is defined as expansion to markets that are significantly different from the domestic market in regards to cultural and geographic qualities. According to this analogy, the internationalization of born-global firms is a radical innovation.

Innovation as a Result or as a Stimulus of Internationalization

Although numerous researchers suggest a close relationship between innovativeness and internationalization, a debate exists as to which is the cause and which is the effect. For example, Ramos Acedo, and Gonzalez (2011) suggest that the tendency to export is positively influenced by technical innovation. This is also acknow-

ledged by Baronchelli and Cassia (2014), who describe that investments in product innovation accelerate the internationalization process of born-global firms. According to them, born-global firms have a higher level of innovativeness and innovation skills that they use to compete successfully, which in turn allows them to be more successful in penetrating new markets. The result is higher foreign sales relative to total revenues when the company commercializes an innovative product abroad. Knight and Cavusgil (2004) and Ramos and colleagues (2011) agree that innovative firms internationalize more rapidly as compared to other companies. In other words, the innovation culture of an organization and its proclivity to pursue international markets influence its internationalization speed.

On the other hand, there are scholars who view a firm's innovativeness as one of the outcomes of early internationalization. In other words, innovativeness, knowledge, and capabilities that increase the new venture's probability for growth and for success in foreign markets are gained through the process of internationalization. Hessels and Van Stel (2011) suggest that exporting new ventures develop completely new human capital and innovation management skills through the export activities themselves. Therefore, exporting new ventures will have a better chance of pursuing new market opportunities and commercializing new ideas. Such firms will be even more conducive to innovation as compared to the majority of domestically operating new ventures.

It seems that the polarity of the two different streams might be smoothed out if one goes beyond the classical way of seeing entrepreneurship as a rational, strategic process where opportunities are discovered through a well-planned search process. Many researchers started seeing entrepreneurship as a process of effectuation instead (Sarasvathy, 2001). Effectuation means that entrepreneurs start with a generalized idea and then attempt to work towards that idea using the resources they have at their immediate disposal. The strategy of a new firm is not clearly envisioned at the beginning, and the entrepreneurs and firms that use an effectuation processes can to a large extent remain flexible, take advantage of new ideas and opportunities as they arise, and constantly be learning (Perry et al., 2012). Under such circumstances, we can see the processes of innovation and internationalization as closely interlinked, and the search for an explicit causal relationship becomes irrelevant.

Conceptualizing Innovation in Born-Global Firms

Erik Zijdemans and Stoyan Tanev

The Role of Innovation in the Emergence of a Born-Global Firm

Innovation plays a significant role in the emergence of the born-global firm. Laanti and colleagues (2007) even suggest that the main innovation is often developed prior to the establishment of such companies and is the reason why they were established in the first place. After the foundation of the company, innovation will keep playing a central role, regardless of the nature of the industry in which the firm competes. The presence of born-global firms in different industry sectors, high tech, low tech, or non tech, suggests that they must be innovative in all areas of value creation, both technological and non-technological (Weerawardena et al., 2007).

The early internationalization of born-global firms affects their innovativeness in terms of the emergence and implementation of their specific marketing strategies (Hallback & Gabrielsson, 2013). It is crucial that the firm is able to innovate, adapt, or reinvent its marketing strategies to suit the local markets, so that they can compete against incumbents in multiple foreign countries. According to Kocak and Cavusgil (2009), the firm's competitive advantage in the foreign market is maintained with the use of specific isolation mechanisms. An isolation mechanism is a way for a firm to isolate itself from competitors on one or more levels. One of the ways to build an isolation mechanism is innovation. In turn, knowledge acquisition and networking capabilities are essential in acquiring competitive advantage through innovation.

Knowledge as a Key Innovation Resource

Both Tolstoy (2009) and Prashantham and Young (2011) agree that innovative behaviour is driven by knowledge combination, an approach that is supported by entrepreneurship theory and practice. Entrepreneurship theory builds on the idea that different individuals know different things, which makes the combination of knowledge essential for opening up new opportunities. Especially the combination of market knowledge and technological knowledge is important to firms in achieving innovation and competitive advantage (Prashantham & Young, 2011). Therefore, top management has a key role in providing opportunities for employees from different functions and different departments (and sometimes even from other companies) to share and combine knowledge, for example through the reinforcement of organizational cohesiveness and collective goals.

The knowledge-based view regards knowledge as the most important resource and firms as superior to individuals in creating knowledge (Tolstoy, 2009). Knowledge creation can be either gradual or radical depending on its degree of impact on a firm's capabilities. Presutti, Boari, and Fratocchi (2007) suggest that the knowledge acquired from foreign business relationships positively influences foreign development of high-tech startups. The knowledge acquired through the network ties emerging between a globally present high-tech startup and its primary foreign customers can be exploited for both economic and innovative outcomes. In this way, knowledge acquisition from foreign customers is an important mechanism for the innovative effort of high-tech startups aiming to engage in collaborative R&D activities abroad.

The Innovative Role of Networking Capabilities

It was already pointed out that the acquisition and management of knowledge is frequently identified as an important antecedent of innovation. On the other hand, knowledge-development capabilities are directly related to the capacity of the firm to apprehend and use the relation among different informational factors to achieve their intended goals (Autio et al., 2000). According to Mort and Weerawardena (2006), the innovativeness of born-global firms is, among other things, expressed in their ability to develop networking capabilities in order to overcome their scarce tangible resources. One could argue, therefore, that the innovative behaviour of international entrepreneurial firms is stimulated by the degree of their engagement in networks (Tolstoy, 2009). There is a dialectical relation between networks and innovation, where network structure is shaped by innovations while the network structure contributes to firms' ability to innovate (Tolstoy, 2010).

Scholars agree that the emergence of born-global firms is not limited to the technology domain. Technology-driven born globals, however, manifest a stronger tendency towards the formation of open innovation networks. Blomqvist and colleagues (2008) explain that fast technological change and the need to innovate under limited resources and time pressure shape the type and the nature of the international networks born-global firms form or access. Under these circumstances, networks with hierarchies are not efficient enough, which often forces the firms to engage in open innovation initiatives and networked R&D activities catering to more flexibility, fast access to information, and high responsiveness. Capron and Mitchell (2010) elaborate on the lo-

Conceptualizing Innovation in Born-Global Firms

Erik Zijdemans and Stoyan Tanev

gic of collaborating with other firms to acquire new resources and capabilities on the level of, for example, R&D. They argue that, once a firm decides to go for an external collaboration, the selection of the specific co-operation format should depend on the nature of the resource gap and that the choice should be made between a purchasing contract, alliance, or acquisition depending on the relevance of the resources, agreement on resource's value, and the desired closeness to the resource provider.

The Lean Startup Approach to the Management of Innovation

The lean startup approach (Blank, 2013) emphasizes the need for quick and responsive product development with a focus on customer feedback. The promoters of this approach propose the deployment of a minimum viable product to the market as early as possible in order to minimize the exposure of the startup to uncertainty (Moogk, 2012). The adoption of this approach is quite natural for the uncertain environment of technology-driven born-global firms. In fact, it was already suggested that one should introduce the concept of lean global startup as a way of emphasizing the impossibility for new technology startups to deal separately with business development, innovation, and early internationalization (Lemmingier et al., 2014). In other words, for a newly established technology firm, the task of being global and innovative at the same time should be seen as one process.

The lean startup approach correlates with other frameworks emphasizing the emergent nature of the business environment of technology-based startups. For example, Onetti and colleagues (2012) introduced a business model framework for technology startups by emphasizing the link between entrepreneurship, innovation, and internationalization. The framework defines the business model as the way a company structures its own activities in determining the focus, the locus, and the modus of its business, whereby the "focus" of the business refers to the activities providing the basis for the articulation of a specific value proposition (i.e., the set of activities on which the company's efforts are concentrated); the "locus" refers to the location or locations across which the firms resources or value-adding activities are spread (i.e., local vs. foreign-based activities, inward-outward relationships with space, entry modes, local embeddedness, etc.); and the "modus" refers to the specific business approach with regards to the internal organization and the network design (i.e.,

insourcing and outsourcing of activities along social and inter-organizational ties, inward-outward relationships with other players, strategic alliances, etc.). This business model framework is probably the only one to accommodate the global allocation of resources and the emergence of global technology markets as an explicit part of the business model. Onetti's approach also emphasizes that the value proposition and the revenue model should be considered independently of the specific business activities because the value proposition and the revenue model belong predominantly to the strategic rather than to the operational level. Such focus on the relative independence of the value proposition could be considered as correlative to the focus on the emergent aspects of the business model in the lean startup approach where the emphasis is on the specific business activities helping the emergence of a specific value proposition and not on the business operationalization of a predefined value proposition.

After taking into account Onetti's approach to business model development of technology startups, one could argue that, in addition to the focus on the development of a minimum viable product, firms should focus on the clear articulation of the locus, focus, and modus of their businesses. The development of the minimum viable product and the modus of the startup could be regarded as key drivers of early internationalization when they push startups to find sourcing partners internationally for the required components, processes, or services that are not within the focus of the startup itself. Born-global firms make continuous innovation possible by linking these external value-creating actors to the internal processes of the firm in innovative ways (Bailetti, 2012). The adoption of the lean approach by technology startups influences the way the company manages its innovation processes (Tanev, 2012). The lean startup approach (Blank, 2013) significantly shortens the technology development cycle and time to market as well as lowers the risk of getting the product wrong. At the same time, it should be pointed out that companies should manage the competitive risks that could be associated with going to market with a product that is only "half-baked".

Conclusion

The main goal of this article was to elaborate on the understanding of innovation in born-global firms in the way it is articulated in academic research journals. The literature on born-global firms is consistent in its conclusion that studying the sources of innovativeness

Conceptualizing Innovation in Born-Global Firms

Erik Zijdemans and Stoyan Tanev

of these companies is very important for other firms willing to engage into a “born-global journey”. Although the topic of innovativeness has been touched on by many different authors in the literature focusing on born-global firms, it has not been addressed in an explicit and contextual way. This article offers a first step in this direction in the anticipation of future studies that could offer a more comprehensive analytical approach.

About the Authors

Erik Alexander Zijdemans is a Master’s degree candidate in Product Development and Innovation with a focus on Global Supply Chain Development at the University of Southern Denmark in Odense. Additionally, he holds a BEng in Business Engineering from Hogeschool Utrecht, The Netherlands. He has over two years of working experience in project management and employee safety management. Currently, he is conducting his research at Carleton University in Ottawa, Canada, focusing on the role of business development agencies in the support of early globalization in technology startups.

Stoyan Tanev is an Associate Professor in the Department of Technology and Innovation and member of the Centre for Integrative Innovation Management at the University of Southern Denmark, Odense, Denmark, as well as Adjunct Professor in the Department of Systems and Computer Engineering at Carleton University in Ottawa, Canada, where he was previously a faculty member in the Technology Innovation Management Program. He has a MSc and a PhD in Physics jointly from the University Pierre and Marie Curie, Paris, France and the University of Sofia, Bulgaria, a PhD in Theology from the University of Sofia, Bulgaria, an MEng in Technology Innovation Management from Carleton University, Canada, and an MA from the University of Sherbrooke, Canada. He has multidisciplinary research interests with a focus on the fields of technology innovation management, global technology entrepreneurship, business model design and value co-creation. Dr. Tanev is Senior IEEE member, and he is a member of the editorial boards of the *Technology Innovation Management Review* and the *International Journal of Actor-Network Theory and Technological Innovation*.

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Conceptualizing Innovation in Born-Global Firms

Erik Zijdemans and Stoyan Tanev

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Keywords: innovation management, early internationalization, born global, lean startup approach, business model

Developing a Social Network as a Means of Obtaining Entrepreneurial Knowledge Needed for Internationalization

Chen Han and Adeleye Afolabi

“The hunger and thirst for knowledge, the keen delight in the chase, the good humored willingness to admit that the scent was false, the eager desire to get on with the work, the cheerful resolution to go back and begin again, the broad good sense, the unaffected modesty, the imperturbable temper, the gratitude for any little help that was given – all these will remain in my memory though I cannot paint them for others.”

Frederic William Maitland (1850–1906)
Jurist and historian

An internationalization process for startups is based on the exchange of knowledge and other resources required for early internationalization and fast growth, and it requires ventures to identify opportunities, conduct business, and gain a competitive advantage in a foreign market. But, how do entrepreneurs obtain the knowledge required for internationalization? Previous research suggests a role for the utilization of social networks, leading managers to ask three basic questions: i) what kinds of knowledge-based resources are urgently needed by international new ventures?, ii) how do needs for knowledge change according to different stages in the internationalization process?, and iii) how can changing needs for knowledge be met by developing and leveraging a social network? In this article, we review the related literature, discuss potential answers to these basic questions, and we suggest how a dynamic process can guide new ventures to acquire knowledge for developing resources and conducting business toward internationalization.

Introduction

Internationalization is a challenging process, especially during the early stages of a firm. New ventures that wish to expand their business in new foreign markets have to overcome a lack of legitimacy and their liability of newness, smallness, and foreignness (Englis et al., 2007; Sepulveda & Gabriellson, 2013). Entrepreneurs have to rely on their networks to overcome their shortcomings.

Internationalization involves and requires the exchange of knowledge-based resources needed, directed towards recognizing opportunities to guide a business

and also gain competitive advantages in the global market. Promoting the required processes leads to three basic questions asked by entrepreneurs and managers with the goal of expanding their business in new foreign markets:

1. What kinds of knowledge-based resources are urgently needed by international new ventures?
2. How do needs for knowledge change according to different stages in the internationalization process?
3. How can changing needs for knowledge be met by developing and leveraging a social network?

Obtaining Entrepreneurial Knowledge Needed for Internationalization

Chen Han and Adeleye Afolabi

According to Sepulveda and Gabrielsson (2013), entrepreneurship research has a rich history of network studies, and many of them discuss how networks evolve through a domestic venture-creation process. Several studies have also demonstrated how social networks play an essential role in internationalization and resource acquisition. For example, global startups rely on networks to increase intangible content, including commercial knowledge, strategic information, and other valuable resources (Sepulveda & Gabrielsson, 2013). Those firms placed centrally in a network could acquire more, better, and earlier knowledge and unexpected information compared to their competitors, which may influence their internationalization (Sharma & Blomstermo 2003). However, previous research has rarely focused on the knowledge-based resources that are essential in the early stage of internationalization or how they are obtained. Previous researchers have generally overlooked changes in needs for knowledge during the dynamic venture process and how entrepreneurial networks develop to accommodate these different needs when entering a new foreign market (Slotte-Kock & Coviello, 2010).

This lack of research on the dynamic process and pragmatic strategies for business relationship development motivated our study. In this article, we first categorize knowledge required for internationalization by new ventures (i.e., technological knowledge, experiential knowledge, foreign institutional knowledge, and business knowledge), and identify the most likely means of acquiring each type of knowledge. Second, we identify three stages of growth (i.e., foreign market intention, active involvement, and committed involvement) and how needs for knowledge change according to these stages. Third, we emphasize a pattern of leveraging initial networks in domestic markets to develop new business relationship in foreign markets, as well as strategies integrated with tie-strength theory for acquiring knowledge associated with different stages and requirements.

Owing to an extensive discussion of the solution in a dynamic process, this article could serve as a guide for new ventures in developing their ability to identify opportunities, acquire knowledge, and gain competitive advantage by facilitating and networking a collective set of relationships required for internationalization.

Literature Review

Previous research suggests a role for the utilization of social networks in acquiring knowledge for developing

resources and conducting business toward internationalization. In this article, we review the related literature, discuss potential answers to the three basic questions described earlier: i) what kinds of knowledge-based resources are urgently needed by a international new ventures?, ii) how do needs for knowledge change according to different stages in the internationalization process?, and iii) how can changing needs for knowledge be met by developing and leveraging a social network?

Englis and colleagues (2007) see a global startup process as "a process of organisational emergence" where ventures are involved in the exchange of knowledge, information, and other valuable resources with international contacts to recognize and explore business opportunities in the global market. Internationalization depends on gaining competitive advantage from "the use of resources and the sale of outputs in various countries" (Oviatt & McDougall, 1994). However, according to Sepulveda and Gabrielsson (2013), new international firms usually have to overcome a liability of newness (e.g., inadequate financing, knowledge, and experience), smallness (e.g., a lack of reputation and legitimacy), and foreignness (e.g., a lack of familiarity with varied international business environments) in their early stages. To overcome these shortcomings, global startups have to obtain critical resources required for their early internationalization and sustainable growth, not only internally but also beyond the boundaries of the organization, within their networks.

Knowledge is a key resource that plays an essential role in the development of global startups (Sepulveda & Gabrielsson, 2013). Sharma and Blomstermo (2003) state that a firms' internalization process is "driven by their knowledge base". The firms' knowledge base encompasses a well-organized management of knowledge flows across its domestic borders, which is important for a firm success, especially in new growing firms that function under certain resource limitations (De Clercq & Arenius, 2006). Seeking opportunities with little control over the required resources is a difficult task. Specific knowledge and information needed to "get things done quickly" has proven to play a key role in the success of most ventures, which shows its importance relative to access to capital resources (Kuemmerle, 2002). Furthermore, knowledge has direct impacts on the control and guidance of the venturing opportunity. The opportunities required by global startups are knowledge-intensive, as knowledge is the most important factor in their offering or a prerequisite in the development of their offering. Penrose (1959) articulated

Obtaining Entrepreneurial Knowledge Needed for Internationalization

Chen Han and Adeleye Afolabi

that knowledge provides the best possible ways of understanding how initial ideas could be transformed into market offerings and also how entrepreneurs or firms can utilize such offerings. For example, technological knowledge and business knowledge could be used in assessing the feasibility and desirability of an offering, while knowing the clients' readiness and their decision-making process can lead to future business (Englis et al., 2007). Lastly, the ability to accumulate, manage, and mobilize knowledge to achieve specified business goals for growth are antecedents to successful entrepreneurship (Kuemmerle, 2002). For instance, knowledge shapes the "absorption capability" of the internationalizing firm, thereby forming a basis of the knowledge that the firm will be able to absorb in the future (Cohen & Levinthal, 1990).

1. What kinds of knowledge-based resources are urgently needed by a global startup?

By synthesizing the related literature, we found that four types of knowledge are required by international new ventures, as described below and illustrated in (Figure 1).

First of all, *technological knowledge* is organized tacit knowledge that is associated with the firm's functionality and application offerings (Englis et al., 2007). The most resourceful way of extracting this kind of knowledge is through the combination of an international and domestic network because knowledge in relation to human resources can best be obtained internationally through sharing information with other business people, whereas that which is developed in R&D facilities is much easier to obtain locally.

Second, *experiential knowledge* consists of knowledge about venturing, network experience, and internationalization, which is essential because firms tend to trust past knowledge accumulated from experience more than new information during an expansion process (Englis et al., 2007). Specifically, venturing knowledge is needed by firms to ensure sustainable creation of value through the exploitation of the venture opportunity (Van der Veen & Wakkee, 2004). Network experiential knowledge could enhance the firms' capacity to identify and develop business relationships and conduct business in a network. Internationalization experiential

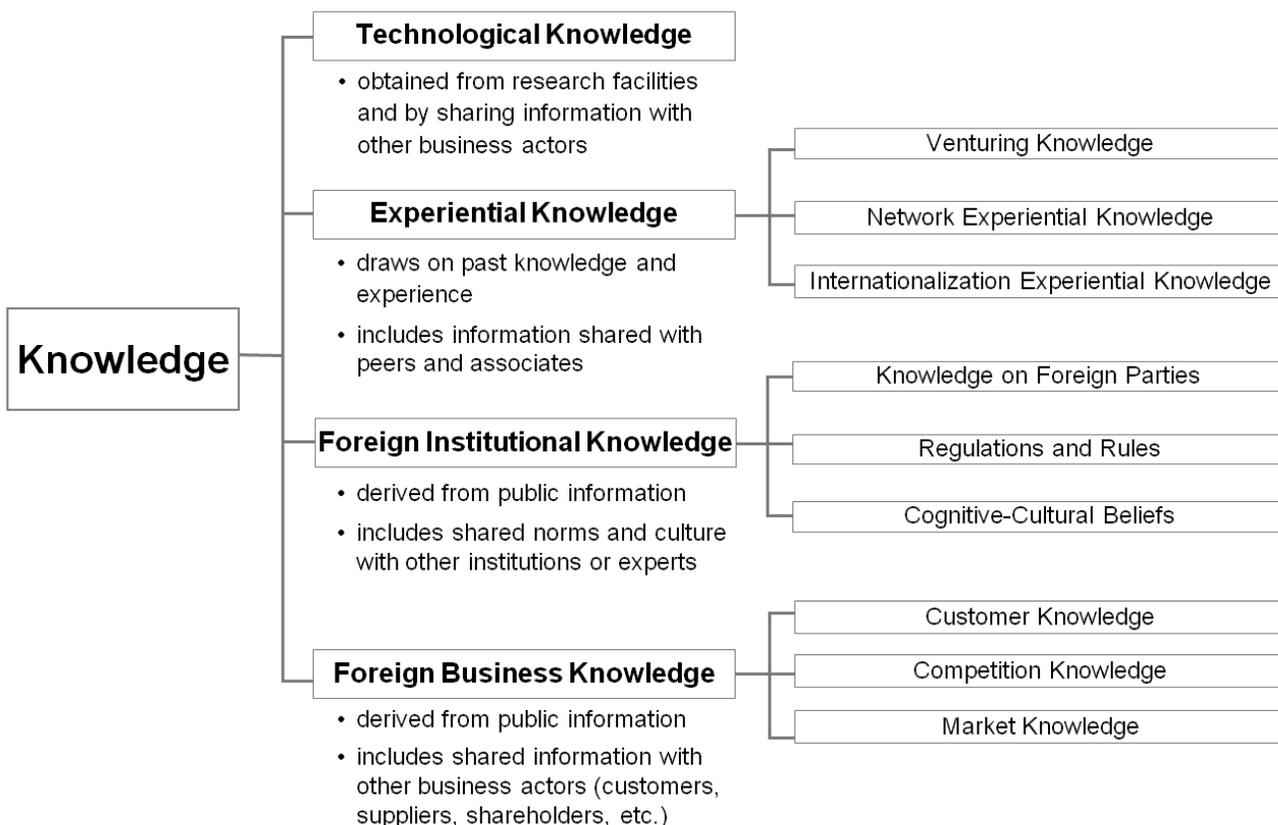


Figure 1. Types of knowledge required by international new ventures

Obtaining Entrepreneurial Knowledge Needed for Internationalization

Chen Han and Adeleye Afolabi

knowledge is believed to help management teams possess and make use of more foreign strategic partners to grow faster than firms with less experiential knowledge. Generally, these three kinds of experiential knowledge could be gained from past experience, training, consultation, and “business operations in relation to other actors in networks” (Englis et al., 2007).

Third, *foreign institutional knowledge* focuses on the knowledge about government, institutional frameworks, rules, norms, and cognitive-cultural beliefs (Eriksson et al., 1997). Javernick and Levitt (2009) suggest that international projects require managers to work with diverse participants in various countries, and are thereby faced with many challenges that arise from cross-national differences. Therefore, knowledge of these institutional elements is essential for sustainability and profitability for the firm, as well as being beneficial in reducing the risks of misunderstanding, delay, and cost in the global market. Also, explicit institutional knowledge is usually embedded in public information, such as local laws or research results, whereas tacit knowledge could be acquired through social processes, seeking information from experts in corresponding fields, and exchanging connections with other business people with related experience.

Fourth, *foreign business knowledge* includes knowledge on customers, suppliers, and competitors, which gives startups an advantage. This advantage comes about because business knowledge remain conducive to helping firms promote customers relationship, predict competitor behaviour, and react to market demands. Having knowledge about customers’ willingness and ability to cooperate appears to be a foundation upon which a small or medium-sized business can expect its future business to develop. Also, knowledge associated with product offerings and the weaknesses and strengths of rivals and competitors, provides global startups with an improved offensive and defensive strategy with respect to identifying opportunities and threats (Fleisher & Bensoussan, 2007), as well as developing competitive strategies to differentiate it from its competitors (Englis et al., 2007). Market knowledge relates to “the desirability of the offering” (Van der Veen & Wakkee, 2004) and concerns both “legislative and cultural issues, and also the socio-economic and technological landscape of the market” (Englis et al., 2007). In addition to acquiring this type of knowledge through public databases and research institutions, another effective means of acquiring less codified know-

ledge or knowledge related to specific situations is through the exchange of information with other entrepreneurs, customers, suppliers, and other actors (Javernick et al., 2009).

2. How do needs for knowledge change according to different stages in the internationalization process?

As discussed earlier, internationalization is the process of exchanging knowledge and other resources required by early internationalization and fast growth, to recognize opportunities, conduct business, and gain a competitive advantage in the foreign market. Internationalization has three stages, as identified by Coviello and Munro (1997):

1. Foreign market intention: In this stage, global startups have an intention to enter a foreign market. They discover profitable opportunities and prepare for the exploitation of these activities. During this stage, the process of opportunities discovery and preparation is affected by prior experiential and technological knowledge (Shane, 2000), as well as information regarding the business actors and demands in the target market. According to Englis, Wakkee, and van der Sijde (2007), the entrepreneurs “discuss their ideas and opportunities-in-progress with potential resource providers and prospective customers to develop an initial idea into a viable business opportunity by matching (future) attainable resources and perceived market needs”. These authors also point out that initial ideas may be discovered in the domestic context, when startups are typically engaged in information exchanges with individuals and institutions located internationally.

2. Active involvement: In the second stage, entrepreneurs of global startups involve themselves in activities of “exploring the feasibility to create the business elements, mobilization of relevant suppliers, customers and partners, location of relevant resources and using the network to explore the novelty creation” (Englis et al., 2007). In this stage, experiential knowledge in venturing, networking, and internationalization, as well as foreign institutional knowledge, would significantly affect the activities in relation to exploring new markets and meeting resource needs required to act on opportunities. The types of knowledge required for this active involvement stage are often diverse or scattered around the world. So, the entrepreneur should be able to learn and internalize knowledge by interacting with diverse network ties and bridging previously unconnected parties (Sepulveda & Gabriellsson, 2013).

Obtaining Entrepreneurial Knowledge Needed for Internationalization

Chen Han and Adeleye Afolabi

3. Committed involvement: In the third stage, the entrepreneur focuses on creating desirable offerings and gaining competitive advantage. Firms require highly privileged information for “rare, non-imitable benefits” (Sepulveda & Gabriellsson, 2013) as well as specialized knowledge in venturing and global business for “generating its own working capital” (Dyer, 1996) and strengthening market position. So, entrepreneurs must to seek and obtain such information and knowledge by building up a strong link with key stakeholders (Gabriellsson et al., 2008) and constantly expanding their social network to enhance their visibility and lower risks and uncertainty in new markets.

Table 1 summarizes the types of knowledge required by the entrepreneur through these three stages. At each stage, the needs for knowledge may be different, different means of obtaining this knowledge may be required, and there may be different ways that the knowledge can be “transformed, combined, or lead to a unique advantage” (Brush et al., 2001).

3. How can changing needs for knowledge be met by developing and leveraging a social network?

International new ventures, with limited time and resources in their early stages, need to develop strategies that enable them to “create, obtain and control knowledge efficiently and effectively”. With structures of relative stability and predictability, which reduce perceived uncertainty (Hakansson & Snehota, 1995), and with systems of joint learning and distribution of information between the firms (Schumpeter, 1934), the use of networks is critical at this period. Founders rely

on their networks to support their future establishment (Greve & Salaff, 2003) and overcome their liabilities.

Also, most of the knowledge required for internationalization is experience-based or located internationally, meaning it is hard to acquire from traditional approaches. Although a social network is usually helpful for intangible resource exchange or overcoming geographical barriers. Hence, firms must gain knowledge through deliberate networking in both their domestic and foreign markets to meet knowledge needs.

Internationalization for entrepreneurs is usually opportunity driven and often depends on existing network relationships, such as for exchanging required knowledge from existing sources. Entrepreneurs also tends to gain legitimacy and increase the chances of their firm's survival by leveraging their networking contacts to develop new relationships and gain access to extended networks. With the establishment of mutuality, trust, and independence among new ties, entrepreneurs are more likely to develop their social network and firms globally. (Figure 2).

In their early stages, most startups have only domestic relationships. As Englis, Wakkee, and van der Sijde (2007) found, these startups should leverage established ties (e.g., investors, customers, and suppliers), and work as brokers to build new ties. When their existing network is not suitable for working with new businesses or are found in narrow niches, startups could hire people who have network contacts that firm needs or who have foreign work experience. After they bridge

Table 1. Business internationalization stages and corresponding knowledge needs

	Internationalization Stages		
	Foreign Market Intention	Active Involvement	Committed Involvement
Key Activities	<ul style="list-style-type: none"> Exchange knowledge Recognize opportunity 	<ul style="list-style-type: none"> Enter new market and find new customers Locate, obtain, and control resources 	<ul style="list-style-type: none"> Develop new product and market Gain competitive advantage
Knowledge Needs	<ul style="list-style-type: none"> Technological and business knowledge transformed into a viable business opportunity by matching attainable resources and perceived market needs 	<ul style="list-style-type: none"> Experiential knowledge and foreign institutional knowledge for entering new market and controlling diverse resources 	<ul style="list-style-type: none"> Highly privileged information for non-imitable benefits Specialized business knowledge for generating capital and strengthening a dominant market position

Obtaining Entrepreneurial Knowledge Needed for Internationalization

Chen Han and Adeleye Afolabi

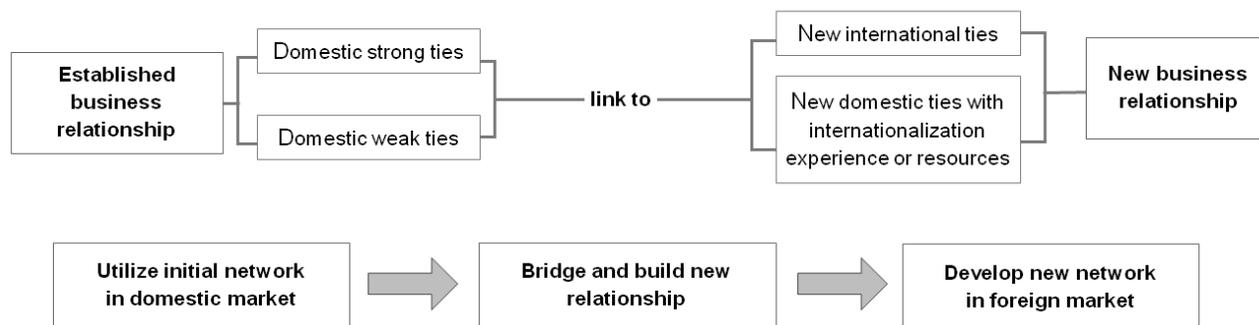


Figure 2. Social network and business relationship development

and build new relationships in international markets, ongoing business with customers and suppliers is also essential for new network development, for example, by offering products at a discount and asking international lead users to spread the word. As these new relationships grow, global startups accumulate knowledge and capabilities that empower them adapt to a new foreign market.

Using existing networks for foreign market intention

According to the review of the importance of various knowledge types through the three stages of internationalization, we now analyze how global startups manage and develop their social networks to meet their changing needs for knowledge based on the strength of different ties.

The initial idea to enter foreign markets may be found by scanning, selecting, and exploring existing relationships (Englis et al., 2007). Through interaction with strong ties (i.e., family, friends, other business actors with higher emotional intensity and reciprocal commitments) (Granovetter, 1973), the entrepreneur exchanges fine-grained information about target foreign market and rivals (i.e., business knowledge) and tacit technological knowledge, to lower risks in a new, uncertain environment. As a consequence, the opportunities that match their attainable resources and market needs can be identified and decisions can be made about whether or not they are worth pursuing (De Koning, 1999; Puhakka, 2002).

Furthermore, Granovetter (1973) and others have suggested that weak ties are also important in this process, because they provide access to novel information and thus to new options, especially when the entrepreneur needs diverse channels or approaches for seeking knowledge that go beyond their close relationships.

Thus, a balanced network of strong and weak ties is required to avoid being shielded or blind to multiple potential opportunities during preparation stages.

Bridging and building new relationships

To enter new foreign markets and control resource for international expansion, most entrepreneurs have to employ strategies that expand their current domestic networks, because the experiential knowledge and foreign institutional knowledge needed in this stage are generally distributed around the world. Using existing strong ties with “an indirect history and level of trust” (Sepulveda & Gabrielsson, 2013) to develop and accumulate additional knowledge and capabilities, could save both time and money.

However, this approach may restrain the adaptive behaviour of firms if they only rely on strong ties for mutual learning or as a bridge to new contacts; it will expose them to risk in an unfamiliar environment, where they need timely detection and rapid response to mistakes caused by inexperience (Sharma & Blomstermo 2003). Hence, firms also need to use weak ties (e.g., a diverse set of persons working in different contexts) to gain access to unconnected network actors for seeking complementary knowledge about target foreign market that “go outside their existing channels” (Sharma & Blomstermo, 2003). Thus, weak ties are better than strong ties in providing a beachhead or entry node to support rapid international expansion.

Developing new networks for committed involvement

In the stage of committed involvement, global startups pay attention to legitimacy and gaining competitive advantage. Specialized knowledge and highly privileged information are required to establish a strong market position.

Obtaining Entrepreneurial Knowledge Needed for Internationalization

Chen Han and Adeleye Afolabi

After building new business relationships in foreign markets, entrepreneurs need to continue to develop their network, making it more attractive to new and more influential network partners (Hite & Hesterly, 2001), in order to enhance their ability to gaining differentiated knowledge and building positive resource flows. Over time, these changes increase the density and interdependence of the new international network (Sepulveda & Gabrielsson, 2013). So, firms should try to transform new ties into well-known relationships with trust, then through them, develop more weak ties, which gives the firm a higher centrality in their network for receiving more, better, and early knowledge compared to their competitors (Sharma & Blomstermo 2003).

Conclusion

Knowledge-based resource and capabilities determine the direction of the opportunities and how to transform the initial idea into the offering (Englis et al., 2007) for legitimacy and improved chances of survival in international markets. The main focus of this article is how to meet an entrepreneur's knowledge-based need for internationalization. The intention is to provide entrepreneurs a roadmap and vision for understanding some of the necessities and development patterns for internationalization, as well as a guide of strategies adopted for utilizing and developing social capital.

This article has reviewed literature on knowledge-based resources, the internationalization process, and the value of networks for new ventures. It brought together insights to analyze three key problems faced by international entrepreneurs in terms of what types of knowledge are needed at various stages of internationalization and how to acquire them. The contributions of this article include the categories of needs for knowledge (Figure 1), a synthesis of the changing needs for knowledge at each stage (Table 1), and a list of strategies combined with social network development and tie strength (Figure 2).

For researchers and scholars studying networks and internationalization, more research is needed to examine the role of social network in the internationalization process for ventures from different industries and in different position in networks, because the value of a social network depends on the position of actors in social hierarchies, the number of competitors (Burt, 1997), the entrepreneurs' connections with brokers, and the specific instrumental actions performed. Other research could

be conducted to link the entrepreneurs' ability of absorbing and internalizing knowledge to the performance of international ventures, if possible, from multiple countries with various cultural backgrounds.

In summary, entrepreneurs must be aware that each of the three phases of the internationalization process have different knowledge needs, so network and business relationships must be developed to fulfill these needs. Moreover, for internationalization, it is important to rely on local networks to build and bridge relationships, through which entrepreneurs can develop new networks in new markets. In addition, when using social capital, all ties should be seen beneficial to entrepreneurs, but the entrepreneur's situation determines which ties are more beneficial than others.

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Obtaining Entrepreneurial Knowledge Needed for Internationalization

Chen Han and Adeleye Afolabi

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Keywords: entrepreneurship, internationalization, knowledge acquisition, social networks, business relationships

Down the Rabbit Hole: How Structural Holes in Entrepreneurs' Social Networks Impact Early Venture Growth

Mackenzie Adams, Maged Makramalla, and Walter Miron

“A wise man will make more opportunities than he finds.”

Francis Bacon (1561–1626)

Philosopher, statesman, scientist, and jurist

Social networks play a significant role in the success of new entrepreneurial ventures. They provide an accumulation of tangible and intangible resources that are linked to entrepreneurial outcomes such as growth and innovation. The structure of social networks, specifically, has been linked to these outcomes; structural holes in social networks have shown an association with entrepreneurial success. Entrepreneurs who have many structural holes in their networks are thought to benefit from a rich source of divergent information.

This article examines the complex nature of the relationships among social networks, formal institutions, and the outcomes of new ventures. It also explores the effects of a social network's structural holes on growth in the early years of a venture's development. We propose that structural holes of a social network, through a mediating role of institutional polycentrism, play an important role in the growth and profitability of a new venture as well as potential threats of exploitation. We then provide recommendations based on the reviewed literature for entrepreneurs and managers of formal institutions.

Introduction

Entrepreneurs build and use social networks to harvest resources necessary for their new ventures' growth, including knowledge, customers, supplies, and capital (Stuart & Sorenson, 2007). According to Todeva (2011), entrepreneurial networks are composed of a wide range of individuals, organizations, and institutions, including family and friends, customers, professional bodies, government institutions, business partners, vendors, and other entrepreneurs. Each network has a unique structure, diverse qualities, and fulfills a different role for the entrepreneurial venture (Martinez & Aldrich, 2011; Todeva, 2011). For instance, a professional body is likely to be a strong source of knowledge acquisition and development for a venture. Customers, on the other hand, are likely to expand a venture's consumer base through word-of-mouth communication, in addition to providing feedback on products and services.

In a new venture, an entrepreneur's social networks are critical to outcomes of knowledge and resource gathering. This is especially true for a small venture whereby its products or services are otherwise in development or not known, and thus it may not have developed its own networks (Jones & Jayawarna, 2010; Rost, 2011). The entrepreneur's networks, thus, act largely as the main networks for the venture itself. The strength of ties to network components, as well as the network's structure, determine the type of support that an entrepreneur gathers, and consequently the impact on outcomes such as growth. For example, multiple strong ties and connections to unrelated components within a network may help an entrepreneur secure new business opportunities and resources despite the double barriers of “newness” and “smallness”. When an entrepreneur acts as a bridge between two unrelated individuals or groups within a social network, they are said to occupy a structural hole (Burt, 2000). Structural

How Structural Holes in Social Networks Impact Early Venture Growth

Mackenzie Adams, Maged Makramalla, and Walter Miron

holes often represent a unique state where the unrelatedness of the two groups in the social network is likely to give an entrepreneur access to heterogeneous ideas and non-overlapping resources. Structural holes have emerged as a source of unique resources for entrepreneurs, and have been related to venture performance, especially in the early stages of development (Aarstad, 2012; Batjargal et al., 2013; Rost, 2011; Sullivan & Ford, 2014; Cowan & Jonard, 2007).

This article is structured as follows. First, we provide an overview of social networks and structural holes and discuss their advantages, inherent risks, and effects on entrepreneurial variables. Then, we discuss how institutional contexts impact the development of social networks and the growth of new ventures. We conclude by presenting three lessons for entrepreneurs to help maximize the benefits of social networks and structural holes in the context of weak formal institutions: i) learn from existing success stories on collaborative networks, ii) analyze existing social networks for potential impact on venture outcomes, and iii) assess these networks continuously in response to the shifting needs of the venture.

This article is most relevant to entrepreneurs in the early stages of a venture who must consider the impact of both formal institutions and informal factors (e.g., social networks) on early success; the outcomes include product development and growth, and they provide insights into critical success factors that incorporate institutional contexts. The article is also relevant to those who help educate and support entrepreneurs and can connect them with necessary resources.

Social Networks: Structure and Impact

Some ties to the social networks of an entrepreneur, such as those to family, friends, or mentors, can be especially strong and reliable (Stam et al., 2014). For new ventures, an entrepreneur leans towards these networks for support because they are likely to have fewer opportunity costs. For example, an entrepreneur who secures a loan from his parents may be able to negotiate a low or zero interest rate and a long repayment period. Unlike a loan from a bank with potentially high interest rates and punitive (for a new company) repayment terms, the opportunity costs of tapping into such a social network are lower.

Social networks to which an entrepreneur has strong ties can, however, lack diversity in terms of resources

needed, especially in the early years of a venture. In those cases, entrepreneurs may need to resort to social networks to which they are tied weakly. Granovetter (1983) proposed that weak ties in social networks were significant components of a social structure whereby new or unique information could flow. For example, technology entrepreneurs are likely to require specialized knowledge such as codes and design features that are not available in networks to which they have strong ties. This knowledge may be found in networks, such as professional organizations, to which entrepreneurs have weak ties; for instance, these ties could have high opportunity costs for the venture such as the requirement to purchase knowledge or secure membership. In other words, an entrepreneur may have to “pay to play” when a tie to a social network is weak. For entrepreneurs of new ventures, the challenge is to determine configurations of weak and strong network ties that would provide the greatest benefits against the lowest costs (Jones & Jayawarna, 2010; Stam et al., 2014).

Social Networks and Structural Holes

It is not only the strength of ties to social networks, however, that impact an entrepreneur’s outcomes. How components of their networks relate and their proximity are also important. Imagine that a new learning software entrepreneur is connected to two online communities that focus on financial support for new ventures. The two communities, A and B, have a large overlap in members and much of the same information flows through them. Community A members are connected to community B members, and the entrepreneur engages in activities that often include both.

Now imagine that the entrepreneur is also connected to two other online communities, C and D. Online community C focuses on the latest in pedagogy while community D focuses on programming and design. Unlike the first pair, the members of this second pair not connected. Each has a circle of contacts, events, and specialization, and each provides the entrepreneur with unique knowledge and information. Burt (1992, 2000, 2002) proposed that an individual who acts as a bridge between two unrelated contacts (C and D) in a social network occupies a structural hole. The learning software entrepreneur is said to occupy a structural hole in their social network, as shown in Figure 1.

Burt used the term to reflect the separation of groups, where each group’s members on a side of a hole exchange ideas based on their unique skills and know-

How Structural Holes in Social Networks Impact Early Venture Growth

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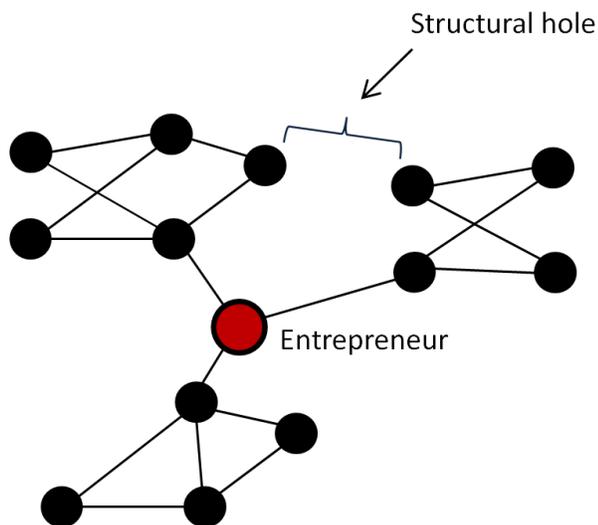


Figure 1. Structural holes in a social network

ledge. The implication is that lack of contact between groups is likely to reduce redundancy in knowledge and overlap in resources as could be seen in the example of online communities A and B. These groups could be business units within the same company, occupying the same building, or across branches, or different groups in other companies and institutions (Burt, 2000).

Advantages of structural holes

The advantages of structural holes in a social network have been examined by researchers across different industries. Ahuja (2000) explored the relationship between a firm's position in a collaborative network and its innovation output and posited that such networks are key to a firm collecting external knowledge. Ahuja found that structural holes had both a positive and a negative impact on a firm's innovation. The presence of more structural holes in their social networks provided ventures with a diverse source of knowledge and information (Aarstad, 2012). In general, knowledge and resource-sharing benefits of collaborative networks rely on trust and shared norms of behaviour (Bizzi, 2013). These trust and behaviour norms are more likely to be present in strongly tied connections within a network, especially in the knowledge fields. McFadyen, Semadeni, and Cannella (2009) found that scientists who had strong ties within their networks (demonstrated by repeated collaborations with the same authors) and sparse networks (indicating the presence of numerous structural holes) published more often in high-impact journals.

Risks of structural holes

Inherent risks associated with structural holes differ by the stage of a venture's development. Rowley and colleagues (2000) argued that, when an industry is in its early stages of development, its actors explore different technologies and adopt those technologies rapidly. Thus, access to innovation is important, which necessitates connections to both geographically and technologically distant networks. The benefits of structural holes whereby there is less likelihood of redundant information available to ventures in young industries is weighed against the risk of exploitation (Aarstad, 2012; Ahuja, 2000; Goyal & Vega-Redondo, 2007).

Other researchers have also noted that structural holes, while beneficial in access to divergent information in many instances, can also pose negative consequences (Bizzi, 2013; Obstfeld, 2005). Obstfeld (2005) argued that the concept of structural holes in a social network is largely based on adversarial relationships whereby the focus is on how much benefit an individual or a firm can extract from members of a network, and that the size of this extraction is maximized based on members not knowing each other. Burt (2000) supported this view by stating that individuals chase after the network benefits of resource sharing through a mechanism whereby "ambiguous or distorted information is strategically moved between contacts by the tertius".

Entrepreneurial factors significant to structural holes

Despite these potential risks, in addition to innovation, structural holes are associated with positive outcomes for ventures, especially those in early stages of development. Aarstad (2012) proposed that an extensive social network and the presence of structural holes in the network affected entrepreneurial performance positively. The implication is that the numerous ties found in an extensive and rich network provide an accumulation of tangible and intangible resources that are linked directly to entrepreneurial outcomes such as growth and profitability (Baum et al., 2000; Cowan & Jonard, 2007; Zhao, Frese & Giardini, 2010; Zaheer & Bell, 2005).

Inconsistent associations between these outcomes and structural holes, however, provide an impetus to explore potential factors that could impact entrepreneurial ventures (Martinez & Aldrich, 2011). Ostrom, Schroeder, and Wynne (1993) advanced the position of institutional theorists by proposing that these outcomes are reliant on local institutional contexts. These contexts include the impact of multiple institutions

How Structural Holes in Social Networks Impact Early Venture Growth

Mackenzie Adams, Maged Makramalla, and Walter Miron

with poly (multi-) centers of decision-making (Ostrom, 2005). Batjargal and colleagues (2013) defined institutional polycentricity as “spontaneous interactions of multiple institutional rules and norms, and mutual adjustments among institutional actors”. Against these interactions, entrepreneurs “pursue their goals in polycentric institutional settings where they comply with multiple governance rules at different levels and scales embedded in local knowledge and particular settings”.

Thus, the question is whether institutional structures (i.e., polycentricity) would expand on our understanding of the relationship between a network’s structural holes and a venture’s success. One way to explore this question is to compare how structural holes affect entrepreneurial success in different countries, thereby shedding light on the influence of institutional contexts.

Institutional Order and Social Networks

The building and cultivation of social networks has been found to be influenced by institutional contexts that determine to a large extent how ventures are regulated and supported and which, in turn, affect the nature of entrepreneurs’ social networks (Batjargal, 2010; Baumol, 1990). Literature in this area suggests that institutional polycentrism – whereby a formal institution’s rules and norms are created in multiple centres of decision-making – may act as a mediator between structural holes in a social network and a new venture’s outcomes such as profitability, growth, and product development (Batjargal et al., 2013; Boettke & Coyne, 2009). Specifically, research in this area explores how these institutions affect the development of an entrepreneur’s social networks and the subsequent impacts a new venture’s outcomes. According to Batjargal and colleagues (2013), “the notion of polycentricity refers to a spontaneous order in which multiple and independent decision-making centers and actors make mutual adjustments for ordering their relations within a general framework of rules and norms”. A young, entrepreneurial venture is much more sensitive to institutional polycentrism than an older, more established one. A new venture’s growth in the early years of development is especially at risk.

Weak and inefficient institutions

Weak and inefficient political institutions can affect entrepreneurial networking and outcomes. Weak institutions are defined as those that impose unreasonable restrictions on entrepreneurs’ social activities. These restrictions are believed to impede entrepreneurs’ pur-

suit and identification of opportunities, which in turn negatively affect their innovation. Tonoyan and colleagues (2010) found that these types of institutions impose rigid, bureaucratic controls that often lead to bribery and other forms of corruption. For new ventures that cannot manoeuvre or do not have the resources to bypass the bureaucracy, weak institutions significantly hinder entrepreneurial activities.

Similarly, inefficient institutions place severe burdens on new ventures. Inefficient institutions, which are often regulatory bodies, are those with insecure contractual agreements and property rights. When entrepreneurs start or want to grow a venture in a local environment rampant with these institutions, they face uncertain outcomes of their strategic actions. For example, entrepreneurs may be reluctant to purchase land or launch a new product given how their physical or intellectual property may not be fully under the protection of the law (Tonoyan et al., 2010).

New ventures and structural holes in polycentric institutions

With weak and inefficient institutions, an entrepreneur, especially in the early years of a venture’s development, will spend time and resources dealing with these institutions, which reduces the likelihood of entrepreneurial success and increases opportunity costs (Batjargal et al., 2013). A young venture is especially vulnerable to weak economic institutions as much needed capital becomes difficult to access and obtain.

In a study with software ventures that were six years old or younger, both advantages and risks with structural holes were found (Batjargal, 2010). Polycentric institutions affected the relationship between structural holes in the entrepreneurs’ social networks and two entrepreneurial outcomes: product portfolio and revenue growth in the early stages of development. Batjargal (2010) found that the effect of structural holes on venture success is dependent on two factors: country institutional context and venture development stage. In general, and especially for ventures in their early years of development, structural holes have a positive effect on product portfolio. According to Batjargal (2010), “structural holes in entrepreneur’s personal networks facilitate product development because they provide access to nonredundant information, diverse resources, and third-party referrals. The entrepreneurs whose networks are rich in structural holes combine and re-combine various program codes, modules, functions, design features, and languages to produce software applications for numerous market segments”.

How Structural Holes in Social Networks Impact Early Venture Growth

Mackenzie Adams, Maged Makramalla, and Walter Miron

The combination of weak and inefficient institutions is associated with an increasing number of structural holes in an entrepreneur's social networks. Batjargal and colleagues (2013) found that this combination leads to "negative synergy because of destructive mutual reinforcement and increased institutional contradictions and reversals that disrupt venture growth processes and trajectories". Not surprisingly, these researchers found that an institutional order rife with weakness and inefficiency negatively impacted the revenue growth of new ventures. However, they also found that entrepreneurial networks with rich structural holes reduced this impact by having a positive effect on revenue growth. As seen in Figure 2, weak and inefficient institutions provide an impetus for an entrepreneur to build and use social networks that may provide resources for a new venture.

The mechanism that facilitates this positive effect is thought to be due to nonredundant private information that these structural holes provide. In other words, entrepreneurs are able to gain information on new sales opportunities, new products for existing customers, new distribution channels, and new segments for existing products. This divergent information leads to greater sales, which increase revenue growth. The revenue growth impact for new ventures is stronger among en-

trepreneurs who are dealing with weaker and more inefficient institutions. Thus, the worse the institutional context, the greater the impact of structural holes on new ventures' growth.

Structural holes may provide dividends in divergent knowledge acquisition but due to the issues of poor communication and a difficulty in mobilizing revenue-generating resources, they may not lead to increased revenues in the early years of the venture. Table 1 summarizes how, within institutional contexts, an entrepreneurial venture fares with structural holes given its age. The most vulnerable ventures are young startups (i.e., those less than 5 years old) and those that are largely based on technology or innovation. These companies are often too small, too new, or too cash-strapped to have their intellectual property rights protected by patents and trademarks. Given that their success relies on staying on top of knowledge in their fields, structural holes are a necessity from which they access this knowledge. These companies must engage and connect with others, thereby exposing their products, codes, and functions to more mature companies. Because they are new ventures, the trust and mutual exchange of information is in its infancy and these established companies may very well exploit the new ventures' developments and ideas.

Product-based companies are the least vulnerable and, even though they rely on innovation to remain competitive, they likely have protected themselves with patents and trademarks. For these companies, structural holes are not primarily there to fill gaps in knowledge. Established companies usually build their knowledge centres in-house or commission them to smaller companies. For them, structural holes may provide access to new markets and customers, or help them in market research. Ventures that are knowledge-based, even when not new, may be vulnerable to exploitation if they rely on structural holes in their social networks to fill gaps in their knowledge.

Batjargal's own research (2003, 2007, 2010) and research with colleagues (2013) is a departure from earlier work on social networks and ventures' growth (e.g., Boettke & Coyne, 2009; Burt, 2000; Elfring & Hulsink, 2003; Stuart & Sorenson, 2007; Tonoyan et al., 2010) in that it elucidates the role of formal institutions to great depths using the concept of polycentrism. Previous work had either studied structural holes in social networks and their impact on venture outcomes, or had studied institutional characteristics in relation to the success of entrepreneurial ventures.

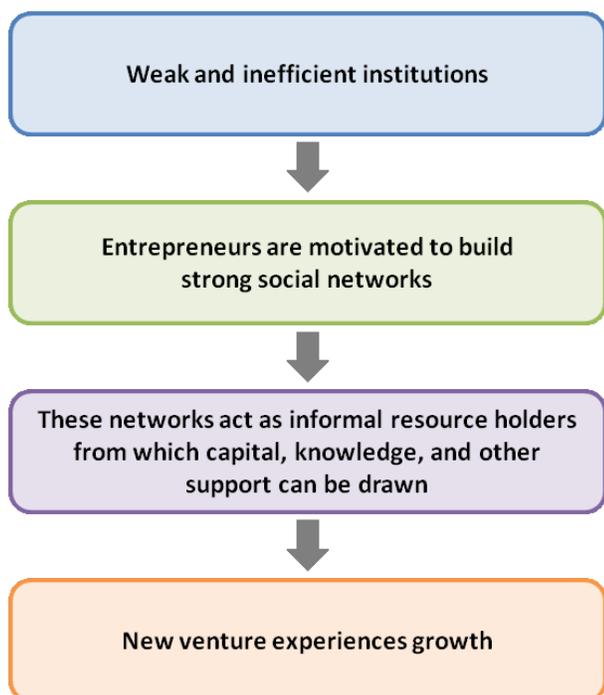


Figure 2. Institutional order and social networks in the outcomes of new ventures

How Structural Holes in Social Networks Impact Early Venture Growth

Mackenzie Adams, Maged Makramalla, and Walter Miron

Table 1. The influence of venture age and focus on vulnerability to exploitation

Venture Age	Focus	Intellectual Property	Dependency on Structural Holes	Vulnerability to Exploitation
Older, established	Products	Likely to have patents and other protections	Low	Very low
Older, established	Products (but reliant on continuous innovation)	Likely to have patents and other protections	Low	Low
Medium-aged	Technology or ideas	May have patents and other protections	High	Medium
Young startups	Technology or ideas	Unlikely to have patents and other protections	High	High

Recommendations to Entrepreneurs and Managers

For entrepreneurs to maximize on their social capital benefits, connections to networks must fill in for resources that are otherwise in short supply. New venture entrepreneurs are especially often short on finances, markets, and knowledge, among others, and could learn lessons from using structural holes in their social networks to extract what they need for growth and innovation. The first lesson is to learn what larger, established companies do in fostering collaboration across social groupings to enhance learning (Di Vincenzo et al., 2012), problem solving (Heng & Loosemore, 2013), and technical innovation. 3M's collaborative approach among scientists of different departments and specializations is credited with its innovation and the exchange of new ideas (Scanlon, 2009). The company built an internal web-based social network called the "Technical Forum" to help its scientists bridge structural holes and harness the creative problem-solving potential of groups previously siloed in their departments or units. Similarly, a group of hospitals used structural holes among its organizations to facilitate the integration of information (Heng & Loosemore, 2013). How can a new venture, cash-strapped and a newcomer in its industry, emulate 3M and similar large companies? If large enough as a venture, it can create in-house collaborative platforms whereby people from diverse specializations such as programming or strategy can communicate easily in solving problems (Scanlon, 2009). Regardless of its size, the venture should use existing support networks, especially those online, to ac-

cess information. If not available or in existence, then it should build them and encourage individuals, other entrepreneurs, and established organizations to participate.

The second transferrable lesson for new ventures is to recognize the significance of the nature of social networks before bridging structural holes. It is not enough for an entrepreneur to be the only connection between two isolated groups; the groups themselves have to offer access to business opportunities and knowledge needed for innovation and growth. For an entrepreneur, understanding their social networks means a thorough analysis that takes the venture's and its networks' variables into account. In other words, entrepreneurs cannot be in the dark about who can offer them what, especially in the early years of the venture. Fornoni, Arribas, and Vila (2012) studied Argentinian startup entrepreneurs and the impact of their social networks on their performance in accessing markets and information. They found that three dimensions of their social networks had the greatest impact on their performance: "the relational dimension facilitates access to information; the resources dimension makes access to finance easier; the structural dimension helps the entrepreneur to access markets" (Fornoni et al., 2012). Entrepreneurs, especially those of new ventures, will recognize the importance of analyzing their social networks for potential impact on their growth and innovation.

The third lesson for entrepreneurs is to realize that creating and analyzing social networks, and bridging structural holes in them, are not enough. As with every

How Structural Holes in Social Networks Impact Early Venture Growth

Mackenzie Adams, Maged Makramalla, and Walter Miron

aspect of an early venture's development, social networks change. Some evolve and some disappear. The challenge for entrepreneurs is to assess these networks continuously in response to the shifting needs of the venture (Sullivan & Ford, 2014). This challenge is especially relevant to new ventures arising or growing in environments with weak and inefficient formal institutions. The survival of the venture in these circumstances relies to a great extent on robust, dynamic social networks that are responsive to ongoing challenges. Therefore, "the character of entrepreneurs' networks should change in both composition and structure to ensure that they include the appropriate mix of partners to gain access to needed resources" (Sullivan & Ford, 2014).

Based on our review of structural holes in social networks, the role of formal institutions, and new ventures' outcomes, we can offer these further recommendations for entrepreneurs:

1. *Identify risks inherent in ideas-based business ecosystems.* New entrepreneurs in technology- or innovation-based startups should protect their intellectual property rights as best as possible with patents and trademarks.
2. *Conduct a systematic review of financial, knowledge, and networking resources.* In the early years of development, new ventures will rely on both institutional support and informal social networks. For knowledge gaps, whereby the greatest risk of exploitation through structural holes occur, entrepreneurs should exhaust institutional sources of this knowledge.
3. *Seek institutional support first.* Entrepreneurs should explore innovative entrepreneurship and incubation that provide protections for entrepreneurs' ideas and are not likely to share in the mores of traditional polycentric institutions such as government and banks. This recommendation is especially relevant if the institutions are only modestly supportive of entrepreneurship.
4. *Protect your "secret sauce".* To reduce their risk of exploitation, when new startups and young ventures approach social networks to fill gaps in knowledge, they should be wary of structural holes for resources and protect secrets that will be critical to their success.

And, we offer the following recommendations for managers in formal institutions:

1. *Be knowledgeable of new venture risks and vulnerabilities.* Managers in formal institutions should be aware of the vulnerabilities faced by new startups and young ventures regarding intellectual property and knowledge gaps.
2. *Provide innovation hubs for idea development.* Managers should create these hubs with training and support in intellectual property protection. New startups and entrepreneurs will find an alternative to social networks to gain necessary knowledge. Instead, they will seek these networks for other purposes such as expansion of a customer base.

Conclusion

Social networks are an essential factor in the success of new ventures (Elfring & Hulsink, 2003; Martinez & Aldrich, 2011). New entrepreneurs cannot eliminate all risks that are associated with expanding their social networks, especially those related to structural holes. Similarly, managers in formal institutions cannot protect entrepreneurs and their ventures from inherent risks associated with bringing ideas to the outside world. However, this article has provided a number of recommendations they can use to support ventures in those early critical years.

We have examined how the theory of institutional polycentrism and social network theory explain the role of networks' structural holes in the early success of a new venture. We have also examined how different institutional contexts have a mediating role in this success. The research indicates that ventures, especially in their early stages of development, would benefit potentially from structural holes in outcomes such as product development and revenue growth. New entrepreneurs should, however, reduce their risks of exploitation by protecting their intellectual property rights.

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Mackenzie Adams, Maged Makramalla, and Walter Miron

About the Authors

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How Structural Holes in Social Networks Impact Early Venture Growth

Mackenzie Adams, Maged Makramalla, and Walter Miron

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Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil

Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon

*“There is no kind of problem that baffles one or a dozen experts”
that cannot be solved at once by a million minds that are given
a chance simultaneously to tackle a problem.*

Marshall McLuhan
Philosopher of Communication Theory

A large crowdsourcing project managed by Fiat Brazil involved more than 17,000 participants from 160 different nationalities over 15 months. Fiat promoted a dialogue with an enthusiastic community by linking car experts, professionals, and lay people, through which more than 11,000 ideas were selected and developed to create a concept car using a collaborative process. Through an in-depth case study of this crowdsourcing project, we propose a new approach – the accordion model – which uses project management to help maximize the beneficial inputs of the crowd. Whereas the stage-gate process relies on a “funnel” of articulated sequences expressing a progressive reduction from an initial stock of potential ideas and concepts, in this article, we suggest that crowdsourced projects are more akin to a process that articulates a succession of broadening and funnelling periods that represent information requests and deliveries. We use the metaphorical terminology of “the sacred and the profane” to illustrate the interaction of sophisticated and ordinary ideas between the “sacred” experts from Fiat and the “profane” lay people associated with the project. Lessons learned from the Fiat Mio case suggest how both organizations and Internet users may benefit from successful crowdsourcing projects.

Introduction

Imagine that you are a carmaker and you want to modernize your practices in product innovation. Despite all your technological progress in production, your integration of key systems, and your adoption of a state-of-the-art management style, the way you produce cars is similar to other industries: you create a first version, test it, gather feedback, produce a new version, test it again... repeating this cycle until finally you are ready to produce and sell the finished version to your customers. Essentially, this series of iterations or loops of building, testing, gathering feedback, and revising (Cooper, 2006) is still used in the majority of industries. However, what might happen if you invite your customers to co-create a car with your engineers and designers over the whole process? Would the pace still remain the same? How could you motivate and engage people in this task? Put simply, what is the best way to work with the crowd to innovate?

Starting from a single idea – to collaboratively create a car with Internet users – Fiat foresaw a favourable circumstance to achieve two goals: create a product and engage consumers. To emphasize that consumers would feel that the product belonged to them, Fiat named the project *Fiat Mio*, or “My Fiat” in English. The Fiat Mio project was not a competition to find the best idea or reward a winner. Right from the beginning of the project, Fiat executives felt it was improbable that lay people could come up with an idea that would surpass the quality of ideas from the experts. Nonetheless, Fiat invited consumers and their first-hand experience with cars in the hopes that they might bring novel ideas that might never have occurred to design and production experts.

In the form of “the crowd”, consumers are being recognized as a new source of innovation, as evidenced by the recent crowdsourcing efforts of diverse companies and brands, such as Boeing, Eli Lilly, Du Pont, Procter &

Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil

Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon

Gamble, Doritos, and Kit Kat (Huston & Sakkab, 2006; Brabham, 2008; Lafferty, 2012). Through crowdsourcing campaigns, consumers can act as co-creators by bringing their knowledge, skills, and willingness to learn and experiment while engaging in an active dialogue with the sponsor companies (Pralhad & Ramaswamy, 2000). In the crowdsourcing literature, very few studies, if any, have examined a large-scale project in the automobile industry or have detailed different phases of the process exploring how different levels of participation are demanded from the crowd. There is also a lack of examples on how firms adopt mechanisms to provide purposeful content to the crowd to enrich their contribution to the process and, on the other hand, how organizations may overcome cognitive fixation, meaning the tendency for experts to fixate on past examples or success, leading to less innovative ideas (Smith et al., 2013; Le Masson et al, 2006).

In this article, we examine the crowdsourcing process used by Fiat Brazil in the development of a prototype concept car. After a brief description of our methodology and the case itself, we present and analyze our results using the metaphorical terminology of “the sacred and the profane” to illustrate the role played by experts and lay people during a crowdsourcing project. Despite the fact that the product created would never be commercialized, the process itself is more relevant than its final result, as is demonstrated by the accordion model, the new approach to manage large crowdsourcing projects, which we propose based on our analysis of this case. We conclude by discussing the implications of the accordion model for Fiat Brazil and other companies engaging in crowdsourcing projects.

Our Case Study Methodology

Our methodological approach is based on an in-depth case study that is both intrinsic and instrumental. It is intrinsic because the case itself – the Fiat Mio project – deserves a deep investigation due to its originality and its pioneering characteristic in the automotive industry, particularly in South America. It is instrumental because the analysis of this particular case will allow us to advance the understanding of a broader issue: the management of large-scale projects involving a crowd of Internet users (Stake, 1998).

The data collection involved two main sources. First, we examined a large number of written materials, particularly those posted on the website of the Fiat Mio project and a book published by Fiat, but also other books, academic manuscripts, and articles in the press.

Second, we performed a number of interviews with three major participants in the project. These respondents represent the two main branches of the process: the organization that created the project and the advertisement agency that conceived three phases of the project: mapping scenarios, concept ideas, and concept design. On a daily basis, the agency oversaw the traffic of data on the web-based platform and was also the link connecting Internet users with Fiat and vice versa.

The data analysis was mainly based on visual mapping techniques (Langley, 1999). We represented the different phases visually, with components and mechanisms identified in a processual-based logic.

The Fiat Mio Crowdsourcing Project

Fiat Brazil started to sow the seeds of crowdsourcing and open innovation in 2006, when the organization created a “tournament of ideas” in cyberspace. As part of their celebration of a 30-year presence in Brazil, Fiat began a discussion on its website, inviting people to freely imagine the future by posting photos, videos, comments, etc. The initial aim was to promote a marketing survey, however, as popular interest surged, it was transformed into a marketing campaign. In the same year, coincidentally, Fiat presented its first Fiat Concept Car (FCC I), which was developed by the design team of the Fiat Style Center. Two years later, the second prototype (FCC II) was presented at the 2008 edition of the Sao Paulo Auto Show. The Fiat Mio project was intended to create the third prototype, which Fiat Brazil would exhibit at the 2010 Sao Paulo Auto Show, as described in this video: tinyurl.com/pt7ll9a. The project began with the simple idea of using a crowdsourcing approach to design a new concept car, and it progressed through five additional phases, which ended with the launch of the prototype. Once enough content was generated and discussed by the crowd, the firm withdrew to treat the data internally, afterwards releasing a new briefing and a new challenge, to be collectively and continuously solved.

Phase 1: Original Idea

Seeking inspiration to build the third Fiat Concept Car (FCC III), one of the Fiat executives reported learning that automobile manufacturers tend not to respond to consumers’ real needs because some of their demands are lost during the long time lag between marketing surveys and the final launch of the product. Meanwhile, one executive from AgênciaClick Isobar, Fiat’s advertising agency in Brazil, sent copies of the book *What Would Google Do?* (Jarvis, 2009) to certain Fiat execut-

Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil

Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon

ives to stimulate their thinking about enhancing Fiat's approach to innovation based on the lessons from Google.

Intrigued by how such new approaches could influence the way carmakers produce cars, this Fiat executive had an insight: to develop a collaborative co-creation process for a concept car where, through a blog on the Fiat website, people who wanted to participate could share their ideas. The idea of this project was discussed among other Fiat executives, and an opportunity for Fiat to enhance its communication approach with its clients was also identified. As a result, the advertising agency was given the task of developing a communication plan for this co-creating process addressed to stimulate the participation of Internet users worldwide. The agency would also help to guide the flow by giving the crowd references, through images and texts, regarding what was feasible. The advertising agency came up with a proposal, which divided the project into three main phases: Mapping Scenarios, Concept Ideas, and Concept Design. Based on our observations of the overall process, we identified two additional phases: Modeling and Launch.

Phase 2: Mapping Scenarios

One of the main goals of this initial stage was to generate a key question that would steer discussions on the open platform and that would later be available on the Fiat website for crowdsourcing participants. Fiat outsourced research to six automotive journalists to investigate "the car of the future and the future of cars". Their mission was to interview specialists and map future trends and scenarios. The result of their work was an extensive report that was later summarized and presented during a workshop organized by Fiat.

Developing the open question was the final part of the Mapping Scenarios phase; when the question was posted on the Fiat Mio platform on August 2009, the crowdsourcing project was officially online. Fiat and the advertising agency released the following open question on the platform to guide customers' discussions:

"In the future we are building, what must a car have in order for me to call it mine, without ceasing to serve other people?"

Phase 3: Concept Ideas

With the release of the Fiat Mio collaborative platform, the aim was to stimulate Internet users worldwide to participate by adding their ideas to the project, as well as to comment and vote for the ideas of others. Posts were published three times a day, and incentive re-

mindings were sent by Twitter inviting followers to access the Fiat Mio website and collaborate. Originally, Fiat expected to receive about 500 comments, but instead they received 7,078.

Fiat's advertising agency managed the web-based platform, and a single brand content editor condensed all the information received from the crowd. In tandem with Fiat engineers and designers, this editor classified and segmented the information so that Fiat could understand the desires expressed by users. This editor acted to some extent as a bridge, connecting the professionals and lay people – "the sacred and the profane". All of the content was filtered by the editor and, in conjunction with designers and engineers from Fiat, 21 topics of discussion were distilled (e.g., cabin space, fuel efficiency, noise cancelling, onboard biometrics) and they also served as the skeleton to be fleshed out during the next phase.

Phase 4: Concept Design

After these 21 topics had been identified, they were posted on the website for further consideration by Internet users who were participating in the project and also others who could, at any time, become part of this community. Each topic was open to individual discussion for a period of 10 days to clarify the path that designers and engineers should take. Following each question, there was explanatory text that was often accompanied by a secondary question, as the following example illustrates:

"Cabin and passengers: How many seats and doors should the Mio have? (To respond to these subjects and define the space specifications in the Mio, one must consider the following question: is the most common configuration of four to five passengers the ideal one, or would it be better to try something smaller, up to two passengers? What vehicle is missing among the wide range of options available on the market today?)"

To ensure that the suggestions would be realistic, Fiat provided 281 posts over the course of the project, including reference images and texts regarding what could be inspiring and feasible. The brand content editor guided the production of this content in collaboration with Fiat's designers and engineers. With the purpose of giving life to a prototype and in line with the suggestions submitted, the designers at Fiat started to research images, concepts, and references that would serve to produce the first sketches. They found that two concepts summarized Internet users' aspirations: i) an organic and winding style and ii) a defined, squarish design. These orientations generated different draw-

Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil

Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon

ings, which were grouped under two different lines: the Sense Line (i.e., organic) and the Precision Line (i.e., minimalistic). Internet users were asked to answer precise questions and then vote for their preferred option. They were also asked to indicate their preferences for proposed new technologies and design details.

Phase 5: Modelling

The dialogue did not stop when Fiat's designers began to build the prototype. Throughout the modelling phase, Fiat continued to encourage participation in the platform until the designers judged that they had enough elements to begin modelling the prototype. Fiat designers interpreted suggestions given by the crowd and presented them with options on which to vote and comment. Again, once the designers and engineers were satisfied with the features arrived at by votes and comments, they were then able to move on to another phase. The website announced:

"The unveiling of our collaborative concept car is right around the corner. Nonetheless, your participation will continue up to that moment. Now we want to show you 4 paint settings for the FCC-III to look even better when it premieres at the Auto Show. Which one do you prefer?"

Phase 6: Launch

The prototype took six months to build and it was delivered in time to be exhibited at the Sao Paulo Auto Show. Invitations were sent through Twitter, and an intensive advertising campaign encouraged participants – “the people who made it” – to see the result in person at the showroom. Fiat Cars named the crowdsourcing participants “Fiat Mio Creators”. In December 2010, hundreds of Fiat Mio Creators stood beside the mock-up at the auto show, and some of them gave testimonials about their participation, as shown in the following video: tinyurl.com/pvmzpej.

Following the launch, a Fiat executive we interviewed affirmed that the project has changed the way everyone at Fiat works. Another executive remarked that “the project sent the whole automotive industry to the “psycho-analysis couch” (Silva, 2010), while another Fiat executive we interviewed said that, in Fiat Brazil, everyone agrees that “surprising innovations come from the periphery; as they are embodied, an innovative project then moves towards more central positioning in the organization”. Fiat Mio was initially designed to be a tiny project that would involve only a handful of car aficionados around the factory, but it quickly took shape and moved from a peripheral to central concern at Fiat.

Fiat Brazil thus reinforced its connection with its customers – and hopefully gained new ones. The Fiat Mio platform continued to accept suggestions and comments by extending the period for receiving data from its consumers about their likes, preferences, habits, etc., for future use. However, both Fiat and the crowdsourcing participants were aware that the concept car might not be built as a mass-market vehicle, or might not even be commercialized. Thus, the prototype was regarded mostly as a map of consumer wishes, and some of the new features could ultimately be integrated into new cars available for purchase. As one Fiat executive said: “There are small things that don't cost much and bring great satisfaction to consumers, but haven't been given much attention. A lot of their ideas will end up going into our cars” (Wentz, 2009).

Analysis and Findings

Figure 1 illustrates the six phases of the Fiat Mio project, the interaction between Fiat and Internet users, as well as the interaction between Internet users over the process. In phase 1, the original idea was generated, and the project progressed through the other phases until the completion and the launch of the prototype. The central, accordion-like shape presents broad and narrow areas that represent moments where Fiat requested and received ideas from the crowd. The shape of the figure shrinks at intervals, representing moments where Fiat digested the ideas received and then released another challenge to the crowd. For instance, at the end of the Mapping Scenarios phase, the team came up with an open question, leading to the Concept Ideas phase.

The dashed lines bypassing the shape represent the permeable boundaries separating the organization from its market environment. The illustrated faces represent crowdsourcing participants that received content from the firm – videos, references, and inspirational posts – which helped them to provide more constructive ideas to the process and to comment and vote on the ideas of others.

While analyzing the phases of the Fiat Mio project, we identified that this succession of broad and narrow areas, or opening and closing periods, inspired us to give it the label of the “the accordion model”. The funnelling process is non-linear: an initial idea or briefing is released to the crowd, and the crowd responds to this challenge, leading to an expanding phase of idea generation. That process may reveal new trends or direc-

Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil

Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon

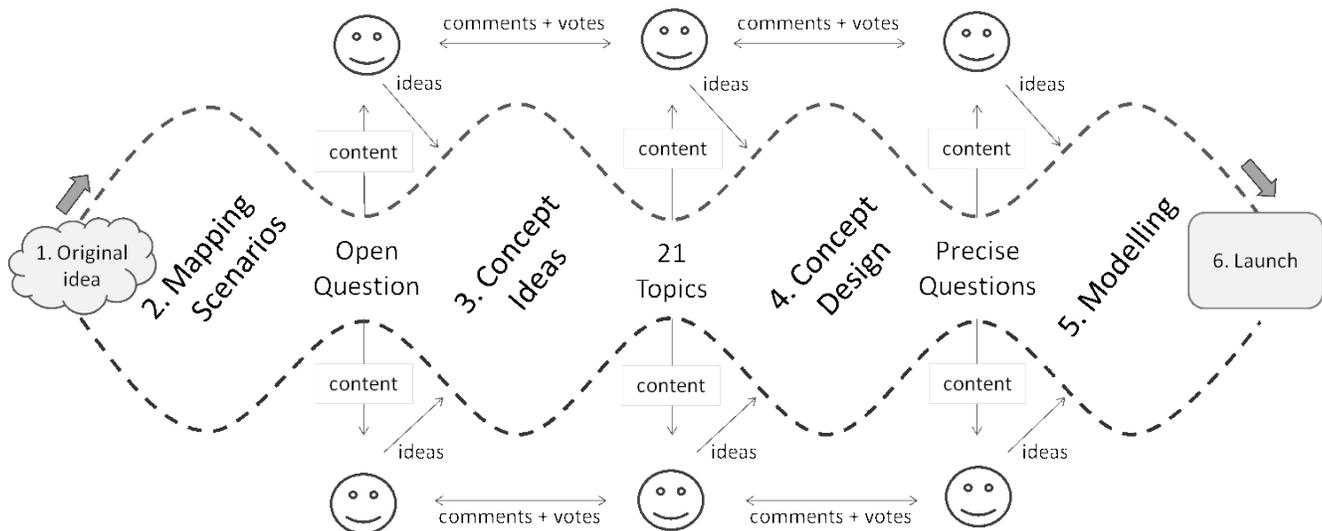


Figure 1. The accordion model showing the phases of the Fiat Mio crowdsourcing project

tions, which narrows towards another briefing or challenge to be tackled again by the crowd, and so forth. In short, when triggered by provoking questions and inspiring content, the crowd provides ideas to the process. The organization thus analyses the ideas provided by the crowd. After one or more iteration, if the organization judges that there is enough content, the project can move to another phase. Otherwise, another idea-generation phase may be triggered to generate more content. This opening-and-closing, or "accordion", process progresses until the production of the prototype.

The accordion model differs from the classic stage-gate model (Cooper, 1990) and the open innovation process (Chesbrough, 2003) where, as time progresses, both praxis progressively converges until the product is achieved. Whereas the stage-gate process relies on a linear and convergent "funnel" of articulated sequences expressing a progressive reduction from an initial stock of potential ideas and concepts, the accordion model relies on alternating periods of broadening and funnelling, where ideas are collectively generated, commented on, and selected. The difference between this linear funnelling of the stage-gate model versus the non-linear funnelling of the accordion model relies on the idea-generation mindset: in the stage-gate model, ideas are progressively eliminated, but in the accordion model, ideas are constantly and collectively multiplied. As a result, by observing the Fiat Mio pro-

ject, we have identified some key characteristics that distinguish the accordion model from the classical stage-gate process: (1) the management of a lively community of users that enables (2) a rich dialogue between the "sacred" high qualified personnel of Fiat and the "profane" crowdsourcing participants who may ultimately be potential consumers.

1. Managing a lively community of users

Regarding the inspirational posts provided by Fiat, by supplying the crowd with references and purposeful content, Fiat's advertising agency was attempting to both foment participation and improve the knowledge of crowdsourcing participants, which would be useful to enrich the discussion and receive more realistic ideas. Consequently, the crowd was prompted to provide better solutions related to the problem briefed by Fiat. Plus, we observed that, by doing this, Fiat filled the three key conditions that allow the emergence of groups (Sartre, 1985) or self-selected virtual communities: i) the *interdependence* between members, or web users, because participants were stimulated to see, comment, and vote the ideas of the others; ii) the *awareness of a common goal*, the Fiat Mio; and iii) the *organization of crowd interaction*, which Fiat guided and nurtured in cyberspace. This social interaction also met the needs of Internet users searching for networking and eventual recognition of the value of their ideas. For organizations, the act of attracting, gathering, and stimulating communities of users, lay people,

Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil

Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon

consumers, and eventually some experts from the crowd through a well-managed social interaction plan could be a successful tool for marketing and customer relationship management in the long run. Ultimately, we could consider that a successful crowdsourcing project would help to identify emerging groups of individuals from the collective by engaging them into a common goal, thereby bringing both experts and non-experts together.

2. Promoting a rich dialogue between the “sacred and profane”

This interaction between “the sacred” (Fiat designers and engineers) and “the profane” (crowdsourcing participants, lay people) embodied by the Fiat Mio was constructive for many reasons. First, the investment made in providing relevant content provided benefits because it helped to improve customers’ subjectivity and to reduce cognitive fixation, or “something that blocks or impedes the successful completion of various types of cognitive operations, such as those involved in remembering, solving problems and generating creative ideas” (Smith, 2003), that expert professionals are likely to undergo (Bayus, 2013). On the other hand, the individuals from the crowd benefited, because the eventuality of “working outside” the company helped some of them to develop a network and obtain some visibility according to the success of their ideas.

Second, regarding information exchange, by providing clear, relevant, and purposeful content to crowdsourcing participants, the organization optimized the quality of the ideas provided by the crowd in terms of feasibility and innovativeness, therefore, making the ideas useful for experts. By both posting a challenge and providing inspiring content related to the solution desired, the crowd provided, with their ideas, free association of uses and applications that appeared innovative and original for the “sacred” experts’ eyes.

And, finally, crowdsourcing also destabilized and brought a slight amount of cognitive dissonance into Fiat Brazil, which, according to one executive interviewed, “it was also important for us to understand changings and trends in the market environment”. This interaction between “the sacred and the profane” also favoured the dialogue between sophisticated and ordinary ideas that, for Fiat, helped them to rethink some of their own organizational routines and paradigms.

Lessons Learned

For executives of Fiat Brazil, the project brought valuable lessons:

1. An external collaboration process cannot function effectively without an organizational willingness to adapt. The collaborative process established outside the company required an *in-house collaborative mindset* across several departments, such as R&D, design, engineering, marketing, and communication. Every team was eager to hear what Internet users had to say.
2. The need to leave out some good ideas was a source of frustration for both the organization and the crowdsourcing participants. Many of the ideas were mutually exclusive; it would have been impossible to act on every good suggestion. In projects with high levels of participation and many good suggestions, many contributors can become frustrated if their ideas are not included.
3. The product may not be the real outcome. Some executives realized that the prototype itself was almost not relevant. Instead, it represented the *outcome of a lively discussion*, a relationship built between Fiat and its consumers that, ultimately, made Fiat learn how to better communicate with people, by also assimilating their knowledge. Perhaps the most meaningful legacy of the Fiat Mio is the communication platform built between Fiat and consumers and the large amount of data that Fiat collected from the crowd. The organization also obtained synapses, links, solutions, and new ways of working that they never would have developed on their own.
4. The Fiat Mio project gave the company new perspectives on problems and caused them to rethink some of their paradigms. According to a Fiat executive: “When we have simplistic and naive points of view about something that has become deeply technical and complex for us, we have undergone a kind of disconnection; and I think this is a good thing.” On the other hand, Internet users were enthusiastic about co-creating a crowdsourced car. As one participant said: “That’s it! It’s Mio! If the idea came from you, if you have participated, even from the outside, you feel like you’re in the factory working.” Many of the participants also became briefly well-known as being the owner of a specific idea materialized in the prototype.

Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil

Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon

Conclusion

In this article, we aimed to present how Fiat managed a large crowdsourcing project to create a concept car and also filled a gap in the crowdsourcing literature, because very few studies, if any, have reported a large crowdsourcing project in the automobile industry. We presented the accordion model, which revisits the classical stage-gate model by proposing a non-linear funnelling development. This new approach includes the presence of a lively community of users, which enables a rich and iterative dialogue between experts and lay people, the “the sacred and the profane”. As with any emergent phenomenon, other processes and characteristics of crowdsourcing are still barely known, which provides a vast field of subjects for further research.

From the lessons learned by the case, future research should focus on how the organizational structure may change prior to or after a crowdsourcing project. For instance, a need to engage knowledge brokers may arise, as was seen in this case when Fiat engaged its advertising agency into the core of the project. It would also be relevant to understand how to take advantage of the likelihood that some experts may emerge from the crowd: how crowdsourcing could be eventually seen as a recruitment tool. As each phase is constrained and enabled by choices that were made in a previous phase, it would be equally important to further investigate how to deal with crowd frustration before it may turn against the organization, which may trigger the so-called crowdslapping effect (Brabham 2009) if many ideas are not used. Finally, another field of research should investigate how to quantify the “legacy” of a crowdsourcing project in terms of the amount of the consumer data collected for the future development of products or services. We believe that the accordion model is indeed adjustable and applicable to other sectors of the industry, given that its phases demonstrate the steps to follow in a crowdsourcing project. Future research could also validate empirically the application of this proposed model.

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Challenging the Stage-Gate Model in Crowdsourcing: The Case of Fiat Mio in Brazil

Fabio Prado Saldanha, Patrick Cohendet, and Marlei Pozzebon

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Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance for Strategic Advantage

Derek Smith

“ *We must not always judge of the generality of the opinion* ”
by the noise of the acclamation.

Edmund Burke (1729–1797)
Statesman, political theorist, and philosopher

Patent evaluations based on prior art citation data are business methodologies that can reveal hidden relationships between a patent and the associated prior art citations. These hidden relationships can further identify firms, actors and, technology and can identify strategic business relationships and opportunities. However, a fundamental problem with existing methodologies for discovering relevant relationships in citation data is noise. Citation noise obscures relevant relationships and impedes the potential value of these methodologies. This article reviews the literature on prior art citations as they relate to citation-based patent evaluation methodologies. A framework is presented to overcome citation noise and reveal relevant relationships to evaluate knowledge, technology, and invention properties, thereby opening up strategic and competitive advantages to the evaluating firm. The article provides guidance to executives and managers to help improve strategic decision making through relevant citation-based patent evaluations.

Introduction

Any decision to obtain a patent requires careful and strategic business consideration because patents are very expensive and they do not always generate the anticipated business value. Value may be limited in a business sense due to a firm's capabilities or misalignment to the strategic vision. The overriding challenge is therefore to create as much strategic or competitive advantage as possible from each patent.

The value of a patent can be assessed in a number of ways, many of which focus on the relationship of the patent to its citations of older technology information, or "prior art". A citation-based patent evaluation can provide strategic or competitive advantage if it can reveal relevant, hidden relationships and an assessment of: i) knowledge flow, ii) technology properties, or iii) invention properties.

Patents and their prior art citations enable this obscure form of strategic or competitive advantage based on the

underlying business and technology relationships that may be identified from the relevant prior art citations. Extracting this form of strategic advantage requires revealing the relevant relationships that can provide insight pertinent to the strategic or competitive advantage of a firm.

Extant research on prior art citations, their applicability, and limitations to patent evaluation methodologies has focused on individual, distinct applications. However, many authors (e.g., Hu & Jaffe, 2003; Gay et al., 2005; Criscuolo & Verspagen, 2008) also identify citation noise as a problem that limits the effectiveness of these methodologies.

Citation noise occurs due to timing in the patenting process, the point in time when the prior art references are identified and the amended state of the patent claims at that point in time. Citation noise also occurs due to different perspectives and comprehension concerning the technology and invention. Prior art references may be provided by many actors such as the

Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance

Derek Smith

inventor with the patent application, a searcher during a patent office search phase, an examiner during a patent examination phase, or an interested third party after publication of the application. Inventor-supplied citations are typically addressed before filing a patent application and are typically not relevant at the time of filing the patent application. Searcher-supplied citations and third party supplied citations may arrive later, after amendments. They may not be relevant due to the preceding amendments that redefine the invention. Together, all citations that have been identified form the raw citation data associated with the patent. The differing perspectives and comprehensions are resolved during prosecution of the patent by the examiner and patent agent. During this process, the relevant prior art citations are identified from the raw citation data based on the patent claims or amended state of the patent claims and reaching agreement on the final form of the patent claims.

Citation noise arises from prior art citations in the raw citation data that are not relevant to the patent, and it can be substantial. As Jaffe and colleagues (2000) observed: "There is, however, a large amount of noise in citations data; it appears that something like one-half of all citations do not correspond to any perceived communication, or even necessarily to perceptible technological relationship between the inventions." Unfortunately, existing citation-based patent evaluation methodologies lack an effective way of filtering out this noise. If there was a means of discovering the *relevant* prior art citations, or filtering out the citation noise, the effectiveness of the various evaluation methodologies could be improved.

The author of the present article previously described how citation information, business information, and patent information might be combined in a patent evaluation to reveal insight by identifying four key business considerations: strategic partners, strategic innovation, strategic invention, and strategic linkages (Smith, 2014a). In this article, the author describes how citation information may be filtered to discover relevant citations from the noise, thereby revealing insight from three key perspectives: knowledge flow, technology relationships, and relative degree of invention. A framework is also provided that illustrates how discovering the *relevant* prior art citations from the noise can lead to clear outcomes, thereby assisting executives and managers with the strategic assessment of opportunities concerning an individual patent or portfolio of patents.

The remainder of this article is organized as follows. The first section reviews the literature concerning prior art citations, citation noise, and the interdependency between prior art citations and patents. The second section describes a patent evaluation framework based on relevant citations (i.e., those discovered from the noise of citation data), which is accompanied by three example scenarios. A final section concludes the article.

A Review of Prior Art Citations and Citation Noise

Citation-based patent evaluation methodologies enable the assessment of patent metadata to reveal hidden details and relationships that can provide strategic insight. These methodologies focus on the raw data – prior art citations – that are used for different types of measures or proxies that generally relate to properties concerning knowledge, technology, or invention.

Prior art citations identify technology that was known, or the "state of the art", prior to the invention of the patented technology. These citations may create a legal link and relevant relationship between the prior art and the patented technology. When a prior art citation refers to an existing, older patent, this technology coupling or link is made explicit with the patent through what is called a "cited citation". However, the older patent also inherits a citation forward in time to the new patent, and this is called a "citing citation". Thus, a given patent may have cited citations (i.e., referring backwards in time to prior art) and the patent may also be listed as a citing citation (i.e., referring forwards in time to newer patents). Together, both types of links can create a network of insightful interrelationships between citations and patents, but only if they can be discovered from the background noise commonly found in citation data.

The objective of this literature review is to examine the current state of knowledge in prior art citations as they relate to citation-based patent evaluation methodologies. The relevant literature was located using a broad keyword search of scholarly journals in the Business Source Complete database (tinyurl.com/22teqry) with respect to prior art citations. The abstracts and introductions of the articles were examined closely with a focus on prior art patent citations. This step resulted in a list of 11 relevant articles and a book related to the topic of prior art citations. Ten of the articles are based on empirical research; one article is a literature review. Many of the authors identified a long-standing problem with prior art patent citations: citation noise.

Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance

Derek Smith

Prior art citations

A patent evaluation methodology can use prior art citations in a number of different ways. For example, they can be used to track a flow or exchange of knowledge between the patent and the prior art citations (Bacchiocchi & Montobbio, 2010; Criscuolo & Verspagen, 2008; Hu & Jaffe, 2003), especially if they are cited citations (Hu et al., 2012). When the flow of knowledge is traced with secondary data associated with each prior art citation, the patent can be used to evaluate other aspects such as firms, actors, regions, and countries, and it can be used to identify technology segments associated with the knowledge (Bacchiocchi & Montobbio, 2010; Hu & Jaffe, 2003). Criscuolo and Verspagen (2008) found that European patents typically have fewer prior art citations than patents from the United States. They also found that prior art citations provided by an patent examiner tend to anticipate the claims having a strong relationship between the patent and prior art citations whereas prior art citations provided by the inventor tend to have a much weaker relationship.

Prior art citations can be used to evaluate the technical value or significance of an invention and indicate the origins of the flow or exchange of knowledge. Prior art citations also reveal a network of technological communities based on the links in a citation network. Cited citations reflect codified cumulative knowledge. Secondary data with citations can reveal business intelligence concerning actors, geographic proximity, and the exchange of knowledge between actors (Gay & Le Bas, 2005).

Gay and colleagues (2005) found that prior art citations can be used to evaluate the technical value of an invention based on a citation rate, especially if they are citing citations (Hu et al., 2012). Trajtenberg (1990) found that prior art citations can be an indicator to the importance or value of a patent. The frequency of a citation in technological fields also suggests value (Gay et al., 2005; Jaffe & Trajtenberg, 2002). A long-standing cited citation that is frequently cited in other technological fields suggests a broader, more valuable patent, or a core technology required by many other technologies. Similarly, a high number of citing citations can be used to identify a high potential or breakthrough invention, in part because breakthrough inventions are built upon past knowledge that would be reflected in the number of cited citations (Kelley et al., 2013). A higher number of citations indicates a higher value for appropriating an invention (Nikulainen et al., 2008).

Van Zeebroeck (2011) found that the network associated with prior art citations illustrates linkages between upstream and downstream technology knowledge that may be evaluated. The upstream prior art citations suggest a more valuable invention and patent.

Trajtenberg and colleagues (1997) found that cited prior art citations relate to the basicness of an invention and citing prior art citations relate to the appropriability of the invention. A patent with a higher count of citing citations is relatively more important than a patent with a lower count of citing citations.

The prior art citation literature may be further synthesized into three groups of properties that relate to citation-based patent evaluations, as shown in Table 1. The first property relates to knowledge surrounding the invention, where the prior art citations are generally applied to reveal the relationship with knowledge over a period of time between the date of the patent and the dates of the prior art citations. The knowledge properties can identify firms and actors associated with a particular patented technology and are beneficial when seeking to identify strategic relationships around a patented technology.

The second property relates to the technology, where the prior art citations can be applied to evaluate the technology described and claimed in the corresponding patent. The technology property can identify technological value of a patent and be beneficial when seeking, or offering, venture capital based on a particular patent or group of patents. This property works both ways and should be made relevant to focus on real technological value.

The third property relates to the invention, where the prior art citations are applied to evaluate the degree of originality. The invention property can identify invention value disposed within a patent and can be beneficial when managing a patent portfolio or considering expenses. This property can distinguish inventions with a high degree of originality from inventions with a lower degree of originality.

Citation noise

The literature review revealed citation noise as a long-standing problem. It remains as a missing piece in our knowledge and understanding of patent evaluations based upon prior art citations. Citation noise is a problem that appears in the literature as early as 1990 (Trajtenberg, 1990) and continues to be a known problem referenced by many authors at least up to 2013 with a paper by Kelly, Ali, and Zahra (2013).

Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance

Derek Smith

Table 1. The applicability of prior art citations to patent evaluations

Aspect	Applicability of Prior Art Citations
Knowledge Properties	<ul style="list-style-type: none"> • Can be a proxy to track knowledge flows between patents and measure the intensity of knowledge flows. Secondary patent data provides an indication of regions, countries, and specific technologies (Bacchiocchi & Montobbio, 2010). • Are a proxy for knowledge flow and create a paper trail of the flow of knowledge (Criscuolo & Verspagen, 2008). • Provide the linkages between upstream and downstream technology knowledge. Downstream, they reveal previous research activity; upstream, they suggest value of inventions (van Zeebroeck, 2011). • Can be an indicator to the importance of value of a patent. A frequency or count of citations is applied to calculate a weighted count of patents. Citations that cross technology areas are indicative of knowledge spillover (Trajtenberg, 1990).
Technology Properties	<ul style="list-style-type: none"> • May be a proxy to assess the technical value of inventions, indicate the origins and flow of codified knowledge, or lead to a measure of technical significance. Patent citations can reveal the network of technological communities. Cited citations contain codified knowledge and are a proxy for cumulative knowledge. Cited and citing citations are a proxy for knowledge flow. Secondary information reveals business intelligence concerning the actors associated with the patent citation, geographic proximity, and knowledge exchange between actors. Citing patents represent knowledge flows of new ideas and knowledge (Gay & Le Bas, 2005). • Can be a proxy to the technological value of inventions based on the citation rate or frequency of citation in other technological fields (Gay e al., 2005) • Are a proxy for knowledge flows between patents. With secondary patent data such as the inventor name and country, can be a proxy for knowledge flows between countries (Hu & Jaffe, 2003). • Can be a proxy to technological value when citing and a proxy to knowledge flow when cited against the target patent. Cited patents represent knowledge flows of old or known knowledge (Hu et al., 2005).
Invention properties	<ul style="list-style-type: none"> • Make it possible to trace the links between patents and citations and the flow of technological knowledge between the citations and patent. Citations may be an indicator of invention importance for the degree of generality or originality. Citations illustrate how technological knowledge combines to produce new knowledge over time. A highly cited patent suggests importance. Citations may also be used as a proxy for technological impact and, when used to weight a count of patents, can lead to more meaningful information (Jaffee & Trajtenberg, 2002). • Can be a proxy for high potential or breakthrough inventions, based on the highest number of citing citations. Cited citations can be a proxy for intermediate value of a technology (Kelley et al., 2013). • Cited citations are a proxy for the present economic value of a company, and they position the patent with respect to the basicness and originality of the patent. A relatively low count suggests low basicness and technological significance. Citing citations are a proxy for technological significance, indicating a potential for higher economic return. More citing citations suggests higher value for appropriating and applying the invention (Nikulainen et al., 2008). • Aspects of basicness and appropriability exist in the relationships between cited and citing patent citations. Basic relates to each innovation building upon a body of existing knowledge before it and appropriability relates to benefiting from the earlier patented innovation. Citations can therefore identify and trace the citation relationships. A patent is important if it is highly citing, and a patent is basic if it is highly cited (Trajtenberg, et al., 1997).

Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance

Derek Smith

Citation noise occurs as a natural result of timing and different perspectives and comprehension during the process to obtain a patent. Some jurisdictions have a higher degree of noise in the citation data when compared to other jurisdictions (Criscuolo & Verspagen, 2008; van Zeebroeck, 2011; Gay & Le Bas, 2005). Bacchiocchi and Montobbio (2010) found a home bias effect, where local citations are more likely to be included than citations from other jurisdictions. A home bias effect depends on different legal and patent examination procedures that generate the representative patent citations. They also found that patent citations are localized at the European Patent Office, with fewer citations per patent than observed at the United States Patent & Trademark Office. This occurs because of differences between the jurisdictions. The United States Patent & Trademark Office places a duty to disclose prior art references upon each applicant in contrast to the European Patent Office, which has no such duty to disclose. The duty to disclose prior art and the consequences for not disclosing prior art tend to drive up the citation count and corresponding citation noise.

Patents may contain some amount of noise in the associated citation data (Criscuolo & Verspagen, 2008; Gay & Le Bas, 2005; Gay et al., 2005; Hu & Jaffe, 2003; Hu et al., 2012; Jaffe & Trajtenberg, 2002; van Zeebroeck, 2011) or the citation data may not capture any flow of knowledge between the patent and prior art citation (Hu et al., 2012). The amount of noise in the citation data is a factor of the total number of prior art references supplied by interested actors; the number of differing perspectives, miscomprehensions between the technology described in the prior art references and the technology covered by the patent claims; and the timing in the process. Raw or simple counts of citations

may underestimate the actual number of citations (van Zeebroeck, 2011) and may not be suitable across different technology fields (Hu et al., 2012).

Citation noise therefore presents a major challenge to the effectiveness of patent evaluation methodologies, which may therefore be poor indicators of the economic value of patents (Gay & Le Bas, 2005). When the noise is caused by citation lag and citation variability, an evaluation concerning technology value may result in a diversity of technology value (Gay and colleagues, 2005). A timing issue causes this type of noise when a patent is evaluated with respect to the number of citing (future) citations. Citation noise may further impact evaluations relating to knowledge flow if many citations are not associated with knowledge flow (Hu & Jaffe, 2003). Knowledge flow occurs when a patent is building upon or improving older technology and may be identified when there is direct link between the claims of the patent and relevant citations.

Citation-based patent evaluation methodologies

Based on the literature review, the patent evaluation methodologies that use prior art citations are summarized and illustrated in Figure 1. Depending on the business strategy of the evaluator, a patent and its associated noisy prior art citation data may be evaluated through a lens of three different properties – knowledge, technology, and invention – that can yield three distinct potential outcomes. However, any potential evaluation using current methodologies is impeded and limited by the citation noise within the citation data and propagates through to each of the three potential outcomes. Citation noise results in an obscured or unreliable potential outcome.

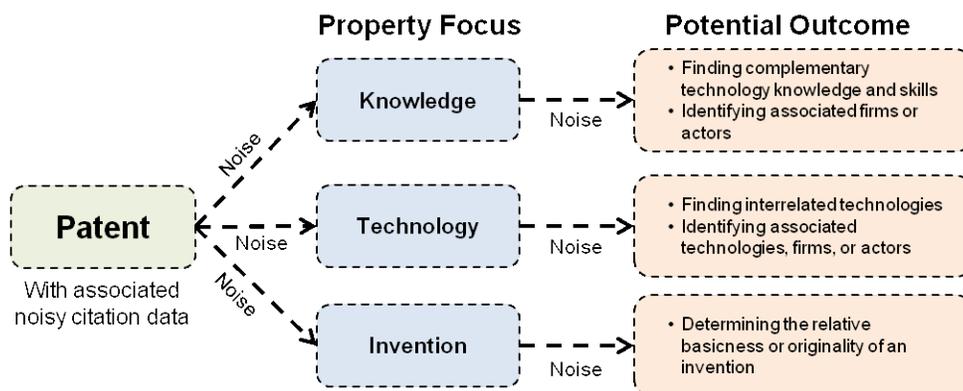


Figure 1. Three views of citation-based patent evaluations and potential outcomes influenced by citation noise

Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance

Derek Smith

Interdependency between prior art citations and patents
 Citation noise was identified as a common problem in the literature as it relates to distinguishing relevant prior art citations from the prior art citations that are not relevant to the patent. Therefore, a second stream of literature consisting of six articles was located using a broad keyword search of scholarly journals in the Business Source Complete database with respect to interdependency between prior art citations and patents. Interdependency is a legal relationship that may or may not form between a prior art citation and the patent as part of the patent examination process.

The mere presence or listing of a prior art citation in citation data does not provide any indication of the relevance or lack of relevance of the prior art citation (Abbott Laboratories Inc. v. Baxter Pharmaceutical Products Inc., 2003). The patent examination process (i.e., prosecution) may result in a formal rejection based on a prior art citation and an amendment to the patent claim (Berger et al., 2011). Patent applications are examined using the prior art citations. A prior art citation, or combination of prior art citations, is relevant when an examiner accepts an amendment to overcome a rejection. Amendment may or may not occur and the application may be granted or be rejected based on the legal arguments or amendments to the pending claims (Kica & Groenendijk, 2011). The author of this article further found that the interdependency between a patent and prior art citation could discover relevant citations and eliminate the noise in citation data (Smith, 2014b).

In the United States, a formal rejection may be based on novelty or obviousness; in Europe, a formal rejection may be based on novelty or inventiveness (Laub, 2006). Other jurisdictions are similar. The prosecution process and the formal rejections are documented in

the form of a patent prosecution history file. This file is available from a patent office and contains documents that codify formal rejections and amendments accepted by an examiner (Cotropia et al., 2013).

A Framework for Relevant Citation-Based Patent Evaluations

A framework for relevant citation-based patent evaluations is proposed from the ideas identified from the first literature stream concerning prior art citations and citation noise in combination with the ideas from the second literature stream concerning patent and citation interdependency. As shown in Figure 2, the framework synthesizes these ideas while incorporating the associated linkages between the three properties, as viewed through a citation-data lens. The linkages first relate to a flow of noisy citation data. The noisy citation data is passed through the citation relevancy filter to discover relevant citations from the noise. Relevant citations are then evaluated with respect to knowledge properties, technology properties, or invention properties. This framework results in a clear potential outcome based on the evaluated property.

The framework presented in Figure 2 builds on Figure 1 with the addition of a citation-relevancy filter. When applied to a list of prior art citations included in the raw citation data, this filter identifies the citation as relevant if it has been cited by an examiner *and* resulted in an amendment to the patent claim or prevented grant of the patent. Thus, the filter is an evaluation tool for reviewing the patent prosecution history file and associated documents concerning the patent to be evaluated. Without the filter, the potential outcomes are obscured by the citation noise (Figure 1); with the filter, the path is clear and the likelihood of a successful, more reliable outcome is greater (Figure 2).

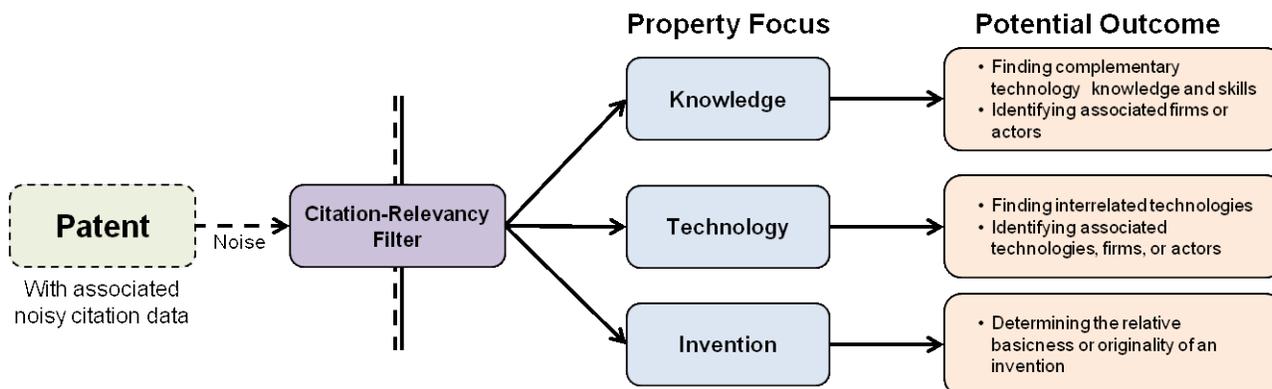


Figure 2. A framework for relevant citation-based patent evaluations

Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance

Derek Smith

In the subsections below, three example scenarios illustrate potential applications of the framework from Figure 2 for relevant citation-based patent evaluations.

Scenario 1: Knowledge properties

Consider a patent holder that has limited resources and skills to create technology based on their patent. One option is to identify other firms or actors to possibly collaborate with to create the patented technology.

In this scenario, a patent evaluation with a focus on the aspect of knowledge properties is beneficial to identify other firms or actors with similar or advanced skills relating to the patented technology. Such an evaluation could use the framework identified here to discover relevant citations from the associated patent citations, as follows:

1. List each prior art citation from the raw citation data associated with the patent.
2. Access the patent office website that granted the patent and locate the patent prosecution history file.
3. Scan the documents disposed with the prosecution history file to find: i) each prior art reference that was cited by an examiner and ii) any amendments to the patent claims based on each cited reference.
4. Finally, note whether or not the examiner accepted the amendment to the patent claims.

A relevant citation is identified for each prior art citation that was i) listed as a prior art reference to the patent and ii) was cited as a prior art reference by the examiner, and for which an amendment to the patent claims was entered and accepted by the examiner.

Relevant citations for this scenario relate to a flow or exchange of knowledge between each relevant prior art citation and the patent, as well as the linkages to the citations. For each relevant prior art citation identified, the evaluator should locate the document and the secondary information associated with the document to reveal at least the firm and actor associated with the document. This step identifies strategic firms and actors that have experience with the same or similar technology to that of the patented technology.

Scenario 2: Technology properties

Consider a firm that has interest in accessing the technological value from the perspective of the importance of the technology to other technologies as a required

building block. An example is the relationship of a new battery technology and the importance to many other portable electronic devices that require this battery technology.

In this scenario, an evaluation might occur before seeking venture capital based on the patent. Technological value can be evaluated based on the number of relevant *citing* citations: the higher the number of relevant citing citations, the higher the relative technological value of the patent.

The same process described in Scenario 1 can be used to discover relevant citations. But, here, the total number of relevant citing citations associated with the patent should be counted. The patent may then be compared to other similar patents to evaluate the relative value. If there are no relevant citing citations, the patent may not be valuable from a technology perspective or is still in an immature state.

Scenario 3: Invention properties

Consider a firm that wishes to assess the originality (or basicness) of its patent. In this case, it is the number of relevant *cited* citations that is important: the higher the number of relevant cited citations, the more basic the invention. The purpose of this evaluation could be to rate and rank multiple inventions within a patent portfolio.

Again, the process begins with discovering the relevant citations as described in Scenario 1. However, in this scenario, the evaluator should count the total number of relevant *cited* citations associated with the patent. The patent may then be compared to other similar patents to evaluate the degree of originality or basicness. If there are no cited citations, the invention is not basic, it is an invention with a high degree of originality.

Conclusion

Existing citation-based patent evaluation methodologies are limited due to citation noise. A patent evaluation based on relevant citations eliminates citation noise and identifies relevant hidden relationships and insight in support of identifying potential strategic relationships and in conducting technology and invention assessments. A patent evaluation based on relevant citations can also provide strategic and competitive advantage to a firm, especially when aligned with the present and future needs of the business.

Future research should focus on testing the framework for relevant citation-based patent evaluations. Other

Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance

Derek Smith

citation-based patent evaluation methodologies that include patent and business information could also be examined to build upon the framework.

In practice, executives and managers should proactively conduct a relevant citation-based patent evaluation as part of a patent portfolio management activity and routinely assess strategic opportunities.

About the Author

Derek Smith is the founder and principal of Magneto Innovation Management, an intellectual property consulting firm that assists entrepreneurs and small businesses with difficult intellectual property issues. He is a registered patent agent in both Canada and the United States, and he has over 20 years of experience working as an intellectual property management consultant and patent agent for IBM Canada, Bell Canada, and Husky Injection Molding Systems where he was Director of Global Intellectual Property. Prior to entering the field of intellectual property, he was an advisory engineer at IBM Canada where he was involved in a variety of leading-edge software development projects. Derek holds an MSc degree in Technology Innovation Management from Carleton University in Ottawa, Canada, for which he was awarded a Senate Medal for Outstanding Academic Achievement. His thesis is "A New Methodology For Citation Dependent Patent Evaluations". Derek also holds a BEng degree in Systems and Computer Engineering, also from Carleton University.

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Finding the Signal in the Noise of Patent Citations: How to Focus on Relevance

Derek Smith

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Keywords: intellectual property, patent evaluation, patent evaluation limitations, prior art citations, citation-based patent evaluation, citation noise, literature review

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- Thoroughly examine the topic; don't leave the reader wishing for more.
- Know your central theme and stick to it.
- Demonstrate your depth of understanding for the topic, and that you have considered its benefits, possible outcomes, and applicability.
- Write in a formal, analytical style. Third-person voice is recommended; first-person voice may also be acceptable depending on the perspective of your article.

Format

1. Use an article template: **.doc .odt**
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4. Begin with a thought-provoking quotation that matches the spirit of the article. Research the source of your quotation in order to provide proper attribution.
5. Include a 2-3 paragraph abstract that provides the key messages you will be presenting in the article.
6. Provide a 2-3 paragraph conclusion that summarizes the article's main points and leaves the reader with the most important messages.
7. Include a 75-150 word biography.
8. List the references at the end of the article.
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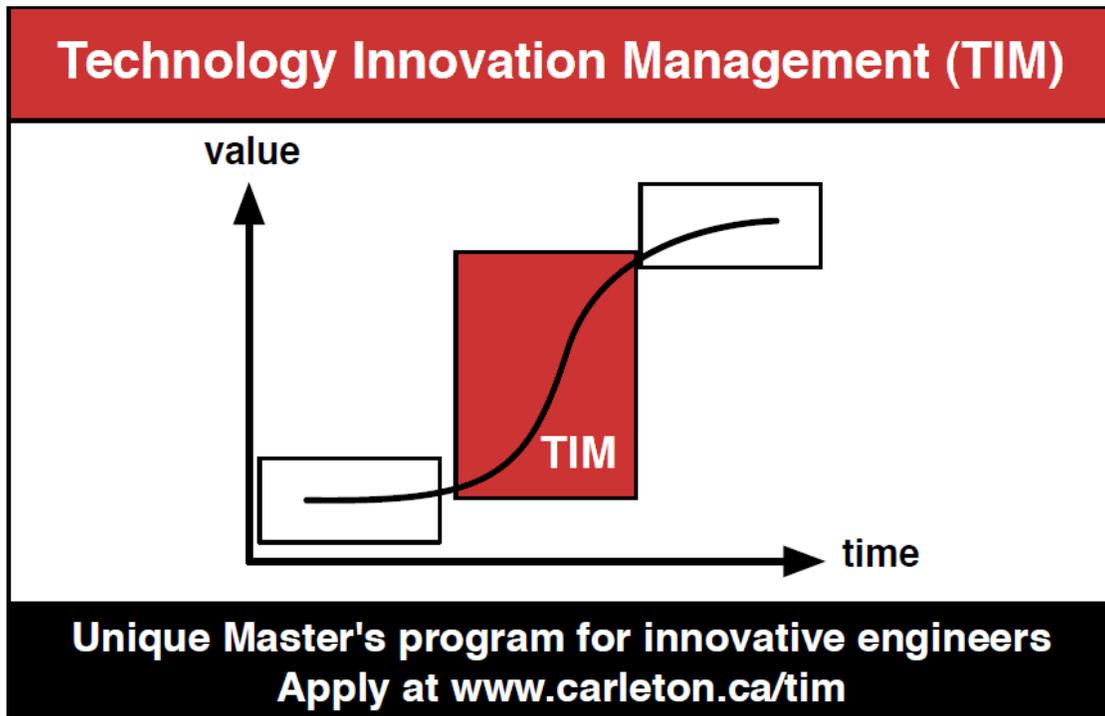
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