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LEVERAGING DESIGNERS FOR PATENT CONTENT

GENERATION AND ACQUISITION OF INTERDISCIPLINARY INFORMATION

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PAPER ABSTRACT: Growth through innovation is critical to Small and Medium-sized Enterprises (SMEs) and the use of patents is necessary to attract needed funding. SMEs' use of the patent system is not as effective as larger companies. This research inquiry considers product development stakeholder's knowledge to increase the relevance of patent disclosure content for more successful patents and business competitiveness. This empirical research uses a mixed method questionnaire to gain insight from product development experts that include design, marketing, engineering, upper management, entrepreneur and legal representation. The subset of collected participant data that is the subject of this paper is focused on challenges with gaining access to the team's relevant information for inclusion in patents. The quantitative and qualitative data identifies barriers to the acquisition of this knowledge. Additionally, insight generation techniques are applied to arrive at solution approaches that include interdisciplinary activities to facilitate tacit to explicit information transfer. The industrial designer is identified as having attributes and knowledge that could be developed to assist the cross-boundary communication needed to acquire new knowledge from product development stakeholders for more valuable and future-effective patents.

Keywords: industrial design, stakeholders, effective patents, cross-boundary communication, patent-storming

1. INTRODUCTION

Small versus large firm patenting behavior differs since Small and Medium Enterprises (SMEs) can afford to file fewer patents making each individual patent of higher importance (Coughlin, 2007). To be considered for venture capital SMEs are often expected to have patents or patent applications as assets (Coughlin, 2007; Nikzad, 2015). Pisano and Teece indicate that managers working towards competitive advantage often consider the intellectual property (IP) environment as being "beyond their control" but they argue that it can be shaped (Pisano & Teece, 2007). This suggests that management may be underutilizing patents because they are not understood. The concern is that SMEs' lack of knowledge about the patenting process results in outcomes that are less effective than they could be (Burrone, 2005). The World Intellectual Property Organization's (WIPO) Patent Drafting Manual emphasizes the importance of the disclosure content filed in a patent since it is not possible to file amendments with new technical disclosure during its prosecution (*WIPO Patent Drafting Manual*, 2007). Allison describes patent continuation where the same disclosure is used to file different sets of claims (Allison et al., 2004;

Coughlin, 2007) thus requiring sufficient supportive content for each claim set within the originally filed disclosure (*WIPO Patent Drafting Manual*, 2007). The claims of invention are entirely dependent on the content of the patent disclosure selected by the applicant firm and there may be valuable information created by the development team that is not readily accessible (Watters & Craib, 2017).

The steps for creating patent content include the collection of information that describes the invention, communication of this information to the person or group writing the patent and their final selection of information for formatting into the patent disclosure. Once filed, the patent examiner's role is to determine that the claims of invention are novel, inventive, and useful. The patent is typically rejected initially, and this drives a necessary response from the applicant where the claims of invention are narrowed in response (*WIPO Patent Drafting Manual*, 2007). The patent itself, if granted, is an asset defining rights to the established claims of invention that can be used by its owner for commercial advantage to exclude others from its use. A patent process is outlined in Figure 1-1 below, where the authors have added dates and typical interactions along a timeline with typical interactions comprising the patent prosecution phase.

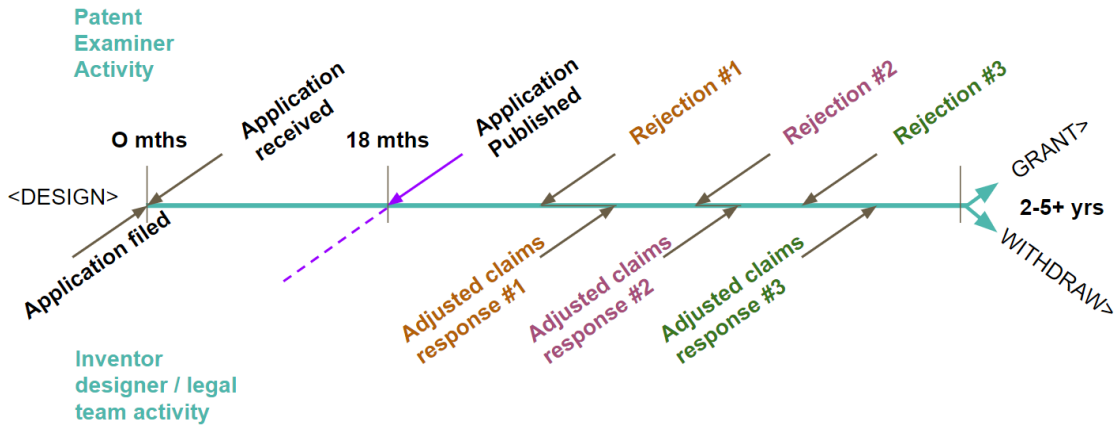

Figure 1-1. Patent Timeline - The Examination Process that Follows a Patent Application Filing

This research focused on SMEs with multiple stakeholders involved in their product development and the process by which the inventive information is considered, collected, improved, and codified for transfer to the patent agent or attorney. This research assumes a co-creation perspective where the generation of utility patent content can be the result of a team effort.

- The overall research was to determine whether a gap in the capture of information for patents disclosures involving multiple product development stakeholders exists in SMEs.
- The scope of this paper is to identify how designers, embedded within the SME product development team could facilitate improved patent content.

- It explores how insight generation techniques can be applied to empirical qualitative data and result in a framework to improve patent knowledge transfer within small teams.

2. LITERATURE REVIEW

Innovation happens deliberately more often than it does by inspiration (Petre, 2004).
Product development can create an abundance of initial concepts and narrow to a single commercialized product (Cross, 2011; Watters & Craib, 2017). There is a challenge in aligning patents with future products. Allison describes valuable patents as those that are successful at excluding competitors and provide substantial economic benefit to their owners (Allison et al., 2004) through patent claims that align with the marketable product (Wagner, 2009). Of particular importance for SMEs with a limited patent portfolio is the quality of the claims (Coughlin, 2007) following several years of prosecution during which many market and competitive changes may take place (Wagner, 2009). The disclosure should be written in anticipation of these changes to maintain competitive relevance (Wagner, 2009) and that a patent document's disclosure with only one state of the invention risks being too narrow, but a range of useful redundancy can ensure a diversity of content (Fromer, 2008) for usefulness over a decade or more (Parchomovsky & Wagner, 2005). If firms consider this challenge, they may realize that they already have diverse content available for inclusion into their disclosure from their product development process (Watters & Craib, 2017).

PRODUCT DEVELOPMENT TEAMS AND INFORMATION BOUNDARIES

Within the context of this research, it is the product development participants that are being studied as sources for useful contribution towards the improved patent information for the future. A seemingly simple task, the determination of who participated in the claimed inventive aspects of a new product, is not that simple (Murphy, 2012). The knowledge within a company exists within its people, it is not easily transmitted, but it is necessary to codify and replicate, as it creates the knowledge base for the company's competitive capabilities (Kogut & Zander, 1992). Manzini, in their longitudinal case study identifies five phases of the New Product Development process from which intellectual property must be considered differently because of boundaries between these stakeholder groups and the differences in the knowledge they hold; the internal product development group classifications included business development, industrial design, engineering, manufacturing, and commercialization (Manzini & Lazzarotti, 2015). An empirical study observing practices of 12 engineering companies involved with multidisciplinary teams with strong innovation track records indicates that innovation occurs at the boundaries between disciplines and from the transfer of information across boundaries (Petre, 2004). It is often in the zone of a conflict such as between technology and price or between design and engineering that the effort to resolve issues can lead to true innovation (Petre, 2004). Cross recognizes that innovative design can arise from conflicting stakeholder goals or requirements and that creativity seems to result when trying to resolve the conflict (Cross, 2011). Even the challenges with cross-discipline communication and interaction may be leveraged for insight or innovation.

CODIFICATION OF INFORMATION

Knowledge within a firm is one of its most important strategic assets and it resides within stakeholders as tacit knowledge until it is converted and made accessible to others (Civi, 2000). The firm's stakeholders, interacting according to the firm's organizing principles, generate profitable output from the firm's knowledge and capability function (Kogut & Zander, 1992). Identification and transmission of knowledge within the company is described as both a "barrier and information" and as "localized, embedded and invested" (Carlile, 2002). At the product development level, Manzini's case study research suggests that most product development information remains inaccessible in the early stages of development since it is not codified (Manzini & Lazzarotti, 2015). Codification is the conversion of knowledge to a level where it is usefully accessible and this is a challenge with multiple stakeholder groups, but it improves with face to face interaction (Cairó Battistutti & Bork, 2017; Civi, 2000) and knowledge engineers can assist in the conversion of mental models to a common language among participants (Cairó Battistutti & Bork, 2017).

3. METHODS AND PROCESSES

The literature into enhancing forward-looking patent content using extended stakeholders for the benefit of SME patent performance is limited. The researchers determined that a mixed methods research survey with both quantitative and qualitative data collection offers the option to triangulate data to develop "a more coherent justification for themes" (Creswell, 2014). The participant population inclusion criteria required industry experience in the development of products that have been patented and a minimum of 5 years of product development experience. Palinkas describes the wide use of purposeful sampling for qualitative research into information-rich cases to arrive at deep knowledge (Palinkas et al., 2015) with the participant sampling as non-probabilistic, it relied on accessing people known to the researchers and focused on product development professionals with a range of roles in product development with no prior awareness of this research.

QUESTIONNAIRE DESIGN AND QUALITATIVE CODIFICATION

The online questionnaire was composed of 40 multiple choice questions and 3 qualitative open-ended questions within 7 distinct sections of inquiry, each to solicit feedback about the main research question or its sub questions (Watters, 2018). This paper's focus is the inquiry into challenges with the acquisition of patent related information from development team stakeholders and ideas for improvement through the two open qualitative questions about accessing extended product development stakeholder knowledge and one about the involvement of product designers for this purpose. The researchers decided on categorizing key emergent themes using an inductive approach in accordance with the realist philosophical approach where inductive analysis includes grounded theory, discourse theory, and phenomenology (Thomas, 2006).

For the data codification approach, the participants' responses to each open-ended question were reviewed and each key concept was codified to form categories of similar concepts. These categories

were combined into fewer categories to reduce their number while still clearly reflecting the initial intent where Creswell describes this as an approach to codification of qualitative data from many participants (Creswell, 2014). Corbin and Strauss describe the process of identifying concepts when reviewing the data where some concepts about a common phenomenon may be grouped to form a category that is at a higher level and are more abstract than concepts but are formed using the same analytic process to highlight similarities and differences (Corbin & Strauss, 1990).

An affinity diagramming technique for insight generation was applied, which incorporated the categories resulting from the codified open-ended questions, in order to generate themes. Martin describes Affinity Diagramming as "the visible clustering of observations and insights into meaningful categories and relationships" (Martin & Hanington, 2018, p.3) that can result in tacit knowledge becoming visible for research synthesis (Martin & Hanington, 2018). The researchers identified that these affinity diagramming theme results could offer the opportunity for further insight generation (Corbin & Strauss, 1990; Thomas, 2006; Watters, 2018) from an additional insight generation method. The themes were considered with the lens of Kumar's Foresight Scenario method "for considering hypothetical futures based on emergent trends and then formulating alternative solutions designed to meet those possible situations" (Kumar, 2013. p.235). The affinity themes were arranged in a 2x2 grid and used to form associated corresponding foresight solution themes into a projected grid (Kumar, 2013).

4. RESULTS

Questionnaire responses were collected over 23-days from 38 qualified participants with the majority having over 16 years of experience. There were three open-ended questions about acquiring knowledge for patent disclosures; why extended stakeholders were not accessed for patent content (#47), how to access information from extended stakeholders (#49) and how to use industrial designers to improve stakeholder patent content (#50). The average length of response had between 20 to 22 words per participant for each question. There were between 1 and 5 ideas per response with an average of two. The data codification resulted in 6, 9, and 6 category headings for open-ended questions 47, 49 and 50, respectively (Watters, 2018). The categories arrived at through this inductive analysis process are seen on the left half of Figure 4-1 in typed font associated with their question numbers.

Following the use of an affinity insight technique, 4 themes emerged representing barriers to greater stakeholder participation as seen on the upper right of Figure 4-1; Lack of Resources, IP Complexity, IP Undervalued, and Inertia for Status Quo. The research indicates that a barrier to extended stakeholder involvement results from stakeholders' lack of understanding about the patent process generally. Participants expressed a need for stakeholders to further understand how the process works at the product development level. Another insight is that extended stakeholders want to be made aware of the role they could play and to be provided with a sense of the types of contributions they could be expected to make based on their field of knowledge. Suggested approaches to achieving this include

being provided with a simplified understanding of the process and relevant information, like Fromer's suggestion of simplifying patent disclosure (Fromer, 2008).

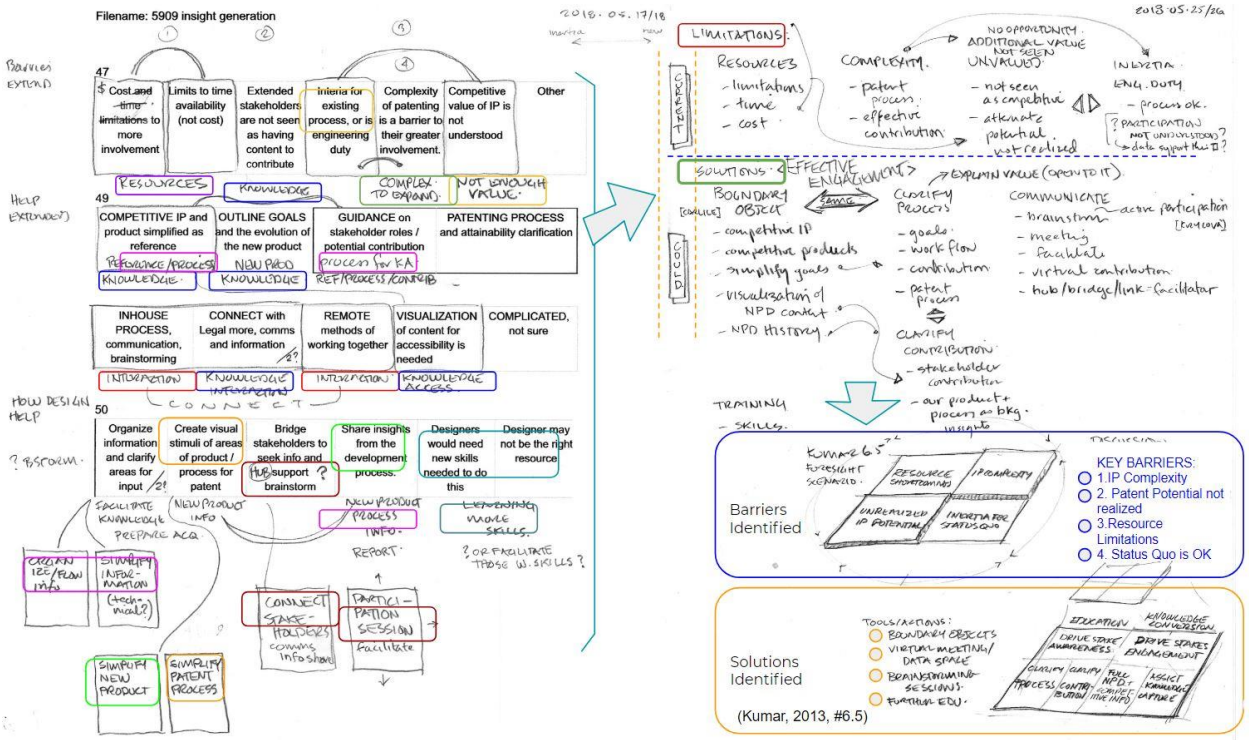

Figure 4-1. Insights Process – Affinity Technique (left and top right) and Foresight Scenario (bottom right)

The four barrier themes from the affinity technique were then further considered with Kumar's Foresight Scenario (Kumar, 2013) to gain insight on potential solutions to the identified barriers. On the lower right side of Figure 4-1, the Barriers Identified grid in the blue box was used to project a related foresight grid using a solution-oriented lens to consider and generate solution themes, seen in the orange box labelled Solutions Identified.

In Figure 4-2 a simplified visualization of the findings is shown as a framework for communication of the barriers to greater stakeholder involvement in patenting (left) and possible solutions for overcoming these barriers through guided engagement with extended stakeholder teams for improved patent content (right). There are two related but distinct solution themes resulting from the Foresight Scenario generation; a. 'Education and Orientation' of stakeholders to drive awareness about patenting and convey participation approaches that could happen prior to patenting, and b. 'Knowledge Conversion' involving engagement with stakeholders to refresh them on the development history, generate ideas, capture, and convert information for patent disclosure consideration.

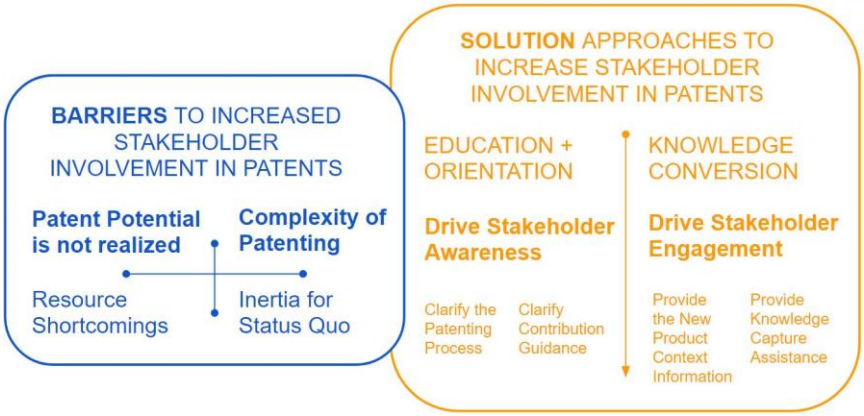

Figure 4-2. Simplified Visualization - Results from the Affinity Technique and Foresight Scenario

5. DISCUSSION

Participant support for a brainstorm session prior to patenting was significant in response to both the multiple-choice and open-ended questions. The term Patent-Storming was developed by the researchers, through combining the idea of Brainstorming for content on improved Patents, into a single term. This activity can both recapture ideas from the development process and generate new relevant content just prior to patenting. Participants indicated strong support for 'designers' as patent disclosure facilitators as well as for 'legal' and 'entrepreneur/inventor'. The data also shows that compared to other stakeholders, designers often have the longest involvement through a product development cycle. This exposes the designer to valuable information about the full development decision path taken and provides an awareness of goals and concepts that were not selected for commercialization but that may have relevance over the duration of the patent timeframe. Designers were identified as having a strong role in affecting cost/quality and as being very connected to the range of interdisciplinary stakeholders (Watters, Field & Rod, 2020). These are useful attributes for facilitating improved patent content.

In consideration of the barriers identified by the research participants, the insights into ways to overcome the barriers, the identified pre-patent filing activities may be realized through the engagement of designers. The nature of any specific training for designers in this role should be considered in future research. More immediately, design education could further consider adjustments to current design pedagogy to increase designer's understanding of effective patent disclosures and approaches for using design skills in the acquisition of knowledge within interdisciplinary teams. Also identified in this research is a complimentary working synergy between designers and legal. SMEs' legal representation is often engaged at the end of the development process and lacks an overall understanding of the development scope and has no connection with the extended stakeholders.

The updated patent process map in Figure 5-1 incorporates the research findings within the timeframe prior to filing the patent application. The Education and Orientation quadrant indicates detailed steps that could orient the extended stakeholder team to the internal patenting process. The Knowledge

Conversion quadrant outlines detailed interdisciplinary activities to assist with the acquisition of relevant patent information from the extended stakeholders.

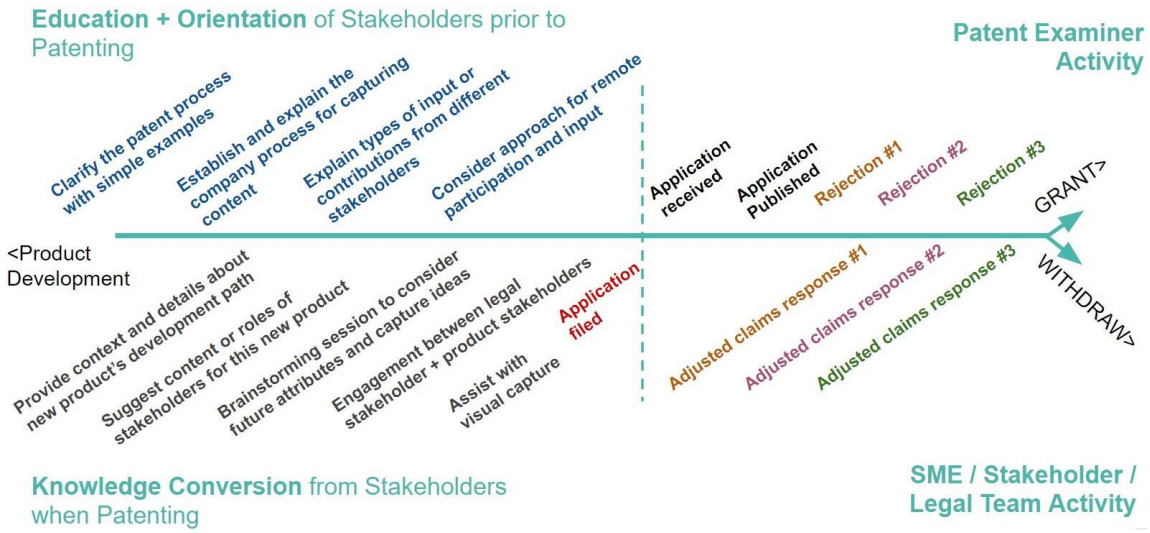

Figure 5-1. Pre-Patent Actions - Research Informed Update to Patenting Timeline

6. CONCLUSION

For this empirical research, a mixed method questionnaire was completed by 38 North America-wide experts with product development and utility patent experience. They are stakeholders to the product development process, and they included design, engineering, marketing/sales, upper management/CEOs, legal, and entrepreneur/inventors. They provided quantitative and qualitative data about product development teams, the creation of patent content, insights into the barriers and opportunities related to increased stakeholder engagement for more competitive patent content. This data was analyzed and insight generation techniques were applied to the codified data. The findings of this research indicate that the content of SME patents can be improved through better use of extended stakeholder knowledge. Access to this information is not simple but augmented effort by the designer and increased participation by legal could result in an improvement to the future competitiveness of SMEs' patents. The research participants indicate that designers have capabilities that could facilitate stakeholder contribution. These include the ability to simplify information, acquire necessary knowledge, educate stakeholders and to communicate well with multiple stakeholders. Important strategic business value could result from the design profession's further consideration of the designer in an enhanced role for the creation of content and the capture of information embedded within interdisciplinary product development teams for more valuable and future-effective patents.

REFERENCES

Allison, J. R., Lemley, M. A., Moore, K. A., & Trunkey, R. D. (2004). Valuable patents. Georgetown Law Journal, 92(3), 435–479. https://doi.org/10.2139/ssrn.426020

Burrone, E. (2005). Intellectual Property Rights and Innovation in SMEs in OECD Countries. Journal of Intellectual Property Rights, 10, 34–43.

Cairó Battistutti, O., & Bork, D. (2017). Tacit to explicit knowledge conversion. Cognitive Processing, 18(4), 461–477. https://doi.org/10.1007/s10339-017-0825-6

Carlile, P. R. (2002). A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development. Organization Science, 13(4), 442–455. https://doi.org/10.1287/orsc.13.4.442.2953

Civi, E. (2000). Knowledge management as a competitive asset: A review marketing intelligence and planning. Journal of Knowledge Management, 18(4), 166 – 174.

Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. Qualitative Sociology, 13(1), 3–21. https://doi.org/10.1007/BF00988593

Coughlin, S. M. (2007). Is the Patent Paradox a Result of a Large Firm Perspective? Differential Value of Small Firm Patents Over Time Explains the Patent Paradox. Santa Clara High Tech Law Journal, 23(2). https://digitalcommons.law.scu.edu/chtlj/vol23/iss2/5/

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches. Sage Publications, Inc. : Thousand Oaks, CA.

Cross, N. (2011). Design thinking: Understanding how designers think and work. New York, NY: Bloomsbury Academic.

Fromer, J. C. (2008). Patent Disclosure. Iowa Law Review, 94, 539–606.

Kogut, B., & Zander, U. (1992). Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. Organization Science, 3, 383–397. https://pubsonline.informs.org/doi/abs/10.1287/orsc.3.3.383

Kumar, V. (2013). 101 design methods: a structured approach for driving innovation in your organization. Hoboken, NJ: John Wiley & Sons, Inc.

Manzini, R., & Lazzarotti, V. (2015). Intellectual property protection mechanisms in collaborative new product development. R&D Management, in press, 1–17. https://doi.org/10.1111/radm.12126

Martin, B., & Hanington, B. (2018). The Pocket Universal Methods of Design. Beverly, MA: Quarto Publishing Group.

Murphy, S. L. (2012). Determining Patent Inventorship: A Practical Approach. North Carolina Journal of Law & Technology, 13(2), 215–246.

Nikzad, R. (2015). Small and medium-sized enterprises, intellectual property, and public policy. Science and Public Policy, 42(2), 176–187. https://doi.org/10.1093/scipol/scu038

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. Administration and Policy in Mental Health and Mental Health Services Research, 42(5), 533–544. https://doi.org/10.1007/s10488-013-0528-y

Parchomovsky, G., & Wagner, R. P. (2005). Patent Portfolios. University of Pennsylvania Law Review, 154(1), 1–77. https://doi.org/10.2307/25047582

Petre, M. (2004). How expert engineering teams use disciplines of innovation. Design Studies, 25(5), 477–493. https://doi.org/10.1016/j.destud.2004.05.003

Pisano, G. P., & Teece, D. J. (2007). How to Capture Value from Innovation: Shaping Intellectual Property and Industry Architecture. California Management Review, 50(1), 278–296.

Thomas, D. R. (2006). A General Inductive Approach for Analyzing Qualitative Evaluation Data. American Journal of Evaluation, 27(2), 237–246. https://doi.org/10.1177/1098214005283748

Wagner, R. P. (2009). Understanding Patent-Quality Mechanisms. University of Pennsylvania Law Review, 157(6), 2135–2173.

Watters, R., & Craib, D. (2017). Protecting Design: Leveraging Design for Robust Content and Knowledge Transfer into Patents (pp. 349–357). Springer International Publishing. https://doi.org/10.1007/978-3-319-42070-7_32

Watters, R. D. (2018). Improving Utility Patent Value by Design: Future Business Competitiveness Through Multi-Stakeholder Engagement for Patent Content Creation. Ottawa, Canada: Carleton University. https://doi.org/10.22215/etd/2018-13271

Watters, R., Field, S., & Rod, M (2020). Leveraging Product Development Teams: The Use Of Future Oriented Patent Attributes. Industrial Designers Society of America. https://www.idsa.org/educationpaper/leveraging-product-development-teams

WIPO Patent Drafting Manual. (2007). World Intellectual Property Organization. http://www.wipo.int/edocs/pubdocs/en/patents/867/wipo_pub_867.pdf