CONTEXTUALIZED INTELLECTUAL PROPERTY MANAGEMENT IN CO-CREATION: A CONFIGURATIONAL APPROACH TO STRATEGY DEVELOPMENT

Doctoral Thesis

by

ANJA TEKIC

DOCTORAL PROGRAM IN ENGINEERING SYSTEMS

Supervisor
Professor Kelvin Willoughby

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Abstract

Intellectual property (IP) has become enormously important in the knowledge-based, innovation-driven economy of the 21st century. However, the recent trend towards open innovation, in which innovative companies draw upon the activities of multiple external actors to augment or support corporate innovation projects, has made the management of IP in such projects more complex and challenging.

The research that forms the basis of this PhD thesis is focused on IP management in a specific manifestation of open innovation, namely *co-creation*, defined for the purpose of the research as collaborative innovation initiated by a company, involving individual external contributors or co-creators—such as customers, students, experts or innovation enthusiasts—who may provide valuable input to the company's innovation projects. Co-creation requires the contribution of information, knowledge and IP from both the company's and the co-creators' side, and it involves the generation of new intellectual assets and associated IP rights. Thus, co-creation is almost inevitably followed by challenges related to IP protection and ownership.

The need for harmonizing control and openness of the IP in collaborative innovation, exacerbated by the tension between dynamic innovation activities and conventional static methods of IP protection, pushes companies to cultivate new IP management strategies that facilitate rather than obstruct involvement of multiple external actors into corporate innovation. Additionally, given that a 'one-size-fits-all' approach to IP management in collaborative innovation is not viable, companies need to adapt their IP management strategies to the specificities of particular projects.

Arguing that companies need to customize their IP management strategies to fit the distinctive characteristics of particular co-creation projects, by artfully harmonizing IP control and openness, this PhD research draws upon ideas from both *contingency*

theory and *configurational theory*. Thus, the overall objective of this PhD research is to develop the concept of *contextualized IP management in co-creation* and, on that basis, to address the main research question of the thesis, which is, *what are best practices for configuring IP management strategies across a variety of co-creation contexts determined by the specific characteristics of a company's projects of collaborative innovation with individual external contributors?*

This research adopted an *inductive exploratory empirical* approach, commencing with specific real-world observations and in-depth insights drawn from a variety of cases, with the aim of generating broad generalizations and theories. Bearing in mind that academic literature on the topic of IP management in co-creation is still embryonic, the research strategy relied on the interplay of theory and practice. Accordingly, the research process comprised three broad stages, namely, a *critical literature review*, a *preliminary empirical study* and the *main empirical study*.

By providing insights about how IP management strategies may be customized to fit specific co-creation contexts, this PhD thesis makes several *contributions to research* on co-creation and open innovation in general. First, to ensure the robust basis for the empirical research on IP management in co-creation, this thesis contributes to more comprehensive conceptualization of co-creation by providing a more rigorous definition of this concept, thereby differentiating it from a broader concept of open innovation. Further, this thesis includes the first systemic empirical work focused on best practices in configuring IP management strategies across a variety of co-creation contexts. As such, it contributes to the extant research by identifying the context-dependent character of IP management strategies in co-creation, while emphasizing the value of configurational approaches to strategy development. Additionally, the concept of contextualized IP management in co-creation makes significant managerial implications by offering unique guidelines to co-creation practitioners seeking to develop effective IP management strategies in co-creation.

Publications

- Tekic, A., & Willoughby, K. W. (2019). Configuring intellectual property management strategies in co-creation: A contextual perspective. **Innovation: Organization & Management** (Article in Press). https://doi.org/10.1080/14479338.2019.1585189

- Tekic, A., & Willoughby, K. (2018). Co-creation – child, sibling or adopted cousin of open innovation? **Innovation: Organization & Management**, 21(2), 274–297. https://doi.org/10.1080/14479338.2018.1530565

- Tekic, A., & Willoughby, K. W. (2017). Contextualised co-creation: innovating with individual external contributors throughout the product life cycle. **International Journal of Product Development**, 22(3), 230–245. https://doi.org/10.1504/IJPD.2017.087380

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Definitions

Innovation is an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention (OECD, 1991). This iterative process results in a variety of different innovation types, typically called “radical innovations” for products at the early stages of the product life cycle and “incremental innovations” at the advanced stages of the product life cycle. Innovations do not occur just during the development phases but also may occur during the diffusion process in which a product or process may undergo continual improvements and upgrades (Garcia & Calantone, 2002).

Innovation management encompasses all the activities necessary for the introduction of new products and services into the market, particularly on the basis of new knowledge. It is a cross-functional task, because innovation, as a fundamental driver of competitiveness, affects all departments of a company: from R&D, over production, to marketing. Furthermore, innovation management reaches out to the company’s external environment, to the network of different players – users, customers, suppliers or cooperation partners (Bullinger, 2008).

Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Created by the transformation of companies’ closed boundaries into semi-permeable membranes, this openness enables innovation to move easily between the external and internal environment, involving a diverse array of participants in innovation projects (Chesbrough, 2003).

Co-creation is a form of collaborative innovation initiated by a company, involving individual external contributors or co-creators—not just users and customers, but also field experts, students or amateur innovation enthusiasts—who may provide valuable input to the company's innovation projects (Tekic & Willoughby, 2018). As such, co-creation is distinguished from the broader concept of open innovation.

Intellectual property refers here to the range of intangible materials and intellectual results of co-creation projects that are eligible for IP protection (e.g., novel and non-obvious technical ideas, new product designs, original text, original graphics, or classified business information, and even some types of business or product ideas). Some intangible assets (e.g., technical ideas that are not novel, or "secrets" that neither pertain to commerce nor are actually secret) may not accrue legal IP rights, as such, and hence are not included as part of what is labeled here as "intellectual property." Thus, in this PhD research the term "intellectual property" is not used as a synonym for "intangible assets" in general, but for a narrower sub-category of intangible assets (Tekic & Willoughby, 2019).

Intellectual property management is a sophisticated discipline of designing and implementing strategies for managing intellectual property along the entire innovation process, or life cycle of a product. Going beyond technical domains and legal practices of intellectual property rights protection and enforcement, it has become a company's critical capability to achieve and sustain a competitive advantage (Ernst, 2017).

Chapter 1

Introduction

This introductory chapter describes the research problem, overall objectives, research questions and research strategy of this PhD thesis, and ends by outlining the structure of the thesis.

1.1 Research problem

Intellectual property (IP) has become enormously important in the knowledge-based, innovation-driven economy of the 21st century. As corporate value worldwide is increasingly derived from intangible assets, a great share of which is accounted for by IP, companies accordingly tend to rely upon IP rights to protect and extract value from their innovations (Candelin-Palmqvist, Sandberg, & Mylly, 2012). However, the recent trend towards open innovation, in which innovative companies draw upon the activities of multiple external actors to augment or support corporate product innovation projects, has made the management of IP in such projects more complex and challenging (Bogers, 2011; Bonabeau, 2009; Chesbrough, 2003; Huizingh, 2011; Lakhani & Panetta, 2007).

This PhD research is focused on IP management in a specific manifestation of open innovation, namely *co-creation*, defined by Tekic and Willoughby (2018) for the purpose of this research as *collaborative innovation initiated by a company, involving individual external contributors or co-creators—such as customers, students, researchers, specialized experts or innovation enthusiasts—who may provide*

valuable input to the company's innovation projects. Co-creation is seen as a powerful engine for innovation (Brown & Hagel III, 2005). It requires the contribution of information, knowledge and IP from both the company's side and the co-creators' side, and it involves the generation of new intellectual assets and associated IP rights, for example, patents, copyright, design rights or trade secrets, or even trademarks. Thus, co-creation is almost inevitably followed by challenges related to IP protection and ownership (Antorini & Muñiz Jr., 2013; Boudreau & Lakhani, 2013; Greer & Lei, 2012; Hienerth, Keinz, & Lettl, 2011).

The main problem of this PhD research is located at the intersection of the areas of co-creation and IP management, and is characterized by four sets of limitations of the existing published research:

- *Weak conceptualization of co-creation*
  - in the innovation management literature there are multiple concepts that describe similar collaborative innovation practices, such as open innovation, co-creation, crowdsourcing, user innovation, community-based innovation, co-development, co-innovation or mass customization, creating a conceptual mess in the whole research area (see Section 2.1);
  - there is a need of a clear definition and conceptualization of co-creation (see Section 2.2), to allow building a basis for future research in this area;
- *Scarce research on IP management strategies in co-creation*
  - even though the challenges of managing IP in co-creation projects are widely recognized in the literature, especially when related to the outcomes of such projects, empirical research focused on alternative IP management strategies that companies adopt to face these challenges is still sparse;

- insights about best practices in managing IP related to co-creation outcomes have been missing from the innovation management literature (see Section 2.3);

- *Limited consideration of contextual perspective on IP management strategies in co-creation*
  - the literature emphasizes that a "one-size-fits-all" approach to IP management in co-creation is not viable, and that companies need to adapt their IP management strategies to the specificities of particular co-creation contexts;
  - however, comprehensive studies that take various contexts into account when discussing IP management in co-creation are very limited, leaving the issue of the contextual dependence of IP management still largely unexplored in the co-creation literature;
  - researchers in the field to date have limited their attention to a specific co-creation context of interest, excluding other co-creation contexts from the scope of the research (see Section 2.3);
- *No consideration of configurational perspective on IP management strategies in co-creation*
  - the literature calls for novel IP management strategies that effectively harmonize IP control and openness of collaborative innovation;
  - IP management strategies in co-creation that are too permissive lead to difficulties in IP management, such as troublesome IP protection and difficulties in appropriating benefits from innovation; conversely, IP management strategies that are too restrictive have the potential of obstructing or even killing co-creation, by demotivating external actors

from contributing their ideas and solutions due to their perception of being treated unfairly with regards to IP;

- however, even though the literature considers a variety of dimensions that may be used as building-blocks of IP management strategies, the value of the configurational perspective on the development of these strategies has not yet been taken into account for harmonizing control and openness of the IP in co-creation (see Section 2.3).

Seeing co-creation as a company-centric approach to collaborative innovation, in this PhD research "IP management" is concerned with the means that initiating companies employ to protect co-creation outcomes and with the manner in which they arrange ownership and user rights of those outcomes. In this sense, issues emanating from the configuration of IP management strategies to correspond to various co-creation contexts evoke the need for more profound research that would contribute to extant research on this topic, while guiding practitioners how to deal with the emerging challenges of IP management in collaborative innovation with individual external contributors.

1.2 Overall objective and research questions

Arguing that companies need to customize their IP management strategies to match the specific characteristics of particular co-creation projects, by artfully harmonizing IP control and openness, this PhD research integrates contextual and configurational perspectives on IP management strategies in co-creation. In this sense, it is expected that for each co-creation project there needs to be an IP management strategy that is purposefully configured to fit its context, which is internal to the

project. This internal context is engendered by the co-creation project's characteristics and is distinct from the external contexts of the project, such as industry, company size, etc. The external contexts of the project lie outside the scope of this PhD research.

The *overall objective* of this PhD research is to develop the concept of contextualized IP management in co-creation—i.e. collaborative innovation between a company and individual external contributors, such as users, customers, students, researchers, experts or innovation enthusiasts—based on the in-depth exploration of best practices in configuring IP management strategies across a variety of co-creation contexts.

To achieve this overall objective, the PhD research is guided by the following research questions:

- *Main research question:*
  - What are best practices for configuring IP management strategies across a variety of co-creation contexts determined by the specific characteristics of a company's projects of collaborative innovation with individual external contributors?
- *Supporting research questions:*
  - What elements of the co-creation context influence decisions about the adoption of an IP management strategy?
  - What elements are taken into account when configuring an IP management strategy?
  - What IP management strategies are most frequently adopted in distinctive co-creation contexts?

The theoretical dimension of this PhD research is expressed through exploration of the concepts of context-sensitive strategy and configuration-sensitive strategy, and the relationships between these two concepts. Considering that the resulting knowledge about best practices based on the "objective-means" relationship may be applied in practice to support managerial decision-making processes, this research also has a strong pragmatic character, typically associated with applied science research. Finally, complementary to its theoretical and pragmatic dimensions, the research is also heavily descriptive in character. The descriptive dimensions of the research help to elaborate and illuminate the connections between key theoretical concepts and typical practices related to IP management in co-creation.

1.3 Theoretical background

With the aim of developing the concept of contextualized IP management in co-creation on the basis of best practices for configuring IP management strategies across a variety of co-creation contexts, this research draws upon ideas from contingency theory and configurational theory.

On one hand, *contingency theory* suggests that best practices should be investigated within a specific context (Drazin & Van de Ven, 1985; Miller, 1981; Tidd, 2001), while on the other hand, *configurational theory* suggests that best practices should be based on a combination of multiple elements, rather than on a single element (Dess, Newport, & Rasheed, 1993; Meyer, Tsui, & Hinings, 1993; Miller, 1996). In this sense—taking into account the relationships between the co-creation context, IP management strategies and co-creation project performance—best

practices are determined, for the purpose of this research, as the *most effective configurations of IP management strategies that fit a specific context*.

1.3.1 Contingency theory

Contingency theory assumes that a strategy must fit its context to be effective (Drazin & Van de Ven, 1985; Miller, 1981). There is no universal "one size fits all" strategy that is equally effective in all circumstances (Burns & Stalker, 1961; Lawrence & Lorsch, 1967; Thompson, 1967). For every given context, there is an ideal strategy or set of strategies that fit better than others. The better the fit between the contextual factors and strategy design, the higher the performance (Drazin & Van de Ven, 1985; Tidd, 2001).

In this sense, this PhD research is built on an assumption that there is no universally effective IP management strategy for all co-creation contexts. Not all co-creation projects are the same; their internal characteristics engender the variety of contexts that may affect the way companies manage IP in co-creation. It is expected that for each co-creation project there needs to be an IP management strategy that is purposefully customized to fit its context, which is internal to the project. Thus, to maximize performance an IP management strategy should be adapted to fit the given co-creation context in which it is embedded.

Following the systems approach to contingency theory (Drazin & Van de Ven, 1985), this PhD research aims to explore the effect of IP management strategy design (an independent variable) on co-creation project performance (a dependent variable) as contingent on co-creation context (a contingency variable). By addressing simultaneously multiple elements of co-creation context, IP management alternatives

and performance criteria, the systems approach adopted in this research supports the holistic perspective on context-dependence of IP management strategies in co-creation. In this way, this PhD research responds to a call for studies on complex contingencies, which develop taxonomies that differentiate among a variety of contexts and that systematically consider relationships among variables within each context (Miller, 1981). By categorizing multiple co-creation projects based on their contextual characteristics into homogeneous types, it is possible to avoid unwarranted sample-wide generalizations and to identify the variety in relationships among the variables across the sub-samples.

However, even though contingencies provide a categorization scheme for exploring complex relationships among multiple variables, but they do not determine best practices (Tidd, 2001). To identify what IP management strategies represent an optimal fit for specific co-creation contexts, it is necessary to identify configurational elements of a strategy and investigate how they are combined and aligned among themselves. In this sense, as an extension of the contingency theory, configurational theory provides the grounds for establishing the further assumptions of this research.

1.3.2 Configurational theory

Configurational theory suggests that a strategy is a multidimensional construct, based on a combination of number of specific elements that are more meaningful collectively than individually (Dess et al., 1993; Meyer et al., 1993; Miller, 1996). Determining strategies as complex archetypes, this theory focuses on establishing optimal configurations of interconnected and mutually reinforcing elements that provide superior performance in a given context (Ketchen, Thomas, &

Snow, 1993; Miller, 1996; Tidd, 2001).

Following the main premises of configurational theory, an optimal IP management strategy represents a configuration of multiple elements that are aligned both internally and externally to the given co-creation context. By manipulating these elements, project managers may customize their IP management strategies to fit the specific co-creation projects and maximize project performance. As such, elements of IP management strategies are considered endogenous variables that are determined by the set of exogenous context variables.

Even though the configurational theory has played a significant role in organization theory and management research since late 1960s, it is expected that the studies of configuration still need to live up to their promise (Fiss, 2007).

As Misangyi et al. (2016) discuss in their *Journal of Management* article "Embracing Causal Complexity: The Emergence of a Neo-Configurational Perspective", early configurational research (e.g. Dess et al., 1993; Doty et al., 1993; Ketchen et al., 1993; Meyer et al., 1993; Miller, 1996; Shortell, 1977) was focused on investigating the relationships among the context, structure and performance, thereby building on the systems approach to contingency theory. By relying primarily on conventional correlation-based techniques to analyze configurations and relate them to performance, this research was shaped by the unifinal, additive and symmetrical causality (Fiss, 2007). On the other hand, the more recent configurational research (e.g. Fiss, 2011; Hofman et al., 2017; Juntunen et al., 2019; Misangyi and Acharya, 2014; Torugsa and Arundel, 2017) has explicitly embraced causal complexity, determined by multiple conjunctural causation, causal equifinality and causal asymmetry (Fiss, 2007; Gresov & Drazin, 1997). This research has built on the

intellectual basis of the early configurational research, but has its ontological and epistemological foundation in Qualitative Comparative Analysis (QCA), introduced by Charles Ragin in 1987 (Greckhamer, Furnari, Fiss, & Aguilera, 2018). As a set-analytic approach, QCA is able to fully capture causal complexity. As such, by addressing the incongruity between configurational theory and methods employed, QCA has led to the emergence of "neo-configurational" perspective in management studies (Greckhamer et al., 2018; Misangyi et al., 2016).

In aiming to identify best practices in configuring IP management strategies across a variety of co-creation contexts, by analyzing different configurations and their relation to co-creation project performance within specific contexts, this research explicitly assumes causal complexity, determined by multiple conjunctural causation, causal equifinality and causal asymmetry of configurational elements of an IP management strategy in co-creation.

The *multiple conjunctural causation* means that causal conditions must often combine in order to generate qualitative change and thus cannot be treated in isolation from one another (Fiss, 2007, 2011). This implies that the effect of a single configurational element of an IP management strategy may unfold only in combination with other elements.

The configurational perspective also assumes equifinality as another form of causal complexity. *Causal equifinality* means that different combinations of causal conditions may be related to the same outcome, implying their mutual non-exclusivity, even if the contingencies are the same (Fiss, 2007; Gresov & Drazin, 1997). This implies that within the same co-creation context there is a variety of configurations of

IP management strategies that may be related to the equal result regarding co-creation project performance, providing a strategic choice to project managers.

Finally, the configurational perspective additionally assumes causal asymmetry, in contrast to the common correlational understanding of causality, in which causal symmetry is implied. *Causal asymmetry* indicates that conditions related to the presence of an outcome of interest may be quite different from those related to the absence of the outcome (Fiss, 2007, 2011). The presence of a set and its absence denote two qualitatively different phenomena. This feature of the configurational perspective may enable us to identify which configurations of IP management strategies are related to high and which configurations are related to low co-creation project performance, and based on their comparison identify best practices in configuring IP management strategies across a variety of co-creation contexts.

1.4 Research strategy

This PhD research is based on an *inductive exploratory empirical research* approach, starting from specific real-world observations and in-depth insight into a variety of cases with the aim of generating broader generalizations and theories.

Taking into account that the academic literature on the topic of IP management in co-creation is still embryonic, the research strategy is built on the interplay of theory and practice. Thus, with the aim to generate new knowledge about IP management in co-creation, an interactive research process is conducted, comprising three broad stages of: the critical literature review, the preliminary empirical research study, and the main empirical research study (Figure 1.1).

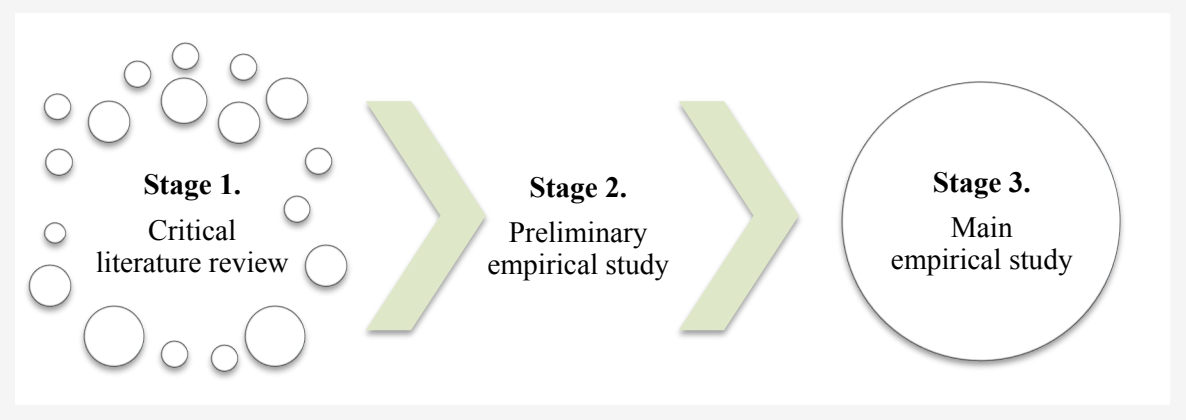

Figure 1.1 Three-stage research process

1.4.1 Critical literature review

The *first stage*, the critical review of the extant innovation management literature, generated an integrative and comprehensive overview of state-of-the-art research on co-creation and related IP management topics, as well as a perspective on the conceptualization of core constructs in the study. This facilitated construing of the conceptual mess within the innovation management literature related to this field.

The main results of the critical literature review are twofold. On one hand, this review produced important insights with regards to delineating between the concept of co-creation and other concepts related to collaborative innovation between companies and individual external contributors, based on which the definition of co-creation and its taxonomy are proposed. On the other hand, the review supported the gathering of scattered empirical insights about IP management in co-creation, especially with regards to managerial challenges and adopted strategies.

1.4.2 Preliminary empirical study

In the *second stage*, the insights from the extensive review of the extant innovation management literature were used in the development of the research framework on the grounds of the conceptual synthesis of the contextual and configurational perspectives on the IP management in co-creation.

Taking into account the paucity of developed theory in the literature about IP management in collaborative innovation between companies and individual external contributors, the preliminary empirical study was conducted by the means of exploratory qualitative research. Following an inductive approach to theory building, evidence about IP management in co-creation collected from multiple cases was analyzed with the aim of identifying what IP management strategies companies actually adopt in distinctive co-creation contexts and how those IP management strategies differ across the co-creation contexts. In this way, the preliminary empirical study served as a test of robustness of the conceptual research framework developed on the basis of the literature review. It supported identification of existing patterns and formulation of tentative propositions to create a more solid foundation for the main empirical study.

1.4.3 Main empirical study

The practical insights from the preliminary empirical research supported the revision of the conceptual research framework, leading to the development of a robust, integrated research framework that guided the main empirical research study in the *third stage* of this PhD research.

By building on the middle ground between quantitative research that is often portrayed as "scientific and broad, but shallow, sterile and oppressive," and qualitative research that is often described as "rich, deep and emancipatory, but narrow and journalistic" (Ragin, 1998), the main empirical study aims to capture case complexity, while still achieving significant level of generalization. Thus, to combine the strengths of the quantitative and qualitative research approaches, Qualitative Comparative Analysis (QCA) was adopted in addressing research questions in this PhD research, with the purpose of formulating new segments of theory through analytic induction (Marx, Rihoux, & Ragin, 2014; Rihoux & Marx, 2013),

QCA was introduced in 1987 by Charles C. Ragin, building on the comparative tradition in social sciences initiated by the work of John Stuart Mill and further elaborated by leading sociologists and political scientists (Marx et al., 2014). Since 2002 application of QCA has increased dramatically, especially in management studies (Rihoux, Alamos, Bol, Marx, & Rezsohazy, 2013; Rihoux & Marx, 2013).

QCA is a comparative case-oriented approach grounded in set theory and Boolean algebra, supporting researchers to deal with complex cause-effect relationships (Marx et al., 2014). It allows cases to be understood as configurations of different interconnected elements, while their comparison provides the basis for constructing causal arguments (Fiss, 2011; Fiss, Marx, & Cambre, 2013; Ragin, 1998). By simplifying the complex causal relationships into ideal types, each of which represents a unique combination of the configurational elements that are believed to jointly and synergistically determine the relevant outcomes, QCA may generate new insights for research and result in integrative theories (Fiss, 2007, 2011).

In this sense, the main empirical study aims to identify best practices in configuring IP management strategies across a variety of co-creation contexts, by analyzing different configurations and their relation to co-creation project performance. Aiming to build the theory upon the main premises of both contingency theory and configurational theory, such an objective assumes multiple conjunctural causation, causal equifinality and causal asymmetry of multiple configurational elements of IP management strategies (Fiss, 2011; Gresov & Drazin, 1997; Rihoux, 2006; Schneider & Wagemann, 2012), while emphasizing the importance of contingency effects of the co-creation context. By providing a categorization scheme for investigation of causality patterns between specific configurations (i.e., an independent variable) and the outcome of interest (i.e., a dependent variable), contingency is a crucial element in theory development (Christensen, 2006).

1.5 Structure of the thesis

The remainder of the PhD thesis is structured in the following manner:

- **Chapter 2 – Critical literature review** provides an integrative and comprehensive overview of the state-of-the-art research on the topics of co-creation and IP management, offering a novel perspective on the relevant constructs;
- **Chapter 3 – Preliminary empirical study** discusses the conceptual research framework, data collection and data analysis procedures, as well as the results of the exploratory qualitative research, conducted to test the robustness of the developed framework for the main empirical study;

- **Chapter 4 – Main empirical study** offers the details about the revised integrative research framework, data collection and data analysis procedures, as well as the results of the Qualitative Comparative Analysis, conducted to fulfill the main goal of this PhD research, i.e., to support the development of the concept of contextualized IP management in co-creation;
- **Chapter 5 – Conclusion and critical discussion** focuses on the theoretical contributions of this PhD research, its limitations and potential future research directions, as well as managerial implications, closing with the final thoughts about the overall research project.

Chapter 2

Critical literature review

Based on the critical review of the extant innovation management literature[1], this chapter offers a novel perspective on co-creation and related IP management constructs, by integrating the insights from the state-of-the-art research on the topics relevant for this PhD research.

2.1 Collaborative innovation with individual external contributors

Academic literature in the field of innovation management has undergone a series of paradigm shifts during the last half-century, from an early emphasis on technology-push thinking through to market-pull thinking, and eventually to the so-called "sixth generation" model of innovation management, emphasizing total

[1] The results of the critical literature review are presented in:

Tekic, A., & Willoughby, K. W. (2017). Construing the conceptual mess around co-creation: innovation management perspective. Presented at the *24th Innovation and Product Development Management Conference (IPDMC)*, Reykjavik, Iceland.

Tekic, A., & Willoughby, K. W. (2017). Contextualised co-creation: innovating with individual external contributors throughout the product life cycle. *International Journal of Product Development*, 22(3), 230–245. http://doi.org/10.1504/IJPD.2017.087380

Tekic, A., & Willoughby, K. W. (2018). Co-creation – child, sibling or adopted cousin of open innovation? *Innovation: Organization & Management*, 21(2). http://doi.org/10.1080/14479338.2018.1530565

Tekic, A., & Willoughby, K. W. (2019). Configuring intellectual property management strategies in co-creation: A contextual perspective. *Innovation: Organization & Management*, (Article in Press). http://doi.org/10.1080/14479338.2019.1585189

innovation systems and innovation networks, as well as knowledge generation, knowledge management and learning (Roberts & Chaminade, 2002).

The "do-it-yourself" mindset of closed innovation that dominated in the R&D of big companies for most of the 20th century receded as a feature of corporate strategy in most industries. Challenged by environmental uncertainty and the complexities of innovation, in recent decades managers awakened to the fact that their companies' innovation projects should not draw solely on internal resources and competences but also on the contributions of a wide range of external players who may accelerate innovation (Bahemia & Squire, 2010; Brown & Hagel III, 2005). They have become mindful that to accelerate innovation they need to tap into both internal and external sources of knowledge (Huff, Moeslein, & Reichwald, 2013). Empirical research has been published showing that technology companies emphasizing open approaches rather than closed approaches to innovation typically demonstrate superior business performance (Willoughby, 2004). The locus of innovation has shifted from internal R&D laboratories to various networks of start-ups, universities, research consortiums, customers, and other external organizations or individuals. This openness, created by the transformation of companies' closed boundaries into semi-permeable membranes, enables innovation to move easily between the external and internal environment, involving a diverse array of participants in innovation projects. The set of phenomena that constitute this trend is usually labeled, in general, as "open innovation" (Chesbrough, 2003).

This general trend towards open innovation has led to recognition that there may be much value in companies collaboratively innovating with individual external contributors—such as consumers, students, researchers, independent experts or

innovation enthusiasts—who are willing to join collaborative innovation projects and who can provide valuable input for innovation, with the result that product offerings may be taken in unexpected directions that serve a much broader range of needs in the market (Brown & Hagel III, 2005). This kind of collaborative innovation practice is not a novel concept. There are many historical examples that show that individuals represent a promising source of innovation. For example, in 1714 the British Parliament established the Longitude Prize, searching for a way to determine longitude at sea, after great scientists failed to come up with a solution. The best solution—a highly accurate chronometer—came from John Harrison, a carpenter and clockmaker from the English countryside (Boudreau & Lakhani, 2013). Another famous example dates from 1869, when Emperor Napoleon III invited people to produce a butter substitute for the armed forces and lower classes, as France was experiencing butter deficiency. The solution came from Hippolyte Mège-Mouriès, a French chemist, who invented margarine in response to this challenge (Rupp, 2014). Nevertheless, involvement of individual external contributors in development of new or improved products and services has intensified among companies only recently, in the last two decades, as the world has become more networked with the development of the Internet and information technologies, allowing them to cultivate the potential of the innovation culture and participatory society.

This kind of collaborative innovation between companies and individual external contributors is typically known as "co-creation" (Piller & West, 2014; Prahalad & Ramaswamy, 2004). Unfortunately, however, the innovation management literature is not coherent in either its portrayals or labelling of the co-creation phenomenon. The literature provides us with a wide range of concepts and terms

referring to similar practices, such as "co-innovation," "co-development," "co-production", "community-based innovation", "crowdsourcing", "user innovation", "mass customization," "open-source innovation," and so on. This kind of conceptual mess does not provide a robust basis for future research in the field of co-creation, as it is not possible to clearly differentiate it from other similar concepts that appear in the innovation management literature.

Thus, the first part of the critical literature review is aimed to provide a general overview of the pertinent state-of-the-art literature that discusses the topic of collaborative innovation between companies and individual external contributors, creating the basis for construing the existing conceptual mess in the literature.

2.1.1 Research design and methodology

With the aim of providing general insights about similar concepts related to collaborative innovation between companies and individual external contributors, the first part of the critical literature review is purposefully focused on three broad segments of the literature, namely open innovation, co-creation and other related concepts.

This review of the literature on *open innovation* and *co-creation* was conducted with the purpose of identifying dominant definitions of the two concepts and of understanding their origins and the core ideas behind them. The review also led to 14 additional concepts related to collaborative innovation with individual external contributors being identified, namely: *community-based innovation*, *user innovation*, *crowdsourcing*, *open-source innovation*, *co-production*, *co-innovation*, *mass customization*, *prosumption*, *avatar-based innovation*, *co-development*, *innosumption*, *peer innovation* and *social production*. Further review of the literature on each of the related concepts

was then conducted, with the similar purpose of identifying dominant definitions of the concepts and of understanding their origins and the core ideas behind them.

To provide robust coverage of a representative body of literature on the topic of collaborative innovation between companies and individual external contributors, the data collection process was conducted by searching for articles on open innovation, co-creation and the 14 identified related concepts published in journals indexed in the SciVerse Scopus database. The reason for choosing the SciVerse Scopus database over Web of Science was because it includes a more comprehensive set of relevant international journals.

2.1.2 Conceptual mess in the research field

2.1.2.1 Open innovation

Open innovation is the concept that has attracted the most attention in the innovation management scholarship focused on collaborative innovation across corporate boundaries. It has evolved from the foundations of the lucid original model articulated by Chesbrough (2003), assuming the permeability of corporate boundaries that allows innovation to move easily between the external and internal environments, both outside-in and inside-out, making open innovation a very broad concept. The concept of open innovation includes much more than the simple idea of complementing internal R&D by involving external source of innovation.

The concept originally encompassed two core modes of open innovation (Chesbrough, 2003), namely *inbound open innovation*, based on external knowledge sourcing, technology exploration and leveraging inventions developed outside the

company's own R&D, and *outbound open innovation*, including external exploitation of internal assets, for example by licensing out, selling intellectual property, or technology commercialization in new markets. *Coupled open innovation*, as the third mode of open innovation involving the joint development and commercialization of innovations through partnerships, was later added to the original model (Enkel, Gassmann, & Chesbrough, 2009). Finally, a variation—the *interactive model* of coupled open innovation—was introduced by Piller and West (2014), focusing on collaborative innovation activities between a company and external individuals.

As research on open innovation has rapidly expanded, it has also become heterogeneous and affected by ambiguity (Randhawa, Wilden, & Hohberger, 2016). Defining open innovation as "both a set of practices for profiting from innovation, and also a cognitive model for creating, interpreting and researching those practices" (Chesbrough, Vanhaverbeke, & West, 2006) has led to classifying an inappropriately broad variety of practices under a single rubric (Dahlander & Gann, 2010). Over time, the term "open innovation" itself has acquired multiple meanings (Chesbrough, 2012), exacerbating the variety of perspectives adopted by researchers, especially regarding the nature of the external actors involved in corporate innovation. Open innovation, as originally conceived in the literature, is related to cooperation between *organizations*, as such (Chesbrough, 2003), either inter-firm (Belderbos, Cassiman, Faems, Leten, & Van Looy, 2013) or university-industry collaboration (Bodas Freitas, Geuna, & Rossi, 2013; Chiaroni, Chiesa, & Frattini, 2011). However, the involvement of *individuals*, most typically customers and users, in innovation processes is increasingly included under the general rubric of open innovation (Bahemia & Squire, 2010; Battistella & Nonino, 2012; Straub, Kohler, Hottum, Arrass, & Welter, 2013; West & Bogers, 2017).

This incongruity in the scholarly understanding of open innovation has become a focus of criticism by researchers, as it not only undermines building a coherent body of knowledge but also makes it difficult to distinguish open innovation from related concepts (Dahlander & Gann, 2010; Elmquist, Fredberg, & Ollila, 2009; Kovács, Van Looy, & Cassiman, 2015). Some researchers have even averred that simply using the term "open innovation," as it is currently employed, has potential to hinder research (Groen & Linton, 2010); and others have argued that use of the term achieves little more than help repackage concepts that have been well known in the innovation management literature for at least five decades (Trott & Hartmann, 2009).

2.1.2.2 Co-creation

Phenomena associated with "open innovation" are often also discussed under the general rubric of "co-creation." Evolving from its origins in the [general] management literature, the concept of co-creation has moved gradually in to innovation management scholarship, where the practice of co-creation is receiving remarkable attention as a powerful engine for innovation (Brown & Hagel III, 2005). According to Barczak (2012), in addition to networks and social media, co-creation is one of the most attractive research fields associated with open innovation. However, the amorphous evolution of ideas associated with co-creation has led to a fragmented body of knowledge about the topic, impeding the development of a widely accepted and comprehensive definition of co-creation in the field of innovation management (Ind & Coates, 2013; Piller, Ihl, & Vossen, 2011; Zwass, 2010).

Scholars have employed a heterogeneous array of definitions of *co-creation*, and have directed their research towards dissimilar aspects of innovation, making it

difficult to build a coherent body of knowledge about the topic. Building on the early ideas of shifting from value chain to value constellation, and involving consumers as co-producers of value (Normann & Ramírez, 1993; Ramírez, 1999; Wikström, 1996), C. K. Prahalad and Venkat Ramaswamy have popularized the term "co-creation" by focusing on co-creation *experience* (Prahalad & Ramaswamy, 2003). They defined co-creation as a function of human experiences stemming from interactions, based on the information access, global view, networking, experimentation and activism of people in all areas, having a great impact in collaborative development (Prahalad & Ramaswamy, 2004). This view of co-creation has served as the basis for a research stream in the academic literature that sees co-creation as a form of collaborative innovation (Piller & West, 2014; Roser, DeFillippi, & Samson, 2013), with the purpose of incrementally improving existing products or developing radically new ones. Such collaborative innovation practices may take place in both online and offline settings purposefully designed to engage individuals in corporate innovation projects. The Internet-based environment of communities, innovation platforms, social networks, or forums supports companies to virtually integrate potential co-creators in their product innovation projects and challenge them to share their ideas and solutions online (Füller, 2010; Haavisto, 2014; Piller & Walcher, 2006). Conversely, the face-to-face environment of specialized workshops or living labs enables companies to establish efficient interaction and communication to stimulate creativity and to evoke an innovative spirit among selected co-creators (Dell'Era & Landoni, 2014; Leminen & Westerlund, 2012; Ramaswamy & Gouillart, 2010).

Among those who view co-creation as a category of collaborative innovation, however, there are wide differences in meaning associated with the term, and the

scope of perspectives on external actors involved is broad. Reinforcing the idea of customer-centric enterprise, co-creation is usually defined as collaboration between producers and users for the purpose of innovation (Kristensson, Matthing, & Johansson, 2008; Santos-Vijande, González-Mieres, & López-Sánchez, 2013) or open innovation with users and customers (Piller et al., 2011; Rayna & Striukova, 2015). Discussion of co-creation in the innovation management literature frequently draws upon the user innovation concept espoused by Eric von Hippel (Gemser & Perks, 2015), with the emphasized distinction that co-creation is a company-driven or company-sponsored form of collaborative innovation, in which companies are explicitly present and act as initiators of such endeavors (Piller et al., 2011; West & Bogers, 2014; Zwass, 2010). Further, co-creation is also defined as collaboration with external individuals during a new product or service development process initiated and facilitated by a company (Piller & West, 2014; West & Bogers, 2014). However, co-creation is nevertheless sometimes also portrayed even more broadly as a kind of continuous feedback loop involving collaboration with all stakeholders in a value network throughout innovation processes (Kirah, 2009).

Consequently, there is scholarly confusion about exactly how this concept differs-from or is similar-to related concepts, such as open innovation, with which it is frequently juxtaposed in the literature. This has created a problem for scholars by undermining the development of clear conceptual foundations for future research about co-creation.

2.1.2.3 Other related concepts

The general review, in this study, of the innovation management literature allowed identification of additional 14 concepts related to collaborative innovation between companies and individual external contributors, namely: crowdsourcing, community-based innovation, open-source innovation, user innovation, mass customization, avatar-based innovation, co-innovation, co-production, peer innovation, co-development, social production, prosumption, and innosumption (Tekic & Willoughby, 2017a).

Crowdsourcing is defined as the act of outsourcing a task to an undefined, large group, network or "crowd" of people in the form of an open call on an online platform (Afuah & Tucci, 2012; Boudreau & Lakhani, 2013; Ghezzi, Gabelloni, Martini, & Natalicchio, 2018). Crowdsourcing is a top-down process, sponsored and directly managed by a company, used as a means to identify innovative input from non-obvious sources through global searches (Battistella & Nonino, 2012; Bogers & West, 2012). It has a huge potential to complement internal R&D, by involving large numbers of heterogeneous, self-selected, and voluntary individuals who are willing to engage in temporary, decentralized problem-solving activities for companies in their free time (Ebner, Leimeister, & Krcmar, 2009; Franke, Keinz, & Klausberger, 2013).

The *community-based innovation* and *open-source innovation* concepts refer to collective and distributed innovation among individuals who socially interact and exchange information in open and flat networks, within virtual environment of Internet-based communities, having a shared purpose—typically to solve problems or develop (new) solutions (Bogers & West, 2012; Dahlander & Wallin, 2006; Nambisan, 2002). The significant difference between the two concepts is that, unlike community-based innovation, open-source innovation assumes involvement of a particular set of

IP policies (West & Gallagher, 2006). Even though they are not originally company-centric, the concepts of community-based innovation and open-source innovation are more frequently seen as forms of collaborative innovation between companies and individuals, as companies have recognized communities as a valuable source of innovation and as complementary assets to internal R&D (Dahlander & Wallin, 2006; Füller, Matzler, & Hoppe, 2008; Jeppesen & Frederiksen, 2006).

As explained by Baldwin and von Hippel (2011), the concept of *user innovation* is based on a single-user innovator, who creates an innovation to use it himself or herself. Similar to community-based innovation and open-source innovation, user innovation was not originally a company-centric concept. However, opportunities for commercializing external innovation created by users exist for profit-seeking companies (Bogers & West, 2012). Thus, there is a stream of research that relates the concept of user innovation to collaborative innovation between companies and individuals.

Even though it is sometimes defined as the capability of companies to offer individually tailored products or services on a large scale (Zipkin, 2001), *mass customization* is highly related to collaborative innovation between companies and individual external contributors. Namely, companies that practice mass customization have identified the dimensions along which their customers differ in their needs, and have developed toolkits that allow users to experiment with new designs until they find the satisfactory one for their customized product. In this sense, mass customization is based on a customer-toolkit dyad (Franke, Keinz, & Schreier, 2008; Gilmore & Pine II, 1997; Zipkin, 2001), where an individual produces a single design as an input to product development using Internet-based configuration tools.

Another concept that is related to collaborative innovation of companies and individual external contributors is *avatar-based innovation* (Kohler, Matzler, & Füller, 2009). Empowered by virtual world media and technologies, companies involve their current or potential customers in corporate innovation through interaction with their avatars. Representing customers' alter egos, avatars are seen as a promising source of innovation and as a channel to users' creativity and preferences.

Finally, the innovation management literature provides a wide array of other constructs, such as *co-innovation* (Buur & Matthews, 2008; Nambisan & Baron, 2009, 2010; Parmentier & Mangematin, 2014), *co-production* (Alford, 2014; Radnor, Osborne, Kinder, & Mutton, 2013; Voorberg, Bekkers, & Tummers, 2014), *peer innovation* (Nambisan & Baron, 2010), *co-development* (Lau, Tang, & Yam, 2010), *social production* (Bogers & West, 2012), *prosumption* (Bauer & Gegenhuber, 2015; Fox & Li, 2012), and *innosumption* (Peine, Rollwagen, & Neven, 2014), which are typically used as buzzwords to loosely describe similar practices of collaborative innovation between companies and individual external contributors, overlapping with previously described concepts.

2.1.3 Discussion of results

This general review of the literature discussing collaborative innovation between companies and individual external contributors reveals that there is a conceptual mess in the whole field. A lack of sharp distinctions between the open innovation, co-creation and other related concepts causes conceptual overlapping, terminological ambiguity and confusion in the extant literature, as all the rubrics are related to similar collaborative innovation practices.

Imprecise conceptualization of concepts related to collaborative innovation between companies and individual external contributors hampers progress in empirical research related to any of these concepts. Employing different terminology for the same practices, and vice versa, has led to relevant prior studies being overlooked and to previous research results being wastefully re-generated. Undermining the development of a coherent body of knowledge in the innovation management scholarly community, this kind of conceptual mess cannot provide a robust basis for future research in this field.

Bearing in mind the particular concern of this PhD research with collaborative innovation between *companies and individual external contributors* in its broadest sense, this part of literature review nevertheless provides some insights that may be helpful for construing the current conceptual mess surrounding this topic. Namely, co-creation appears to be the most commonly used general term describing a wide array of practices related to involvement of individuals in corporate innovation. It does not focus exclusively on specific practices, as is the case with other related concepts, for example, crowdsourcing, community-based innovation, open-source innovation or mass customization.

Nevertheless, due to the all-encompassing nature of the co-creation concept, it is difficult to clearly differentiate it from the concept of open innovation. When the various definitions of co-creation and open innovation are compared it may be readily observed that the two concepts are built on the same ideas of the openness of companies' boundaries, innovation flow between the external and internal environments, and the involvement of a diverse array of external actors in innovation projects. They share a good number of common characteristics and elements, making

the concepts of co-creation and open innovation difficult to distinguish within the innovation management literature. Additionally, the relationship between these two concepts—co-creation and open innovation—is typically portrayed quite vaguely in the literature. Co-creation is almost always seen as being related to open innovation in some way (Giannopoulou, Ystrom, Elmquist, Fredberg, & Ollila, 2010; Randhawa et al., 2016; West & Bogers, 2017), but it is sometimes portrayed as a sub-category of open innovation rather than as a discrete concept in its own right (Barczak, 2012; Piller et al., 2011), and sometimes as the next step in the evolution of open innovation (Bughin, Chui, & Johnson, 2008).

Thus, the next part of this literature review will seek to address these problems by critically examining the intellectual and historical roots of this confusion and by suggesting a clearer conceptual delineation of co-creation.

2.2 Co-creation

The purpose of this part of the literature review is to more clearly define the concept of co-creation and to articulate how it differs from and relates to the concept of open innovation. Confusion in the scholarly literature surrounding the two concepts is arguably interfering with the fruitful development of research about the role of inter-organizational and extra-organizational relationships in corporate innovation endeavors.

As the concept of co-creation has evolved in the innovation management literature its meaning has become ambiguous and the boundaries between it and the concept of open innovation have become opaque. Scholars are divided as to whether co-creation is a subsidiary concept of open innovation, a surrogate concept that is essentially indistinguishable from open innovation, or a separate concept that

developed independently but was subsequently intermingled and interfused with open innovation. Conversely, the heterogeneity of assumptions in the literature about whether other organizations or external individuals, or both, are involved in co-creation and open innovation appears to be the common cause of the ambiguity associated with each of the concepts as a whole.

Thus, this literature review is focused on designating the relationship between co-creation and open innovation and the differences between the two concepts from the vantage point of the *external actors* involved. Such an approach has the advantage of producing lucid insights that go beyond the current state of the literature, providing a basis for proposing a cogent definition and taxonomy of co-creation, and thereby distinguishing it from open innovation (Tekic & Willoughby, 2018).

2.2.1 Research design and methodology

With the aim of identifying whether a clear distinction may be plausibly asserted between the concept of co-creation and the concept of open innovation, and with the additional aim of seeking to understand the relationship between these two concepts, this literature review was designed as a two-stage review of the pertinent academic literature published up to and including December 2017, based on the integration of a "broad brush" and a "deep dive" analysis. Such a two-stage literature review approach enabled more systematic comparison of the concepts of co-creation and open innovation by purposefully combining the general overview of their origins and evolution with the more focused comparison of the two concepts. The SciVerse Scopus online database was employed as the primary source of data.

The first review stage was focused on getting a better understanding of the origins and evolution of the respective concepts of co-creation and open innovation, regardless of the discipline or academic subject-matter domain of the literature in which the concepts appeared. Therefore, it consisted of a "broad brush" analysis of all academic publications indexed in Scopus mentioning co-creation and open innovation. The search identified 14,192 publications that contained "co-creation" or "cocreation" in any part of the text, published in the timeframe between 1979 and 2017, and 17,402 publications that contained "open innovation" or "open-innovation" in any part of the text, published in the timeframe between 2003 and 2017.

The second review stage—the aim of which was to conduct a systematic comparison of the concepts of co-creation and open innovation—was based on a "deep dive" analysis of the academic literature in innovation management, utilizing the extensive online database of SCImago Journal Rank (http://www.scimagojr.com/journalrank.php). The deep-dive search included all journals indexed in the subject category of *Management of Technology and Innovation* within the subject area of *Business, Management and Accounting* (consisting of a total of 159 journals), thus offering a large pool of papers representing the innovation management literature. To enable proper understanding of the relationship between co-creation and open innovation, and designation of the difference between these concepts from the vantage point of the external actors involved, the review involved a systematic search for papers that dealt with both concepts. This approach was based on the understanding that papers where co-creation and open innovation were juxtaposed would provide the most pellucid source of insight about the relationship and differences between the two concepts. Reviewing

papers that exclusively discussed only one of the two concepts could not generate insights about researchers' perspectives on the relationship and differences between the two concepts as reliably or efficiently as reviewing those papers in which both were discussed. The resultant list of publications consisted of 270 papers in which the concepts of both co-creation and open innovation co-appeared, including both "co-creation" or "cocreation" and "open innovation" or "open-innovation" in any part of the text. After exclusion of papers that included these terms within their list of references and not within the title, abstract, keywords and main body of the text, the list was reduced to 123 papers. In accordance with the research goal for the "deep dive" analysis, the review involved a search for papers that offered a perspective on either the relationship between co-creation and open innovation or the differences between the two concepts *from the vantage point of the external actors involved*. This analysis was conducted manually, that is, by systematically studying each of the papers, rather than relying upon automated text-searching software. The final set that made it through the conceptual filter included 77 papers published in 33 different journals, which were carefully re-read, analyzing the definitions and contexts of use of the concepts of co-creation and open innovation in each paper. Thus, the final set of papers consisted of published work where the concepts of both co-creation and open innovation were actually discussed as such by the authors. In this manner the review was able to provide insights about how far the concepts of co-creation and open innovation had converged, or otherwise evolved, in the pertinent literature.

2.2.2 Rise of co-creation in innovation management scholarship

The first stage of this literature review enabled understanding whether the concept of co-creation evolved independently from the concept of open innovation, or whether, as asserted by many authors, co-creation had its roots in open innovation. It consisted of a "broad brush" analysis of the exponentially growing co-creation and open innovation literature indexed in Scopus, with the goal of designating the origins and the evolutionary paths of the two concepts, regardless of the putative disciplines or subject areas of the respective papers. Even though the concepts have attracted attention in a plurality of research fields, both co-creation and open innovation are deeply embedded within the subject area of *Business, Management and Accounting*. This subject area is by far the single largest academic domain in which articles about co-creation and open innovation have appeared, with roughly half of all articles on each topic published within this domain.

The search results containing the terms "co-creation" or "cocreation" in any part of the text led to identifying the first known scholarly paper mentioning co-creation. It was an article on bioethics published in 1979 by Albert S. Moraczewski, in which the term referred to what the author saw as the Christian concept of the role of humans in renewing (i.e., co-creating) the universe (Moraczewski, 1979). Many papers were discovered, across multiple disciplines—including the social sciences (broadly construed), psychology, arts, the humanities, and medicine, etc.—that were published during the next two decades leading to the early 2000s, which featured the term "co-creation." The turning point for the co-creation concept in the innovation management literature is represented by C. K. Prahalad and Venkat Ramaswamy's influential paper "The new frontier of experience innovation," published in the MIT

Sloan Management Review in 2003. Defining co-creation experience in that paper as the basis for value creation, the two authors portrayed experience environments, supported by a network of companies and consumer communities, as the new competitive space for innovation (Prahalad & Ramaswamy, 2003). Prahalad and Ramaswamy catalyzed the process by which co-creation moved from being a subject of general academic interest across multiple fields to a topic of spirited debate within the innovation studies literature. Thus, by the time the literature review for this thesis was conducted (2017), the concept of co-creation had been visible in the formal academic literature for almost four decades.

In contrast, the first scholarly paper containing "open innovation" or "open-innovation" in any part of the text was not published until 2003. There were eleven such publications published that year, but the birth of the concept of open innovation is widely linked to one of the most cited articles on this topic, "The era of open innovation," authored by Henry W. Chesbrough. In that article—published in the MIT Sloan Management Review in 2003—Chesbrough posited a model of open innovation in which knowledge flowed over organizational boundaries, enabling companies to exploit internal knowledge in more diversified markets, as well as to identify and absorb external knowledge to support the internal innovation process (Chesbrough, 2003).

As it can observed from these examples, 2003 was a year of crucial importance for both the co-creation literature and the open innovation literature. Since 2003 the number of publications on co-creation and open innovation has been growing exponentially, following the two most influential works on these topics, authored by Prahalad and Ramaswamy (2003) and by Chesbrough (2003) respectively (which interestingly were both published in the MIT Sloan Management Review). The

timeline of publications on co-creation and open innovation indexed in Scopus since 2003 leads to the conclusion that these two concepts have evolved simultaneously, in parallel, since their paths crossed in the innovation management literature (Figure 2.1).

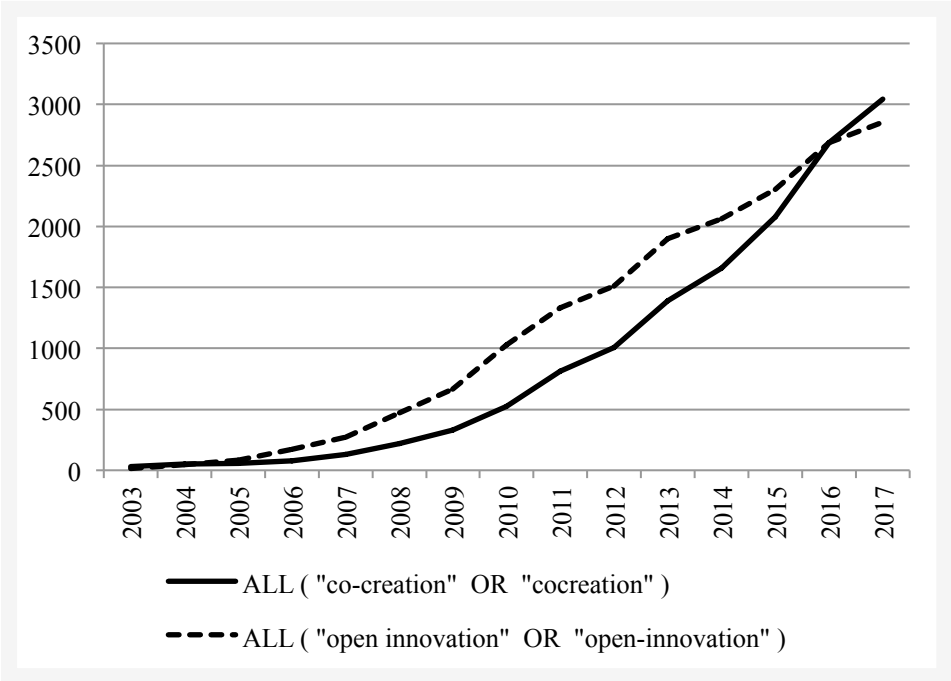

Figure 2.1 Number of publications indexed in Scopus (2003-2017)

The early papers that employ the terms "co-creation" or "cocreation," published between 1979 and the early 2000s, together reveal that the theme of co-creation was in fact embraced by many scholars across a strikingly wide variety of disciplines for many years prior to the emergence of the terms "open innovation" or "open-innovation" in the innovation studies literature and other literatures. Thus, *in contrast with the point of view intimated, presumed or erroneously asserted by many authors, the concept of co-creation did not evolve from the concept of open innovation and is not built upon the concept of open innovation.* The simultaneous evolution of the two concepts since the early 2000s led to a strong relationship and interconnectedness between them. Emphasizing the same ideas of the openness of

companies' boundaries, innovation flow between the external and internal environments, and the involvement of a diverse array of external actors in innovation projects, research on co-creation and open innovation is characterized by observable cumulative interplay.

2.2.3 Refinement of the concept of co-creation

The second review stage was based on a systematic "deep dive" analysis of the innovation management academic literature where the two topics of co-creation and open innovation co-appeared. The final set included 77 papers published in 33 journals indexed in the subject category of *Management of Technology and Innovation* by SCImago Journal Rank (Table 2.1). These papers received 1,603 Scopus citations in total by December 2017, with an average of 20.8 citations per paper. Additionally, the analysis identified the most influential papers from the final set, namely the papers with a citation count above the average citation count of the whole set of 77 papers. Twenty-five papers met this criterion and in aggregate they accounted for 1,305 citations (i.e., 81.4% of the citations for the total set).

Reviewing the whole set of 77 papers, in which the terms co-creation and open innovation were co-mingled, led inevitably to the conclusion that, with some minor exceptions, these two terms are typically used simply as buzzwords to loosely describe similar practices in innovation management, as part of the contemporary fashion in the academic literature to embrace the themes of openness and collaboration.

Table 2.1 List of journals including papers selected for the "deep dive" analysis

Journal Title	Number of papers
British Journal of Management	1
Creativity and Innovation Management	7
Electronic Commerce Research and Applications	1
Electronic Markets	1
European Journal of Innovation Management	3
Group Decision and Negotiation	1
Industry and Innovation	2
Innovation: Management, Policy and Practice	3
Innovation: The European Journal of Social Science Research	1
International Entrepreneurship and Management Journal	1
International Journal of Entrepreneurial Venturing	1
International Journal of Entrepreneurship and Innovation Management	2
International Journal of Innovation and Learning	1
International Journal of Innovation and Technology Management	1
International Journal of Innovation Management	10
International Journal of Knowledge Management	1
International Journal of Knowledge-Based Development	1
International Journal of Management Reviews	2
International Journal of Operations and Production Management	1
International Journal of Product Development	1
International Journal of Technology Intelligence and Planning	1
Journal of Knowledge Management	2
Journal of Management Control	1
Journal of Product Innovation Management	6
Knowledge Management Research and Practice	2
Management Learning	1
Organization	1
R and D Management	2
Research Policy	3
Research-Technology Management	3
Service Industries Journal	3
Technological Forecasting and Social Change	5
Technovation	5
Total number of papers mentioning both "co-creation" / "cocreation" and "open innovation" / "open-innovation"	**77**

The terms “co-creation” and “open innovation” are sometimes used in the same context—e.g., “co-creation platform” (Bogers, Hadar, & Bilberg, 2016; Frow, Nenonen, Payne, & Storbacka, 2015; Zhao, Renard, Elmoukhliss, & Balague, 2016) and “open innovation platform” (Erzurumlu, 2010; Zhao et al., 2016), or “co-creation projects” (Füller, Matzler, Hutter, & Hautz, 2012; Scuotto, Del Giudice, Rosaria, & Tarba, 2017) and “open innovation projects” (Du, Leten, & Vanhaverbeke, 2014; Kohler et al., 2009), or “co-creation networks” (Potts et al., 2008; Valkokari, Paasi, & Rantala, 2012) and “open innovation networks” (Barradas, Mendes Rodrigues, & Pinto Ferreira, 2016; Konsti-Laakso, Pihkala, & Kraus, 2012; Leminen & Westerlund, 2012; Randhawa et al., 2016), or “co-creation ecosystems” (Le & Tarafdar, 2009; Leminen & Westerlund, 2012) and “open innovation ecosystems” (Dell’Era & Landoni, 2014; Konsti-Laakso et al., 2012; Scozzi, Bellantuono, & Pontrandolfo, 2017). Nevertheless, the reviewed set of papers, on the whole, offers a wide variety of perspectives on the relationship and distinctions between these two concepts.

2.2.3.1 Definition of co-creation

Even though most of the reviewed papers describe co-creation and open innovation as related concepts, only about one third of the papers (21 out of 77 or 27.3%) offers a perspective on the nature of that relationship.

Some researchers describe co-creation and open innovation as two separate mainstream innovation management disciplines (Ghezzi et al., 2018), while other researchers see them as two overlapping concepts (Zhao et al., 2016), sometimes defining open innovation as a concept that “implies the existence of innovative processes based on co-creation” (Unceta, Castro-Spila, & García-Fronti, 2017).

Notwithstanding the results from the first review stage, some researchers also portray co-creation as a concept rooted in open innovation (Shanmugam & Durugbo, 2015). Most of the papers describe open innovation as a phenomenon that is broader in scope than co-creation (Barczak, 2012; Kosonen, Gan, Vanhala, & Blomqvist, 2014). As part of the general approach whereby the concept of co-creation is portrayed as being encompassed somehow by the concept of open innovation (Frederiksen & Brem, 2017; Hennala, Parjanen, & Uotila, 2011), co-creation is variously defined as a form of open innovation (Frow et al., 2015), as a part of open innovation (Marchi, Giachetti, & De Gennaro, 2011; Martovoy & Dos Santos, 2012), as an aspect of open innovation (Cheng & Huizingh, 2014; Randhawa et al., 2016), as a dimension of open innovation (Gamble, Brennan, & McAdam, 2016), or as an open innovation practice (Battistella, De Toni, & Pessot, 2017).

Focusing on the theme of the *key external actors involved in co-creation and open innovation* as the central cause of the theoretical ambiguity about the differences between the two concepts, the review of the selected 77 papers was structured to organize the literature in to three different conceptual categories based upon which of the following three points of view they adopted regarding the external actors involved in innovation projects through co-creation and/or open innovation, namely:

- *both individual external contributors and partnering organizations,* including a variety of actors and stakeholders;
- *individual external contributors only*, such as users, customers, scientists, field experts, or innovation enthusiasts;
- *partnering organizations only,* such as other companies (customers, suppliers or competitors), universities, or government institutions.

The results of the literature review, covering the selected papers in which the concepts of both co-creation and open innovation co-appeared, are summarized in Table 2.2. It was not possible to categorize three papers with certainty within this framework, as they did not assert a point of view on the question of external actors involved in innovation projects specifically regarding co-creation and open innovation (El-Ella, Stoetzel, Bessant, & Pinkwart, 2013; Kosonen et al., 2014; Zhao et al., 2016). Even though these three papers do not offer a perspective on the differences between co-creation and open innovation from the vantage point of external actors involved, they offer a perspective on the relationship between the two concepts. This is the reason for taking the three papers into account and including them in the final set.

Thus, the "deep dive" analysis of the innovation management literature enabled successful classification of all papers in the final set, with the exception of the three indeterminate papers (leading to a net total of 74 papers), according to which of the three alternative perspectives they embraced regarding external actors involved in corporate innovation.

Based on the assessment of the most prominent of the three streams of literature (43 out of 74 or 58.1% of the reviewed papers), it can be concluded that, on the whole, co-creation tends to refer to collaborative innovation involving *individual external contributors* who are able to provide a valuable input to innovation projects based on their experience, expertise, knowledge and skills. The categories of individual external contributors are variously presumed in the reviewed literature to include:

- *customers and users of a company's products* (e.g., Barczak, 2012; Candi, van den Ende, & Gemser, 2015; Chesbrough & Brunswicker, 2014; Gamble et al., 2016; Potts et al., 2008; Randhawa et al., 2016; Weber, Weggeman, & Van

Aken, 2012), who are sometimes portrayed as:

  - *lead users* (e.g., Bowonder, Dambal, Kumar, & Shirodkar, 2010; Dell'Era & Landoni, 2014; Füller et al., 2012; Greer & Lei, 2012; Marchi et al., 2011; Roberts, Piller, & Lüttgens, 2016);
  - *innovators* (e.g., Adamczyk, Bullinger, & Möslein, 2012; Bogers et al., 2016; Kim et al., 2008; Marchi et al., 2011; Nordlund, Lempiälä, & Holopainen, 2011; Wang, Chang, & Shen, 2015);
  - *prosumers* (e.g., Bogers et al., 2016; Gabriel, Korczynski, & Rieder, 2015; Kohler et al., 2009; Scuotto et al., 2017);
- *field experts* (e.g., Dell'Era & Landoni, 2014; Füller et al., 2012; Garcia Martinez & Walton, 2014; Ghezzi et al., 2017; Greer & Lei, 2012; Kohler et al., 2009; Marchi et al., 2011; Roberts et al., 2016);
- *students* (e.g., Adamczyk et al., 2012; Dell'Era & Landoni, 2014; Garcia Martinez & Walton, 2014);
- *innovation enthusiasts, amateurs and hobbyists* (e.g., Garcia Martinez & Walton, 2014; Ghezzi et al., 2017; Greer & Lei, 2012; Marchi et al., 2011; Pera & Viglia, 2015; Potts et al., 2008; Simula & Vuori, 2012).

Additionally, there is a subdominant research stream (24 out of 74 or 32.4% of the reviewed papers) identified, in which co-creation was portrayed as involving *a wide variety of stakeholders as external actors* in corporate innovation projects, including both individual external contributors and partnering organizations (e.g., Bogers & West, 2012; Cheng & Huizingh, 2014; Frow et al., 2015), sometimes with special emphasis on the importance of customer and user engagement in co-creation (e.g. Henkel, Schöberl, & Alexy, 2014; Kohlbacher, 2008; Lee et al., 2014).

Finally, in the innovation management literature the notion of co-creation is used only rarely (in 7 out of 74 or 9.5% of the reviewed papers) in association with collaborative innovation strategies exclusively between *partnering organizations* (e.g. Erzurumlu, 2010; Paasi, Lappalainen, Rantala, & Pikkarainen, 2014; Taheri & van Geenhuizen, 2016).

Thus, the *collaboration of a company with individual external contributors* may be seen as a distinctive hallmark of co-creation.

Turning attention to open innovation, the "deep dive" analysis shows that researchers focusing on open innovation typically adopt a perspective on external actors that contrasts with the perspective of those focused on co-creation.

Open innovation is mostly seen as a concept in which a *variety of external actors*, including both individual external contributors and partnering organizations, are involved in corporate innovation projects (e.g., Barczak, 2012; Bogers & West, 2012; Cheng & Huizingh, 2014; Du et al., 2014; Henkel et al., 2014; Randhawa et al., 2016; Roberts et al., 2016). Within this influential stream of literature (64 out of 74 or 85.5% of the reviewed papers), there is a growing research interest in involvement of *customers and users in open innovation*, portrayed similarly to co-creation (e.g., Adamczyk et al., 2012; Candi et al., 2015; Füller et al., 2012; Ghezzi et al., 2017; Lee et al., 2014; Marchi et al., 2011).

On the other hand, there is also a research stream in which the concept of open innovation is related only to cooperation between organizations (9 out of 74 or 12.2% of the reviewed papers), most typically *inter-firm collaboration* (e.g. Erzurumlu, 2010; Ferreras-Méndez, Fernández-Mesa, & Alegre, 2016; Paasi et al., 2014; van Geenhuizen & Nijkamp, 2012) and *university-industry collaboration* (e.g., Miller,

McAdam, & McAdam, 2014; Taheri & van Geenhuizen, 2016), usually supported by contractual agreements between organizations and formalized through strategic alliances, partnerships or joint ventures.

Finally, only one paper was identified within 74 reviewed papers (1.3%) portraying open innovation as a concept that refers specifically to the involvement of customers as individual external contributors to corporate innovation projects (Bretschneider & Zogaj, 2016).

Even though the findings (summarized in Table 2.2) lead to the conclusion that the extant literature in the field of innovation management is congruent in neither its conceptualization of open innovation and co-creation nor its distinction between the two concepts, the findings on the whole nevertheless manifest and support the general proposition that in the case of co-creation the external actors involved in collaborative innovation are *individual persons* who are able to provide a valuable input to innovation projects based on their experience, expertise, knowledge and skills. Conversely, this proposition does not hold in the case of open innovation.

Thus, the "deep dive" analysis of the comprehensive set of papers in the subject category of *Management of Technology and Innovation*, dealing specifically with both open innovation and co-creation, supports discerning and asserting a crucial distinction between the two concepts from the vantage point of the *external actors* involved in corporate innovation. Based on insights from the literature review, and with the purpose of facilitating cogent future research about co-creation, the following differentiation between co-creation and open innovation is proposed:

- *co-creation* is a concept concerned with involving individual external contributors in a company's innovation projects, and

- *open innovation* is a concept concerned with involving a wide variety of actors and stakeholders in a company's innovation projects, including both individual external contributors and partnering organizations.

The heterogeneity of perspectives in the literature concerning the nature of the external actors involved in the innovation process appears to be a common cause of the widespread theoretical ambiguity in the literature associated with both co-creation and open innovation. While bearing in mind that external actors involved in corporate innovation are not the only thing that differentiates the concepts of co-creation and open innovation, it may nevertheless be concluded that recognizing the differences between the two concepts from the vantage point of external actors presents a fruitful pathway for establishing a more solid foundation for future research.

There are 30 papers in the final set of 74 analyzed papers that do not differentiate between co-creation and open innovation regarding the type of external actors involved in corporate innovation. These papers either do not differentiate between the concepts of open innovation and co-creation and use the terms "co-creation" and "open innovation" interchangeably, or they see open innovation as an umbrella concept and portray co-creation more narrowly as a direct act of collaboration through which knowledge, products or value are co-created, within the general approach of open innovation. Even though there is a substantial number of papers that do not positively support the proposed difference between the concepts of co-creation and open innovation (related to the types of external actors involved), the overall findings of this literature review are considered to be robust. The results of the analysis of 25 most influential papers in the final set mirror the results of the analysis

of the full set of 74 papers, thus providing confirmation for the distinction that is proposed between co-creation and open innovation.

Drawing on the insights educed from this literature review, a *definition of co-creation* from the innovation management perspective is offered here:

Co-creation is a form of collaborative innovation initiated by a company, involving individual external contributors or co-creators, who may provide valuable input to the company's innovation projects.

From the vantage point of the inputs they are able to contribute, co-creators may be classified into two groups, namely "expert co-creators" and "consumer co-creators."

Expert co-creators are individuals whose input is based on their knowledge, skills and expertise. They are usually interested in new technologies, like to explore and solve problems, and to apply complex technical knowledge to practical problems and challenges. Typical examples of expert co-creators are *field experts, students, innovation enthusiasts, amateurs and hobbyists* (Adamczyk et al., 2012; Dell'Era & Landoni, 2014; Garcia Martinez & Walton, 2014; Ghezzi et al., 2018).

On the other hand, *consumer co-creators* are individuals whose input is based on their experience, needs and preferences. They represent the majority in the existing market and may be found typically among *companies' current or potential customers* or among *users of a company's products* (Barczak, 2012; Bauer & Gegenhuber, 2015; Candi et al., 2015; Gabriel et al., 2015; Marchi et al., 2011; Randhawa et al., 2016) .

Table 2.2 Overview of perspectives on external actors involved in co-creation and open innovation

	Co-creation	Open innovation
Both individual external contributors and partnering organizations	12 papers *Bogers and West (2012); *Brohman et al. (2009); *Cheng and Huizingh (2014); Frow et al. (2015); Henkel et al. (2013); Lee et al. (2014); Lehmann et al. (2015); Lin and Hsieh (2014); Miller et al. (2014); Rufín et al. (2013); Schulz et al. (2015); Zeng and Glaister (2016)	31 papers *Adamczyk et al. (2012); *Barczak (2012); *Bogers and West (2012); Candi et al. (2015); *Cheng and Huizingh (2014); Dell'Era and Landoni (2014); *Du et al. (2014); *Füller et al. (2012); Gabriel et al. (2015); Gamble et al. (2016); Garcia Martinez and Walton (2014); Henkel et al. (2013); *Kohler et al. (2009); *Konsti-Laakso et al. (2012); Lee et al. (2014); Lehmann et al. (2015); Lin and Hsieh (2014); *Marchi et al. (2011); *Mina et al. (2013); Pera and Viglia (2015); Randhawa et al. (2016); Roberts et al. (2016); Rufín et al. (2013); Ryzhkova and Pesamaa (2015); Schulz et al. (2015); *Simula and Vuori (2012); Sundbo et al. (2015); Taherparvar et al. (2014); Vaquero Martín et al. (2016); Wang et al. (2015); *West and Bogers (2014)
Individual external contributors only	36 papers *Adamczyk et al. (2012); *Agarwal and Selen, (2011); *Barczak (2012); Bauer and Gegenhuber (2015); Bogers et al. (2016); Candi et al. (2015); D'Ippolito (2014); Dell'Era and Landoni (2014); *Du et al. (2014); Fosfuri et al. (2013); *Füller et al. (2011, 2012); Gabriel et al. (2015); Garcia Martinez and Walton (2014); *Greer and Lei (2012); *Kim et al. (2008); *Kohler et al. (2009); *Konsti-Laakso et al. (2012); *Marchi et al. (2011); *Mina et al. (2013); Pera and Viglia (2015); *Potts et al. (2008); Randhawa et al. (2016); Roberts et al. (2016); Ryzhkova and Pesamaa (2015); *Schuhmacher and Kuester (2012); Schweisfurth and Raasch (2015); Shanmugam and Durugbo (2015); *Simula and Vuori (2012); Sundbo et al. (2015); Taherparvar et al. (2014); *Trimi and Berbegal-Mirabent (2012); Vaquero Martín et al. (2016); Wang et al. (2015); Zeng and Glaister (2016); Zhao et al. (2016)	0 papers -
Partnering organizations only	4 papers Lubik et al. (2013); Paasi et al. (2010); Piening and Salge (2015); Taheri and van Geenhuizen (2016)	9 papers Erzurumlu (2010); Ferreras-Méndez et al. (2016); Magnusson and Nilsson (2013); Miller et al. (2014); Paasi et al. (2014); *Potts et al. (2008); Taheri and van Geenhuizen (2016); van Geenhuizen and Nijkamp (2012); Zeng and Glaister (2016)

An asterisk (*) indicates that the paper belongs to the group of the 20 most influential papers in our final set, which received more than the average citation count of 16.095 citations and accumulated 839 citations in total

2.2.3.2 Taxonomy of co-creation

The systematic literature review also identified two important and influential streams in the literature that operate from within the general perspective that open innovation is a broader concept than the concept of co-creation. Further insights from this literature supported delineation of two types of co-creation and an understanding of their position *vis-à-vis* open innovation.

The first stream sees co-creation as a form of inbound open innovation, typically based on crowdsourcing (El-Ella et al., 2013; Garcia Martinez & Walton, 2014; Kosonen et al., 2014). Even though inbound open innovation is mainly seen as a unidirectional outside-in flow of innovative knowledge, it can be a fruitful basis for co-creation with individual external contributors through crowdsourcing, where the solving of a company's defined product innovation problem is outsourced to a loosely defined, generally large, group of people who may possess relevant knowledge (Howe, 2006). Even though a company may collect numerous potential solutions to its problem, all the solutions represent separate contributions, and the actual co-creation takes place with a single co-creator, the contest winner, who may be involved in further stages of product innovation. Thus, taking into account that a single solution is co-created between a company and only one co-creator, this type of co-creation is designated as *"company-to-one co-creation."*

The other influential stream in the innovation management literature portrays co-creation as a form of coupled open innovation (Cheng & Huizingh, 2014; Lee et al., 2014; West & Bogers, 2014), emphasizing the collaborative innovation activities of all parties involved. Bearing in mind that coupled open innovation as introduced by Enkel, Gassmann and Chesbrough (2009) referred to joint development and

commercialization of innovation through alliances, cooperation, and joint ventures, in the development of the second type of co-creation the ideas of Piller and West (2014) are adopted instead. They proposed the interactive model of coupled open innovation, focused on co-creation between a company and customers, users, and other external individuals. With the aim of creating intensive interactions among these external individuals and of taking advantage of their innovation potential, companies frequently support and sponsor communities of people who share interests (Bogers & West, 2012). Sometimes they use these communities to identify and select the most promising contributors for their co-creation workshops, where they intensively interact in problem solving with a selected group of co-creators. Bearing in mind that in these communities and workshops co-creation takes place between a company and a group of co-creators who also interact among themselves and join their efforts to develop a solution to a specific problem, the second type of co-creation is designated as *"company-to-many co-creation."*

The main characteristic distinguishing company-to-one co-creation and company-to-many co-creation is the number of individual external contributors involved in co-creation of a single solution, i.e., one co-creator – one solution and many co-creators – one solution, respectively. Conceptualizing the two types of co-creation proposed here, as portrayed in Figure 2.2, explains how companies practice co-creation as collaborative innovation with individual external contributors, within inbound and coupled modes of open innovation, both involving outside-in knowledge-sourcing processes.

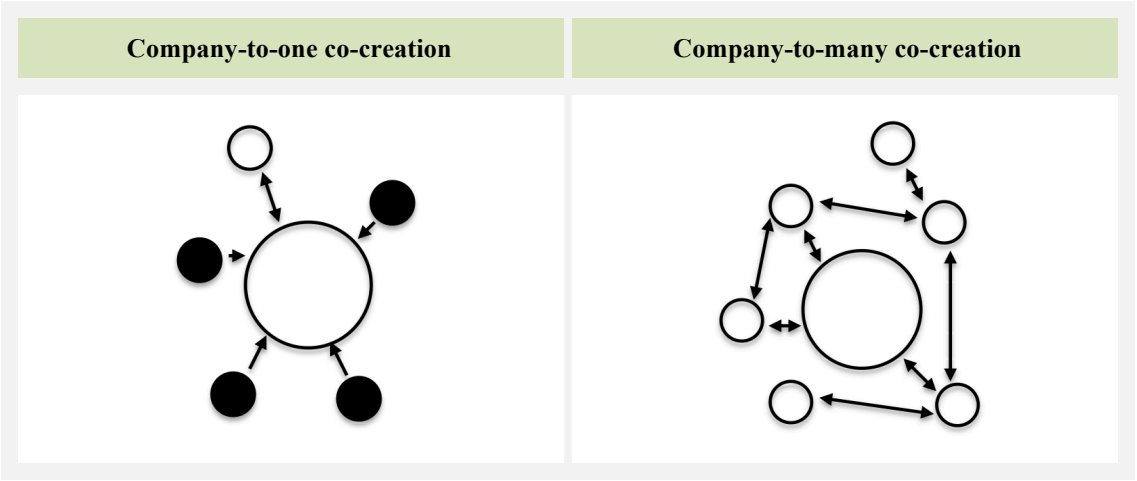

Figure 2.2 Co-creation types

2.2.4 Discussion of results

This literature review represents the first study to simultaneously focus on and systematically analyze the nature of both co-creation and open innovation, and to analyze the purported convergence of the two concepts in the literature. It shows that the popular presumption that the concept of co-creation has evolved-from, or has been built-upon open innovation, is not compatible with the factual evidence. Rather, it provides grounds to support the proposition that co-creation and open innovation correspond to closely related but still distinct concepts of innovation management. Notwithstanding their independent origins and the different perspectives they embody, these two concepts are united by the fact that they both embrace the idea of involving external actors in innovation across organizational boundaries. By focusing purposefully on the external actors involved in companies' innovation projects as the main distinguishing factor between co-creation and open innovation, this literature review offers a perspective on the differences and relationships between the two concepts, providing the basis for development of a cogent definition and a practical

taxonomy of co-creation. In contrast with the concept of open innovation that is concerned with opening the boundaries of a firm to a wide variety of actors and stakeholders, including both individual external contributors and partnering organizations, co-creation is defined here *as a form of collaborative innovation initiated by a company, involving individual external contributors or co-creators who may provide valuable input to the company's innovation projects*. Additionally, the co-creation concept is further elaborated by positing a taxonomy of co-creation, differentiating between the *company-to-one* and the *company-to-many* co-creation type.

This definition accords with the perspective of some commentators that the open innovation concept is broader than the concept of co-creation (Barczak, 2012; Cheng & Huizingh, 2014; Frow et al., 2015; Gamble et al., 2016; Kosonen et al., 2014; Marchi et al., 2011; Randhawa et al., 2016). If the results of the review are compared to the early concepts of co-creation and open innovation that appeared in the innovation management literature at the beginning of the 2000s, it can be concluded that the concepts of both co-creation and open innovation broadened over time from the vantage point of their presumptions about the types of external actors involved in a company's innovation activities. The focus of co-creation moved gradually from the involvement of consumers in innovation, as it was originally posited by Prahalad and Ramaswamy (2003), to the involvement of a diverse array of individual external contributors, i.e., of any persons with the requisite experience, skills, knowledge and expertise. Likewise, open innovation evolved from the original concept dealing with outside-in and inside-out innovation flows between organizations (Chesbrough, 2003) to an expanded concept incorporating the idea of collaboration amongst a variety of actors and stakeholders, including both individual external contributors and partnering

organizations. It can be observed that, even though its picture of what type of person might play the role of an individual external actor broadened over time, the co-creation literature remained mostly stable its general presumption that the external actors involved in co-creation are individual persons. In the case of open innovation, however, the story is different. The expanded perspective in the open innovation literature on the characteristics of external actors involved in open innovation embraced both partnering organizations and individual contributors, thereby leading naturally to overlapping boundaries of the concepts of co-creation and open innovation.

Almost a decade ago Trott and Hartmann (2009) described the open innovation concept as a "work in progress." Taking into account the post-2000 conceptual evolution of both open innovation and co-creation with regards with the nature of the external actors involved in corporate innovation, both concepts are expected to remain works in progress. Bearing in mind the persistent increase in the popularity of the two concepts (see Figure 2.1), they are expected to further evolve. Nevertheless, this review of the state-of-the-art in the innovation management literature has elucidated the relationship and differentiation between co-creation and open innovation, and may hopefully facilitate more coherent treatment of the two concepts by academic commentators as their evolution continues.

The main limitations of this literature review are that the "broad brush" analysis is based solely on publications indexed by Scopus, and that the "deep dive" analysis is restricted to academic papers in journals within the *Management of Technology and Innovation* category within the *Business, Management and Accounting* subject area in the SCImago Journal Rank database. Broadening the reach of the search by including academic papers published in potentially important journals

not captured by these data sources may have allowed generation of a more nuanced set of results. Future research may redress this limitation, although the data sources cited here appear to be sufficiently representative of the focal scholarly domain for the results to be robust**.**

2.3 IP management in co-creation

The mastery of *intellectual property (IP) management*—understood as a sophisticated discipline for designing and implementing IP strategies along the entire innovation process—is an imperative for companies that wish to achieve and sustain a competitive advantage (Ernst, 2017). IP has become enormously important in the knowledge-based, innovation-driven economy of the 21st century. As corporate value worldwide is increasingly derived from intangible assets, a great share of which is accounted for by IP, companies accordingly tend to rely upon IP rights to protect and extract value from their innovations (Candelin-Palmqvist et al., 2012). However, drawing upon the resources and activities of multiple external actors to augment or support corporate product innovation has made the management of IP in such projects more complex and challenging (Bogers, 2011; Bonabeau, 2009; Chesbrough, 2003; Huizingh, 2011; Lakhani & Panetta, 2007).

During the last decade a notable body of published research has appeared on the variety of IP management strategies that companies adopt to cope with the tension between control and openness in inter-firm and university-industry collaboration, with special attention having been given to strategies based on employment of different appropriation mechanisms (Aloini, Lazzarotti, Manzini, & Pellegrini, 2017; Gama, 2018; Stefan & Bengtsson, 2016; Zobel, Lokshin, & Hagedoorn, 2017), IP modularity

and selective revealing (Henkel, Baldwin, & Shih, 2013; Henkel et al., 2014), and co-ownership of IP resulting from collaborative innovation (Belderbos et al., 2013; Drechsler & Natter, 2012). At the same time, issues of IP management in collaborative innovation with individual external contributors have been attracting the attention of innovation management scholars, calling for further research at the interface of co-creation and IP management (Bartl, Füller, Mühlbacher, & Ernst, 2012; de Beer, McCarthy, Soliman, & Treen, 2017; Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010; Mazzola, Acur, Piazza, & Perrone, 2018).

Thus, the final part of this critical literature review (Tekic & Willoughby, 2019) will focus on the emerging literature in the field of IP management in co-creation, shedding light on the importance of the topic of IP management in collaborative innovation between companies and individual external contributors.

2.3.1 Research design and methodology

The final part of this critical review of the innovation management literature is focused on understanding the current state and the existing gaps of the research on IP management in co-creation. Aiming to cover a significant proportion of the representative literature on this topic, the process of data collection started with a search for articles published in journals indexed in the SciVerse Scopus database, containing selected terms within their title, abstract and keywords, related in the first instance to the IP—*intellectual property*, *IP*, *property right**, *value appropriation* or *appropriability*—and in the second instance related to co-creation in general—*co-creation*, *cocreation*, *open innovation*, *crowdsourcing*, *living lab**, *innovation lab**, *innovation contest**, *innovation competition**, *co-innovation*, *co-development*, *open*

collaboration, *user innovation*, *user communit** or *distributed innovation*. Such searching generated 394 publications published during the 1986-2016 period. After reviewing the abstracts of these publications, with the goal of excluding all articles focused specifically on IP management in *inter-organizational* collaboration, the data set was reduced to 93 publications, published during the 2003-2016 period. After the full text review of each publication, the articles that did not explicitly discuss the topic of IP management in collaborative innovation between companies and individual external contributors were excluded, reducing the final set to 31 publications, published in the 2003-2016 period.

Conducted in August 2016, this search for relevant articles enabled creation of the initial set of core literature focused specifically on IP management in co-creation, supporting positioning of this PhD research in the diverse innovation management literature.

Since August 2016, this initial set of 31 publications has been continuously updated, in search for more recent articles discussing IP management in co-creation, being aware of the exponentially growing interest in the topic.

2.3.2 Challenges of IP management in co-creation

Intrinsic to the fact that it requires interaction between a company and individual external contributors outside the organization's boundaries, co-creation entails special risks related to IP management. Co-creation requires the contribution of information, knowledge and IP from both the company's side and the co-creators' side, and it involves the generation of new intellectual assets and associated IP rights, for example, patents, copyright, design rights or trade secrets, or even trademarks.

Thus, co-creation is almost inevitably followed by challenges related to IP protection and ownership (Antorini & Muñiz Jr., 2013; Boudreau & Lakhani, 2013; Greer & Lei, 2012; Hienerth et al., 2011).

Drawing upon widely accepted conventions about the underlying subject matter of IP as promulgated by the World Intellectual Property Organization (WIPO, 2003) and commentary from scholarly sources (Cornish, Llewelyn, & Alpin, 2013; Goldstein & Landova, 2015; Willoughby, 2013), intellectual property is formally defined here as that class of intangible assets on which legal rights have been conferred by a sovereign state whereby the recipients of those rights possess the authority to exclude others from using, making, selling, distributing, importing, copying or otherwise exploiting those assets without permission. Some intangible assets (e.g., technical ideas that are not novel, or "secrets" that neither pertain to commerce nor are actually secret) may not accrue legal IP rights, as such, and hence are not included as part of what is labeled here as "intellectual property." However, the range of intangible materials and intellectual results of co-creation projects that are eligible for IP protection (e.g., novel and non-obvious technical ideas, new product designs, original text, original graphics, or classified business information, and even some types of business or product ideas) is substantial. Thus, in this research the term "intellectual property" is not used as a synonym for "intangible assets" in general, but for a narrower sub-category of intangible assets which are eligible for IP protection. It should also be recognized that some intangible subject matter involved in co-creation projects that does not strictly speaking qualify as "intellectual property" may nevertheless be protected by implicit or informal norms-based practices under

which its creators obtain *de facto* rather than *de jure* exclusive rights over their creations (Bauer, Franke, & Tuertscher, 2016; Fauchart & von Hippel, 2008).

The emerging literature on co-creation recognizes three primary kinds of IP issues associated with co-creation projects, namely the protection of companies' inputs to co-creation projects; the protection of co-creators' inputs to co-creation projects; and the protection and ownership of the outcomes of co-creation projects.

As a necessary feature of their engagement in co-creation activities, companies almost certainly reveal information about their products and innovation strategy to co-creators and, as a consequence, face risks related to unclear accountability if something goes wrong in the co-creation relationship (Hienerth et al., 2011), such as involuntary transfer of knowledge across company boundaries (Bonabeau, 2009; Füller & Matzler, 2007; Greer & Lei, 2012), usage of companies' know-how by co-creators for their own purposes (Enkel, Kausch, & Gassmann, 2005), or failure of participants to maintain confidentiality (Greer & Lei, 2012). Faced with the difficulties of balancing between IP sharing and IP protection (Macedo & Camarinha-Matos, 2011), companies averse to such risks may therefore be reluctant to engage in co-creation, despite foregoing benefits that they might otherwise enjoy.

Likewise, co-creators, i.e., individual external contributors, may also feel protective of their inputs and may curtail the information they share with the company, to avoid the risk of unfair exploitation or appropriation of co-creators' input by initiating companies (Abhari, Davidson, & Xiao, 2018; Bartl et al., 2012; Füller & Matzler, 2007) or by other co-creators through replication, theft and imitation, or free-riding (Bauer et al., 2016; Bockstedt, Druehl, & Mishra, 2016; Natalicchio, Messeni Petruzzelli, & Garavelli, 2014).

Finally, the twin issues of protecting the co-creation outcomes and agreeing on their ownership may become quite problematic, as co-creation is based on joint product innovation, and individual contributions may be difficult to determine (Hoyer et al., 2010; Paasi, Luoma, Valkokari, & Lee, 2010; Romero & Molina, 2009). In co-creation projects the know-how of all parties is inevitably combined, even though co-creators might voluntarily waive their IP rights, they may sometimes nevertheless continue to see co-creation outcomes as their own property, and may eventually claim joint or full ownership, disseminate or exploit co-creation outcomes (Greer & Lei, 2012; Hoyer et al., 2010; Mehlman et al., 2010). Thus, co-creation makes it more difficult and troublesome for companies to appropriate benefits from innovation (Belderbos et al., 2013; Dahlander & Gann, 2010; Fowles & Clark, 2005).

2.3.3 IP management strategies in co-creation

The extant research on IP management in co-creation is to date characterized by the absence of deep insight-about and nuanced analysis-of strategies that companies adopt in managing IP, especially related to the protection and ownership of the co-creation outcomes. The literature on this topic is still embryonic, revealing only tentative or limited portrayals of current practices. Most papers focus only on one approach to IP management, without offering evidence or insights about the potential use of other approaches.

Taken as a whole, however, the literature nevertheless indicates the existence of a variety of IP management strategies involving a plurality of IP rights and various levels of IP control (Alexy, Criscuolo, & Salter, 2009; Belenzon & Schankerman, 2015; Felin & Zenger, 2014). On one hand, more restrictive strategies allow

companies to assert a high degree of IP control, by claiming ownership or by asserting exclusive IP rights over the co-creation outcomes, thereby allowing their full appropriation (Antorini & Muñiz Jr., 2013; Bonabeau, 2009; Chatterji & Fabrizio, 2012; Chatterji & Fabrizio, 2014; Felin & Zenger, 2014; Parmentier & Mangematin, 2014). However, too restrictive an approach to IP management has the potential of obstructing or even killing collaborative innovation, by demotivating external actors from contributing their ideas and solutions due to their perception of being treated unfairly with regards to IP. On the other hand, being based on companies' choice to establish lower degree of IP control, by obtaining some rights over the co-creation outcomes, or to completely eschew any IP rights over the co-creation outcomes, more permissive IP management strategies leave the IP with its creators (Avenali, Battistella, Matteucci, & Nonino, 2013; Felin & Zenger, 2014). Even though such strategies may cultivate the benefits of openness and collaboration, too permissive an approach to IP management in co-creation may lead to difficulties in IP management, such as troublesome IP protection and difficulties in appropriating benefits from innovation.

The need for harmonizing control and openness of the IP in collaborative innovation, exacerbated by the tension between dynamic innovation activities and conventional static methods of IP protection, pushes companies to cultivate new approaches to IP management that facilitate rather than obstruct involvement of multiple external actors into corporate innovation (Alexy et al., 2009; Laursen & Salter, 2014; Lee, 2009; O'Hern & Rindfleisch, 2010). Also, given that a "one size fits all" approach to IP management in collaborative innovation is not viable, companies need to adapt their IP management strategies to the specificities of

particular projects (Alexy et al., 2009; Belenzon & Schankerman, 2015; de Beer et al., 2017; Giannopoulou, Yström, & Ollila, 2011; Lakhani & Panetta, 2007).

Thus, taking into account these challenges, the remainder of this literature review is focused on providing a deeper understanding of how companies develop their IP management strategies in different co-creation projects.

2.3.3.1 Building-blocks of IP management strategies in co-creation

It has been observed that, in contrast with conventional corporate alliances and joint ventures, in which corporate agreements are typically well defined and formalized, relationships between companies and individual external contributors are generally ruled by loose or informal contractual obligations, with the result that in co-creation projects companies do not enjoy the same power of monitoring and enforcement of obligations to which they are accustomed with formal industrial partners (Rayna & Striukova, 2015). Thus, explicit contractual terms and conditions need to be determined for each co-creation project, to ensure proper, fair and transparent treatment of IP, especially with regards to ownership of co-creation outcomes, licensing arrangements between the company and co-creators, and compensation of co-creators (Antorini & Muñiz Jr., 2013; Boudreau & Lakhani, 2013; Brem, Bilgram, & Gutstein, 2018; de Beer et al., 2017; Standing & Standing, 2018).

Transfer of the ownership of co-creation outcomes to the initiating company is seen as a critically important ingredient of the company's quest to appropriate value from innovation and govern the revenue streams that will come from it (de Beer et al., 2017; Feller, Finnegan, Hayes, & O'Reilly, 2012). Obtaining private corporate ownership gives companies control over the IP, freedom to use it and to fully exploit

it as they wish, and the opportunity to accumulate know-how at low cost (Chatterji & Fabrizio, 2014; Hienerth et al., 2011; Mazzola et al., 2018). Nevertheless, assignment of all the IP to the company may also be seen to be demotivating for co-creators, and thereby as retarding and impeding collaborative innovation (Albors, Ramos, & Hervas, 2008; Benkler, 2017; Bogers & West, 2012).

Conversely, *licensing arrangements* in co-creation do not involve transfer of ownership from co-creators to initiating companies, but rather determine specific terms under which companies may exploit co-creation outcomes. Companies may acquire *exclusive licenses* to co-created solutions, under which co-creators may neither grant any other licenses to third parties nor use the solutions themselves, or *non-exclusive licenses*, leaving co-creators the right to grant licenses to third parties or to use solutions themselves (de Beer et al., 2017; Mazzola et al., 2018; Pitkänen & Lehto, 2012). Companies may also employ *Open Source or Creative Commons licenses* in co-creation as institutional mechanisms by which onerous or extreme control over IP is eschewed, but under which IP rights are still asserted. Such licensing arrangements are not used as a blocking device to exclude others, but as a mechanism to include them, with some amount of regulation and control (Benkler, 2016; de Laat, 2005; Parmentier & Mangematin, 2014). In this way, companies create extensive opportunities to promote broad-based creativity and inventive activity in the wider community, thereby increasing the efficiency and effectiveness of companies' R&D, enabling the growth of innovative ecosystems, and securing dominant market positions for companies, or boosting corporate profits (Belenzon & Schankerman, 2015; Benkler, 2017; Nagle, 2018). Nevertheless, even though such "inclusive" and permissive licensing arrangements may be a driving incentive for contribution and

more committed involvement in co-creation, they leave a company without full IP ownership or control, thereby potentially restricting its ability to appropriate value from the co-created IP (Dahlander & Gann, 2010; Henkel et al., 2013).

Finally, companies structure *compensation* in different ways, combining monetary and non-monetary rewards, to recompense co-creators for their efforts and/or for the IP (Bonabeau, 2009; Boudreau & Lakhani, 2013; Füller, 2010; Mortara, Ford, & Jaeger, 2013). Especially when transferring their IP to the initiating company, co-creators tend to have greater expectation of a reward and companies may need to be sensitive to the motivations of co-creators (Antorini & Muñiz Jr., 2013; de Beer et al., 2017). Also, companies possess a preference for monetary rewards, i.e., for paying for the external knowledge, as opposed to just taking it or using it gratuitously. This is because by employing monetary rewards companies are essentially "buying" rights to co-creation outcomes (Felin & Zenger, 2014; Terwiesch & Xu, 2008). In other words, corporate managers may worry that freely revealed external knowledge is not easily controlled, that applying it may require great coordination effort, and that exploiting other people's ideas without financial consideration may, under some circumstances, raise potential legal, ethical and public-relations issues associated with exploiting the unpaid work of co-creators (Schaarschmidt & Kilian, 2014; Standing & Standing, 2018). Nevertheless, despite these risks, companies sometimes do in fact simply rely upon the intrinsic motivation of co-creators (normally users) to donate their input and contribute to corporate product innovation. In such instances, co-creators usually benefit from symbolic rewards, such as privileges and recognition, but their main rewards are typically not monetary.

2.3.3.2 Context-dependence of IP management strategies in co-creation

The innovation management literature suggests a number of different innovation-relevant contextual frames (to be discussed below; see Section 3.1.1) that may be relevant to IP management strategy. However, the particular characteristics and conditions of co-creation projects themselves have not yet been recognized in the literature as significant contextual frames. Nevertheless, there are fragments of evidence in the literature about the potential fit between certain IP management strategies and certain forms of involvement of individual external contributors in corporate innovation.

For example, research on crowdsourcing, which is seen as a way of involving individual external contributors in corporate innovation, emphasizes the importance of employing more restrictive IP management strategies that would enable companies to appropriate the benefits of innovation. In crowdsourcing contests, companies typically obtain ownership of the winner's solution or acquire a license to exploit that solution in exchange for the prize (de Beer et al., 2017; Mazzola et al., 2018; Mortara et al., 2013). There is a number of such co-creation projects discussed in the literature, such as *LEGO Ideas* (Antorini & Muñiz Jr., 2013), *Harvard Catalyst via Topcoder* (Boudreau & Lakhani, 2013), *Dell Inc.'s IdeaStorm* (Alexy et al., 2009), etc.

On the other hand, research on community-based innovation has raised the issue of restrictive IP management approaches tending to deter collaborative innovation and collective creativity, and has thereby highlighted the virtues of free revealing, or employing Open Source or Creative Commons licenses, in such an environment (Albors et al., 2008; Benkler, 2017; Harwood & Garry, 2014). Co-creators involved in communities usually are not rivals and are typically driven by a strong community

spirit (Antorini & Muñiz Jr., 2013). Thus, more permissive IP management strategies hold a promise for delivering the full potential of collaboration with creative communities, in consonance with the open source movement, and the great potential for idea recombination that flows from involving a diversity of participants in product innovation (Kankanala & Mishra, 2012; von Krogh, 2003). The literature offers a number of such examples, including *Local Motors* projects (Langner & Seidel, 2014), *Wikipedia* (Boudreau & Lakhani, 2013), *Propellerhead* (Alexy et al., 2009), etc.

This scattered evidence from the literature provide some insights about the potential significance of the co-creation context determined by the project-specific characteristics for making decisions about IP management strategy. Nevertheless, researchers in the field to date have limited their attention to a specific co-creation context of interest, excluding other co-creation contexts from the scope of the research. Comprehensive studies that take various contexts into account when discussing IP management in co-creation are very limited (Alexy et al., 2009; Boudreau & Lakhani, 2013; Felin & Zenger, 2014), leaving the issue of contextual dependence of IP management still largely unexplored in the literature.

2.3.4 Discussion of results

In this final stage of the literature review focused on IP management in co-creation the main gaps of the extant research are identified.

Even though the research focusing on alternative IP management strategies adopted in inter-organizational collaborative innovation has intensified during the last decade (Aloini et al., 2017; Belderbos et al., 2013; Drechsler & Natter, 2012; Henkel et al., 2014; Zobel et al., 2017), IP management strategies in co-creation and specific

IP arrangements between companies and individual external contributors have only recently garnered the attention of scholars (de Beer et al., 2017; Mazzola et al., 2018). Information in the literature about alternative strategies that companies adopt to manage IP related to co-creation outcomes is still sparse, calling for further research at the interface on IP management and co-creation.

Further, the literature discusses a variety of building-blocks that companies have at their disposal when developing IP management strategies, namely: transfer of ownership and different licensing arrangements (Benkler, 2017; Chatterji & Fabrizio, 2014; de Beer et al., 2017; Mazzola et al., 2018; Pitkänen & Lehto, 2012), by which companies established distinctive degrees of IP control; and compensation (Bonabeau, 2009; Boudreau & Lakhani, 2013; Füller, 2010; Mortara et al., 2013), by which companies reward or remunerate co-creators for their contribution to corporate innovation projects. Representing the core of IP management strategies, these building-blocks need to be laid out in co-creation projects' terms and conditions, to ensure proper, fair and transparent treatment of IP (de Beer et al., 2017; Standing & Standing, 2018). Even though IP management strategies are developed on the basis of distinctive combinations of transfer of ownership, exclusive, non-exclusive or Open Source / Creative Commons licensing arrangements, on one hand, and monetary or non-monetary compensation, on the other hand, the value of a configurational perspective on IP management strategies for harmonizing control and openness of the IP in co-creation has not yet been recognized in the literature.

Finally, there is a lack of evidence in the literature about potential ways to use these building-blocks to customize IP management strategies to fit specific co-creation projects. Comprehensive studies that take various contexts into account when

discussing IP management in co-creation are very limited (Alexy et al., 2009; Boudreau & Lakhani, 2013; Felin & Zenger, 2014). Scattered evidence about the potential significance of co-creation contexts for making decisions about IP management strategies emanates from research indicating that some strategies represent a better fit for specific forms of collaborative innovation with individual external contributors than others.

2.4 Conclusions

Although co-creation has attracted a lot of attention in the academic world since the beginning of the 21st century, a consistent and widely accepted definition of co-creation has been missing in the innovation management literature until now, followed by a poor understanding as to how co-creation differs from and relates to the concept of open innovation.

Based on the insights from this critical literature review, co-creation is defined here *as a form of collaborative innovation initiated by a company, involving individual external contributors or co-creators who may provide valuable input to the company's innovation projects*. Additionally, the co-creation concept is further elaborated here by positing a taxonomy of co-creation, differentiating between the *company-to-one* and the *company-to-many* co-creation types.

By providing a perspective on these issues that goes beyond the current state of the literature, the results of this review contribute to the contemporary conversation in the literature about co-creation and, more generally, collaborative innovation between companies and individual external contributors. Development of a lucid definition and practical taxonomy of co-creation based on the results of this literature review is

especially important in view of the variety of meanings of co-creation extant in the literature (Ind & Coates, 2013) arising from the wide array of disciplines that featured the term or concept prior to the early 2000s. Greater precision in the conceptualization of co-creation and consistency in labeling co-creation practices may support the advancement of empirical research in this field, avoiding confusion caused by the use of different terminology for the same practices, and vice versa. This in turn may help enhance the practical application of academic research about co-creation. The coherent concept of co-creation generated through this literature review provides a more robust basis for conducting more cogent PhD research on IP management in co-creation.

Recognizing that IP management in co-creation is still an underexplored topic in the literature, this critical review identified gaps in the existing literature to guide the subsequent empirical stages of this research. In this project "IP management" refers to the means that initiating companies employ to protect co-creation outcomes and with the manner in which they arrange ownership and user rights of those outcomes. Building on this literature review, the main focus of the rest of the thesis will be to identify and analyze issues associated with configuring IP management strategies to fit various co-creation contexts. In this way the value of the configurational and contextual perspectives for strategy development will be demonstrated.

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Chapter 3

Preliminary empirical study

This chapter provides the details about the preliminary empirical study[2], conducted in the second stage of this PhD research. It describes the conceptual research framework, research methodology, as well as data collection and data analysis procedures, employed in this study to explore the variety of IP management strategies in different co-creation contexts. It also includes detailed presentation and in-depth discussion of the results of the preliminary empirical study.

3.1 Research design and methodology

3.1.1 Conceptual research framework

Relying on the insights from the review of the extant innovation management literature, the research framework employed here is based on the synthesis of the contextual and configurational perspectives on IP management in co-creation.

"Context" as an organizing framework for research has received significant attention in management studies (Bamberger, 2008; Galvin, 2014), emphasizing primarily the importance of, for example, geography (Feldman & Florida, 1994; Rosenthal & Strange, 2003; Scott, 2006), industry (Dess, Ireland, & Hitt, 1990;

[2] The results of the preliminary empirical study are published in:
Tekic, A., & Willoughby, K. W. (2019). Configuring intellectual property management strategies in co-creation: A contextual perspective. *Innovation: Organization & Management*, (Article in Press). http://doi.org/10.1080/14479338.2019.1585189

Rumelt, 1982; Stimpert & Duhaime, 1997; Zahra, 1993), and culture (Evanschitzky, Eisend, Calantone, & Jiang, 2012; Hofstede, 1994; Jones & Davis, 2000; Nakata & Sivakumar, 1996; Rhyne, Teagarden, & van den Panhuyzen, 2002). Nevertheless, as the contextual perspective in innovation management research has become more prominent, the meaning of "context" *vis-à-vis* innovation has broadened (Tekic & Willoughby, 2017b) and now embraces a variety of conditions or factors typically associated with the intra-organizational milieu, such as firm size, firm type, product life cycle stage, product development stage, innovation type, or the degree of the product innovativeness (Huizingh, 2011; Ortt & Duin, 2008; Tidd, 2001).

The innovation management literature presents a number of different innovation-relevant contextual frames that might be pertinent, in principle, to making decisions about which IP management strategy should be adopted in co-creation. Examples include the industrial setting and business model (Lakhani & Panetta, 2007), the type and degree of innovation (Zobel et al., 2017), the technological environment and knowledge distribution (Alexy et al., 2009), or the development stage and knowledge domains (Mazzola et al., 2018). Nevertheless, taking into account the evidence from the literature that, on one hand, companies engaged in crowdsourcing projects tend to acquire all the rights to co-creation outcomes (Boudreau & Lakhani, 2013; de Beer et al., 2017; Felin & Zenger, 2014; Mazzola et al., 2018; Mortara et al., 2013), and that, on the other hand, companies engaged in collective community-based co-creation projects tend to employ Open Source or Creative Commons licenses, or even to freely reveal co-creation outcomes (Albors et al., 2008; Benkler, 2017; Boudreau & Lakhani, 2013; Felin & Zenger, 2014; Harwood & Garry, 2014), it may be argued that particular characteristics and conditions of co-creation projects,

engendered by the number of individual external contributors involved in the co-creation of a single solution, create distinctive contexts for IP management.

Thus, taking into account the differences in the volume of existing relationships in a co-creation project, the potential for recombination of contributions, and the potential for IP control, co-creation types—namely "company-to-one" (one co-creator—one solution) and "company-to-many" (many co-creators—one solution) co-creation (Tekic & Willoughby, 2018)—are expected to have an influence on the decision about which IP management strategy should be adopted in a specific project.

Within company-to-one co-creation, co-creation of a single solution takes place between the initiating company and only one co-creator (Tekic & Willoughby, 2018). This is a context where the number of existing relationships in the co-creation of one solution is small, where the potential for spontaneous recombination of contributions is low, and where IP can be straightforwardly controlled. Conversely, within company-to-many co-creation, co-creation of a single solution takes place between a company and a group of co-creators who are supported to co-create among themselves and join their efforts to solve a specific problem (Tekic & Willoughby, 2018). It is based on joint product innovation and collective intelligence, and hence co-creators' inputs are inevitably combined, making it difficult to determine individual contributions and thus making the protection of IP very challenging (Boudreau & Lakhani, 2013; Jeppesen & Frederiksen, 2006). Thus, company-to-many co-creation represents a context where the number of existing relationships in co-creation of one solution is great, where the potential for spontaneous recombination of contributions is high, and where IP cannot be easily controlled.

Hence, by looking at co-creation from the perspective of the number of individual external contributors involved in the co-creation of a single solution, the two types of co-creation (Tekic & Willoughby, 2018) are distinguished as two different contexts of potential relevance for IP management in co-creation.

Finally, the extant innovation management literature offers evidence about different approaches to developing IP management strategies, revealing a variety of options that companies have at their disposal to control the IP related to co-creation outcomes—i.e., transfer of ownership (Chatterji & Fabrizio, 2014; de Beer et al., 2017; Feller et al., 2012; Hienerth et al., 2011; Mazzola et al., 2018) and licensing arrangements (Belenzon & Schankerman, 2015; Benkler, 2017; de Beer et al., 2017; Mazzola et al., 2018; Nagle, 2018; Pitkänen & Lehto, 2012)—and to reward the co-creators for their contribution to corporate innovation projects—i.e., compensation structure (Bonabeau, 2009; Boudreau & Lakhani, 2013; Füller, 2010; Mortara et al., 2013). These building-blocks are the foundation of IP management strategies and should be explicitly laid out in contractual terms and conditions that are determined for each co-creation project, to ensure proper, fair and transparent treatment of IP (de Beer et al., 2017; Standing & Standing, 2018). This complexity evokes the need to integrate the apparent configurational character of IP management strategies in co-creation into the research framework.

Thus, arguing that companies need to configure their IP management strategies to match the specific type of co-creation they practice, the conceptual research framework of this preliminary empirical study integrates contextual and configurations perspectives on IP management in co-creation (Figure 3.1).

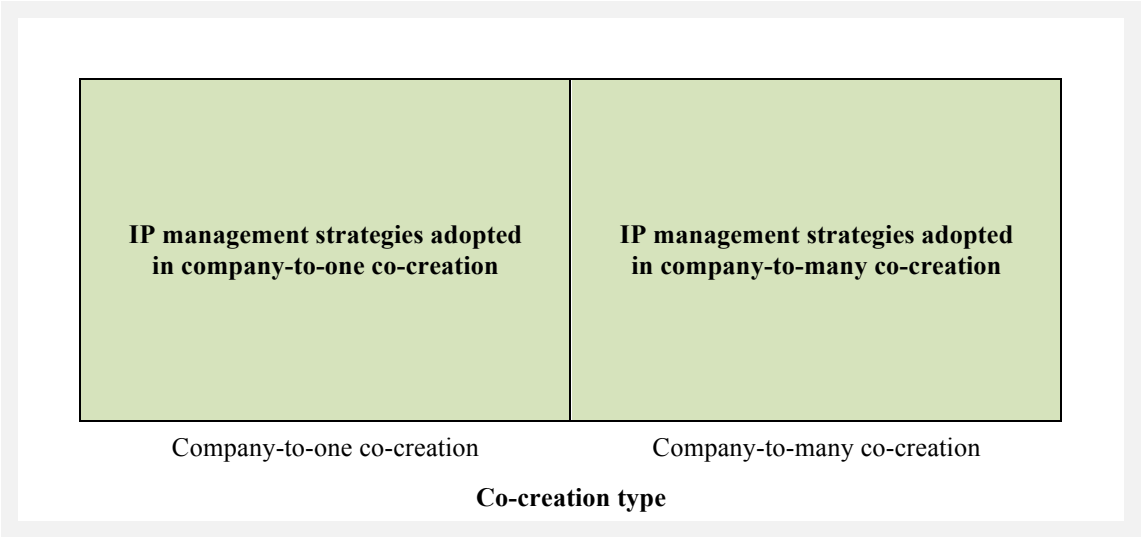


Figure 3.1 Conceptual research framework

With its main purposes being to assess the robustness of the research framework developed through the literature review, and to assess its fitness for the main empirical analysis, the preliminary empirical study was designed to answer the following research questions: (1) what IP management strategies do companies actually adopt in distinctive co-creation contexts; and (2) how do those IP management strategies differ across the co-creation contexts?

3.1.2 Exploratory qualitative research

Given the paucity of theory and empirical evidence in the literature dealing specifically with alternative IP management strategies in collaborative innovation between companies and individual external contributors, the preliminary empirical study employed an exploratory qualitative research methodology, by collecting, generating and analysing information on IP management from multiple co-creation projects.

By effectively addressing the "what" and "how" research questions related to understudied topics (Lee, Mitchell, & Sablynski, 1999), exploratory qualitative

research is an appropriate methodology for the preliminary empirical study of this PhD research. By following an inductive approach to theory building, it allows researchers to begin with specific empirical observations, to identify existing patterns, and to formulate tentative hypotheses (Barczak, 2015).

In view of the fact that a single company may actually adopt a variety of IP management strategies across different co-creation projects, an individual co-creation project itself, rather than the firm that initiated the project, is taken as the basic unit of analysis for this research. Adopting a data-rich qualitative research approach enables both understanding how IP was managed in each individual case and capturing the diversity of IP management strategies across cases.

3.1.3 Data collection

Motivated by the great number and variety of identifiable co-creation projects initiated by automotive companies, the preliminary empirical study is focused specifically on how IP is managed in co-creation within the automotive industry. Insights from industry reports (Hitachi Consulting, 2017; PwC, 2013) show that automotive companies are the leaders in collaborative innovation with external actors across corporate boundaries. Starting with involving customers in product innovation for the purpose of taking advantage of mass customization techniques enabling the configuration and personalization of cars, automotive companies have explored distinctive co-creation practices by involving any interested individuals with the required set of expertise and experience into their innovation projects. The automotive industry has also garnered great attention in the academic literature on open and collaborative innovation, given that a car has become a “platform” for different

technologies, pushing automotive companies to look for know-how outside their organizational boundaries (Ili, Albers, & Miller, 2010; Mueller-Seitz & Reger, 2010; Schuster & Brem, 2015; Wilhelm & Dolfsma, 2018).

3.1.3.1 Internet-based search

To be able to attract potential co-creators to contribute to corporate innovation projects, companies need to provide the description of their co-creation initiatives and be clear about the rules of the participation. Thus, most of the co-creation projects that end up being promoted on the Internet or run online have their terms and conditions transparently laid out.

Taking into account that they describe and determine upfront how IP is handled, terms and conditions are seen as the "legal cornerstone" of co-creation projects (de Beer et al., 2017). Thus, the collection of qualitative data about how IP is managed in co-creation projects initiated by automotive companies was focused on gathering of the individual projects' terms and conditions by the means of a broad Internet-based search.

The broad Internet-based search was conducted in the timeframe between 2015 and 2018, comprising the within-platform search and the open search for co-creation projects initiated by automotive companies. Namely, the within-platform search was focused on intermediary open innovation platforms (i.e. *eYeka*, *jovoto* and *HYVE Crowd*) where the identity of the initiating company or the industry it operated within was available, and on the prominent corporate multi-project platforms in automotive industry (i.e. *Local Motors Launch Forth* and *BMW Co-Creation Lab*). The open search included the search for corporate single-project co-creation platforms or

announcements of different co-creation workshops or hackathons typically identifiable from within automotive companies' websites or social media profiles.

Such broad Internet-based search yielded the set of 168 pertinent cases for the preliminary empirical study. Nevertheless, this initial set provided terms and conditions for only 111 co-creation projects. The terms and conditions of the remaining projects were neither attached to the project website nor publicly available on any other website related to the project or to the initiating company. Further Internet search for the missing terms and conditions, beyond these sources, did not yield any results. Thus, it was possible to conduct analysis of IP management in co-creation based on the data contained within the terms and conditions of projects for about 67% of the initial set.

3.1.3.2 Final sample

The final set of 111 cases of distinct co-creation projects comprises 79 company-to-one (see Appendix 1) and 32 company-to-many (see Appendix 2) co-creation projects. The co-creation projects are initiated by 17 different automotive companies, with headquarters in Germany, USA, UK, South Korea, Japan, Italy, the Czech Republic and France, ranging from around 100 to 640,000 employees and from around 10 years up to 140 years of operation. The identity of the initiating company is kept confidential in the cases of 20 projects in the final sample.

The specific focus on the automotive industry adopted for the study allowed generation of a set of co-creation projects that involves a variety of co-creation approaches (crowdsourcing contests, co-creation workshops, hackathons, community-based innovation, etc.), situated in both the online and offline co-creation settings.

Within the set of 79 company-to-one co-creation projects there are 49 projects organized on online intermediary platforms (33 *eYeka*, 14 *jovoto*, and 2 *HYVE Crowd* projects), 26 projects organized on online corporate multi-project platforms (23 *Local Motors Launch Forth* and 3 *BMW Co-Creation Lab* projects), and 4 projects organized on online corporate single-project platforms (2 *Daimler AG*, 1 *Ford Motor Company* and 1 *Volkswagen AG* projects). Within the set of 32 company-to-many co-creation projects there are 9 projects organized in the offline setting (3 *Audi AG*, 2 *Jaguar Land Rover Automotive PLC*, 2 *Daimler AG*, 1 *BMW AG* and 1 *Toyota Motor Corporation* projects), 22 projects organized on an online corporate multi-project platform (*Local Motors Launch Forth*) and 1 project organized on an online intermediary platform (*HYVE Crowd*).

The sample embraces a substantial variety of co-creation projects with diverse objectives, namely technology development (such as in cases focused on connected vehicles, driverless vehicles, electric vehicles, new mobility services, etc.), product design (such as in cases focused on vehicles' interior and exterior design) and user experience (such as in cases focused on marketing campaigns). Thus, despite the focus on a single industry in this study, such a diverse set of cases may improve the generalizability of the insights across a range of industries in which companies collaborate with co-creators in development of technology-based consumer products.

3.1.4 Data analysis

To extract maximum value from the available qualitative data in the final data set, an iterative process of data analysis was adopted—based on data reduction, data display, and conclusion-drawing—following the established data-analysis approach of

Miles & Huberman (1984). This procedure enabled identifying what IP management strategies companies actually adopt in distinctive co-creation contexts, as well as how those IP management strategies differ between co-creation contexts.

3.1.4.1 Qualitative content analysis

To examine the IP management strategies adopted by companies in each co-creation project in the final set of 111 cases, the projects' terms and conditions were analysed by the means of *qualitative content analysis* (Hsieh & Shannon, 2005; Mayring, 2004). Incorporating both deductive (based on existing theoretical concepts) and inductive (based on collected data) approaches to category system development, as it was done in previous research (e.g., Hutter, Hautz, Füller, Mueller, & Matzler, 2011; Lettl, Herstatt, & Gemuenden, 2006), a hybrid approach to content analysis was used (Fereday & Muir-Cochrane, 2006). Such a hybrid approach supported guided but not restrained content analysis, congruent with the exploratory nature of this research.

First, three broad *a priori* categories were determined, based on the insights from the literature discussing IP management in co-creation (Antorini & Muñiz Jr., 2013; Boudreau & Lakhani, 2013; de Beer et al., 2017; Felin & Zenger, 2014; Mazzola et al., 2018), namely: transfer of ownership from co-creators to the initiating company; licensing arrangements between co-creators and the company by which the company obtains the rights to use co-creation outcomes; and, the compensation structure, i.e., rewards that co-creators receive for their effort and IP. The content analysis of terms and conditions commenced based on these *a priori* categories, but allowed new categories that supported enhanced characterization of IP management in

co-creation to emerge directly from analysis of the collected data. This led to iterative refinement and revision of the category system during analysis.

In addition to data that could be easily classified within the three *a priori* categories, the analysis of the terms and conditions of the co-creation projects generated information about three new categories of IP management practices, namely: the use of non-disclosure agreements (NDAs); employment of potential additional agreements between the company and co-creators not otherwise specified within the terms and conditions as such; and, inclusion of a waiver option by which companies agree to return the rights they obtained through transfer of ownership or different licensing arrangements back to co-creators within a specific period of time if they decided not to use co-creation outcomes.

All the terms and conditions of all the projects were then reanalysed according to the final six categories, which are labelled here as "IP dimensions," namely: (1) *transfer of ownership*; (2) *licensing arrangements*; (3) *compensation structure*; (4) *NDAs*; (5) *additional agreements;* and (6) *waiver option*.

3.1.4.2 Case clustering

Supported by reduction-oriented quantitative tabulations, the individual cases were compared, aggregating the results of the content analysis to create case clusters. The cases were clustered based on the six IP dimensions, taking into account whether the initiating company obtained the ownership rights to the co-creation outcomes or not, what kind of license (if applicable) the company acquired to be able to use the co-creation outcomes (e.g. exclusive, non-exclusive, Creative Commons, etc.), what kind of compensation the company offered to the co-creators for their input to the co-

creation project (e.g. monetary and/or non-monetary), and whether the company employed NDAs, additional agreements and the waiver option as a part of their IP management strategy. The cases that had common features in terms of all six dimensions were allocated to the same cluster. Such case clustering practice was aimed to identify different configurations of IP dimensions, enabling differentiation among various IP management strategies adopted in 111 co-creation projects.

Accordingly, 11 different configurations were identified in the context of company-to-one co-creation and 9 different configurations in the context of company-to-many co-creation. For each configuration representative cases (single or multiple, depending upon the facts) were selected to illustrate the adopted IP management strategy in co-creation. With the goal of exemplifying distinctive or unique project terms and conditions, one representative case was selected within a single setting, i.e., online intermediary platforms (*eYeka*, *jovoto*, or *HYVE Crowd*), online corporate platforms (multi-project platforms, such as *Local Motors Launch Forth* and *BMW Co-Creation Lab*, or single-project platforms), or different offline settings. Thus, due to the variety of cases within a single identified configuration of IP dimensions, some IP management strategies were illustrated by more than one representative case. There were 27 representative cases selected in total, 15 cases for IP management strategies in the context of company-to-one co-creation and 12 cases for IP management strategies in the context of company-to-many co-creation.

3.2 Results

The exploratory qualitative analysis of how companies manage IP in co-creation projects according to six IP dimensions—namely, transfer of ownership, licensing arrangements, compensation structure, NDA, additional agreements and the waiver option—enabled identifying salient links between co-creation contexts and IP management strategies. The results of this preliminary empirical research are summarised below.

3.2.1 IP management strategies in company-to-one co-creation

In the company-to-one co-creation context, co-creation of a single solution takes place between the initiating company and only one co-creator. Each of the 79 analysed cases of company-to-one co-creation projects incorporate the use of online crowdsourcing contests, organized either on the companies' own single-project and multiple-project platforms, such as *Local Motors Launch Forth* or *BMW Co-Creation Lab*, or via a third-party platform, such as *jovoto*, *eYeka* or *HYVE Crowd,* which acts as an innovation intermediary between companies and co-creators.

Among the company-to-one co-creation projects, there are 11 IP management strategies identified to be based on distinctive configurations of the six IP dimensions (Table 3.1).

There are 15 company-to-one co-creation projects, organized on *Local Motors* and *jovoto* platforms, in which the IP management strategy is based on combining full transfer of ownership with monetary compensation, while excluding NDAs, additional agreements and the waiver option. This IP management strategy may be

illustrated by selected excerpts from the terms and conditions of the representative projects. For example, in the case of *LM Autonomous* (a *Local Motors* project), the winners of the contest needed to "*assign and agree to assign to Local Motors all right, title, and interest (including any and all intellectual and industrial property rights of any sort throughout the world) in and to such Selected Design, and every part or piece thereof*." Co-creators were compensated by a monetary prize, in return for the transfer of ownership of co-creation outcomes to the initiating company. Conversely, in the case of *Skoda Experience* (a *jovoto* project), by participating in the project "*all rights (were) automatically passed to the client (of jovoto),*" while all participating co-creators were compensated by a monetary prize.

Additionally, there are 35 company-to-one co-creation projects, organized on the *eYeka* and *jovoto* platforms, in which the IP management strategy is based on the combination of full transfer of ownership and monetary compensation, with the additional employment of a non-disclosure agreement (NDA). This IP management strategy may also be illustrated by selected excerpts from the terms and conditions of the representative projects. For example, in the case of *Citroen Design* (an *eYeka* project) the winners of the contest needed to "*sign an assignment of rights agreement and assign the intellectual property rights on winning submissions to the company on behalf of which eYeka (had) organized the contest,*" in exchange for the monetary prize. The winners also needed to agree to "*keep the submission and the fact that he/she (had) assigned the intellectual property rights on the submission to the company as confidential and not disclose such elements to any third party."* Conversely, in the case of *VW Buzz 2* (a *jovoto* project), winners of the contest transferred ownership rights to the initiating company in exchange for a monetary

prize, while additionally agreeing not to disclose any confidential information in relation to the company or co-creation project.

Within the set of company-to-one co-creation projects, there is one more IP management strategy based on full transfer of ownership. In contrast with the previous two strategies, this strategy combines full transfer of ownership with non-monetary compensation, while ignoring the employment of NDAs, additional agreements and the waiver option. Such a strategy is adopted in only one project, namely *Conf PKW*, organized on the *HYVE Crowd* platform, keeping the identity of the initiating company confidential. Winners of the contest agreed to assign all IP rights to the company, while being compensated by a non-monetary prize (i.e., an iPad).

In the rest of the cases in the context of company-to-one co-creation, ownership rights remained with co-creators. To be able to use co-creators' IP for commercial, research or development purposes, the companies that initiated these projects set up distinctive licensing arrangements.

There are 12 company-to-one co-creation projects, organized on the *jovoto* and *BMW Co-Creation Lab* platforms, in which the IP management strategy is based on the employment of an exclusive license, by which a company obtains the rights to use the outcomes of co-creation, combined with monetary compensation. The following two projects may act as examples to illustrate this IP management strategy. In the case of *Audi Light* (a *jovoto* project) the winners of the contest needed to "*agree to jovoto passing the exclusive rights to the client (Audi AG)… in case the client wishes to license it*." Conversely, in the case of *BMW Trunk* (a *BMW Co-Creation Lab* project) the winners of the contest needed to "*assign the right of use without any limitation in terms of geography, time or content, … to BMW without further conditions and*

without any additional consideration." Such exclusive licensing arrangements leave the co-creators with no rights to use their solutions, even though they retain the ownership of them. In both cases co-creators were compensated by a monetary reward.

Additionally, three IP management strategies in company-to-one co-creation are identified to be based on the combination of exclusive licensing and monetary compensation, distinguished by the employment of NDAs, additional agreements or the waiver option. There are two projects, both organized on the *jovoto* platform, in which NDAs are employed, in addition to exclusive licensing and monetary compensation, as a part of an IP management strategy. For example, in the case of the *Audi Sound* project, winners of the contest agreed to keep the information about the projects confidential and to transfer exclusive rights of their IP to *Audi*, in exchange for a monetary prize. On the other hand, there is one project, namely *Daimler Smart*, organized on the corporate single-project platform, in which the IP management strategy is based on combining an exclusive license and monetary compensation with an additional agreement with co-creators. In this case, the additional agreement was related to the commercial use of the co-creation outcomes, i.e., if *Daimler AG* decided to commercially use a co-creator's submission, the co-creator would receive *"a one-time reimbursement of 1500 EUR."* Finally, a strategy based on an exclusive license and monetary compensation combined with an additional agreement and the waiver option is identified in two *Volkswagen* projects, namely *VW App* and *VW Engineering*, organized on the *HYVE Crowd* and on a single-project platform, respectively. In these projects, even though *Volkswagen* obtained the exclusive rights to use the co-creation outcomes and compensated co-creators by a monetary prize, the company agreed to waive its exclusive rights and return them to co-creators 24 months after the contest

ended, if it decided not to use the outcomes. The company also agreed to sign an additional agreement with co-creators for commercial use of the outcomes.

The exclusive license option is rarely combined with non-monetary compensation. Only one such case is identified, namely the *Ford Innenraum* project, organized on a single-project platform. In this project, the winners of the contest were awarded with vouchers for shopping in the *Ford Online-Shop*, while transferring exclusive rights of use to *Ford*. Similar to previous cases, the exclusive license employed was perpetual, royalty-free, world-wide and irrevocable.

Even though there are no cases in our analysed sample of company-to-one co-creation projects in which the non-exclusive license option is employed, there are nine projects, all of them organized on the *Local Motors* platform, in which the IP management strategy is based on employment of a *Creative Commons* license, specifically the Creative Commons Attribution-NonCommercial-ShareAlike (BY-NC-SA) license. There are two projects in which the employment of this license is combined with monetary compensation, such as in the case of *LM Botbox*, and seven projects in which it is combined with non-monetary compensation, such as in the case of *LM Sketchwall Racer*.

Finally, within the sample of company-to-one co-creation projects there is one single case in which companies eschew obtaining ownership rights or licenses to use co-creation outcomes. This is the case of *Mercedes Digital*, organized on a single-project platform. In this project, *Mercedes-Benz* offered a monetary prize to winners of the contest, retaining the right to further contact them and close an additional agreement in case the company decided to exploit the outcomes.

Table 3.1 presents a summary of IP management strategies in company-to-one co-creation projects.

Table 3.1 Summary of IP management strategies in company-to-one projects

No.	Transfer of ownership	Licensing arrangement	Compensation structure	NDA	Additional agreement	Waiver option	Number of cases
1	Full transfer	NA	Monetary compensation	No NDA	No additional agreement	No waiver	15
2	Full transfer	NA	Monetary compensation	NDA	No additional agreement	No waiver	35
3	Full transfer	NA	Non-monetary compensation	No NDA	No additional agreement	No waiver	1
4	No transfer	Exclusive license	Monetary compensation	No NDA	No additional agreement	No waiver	12
5	No transfer	Exclusive license	Monetary compensation	NDA	No additional agreement	No waiver	2
6	No transfer	Exclusive license	Monetary compensation	No NDA	Additional agreement	No waiver	1
7	No transfer	Exclusive license	Monetary compensation	No NDA	Additional agreement	Waiver	2
8	No transfer	Exclusive license	Non-monetary compensation	No NDA	No additional agreement	No waiver	1
9	No transfer	Open Source / Creative Commons	Monetary compensation	No NDA	No additional agreement	No waiver	2
10	No transfer	Open Source / Creative Commons	Non-monetary compensation	No NDA	No additional agreement	No waiver	7
11	No transfer	No licensing arrangement	Monetary compensation	No NDA	Additional agreement	No waiver	1

3.2.2 IP management strategies in company-to-many co-creation

In the context of company-to-many co-creation, co-creation of a single solution takes place between the initiating company and a group of co-creators who are supported to co-create among themselves and to join their efforts to solve a specific problem. Within the sample of 32 analysed cases of company-to-many co-creation, there are nine projects that took place in the offline setting, in the form of innovation forums, hackathons or ideathons, and 23 projects that took place in the

online setting, in the form of an innovation community on corporate platforms, such as *Local Motors Launch Forth*, or on intermediary platforms, such as *HYVE Crowd*.

Among the analysed company-to-many co-creation projects, we identify nine IP management strategies based on different configurations of the six IP dimensions (Table 3.2).

There are three company-to-many co-creation projects, one organized on the online *HYVE Crowd* platform and two organized in the offline setting, in which the IP management strategy is based on combining full transfer of ownership with monetary compensation, while excluding NDAs, additional agreements and the waiver option. This IP management strategy may be illustrated by selected excerpts from the terms and conditions of the representative projects. For example, in the case of *Conf Digital* (a *HYVE Crowd* project), "*by entering the competition, participants irrevocably and unconditionally (needed to) assign, to the extent legally possible, to HYVE any and all intellectual property rights*." The original rights of the non-winning participants were later re-assigned back to those non-winning participants, since the initiating company chose not to make use of them in its innovation process. In the case of *Jaguar Developer* (an offline project), winners of the contest agreed to "*transfer to Jaguar Land Rover the ownership title in respect of the source code, machine code, any other parts of computer programs (co-creation outcomes)*," while in the case of *Toyota Connected* (an offline project), all participants in the ideathon agreed that *"projects and ideas submitted would be owned by Toyota."* In all these cases, co-creators were compensated by a monetary prize, in return for transfer of ownership of co-creation outcomes.

In the remaining cases within the set of company-to-many co-creation projects, ownership rights remained with co-creators. In these cases, initiating companies

primarily used non-exclusive and Open Source or Creative Commons licenses to obtain rights to use the co-creation outcomes.

The employment of non-exclusive licensing arrangements is identified in five company-to-many projects. There is only one project, namely *Audi ADC*, organized in the offline setting, in which the IP management strategy is based on the employment of a non-exclusive license, combined solely with monetary compensation. In this case, "*in respect of any trade marks and other distinctive signs, patents and other intellectual property rights created in future within the framework of the competition*" participants agreed to "*grant a complimentary, global, simple sublicensable and irrevocable right of use to the other participants as well as to Audi AG and to companies affiliated with it*." Winners of the competition were awarded by a monetary prize. A similar approach was adopted in three projects, organized by *Local Motors*, in which the IP management strategy was based on the combination of non-exclusive licenses and monetary compensation, but complemented by the employment of additional agreements. For example, in the case of *LM Modular*, co-creators agreed to grant "*to Local Motors a royalty-free, sub licensable, transferable, perpetual, irrevocable, non-exclusive, worldwide license*" to co-creation outcomes. Nevertheless, if interested in commercializing co-creation outcomes, the company reserved the right to enter into additional agreements with co-creators, whereby they would assign their ownership rights to the company, in exchange for additional monetary or non-monetary compensation, in the form of a royalty or an award. Finally, there is a single case in which the IP management strategy is based on a non-exclusive licensing arrangement, complemented by a non-monetary compensation. This is the case of *Audi Smart Factory*, a project organized in the offline setting in the form of a

hackathon, in which co-creators agreed to grant *Audi AG* "*a global, unlimited, sub-licensable and irrevocable utilisation right to any copyrights created in the context of the Smart Factory Hackathon, as well as possibly trademarks and other marks, patents or other intellectual property rights for all known and unknown types of use*." Three best teams participating in this hackathon received rewards including the participation in an Audi driving experience and a visit to a tech conference on Big Data and Data Analytics.

There are 20 company-to-many co-creation projects, organized by *Local Motors* and *Audi*, in which companies adopted IP management strategies based on Open Source / Creative Commons licenses, complemented by monetary compensation. For example, in the case of the *LM Strati* project, *Local Motors* obtains rights to use the co-creation outcomes by employing the Creative Commons Attribution-NonCommercial-ShareAlike (BY-NC-SA) license that ensures disclosure while crediting authorship. Additionally, the company offers a percentage of revenue as a monetary compensation for co-creators, according to their level of contribution to the product.

On the other hand, in the case of *Audi Hackovation*, a project organized in the offline setting in the form of a hackathon, *Audi* employs a permissive Open Source license, namely the MIT License, stating that "*everything developed during the hackathon will remain open source projects and contribution will continue by Audi Business Innovation*."

There is a single company-to-many co-creation project, namely *BMW AI*, organized by *BMW* and *Siemens* in the offline setting in the form of a hackathon, in which the IP management strategy employed is based on an Open Source license combined with NDAs and additional agreements, while compensating winning co-

creators primarily by monetary rewards. While agreeing not to disclose any confidential information in relation to the company or co-creation project, participants of the hackathon were "*encouraged to publish their results under an open source license in order to promote innovation by sharing their work with a greater community*." Nevertheless, if their solutions were chosen for implementation, participants were required to grant *Siemens* and *BMW* a license to use the co-creation outcomes under terms and conditions negotiated in an additional agreement.

Finally, within the set of company-to-many co-creation projects there are three projects, all of them organized in the offline setting, in which companies decided to eschew obtaining ownership rights or different licenses to use co-creation outcomes. The detailed configurations of their IP management strategies differ. For example, in the case of *Mercedes Hack*, a hackathon organized by *Mercedes-Benz R&D*, the IP management strategy involved only monetary compensation, combined with an additional agreement with co-creators in the event of interest arising for the realization of co-created solutions. In the case of *Inmotion Hackthon*, a hackathon organized by *Jaguar Land Rover*, the IP management strategy involved monetary compensation and additional agreements, complemented by NDAs, agreeing not to disclose any confidential information nor use it for any purpose other than the *Inmotion Hackathon*. Participants retained all the rights in their solutions, but agreed to potential additional agreements in case of the company's interest in further development of co-creation outcomes. Finally, in the case of *Daimler Hack.LA*, a hackathon organized by *Daimler AG*—and in contrast with the other projects—the company employed an option for an additional agreement "*to enter into an additional*

license or agreement" with participants, complemented by non-monetary compensation, including hardware kits and a visit to a tech conference.

Table 3.2 presents a summary of IP management strategies in company-to-many co-creation projects.

Table 3.2 Summary of IP management strategies in company-to-many projects

No.	Transfer of ownership	Licensing arrangement	Compensation structure	NDA	Additional agreement	Waiver option	Number of cases
1	Full transfer	NA	Monetary compensation	No NDA	No additional agreement	No waiver	3
2	No transfer	Non-exclusive license	Monetary compensation	No NDA	No additional agreement	No waiver	1
3	No transfer	Non-exclusive license	Monetary compensation	No NDA	Additional agreement	No waiver	3
4	No transfer	Non-exclusive license	Non-monetary compensation	No NDA	No additional agreement	No waiver	1
5	No transfer	Open Source / Creative Commons	Monetary compensation	No NDA	No additional agreement	No waiver	20
6	No transfer	Open Source / Creative Commons	Monetary compensation	NDA	Additional agreement	No waiver	1
7	No transfer	No licensing arrangement	Monetary compensation	No NDA	Additional agreement	No waiver	1
8	No transfer	No licensing arrangement	Monetary compensation	NDA	Additional agreement	No waiver	1
9	No transfer	No licensing arrangement	Non-monetary compensation	No NDA	Additional agreement	No waiver	1

3.2.3 Summary of results

The analysis of 111 co-creation projects enabled identification of 17 unique IP management strategies, based on a variety of configurations of the six IP dimensions, namely, transfer of ownership, licensing arrangements, compensation structure, NDA, additional agreement and the waiver option. Being evident not only among the companies' co-creation projects, but also within the sets of projects initiated by a single company, this variety in the adopted IP management strategies indicates that observed configurations are not company-specific, but project-specific (see Appendix 1 and Appendix 2).

Table 3.3 summarizes these IP management strategies, indicating the number of cases of each configuration and the percentage of total cases in each respective co-creation context accounted for by strategy configuration. The 17 unique IP management strategies are clustered in to 5 groups of strategies with common overarching features.

Three IP management strategies are identified to be based on full transfer of ownership of the co-creation outcomes to initiating companies that, as a group, were adopted in almost two thirds (about 65%) of the company-to-one co-creation projects. By embracing such an approach companies gain the right to unlimited and unrestricted use of the outcomes and to their further potential implementation in corporate innovation processes. Nevertheless, it appears that companies rarely employ full transfer of ownership in the context of company-to-many co-creation. There was only one occurrence of such an IP management strategy identified within our set of company-to-many co-creation projects (about 9% of such projects).

Table 3.3 Comparative summary of IP management strategies across the co-creation contexts

No.	IP management strategy	Company-to-one co-creation		Company-to-many co-creation	
		Number of cases	%	Number of cases	%
1	**IP management strategies based on full transfer of ownership**	**51**	**64.6%**	**3**	**9.4%**
1.1	Full transfer of ownership, combined with monetary compensation	15	19%	3	9.4%
1.2	Full transfer of ownership, combined with monetary compensation and NDA	35	44.3%	0	0%
1.3	Full transfer of ownership, combined with non-monetary compensation	1	1.3%	0	0%
2	**IP management strategies based on exclusive licensing**	**18**	**22.8%**	**0**	**0%**
2.1	Exclusive license, combined with monetary compensation	12	15.2%	0	0%
2.2	Exclusive license, combined with monetary compensation and NDA	2	2.5%	0	0%
2.3	Exclusive license, combined with monetary compensation and additional agreement	1	1.3%	0	0%
2.4	Exclusive license, combined with monetary compensation, additional agreement and waiver option	2	2.5%	0	0%
2.5	Exclusive license, combined with non-monetary compensation	1	1.3%	0	0%
3	**IP management strategies based on non-exclusive licensing**	**0**	**0%**	**5**	**15.6%**
3.1	Non-exclusive license, combined with monetary compensation	0	0%	1	3.1%
3.2	Non-exclusive license, combined with monetary compensation and additional agreement	0	0%	3	9.4%
3.3	Non-exclusive license, combined with non-monetary compensation	0	0%	1	3.1%
4	**IP management strategies based on Open Source / Creative Commons licensing**	**9**	**11.4%**	**21**	**65.6%**
4.1	Open Source / Creative Commons license, combined with monetary compensation	2	2.5%	20	62.5%
4.2	Open Source / Creative Commons license, combined with monetary compensation, NDA and additional agreement	0	0%	1	3.1%
4.3	Open Source / Creative Commons license, combined with non-monetary compensation	7	9.9%	0	0%
5	**IP management strategies involving neither transfer of ownership nor licensing arrangements**	**1**	**1.3%**	**3**	**9.4%**
5.1	No transfer of ownership nor licensing arrangement; monetary compensation, combined with additional agreement	1	1.3%	1	3.1%
5.2	No transfer of ownership nor licensing arrangement; monetary compensation, combined with NDA and additional agreement	0	0%	1	3.1%
5.3	No transfer of ownership nor licensing arrangement; non-monetary compensation, combined with additional agreement	0	0%	1	3.1%
	Total:	**79**	**100%**	**32**	**100%**

With regards to licensing arrangements, companies employ a variety of licenses, from exclusive, over non-exclusive, to Open Source / Creative Commons licenses. Exclusive licensing, the common element of five of the 17 unique IP management strategies, is associated solely with company-to-one co-creation projects (about 23% of such projects). There is no evidence of exclusive licensing being used in company-to-many co-creation projects. Conversely, in the sample, non-exclusive licensing is associated solely with company-to-many co-creation projects (about 16% of such projects), and is the common element of three unique IP management strategies adopted in that context. There are no observed instances of non-exclusive licensing in the company-to-one co-creation context. Finally, while the use of Open Source / Creative Commons licensing occurs in both contexts, it is especially prominent among company-to-many co-creation projects, accounting for almost two thirds (about 66%) of such projects. On the other hand, such licensing arrangements are observed in only a small minority (about 11%) of company-to-one co-creation projects. In both of the contexts there are two unique IP management strategies identified to be based on Open Source / Creative Commons licensing.

Interestingly, very few companies adopt IP management strategies that involve neither transfer of ownership nor licensing arrangements. The analysis results show that just over 1% of company-to-one co-creation projects and just over 9% of company-to-many co-creation projects adopted such strategies. Three unique IP management strategies are identified to involve neither transfer of ownership nor licensing arrangements; all of them are employed in the context of company-to-many co-creation, while only one is employed in company-to-one co-creation context.

Most of the IP management strategies adopted in company-to-one co-creation projects (eight strategies out of a total 11 strategies identified in the sample from this context) were based either on full transfer of ownership or on exclusive licensing arrangements between companies and co-creators. Such IP management strategies were adopted in 69 company-to-one co-creation projects (i.e., over 87% of the total set of projects in this context), indicating that companies tend to prefer obtaining all IP rights or exclusive IP rights to the outcomes of company-to-one co-creation projects. On the other hand, most of the IP management strategies adopted in company-to-many co-creation projects (eight strategies out of a total of nine strategies identified in our sample from this context) were based on non-exclusive licensing, Open Source or Creative Commons licensing or complete avoidance of any licensing arrangements between companies and co-creators. Such IP management strategies were adopted in 29 company-to-many co-creation projects (i.e., over 90% of the total set of projects in this context), indicating that companies tend to prefer less restrictive terms that allow co-creators to retain ownership over their IP as well as rights to use co-creation outcomes, when adopting the company-to-many format for projects.

In all of the analysed co-creation projects, companies compensate co-creators for their effort in one way or another, either monetary or non-monetary. However, companies reveal a clear proclivity for employing monetary compensation as a part of their IP management strategies. Monetary reward is identified as an important element of the compensation structure in both co-creation contexts. It is employed in about 89% of the company-to-one co-creation projects, through eight different IP management strategies, and in about 94% of the company-to-many co-creation projects, through seven different IP management strategies. In these cases, monetary

reward is offered either as a one-time payment or as a percentage of revenue or sales of co-creation outcomes. Monetary compensation is sometimes additionally accompanied by non-monetary rewards, of a variety of types, such as vouchers, products, invitations to exclusive events, further involvement in product development processes, or even by giving recognition to co-creators in the final product. The results show that companies very rarely employ solely non-monetary compensation in co-creation. It appears that non-monetary rewards tend to be used to complement other, more dominant, elements of the IP management strategies.

Finally, analysis of the data reveals that IP management strategies involving NDAs, additional agreements or waiver options are not prominent in either of the two co-creation contexts, being present in only a minority of co-creation projects overall. Non-disclosure agreements are employed as part of IP management strategies much more frequently in the context of company-to-one co-creation projects (46%) than they are in company-to-many co-creation projects (6%). In each of the contexts, NDAs are integrated within two unique IP management strategies. Interestingly, however, the two strategies in which the NDAs are integrated differ between the two contexts. Additional agreements—which are typically used to specify further arrangements (not otherwise already specified within the terms and conditions) between companies and co-creators when co-creation outcomes are realized and used commercially—are employed in about 5% of company-to-one co-creation cases, through three different IP management strategies, and in about 22% of company-to-many co-creation cases, through four different IP management strategies. Finally, the results show that the waiver option is the least employed IP dimension in IP management strategies in co-creation. It appears as a part of IP management strategies

in only a tiny minority (less than 3%) of cases overall, and then only in company-to-one co-creation projects. Nevertheless, by limiting licensing arrangements in the situation where companies decide not to exploit co-creation outcomes, the waiver option represents an important element of the less onerous or more accommodating IP management strategies directed towards co-creators.

3.3 Discussion of results

This preliminary empirical study represents a systematic empirical work focused on alternative IP management strategies adopted by companies in different co-creation contexts. The results reveal a clear contrast between the predominant IP management strategies adopted by firms according to whether the co-creation projects take place in the company-to-one or company-to-many context. Company-to-one and company-to-many co-creation may be contrasted according to differences in at least three characteristics, namely, the volume of existing relationships among co-creators in a project, the level of recombination of co-creators' contributions, and the potential for control of IP by the initiating company. Such project-specific conditions, engendered by the number of individual external contributors involved in the co-creation of a single solution, arguably create distinctive contexts for IP management in co-creation.

On one hand, it can be observed that IP management strategies based either on full transfer of ownership or on exclusive licensing arrangements are favoured by companies in the context of company-to-one co-creation, where the number of existing relationships in the co-creation of one solution is small, where the potential for spontaneous recombination of contributions is low, and where IP can be straightforwardly controlled. Such results concur with insights from the extant literature

that, to be able to appropriate benefits from company-to-one co-creation, companies need to obtain ownership of co-creation outcomes or to acquire a license to exploit them, while compensating co-creators for their effort and IP by monetary prizes (Boudreau & Lakhani, 2013; de Beer et al., 2017; Felin & Zenger, 2014; Mazzola et al., 2018; Mortara et al., 2013). On the other hand, the study provides evidence that IP management strategies based on non-exclusive licensing, Open Source or Creative Commons licensing or complete avoidance of any licensing arrangements are preferred by companies in the context of company-to-many co-creation, where the number of existing relationships in co-creation of one solution is great, where the potential for spontaneous recombination of contributions is high, and where IP cannot be easily controlled. Such results concur with some insights from the extant literature that, to cultivate collective creativity and recombination of contributions in company-to-many co-creation, companies need to avoid more restrictive IP management strategies and instead employ Open Source or Creative Commons licenses, or even freely reveal co-creation outcomes (Albors et al., 2008; Benkler, 2017; Boudreau & Lakhani, 2013; Felin & Zenger, 2014; Harwood & Garry, 2014). As is the case for IP management strategies in company-to-one co-creation, monetary compensation represents an important element of IP management strategies in company-to-many co-creation.

In summary, company-to-one co-creation tends to be associated with more restrictive IP management strategies, whereas company-to-many co-creation tends to be associated with more permissive IP management strategies. The overall differences in IP management between the co-creation contexts detailed in Table 3.3 and discussed here are summarized in Table 3.4.

Additionally, adoption of a configurational perspective in this study allowed identification of distinctive elements among ostensibly similar generic IP management strategies. By combining IP dimensions in different ways, companies cultivate new IP management strategies that may reduce the tension between control and openness of the IP in co-creation, and facilitate involvement of individual external contributors in corporate innovation, as called for by scholars in the open and collaborative innovation literature (Laursen & Salter, 2014; Lee, 2009; O'Hern & Rindfleisch, 2010). Even though the results do not show exclusive deployment of each identified IP dimension for a specific co-creation context, they do reveal general variations between contexts, and they broaden our understanding of variety of potential configurations upon which a company may build an IP management strategy.

Table 3.4 Variations in IP management strategies between co-creation contexts

No.	IP management strategies	Co-creation context	
		Company-to-one co-creation	Company-to-many co-creation
1	IP management strategies based on full transfer of ownership	✓✓✓	✓
2	IP management strategies based on exclusive licensing	✓✓	×
3	IP management strategies based on non-exclusive licensing	×	✓
4	IP management strategies based on Open Source / Creative Commons licensing	✓	✓✓✓
5	IP management strategies involving neither transfer of ownership nor licensing arrangements	✓	✓
	Key:	Strategy not employed (×) Strategy employed rarely (✓) Strategy employed moderately (✓✓) Strategy employed frequently (✓✓✓)	

3.4 Conclusions

The preliminary empirical study provides the answers to two research questions introduced in Section 3.1.1: (1) *what IP management strategies do companies actually adopt in distinctive co-creation contexts*; and (2) *how do those IP management strategies differ across the co-creation contexts?* By comparing IP management in company-to-one and company-to-many co-creation, the study has generated evidence that some IP management strategies are associated more closely with specific co-creation contexts than others. Also, by seeing IP management strategies as configurations of different IP dimensions—namely transfer of ownership, licensing arrangements, compensation structure, NDAs, additional agreement and the waiver option—this study points to the importance of employing a *configurational perspective* on IP management strategies in co-creation, to complement the *contextual perspective*.

Nevertheless, the preliminary empirical study faces a number of limitations that ask for certain revisions with regards to the research framework, data collection and research methodology.

Insights from the preliminary empirical study show that the developed conceptual research framework is crude, questioning its fitness for the main empirical study. Namely, the study considers different co-creation types (company-to-one and company-to-many) as the only potentially significant contexts for IP management in co-creation. A single contextual perspective is chosen partly because of the need to be prudent in the scope of inquiry, but also because the literature points to varying project-specific conditions prevailing across different types of co-creation that may influence the effectiveness of an IP management strategy (e.g., Boudreau & Lakhani, 2013; Felin & Zenger, 2014). Nevertheless, future research may benefit from adoption

of a more complex contextual perspective. Exploratory qualitative analysis of 111 co-creation projects emphasized the importance of differentiating between online and offline co-creation projects, in building the context of co-creation, alongside differentiating between the two co-creation types. Thus, the research framework based on company-to-one and company-to-many co-creation in both the online and offline settings may facilitate comparative investigation of IP management strategies in the distinctive contexts of online crowdsourcing competitions and innovation communities, as well as of offline single expert sessions and lead user workshops. Such modification of the elements of the co-creation context may support generation of more refined and sophisticated insights about IP management strategies in a variety of co-creation contexts.

Further, even though the data set embraces a diverse sample of co-creation projects initiated by the automotive companies, it is focused on a single industry. This limits the generalizability of the results of this preliminary empirical study. Thus, the next stage of this PhD research may benefit from examining IP management strategies adopted in co-creation projects by companies from a variety of industries. Additionally, by including only projects which have their terms and conditions publicly available on the Internet, the final sample is subject to potential bias with regards to case heterogeneity. On one hand, the sample is inclined towards online co-creation projects, as offline co-creation projects rarely have their terms and conditions published on the Internet. On the other hand, as single-project platforms are typically closed after a certain period of time following the end of the project, the sample is inclined towards projects organized on intermediary platforms and corporate multiple-project platforms, as they remain active over longer periods of time due to their

ongoing operational activity. Thus, to overcome the restraints of the data collection procedure employed here, the main empirical study should employ multiple data sources that go beyond Internet-based search.

Finally, in order to overcome the limitations of the preliminary empirical study reported here, a more sophisticated research methodology—one that combines the best of both qualitative and quantitative methods, and that would allow more nuanced exploration of different IP management strategies across a variety of co-creation contexts—needs to be adopted to implement the proposals for the main empirical study. The "Qualitative Comparative Analysis" (QCA) approach, that has developed in recent years following the pioneering work of Charles C. Ragin (1987, 1998) and others (Fiss, 2011; Marx et al., 2014), appears to be particularly well suited to this challenge. The QCA approach is especially suitable for cross-case, diversity based research—as distinct from case-oriented and variable-oriented research—and hence lends itself to the kind of inquiry we propose here that incorporates both contextual analysis and configurational analysis.

Chapter 4

Main empirical study

This chapter provides the details about the final stage of this PhD research. It describes the integrative research framework, research methodology, as well as data collection and data analysis procedures, employed in the main empirical study[3] to develop the concept of contextualized IP management in co-creation, based on the best practices of IP management across a variety of co-creation contexts. It also includes detailed presentation and in-depth discussion of the results of this study.

4.1 Research design and methodology

4.1.1 Integrative research framework

Insights from the preliminary empirical study show that different co-creation types ask for different IP management strategies. Taking into account the number of co-creators of a single solution allows distinguishing between the contexts of company-to-one co-creation and company-to-many co-creation (Tekic & Willoughby, 2018), characterized by the various numbers of existing relationships, different potential for recombination of contributions, as well as different potential for IP control, which create the need for customizing IP management strategies to correspond to these circumstances.

[3] The results of the main empirical study are presented in:
Tekic, A., & Willoughby, K. W. (2019). IP management in co-creation: Exploring the value of contextual and configurational perspectives for strategy development. Presented at the *79th Annual Meeting of the Academy of Management (AOM 2019)*, Boston, USA.

Nevertheless, insights from the preliminary empirical study also show that the developed conceptual research framework is crude, asking for a revision of the elements of the co-creation context in developing the research framework for investigating IP management strategies in co-creation.

In addition to the co-creation type, the co-creation setting appears to be another important element of the co-creation context that is expected to influence the effectiveness of IP management strategies, asking for heterogeneity in their configurations. Based on the means of integration of individual external contributors in co-creation projects, it is possible to distinguish between *online* and *offline co-creation settings* (Tekic & Willoughby, 2017b). Characterized by the diversity of their potential for IP control and the differences in depth and breadth of search for external sources of innovation that they allow, different co-creation settings may produce additional distinctive contexts for IP management.

Online co-creation setting refers to Internet-based environment of communities, innovation platforms, social networks, or forums that support companies to virtually integrate potential co-creators in their product innovation projects and challenge them to share their ideas and solutions online (Füller & Matzler, 2007; Haavisto, 2014; Piller et al., 2011). Such an Internet-based environment may lead to numerous IP-related problems (e.g., patentability of concepts published online, IP protection and control in the online environment, etc.), hence keeping the companies' focus on broad search for external sources of innovation that lead to high quantity of potential solutions.

On the other hand, in the setting of offline co-creation, solutions are developed within small and closed groups of people, allowing companies to maintain control

over the process. Companies use purposefully designed settings to stimulate creativity and to evoke an innovative spirit amongst co-creators through specialized workshops, brainstorming sessions, teamwork or experimentation in living labs, idea labs, fab labs or hacker spaces (Almirall Mezquita & Wareham, 2008; Schaffers, Budweg, Ruland, & Kristensen, 2009; Tekic et al., 2013; Wilhelm, 2013). Facilitating face-to-face collaboration, efficient interaction and communication, offline co-creation setting enables companies to orient their focus on in-depth search for external sources of innovation and potential development of high-quality solutions.

Some insights may be gained from scattered evidence in the literature about different IP management strategies that companies adopt in different co-creation contexts. Some published research shows that companies tend to acquire all the rights to co-creation outcomes of crowdsourcing, a form of online company-to-one co-creation (Alexy et al., 2009; Boudreau & Lakhani, 2013; Felin & Zenger, 2014; Mazzola et al., 2018). There is no evidence identified in the literature related to IP management in the context of offline company-to-one co-creation. Further, in community-based co-creation, a form of online company-to-many co-creation, companies tend to employ Open Source or Creative Commons licenses, or even freely reveal co-creation outcomes, to support collective creativity (Alexy et al., 2009; Benkler, 2017; Boudreau & Lakhani, 2013; Felin & Zenger, 2014; Harwood & Garry, 2014). Finally, in lead user workshops, a form of offline company-to-many co-creation, companies tend to obtain ownership of co-creation outcomes (Brem et al., 2018). Such insights from the literature highlight the potential significance of different co-creation contexts, distinguished in terms of different co-creation types and co-creation settings, for making a decision about the IP management strategy.

Thus, arguing that the co-creation types and the co-creation settings mutually create the distinctive contexts for IP management in co-creation, the integrative research framework (Figure 4.1) is developed based on insights from both the critical review of the extant literature and the preliminary empirical research.

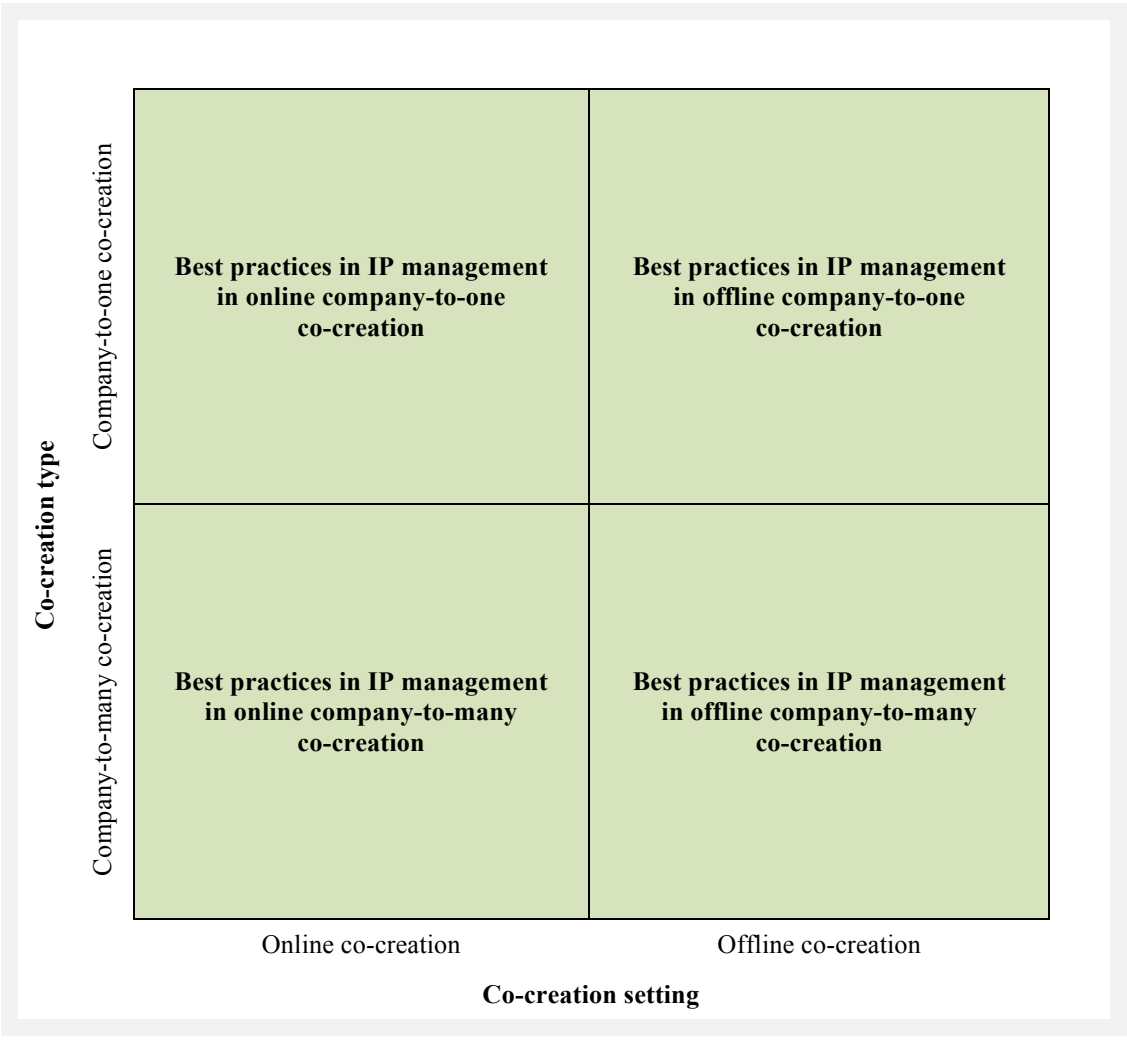


Figure 4.1 Integrative research framework

The developed integrative research framework serves the main purpose of the main empirical study of this PhD research, i.e., development of the concept of contextualized IP management in co-creation, based on the in-depth exploration of best practices in IP management across different co-creation contexts (i.e., online

company-to-one, offline company-to-one, online company-to-many, and offline company-to-many co-creation). As the adoption of the configurational perspective on IP management strategies proved useful in the preliminary empirical study, best practices in different co-creation contexts are analyzed in the main study in terms of the configurations of the six IP dimensions (i.e., transfer of ownership, licensing arrangement, compensation structure, NDAs, additional agreement and waiver option).

4.1.2 Qualitative Comparative Analysis (QCA)

Aiming to explore different configurations of IP management strategies across a variety of co-creation contexts and their relation to co-creation project performance, the main empirical study employs Qualitative Comparative Analysis (QCA) introduced by Charles C. Ragin in 1987, as an inductive, theory-building research methodology.

QCA is a comparative research approach and collection of techniques, which aims to go beyond qualitative and quantitative research methodologies (Figure 4.2), by combining their strengths and finding the middle ground between generality and complexity (Marx et al., 2014; Ragin, 1998). QCA supports a cross-case, diversity-based research, distinct from case-oriented and variable-oriented research (Ragin, 1998). It enables researchers to conduct holistic comparisons of cases, while allowing them to understand and specify broad patterns across a number of cases that hold for a population (Miles & Huberman, 1994; Ragin, 1999). However, QCA is also a case-sensitive approach – each individual case is considered as a complex whole, while the specific interest is kept on how different aspects are combined in each case and how

they fit together. The dialogue between cross-case analysis and within-case analysis is strongly emphasized.

QCA supports both the configurational and contextual perspectives on IP management in co-creation that are adopted in this PhD research. Having individual co-creation projects as the basic unit of analysis, QCA allows cases to be understood as configurations of different attributes, while their comparison provides the basis for constructing causal arguments and creating the overall typology of cases (Fiss, 2011; Ragin, 1998). Additionally, it also allows consideration of how context structures causal connections (Ragin, 1998). Following the ideas of J. S. Mill, Ragin rejects any form of permanent causality taking into account that "causality is context- and conjuncture-sensitive" (Rihoux, 2006).

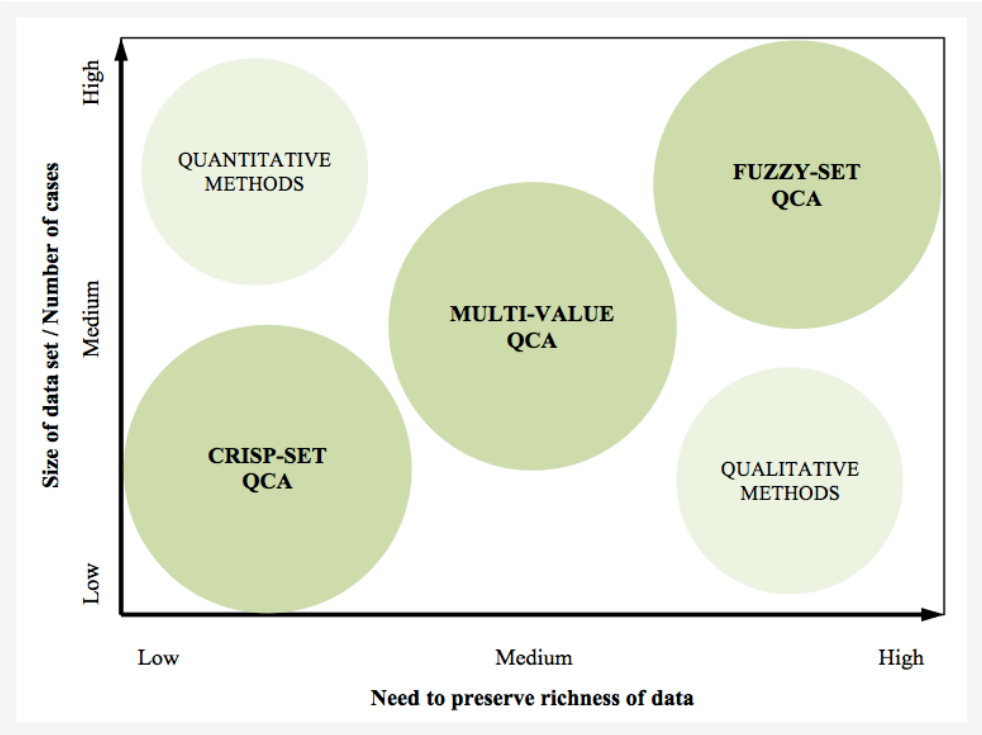


Figure 4.2 QCA as the middle ground between quantitative and qualitative methods - adapted from Herrmann & Cronqvist (2005)

With foundations in set theory, QCA sees each case as a member of multiple sets (Ragin, 1998). In other words, a set can be defined as a collection of cases that share a common property (Dusa, 2019). As different aspects of cases are described in set relations that assess whether, or to what degree, a case is a member of a set, sets entail membership criteria and have classificatory consequences. QCA makes a difference between two types of sets, namely condition sets and outcome sets. Condition sets correspond to independent variables in the conventional template; they are factors which are used to explain the outcome (Schneider & Wagemann, 2012). A combination of conditions which describes a group of empirically observed or hypothetical cases is called a "configuration" (Schneider & Wagemann, 2012). On the other hand, outcome sets correspond to dependent variables, representing an observable change or discontinuity, of a phenomenon under study (Ragin, 2013; Schneider & Wagemann, 2012).

QCA is organized around identifying set relations and drawing inferences from set relationships across many cases (Dusa, 2019). To understand causal patterns, membership combinations are compared, while keeping in mind that both the presence and the absence of conditions in these combinations can influence related outcomes (Ragin, 1998). QCA structures the process of determining superset- and subset-relations and identifying "necessary" and "sufficient" conditions within the great causal complexity, characterized by equifinality, conjunctural causation, and asymmetry (Fiss, 2007; Marx et al., 2014; Rihoux, 2006).

By using Boolean algebra and minimization algorithms, QCA logically reduces causal complexity into configuration sets of fewest possible conditions that lead to the outcome in question, so-called "solutions" (Fiss, 2011; Ragin, 1998). This

analytic feature of QCA allows replication in research studies.

Aiming to identify what are best practices in IP management in different co-creation contexts, QCA is focused on set-relations between configurations of IP dimensions (i.e. transfer of ownership, licensing arrangement, compensation structure, NDAs, additional agreement and waiver option) and co-creation project performance (i.e. high and low project performance).

4.1.3 Data collection

The dataset employed for this main empirical study comprises 116 co-creation projects run by HYVE, a German company that acts as an intermediary between their client companies and potential co-creators, with the co-creation project portfolio capturing a diversity of industries and product types. Most of the DAX (German Stock Index) companies are among HYVE's clients, as well as many large international and small and medium-sized companies (HYVE, 2015).

HYVE organizes a various kinds of co-creation projects for their clients, from crowdsourcing contests, over online communities and co-creation workshops, to single-expert sessions, while governing all aspects related to project management. Nevertheless, this is not the case with managerial aspects with regards to how IP is handled in these co-creation projects. Even though HYVE offers the preliminary template for terms and conditions to the client company starting a co-creation project, the project's final terms and conditions are decided by the legal department of each client company individually.

Congruent with the exploratory nature of this study, data collection involved multiple data sources, employing a combination of obtrusive and unobtrusive data

collection techniques. The overall data collection process comprised three stages, namely field work (on-site collection of project documentation), qualitative content analysis (collection of data on IP dimensions and elements of co-creation contexts through detailed analysis of the collected project documentation) and survey (collection of data on project performance).

4.1.3.1 Field work

Conducted in April 2018, field work involved on-site collection of project documentation at the HYVE premises in Munich, Germany.

The company's whole database containing documentation about co-creation projects conducted for a great variety of clients was reviewed. By the means of manual filtering, the documents that provided detailed overview and description of the co-creation projects, as well as projects' terms and conditions containing information about the IP management strategies employed, were collected.

The procedure yielded a result of 3,312 collected documents for 156 co-creation projects.

4.1.3.2 Qualitative content analysis

In collecting data on IP dimensions and elements of the co-creation context, a *directed approach to content analysis* (Hsieh & Shannon, 2005) was employed. Incorporating predetermined concepts into category system development, such an approach enabled thorough guided analysis of extensive collected project documentation.

The legal terms and conditions of all projects were analyzed according to the six IP management dimensions identified in the preliminary empirical study (Tekic & Willoughby, 2019), namely: (1) transfer of ownership, (2) licensing arrangement, (3) compensation structure, (4) NDA, (5) additional agreement, and (6) waiver option. Conversely, starting from the elements designating the co-creation context, namely co-creation types and co-creation settings, the directed approach to content analysis enabled the collection of data through systematic analysis of documentation that provided detailed project descriptions.

Due to incomplete documentation of 36 projects, i.e., missing data regarding either IP dimensions or elements of co-creation context, the sample was reduced to 120 co-creation projects.

4.1.3.3 Survey

Finally, a survey was employed to collect the data about the co-creation project performance, which is determined as the outcome of interest in the analysis of best practices in IP management in co-creation.

Project managers and supervisors were asked to rate co-creation project performance by indicating on a 5-point Likert scale (from strongly disagree to strongly agree) the degree to which: (1) project outcome was of high quality; (2) project was finished on time; (3) project was finished within the specified budget; (4) client company was satisfied; (5) co-creators were satisfied; (6) project team was satisfied; and (7) top management was satisfied. The responses were collected from 12 project managers and supervisors. As some project managers and supervisors were no longer employed in the company, it was not possible to collect responses for 4 co-

creation projects. This led to the reduction of the final sample to 116 co-creation projects, run in the timespan between 2006 and 2018. A single manager evaluated multiple projects that he/she lead in this period.

The average score on the seven entries is used to measure performance of the rated co-creation projects. The combined scale shows high reliability with a Cronbach's alpha of 0.92.

4.1.3.4 Final sample

Within the final sample of 116 co-creation projects, there are 63 projects classified as online company-to-one co-creation (Appendix 3), 4 projects as offline company-to-one co-creation (Appendix 4), 19 projects as online company-to-many co-creation (Appendix 5) and 30 projects as offline company-to-many (Appendix 6) co-creation.

The final sample includes a great variety of co-creation projects, in terms of industry and client companies. The projects were run in the timeframe between 2006 and 2018 for 74 different client companies, operating in different industries, such as automotive, consumer products, home appliances, telecommunications, transportation and logistics, aerospace, pharmaceuticals, food processing, energy, baby products, education, etc. Having from 90 to 640.000 employees, client companies were large international enterprises, SMEs and government, mainly based in Germany and Austria, as well as in Denmark, Finland, France, Italy, Switzerland, the Netherlands, the UK and the USA, founded between 1845 and 2015.

4.1.4 Data analysis – Fuzzy-set QCA

QCA research methodology encompasses three main specific data analysis techniques, namely crisp-set QCA, fuzzy-set QCA and multi-value QCA (Rihoux, 2006; Rihoux & Marx, 2013), which are typically used independently, not combined with other quantitative or qualitative techniques (Fiss, 2011; Kraus, Ribeiro-Soriano, & Schüßler, 2018).

Crisp-set QCA (csQCA) allows researchers to work with dichotomous or "crisp" sets, using conventional Boolean algebra that treats case memberships in sets as "in" or "out." In other words, case membership is bivalent and can be coded only "1" or "0." Cases can only have or not have a specific property and thus, can only belong or not belong in the set of cases determined by that property (Dusa, 2019; Ragin, 1998). For example, companies are either certified or not certified, or are publicly traded or not publicly traded (Rihoux & Marx, 2013).

Considered to be a direct extension of crisp-set QCA, *multi-value QCA (mvQCA)* enables the analysis of multivalent sets that can contain more than two values. Multivalent sets have no limit on the number of values, but all the values are discrete, separated and distinct from one another. In this way, mvQCA allows researchers to work with multiple-category conditions (Dusa, 2019; Rihoux, 2006). For example, companies can belong to the category of small, medium or large enterprises.

In comparison to previous two techniques, *fuzzy-set QCA (fsQCA)* allows more fine-grained assessment of set membership. It does not treat memberships in sets as absent or present, but as varying degrees to which they satisfy membership criteria, starting from the value 0 (entirely out) to the value 1 (entirely in). For example, the level of economic development can exhibit many gradations from dichotomous to

continuous across cases in an analysis (Dusa, 2019; Rihoux, 2006). However, even though fsQCA enables the analysis of sets with an infinitely large number of possible degrees of membership, this technique also allows the analysis of crisp sets, with values of 0 and 1, lying on the extremes of the fuzzy set continuum.

All three techniques allow the analysis of both small and large number of cases. However, while being able to deal with both crisp and fuzzy sets, fsQCA preserves the richness of data to the greatest extent. It is seen as the most superior of the QCA techniques, taking the most from integration of qualitative and quantitative approaches (Kraus et al., 2018; Rubinson, 2013). Also, expanding significantly during the past decade, fsQCA has been gaining momentum in business and management research, particularly in entrepreneurship and innovation related studies, where it was mostly unknown before 2013 (Kraus et al., 2017; Rihoux et al., 2013).

Thus, aiming to capture high degrees of complexity while exploring different configurations of IP management strategies across a variety of co-creation contexts and their relation to co-creation project performance, fsQCA is employed as a data analysis technique in the main empirical study of this PhD research. After definition of outcome and condition sets in the preparatory step for fsQCA, furthers steps of the analysis, namely calibration of measures, analysis of necessity and analysis of sufficiency, which involves truth table analysis and logical minimization, were conducted using the *R Studio QCA* package (Dusa, 2019). The final step of the analysis, case classification, was conducted using the *R Studio SetMethods* package (Oana & Schneider, 2018). Relying on the detailed explanations of fsQCA offered by Dusa, (2019), Ragin (2008) and Schneider & Wagemann (2012), each step of the data analysis is described in the following sections.

4.1.4.1 Definition of outcome and condition sets

Representing building-blocks of different configurations of IP management strategies, *condition sets* are defined based on the IP dimensions of transfer of ownership, licensing arrangement, compensation structure, NDAs, additional agreement and waiver option (Tekic & Willoughby, 2019). The six dimensions create the basis for five condition sets. Table 4.1 shows how qualitative data collected for the specific IP dimensions are transferred into index measures for each of the QCA condition sets.

Table 4.1 Qualitative index-building for QCA conditions

QCA conditions	Label	Qualitative index-building
IP control	IPCTRL	3 = transfer of ownership 2 = exclusive license 1 = non-exclusive license 0 = no license nor ownership transfer
Compensation	COMP	3 = both monetary and non-monetary compensation 2 = monetary compensation 1 = non-monetary compensation 0 = no compensation
Employment of NDA	NDA	1 = NDA employed 0 = no NDA employed
Employment of additional agreement	ADD	1 = additional agreement employed 0 = no additional agreement employed
Employment of waiver option	WAIV	1 = waiver option employed 0 = no waiver employed

IP dimensions of transfer of ownership and licensing arrangement, are combined into a single condition set, namely "IP control," taking into account companies' freedom to control the IP related to co-creation outcomes. Namely, by employing transfer of ownership, exclusive and non-exclusive licensing arrangements, companies obtain various degrees of IP control over the outcomes of

their co-creation projects, from very high to very low, or even no IP control if no license or ownership transfer is employed. Across the whole sample, most of the projects involve a very high degree of IP control, established through transfer of ownership rights from co-creators to initiating companies (Figure 4.3). In this way, companies obtain full proprietorship over the co-creation outcomes.

Each of the remaining four IP dimensions lies in the basis of separate condition sets, namely *compensation*, *employment of NDA*, *employment of additional agreement* and *employment of waiver option*. Across the whole sample, most of the projects involve monetary compensation offered to co-creators for their effort and IP (Figure 4.3). Conversely, NDAs are employed in less than half of the sample, while additional agreements and the waiver option are very rarely employed as a part of an IP management strategy, in not more than 15% of cases (Figure 4.3).

The outcome set in this fsQCA resembles co-creation project performance. Being based on quantitative data collected through a survey by the means of a 5-point Likert scale, outcome sets did not require prior data transformation for QCA. The average performance in the final sample of 116 co-creation projects is 3.92, with minimum and maximum at 1.29 and 5, respectively, and a standard deviation of 0.82 (Figure 4.4).

To be able to identify best practices of IP management in co-creation based on the comparison of IP management strategies adopted in projects characterized by the above-average or below-average performance, two outcome sets are defined, namely "high performance projects" and "low performance projects."

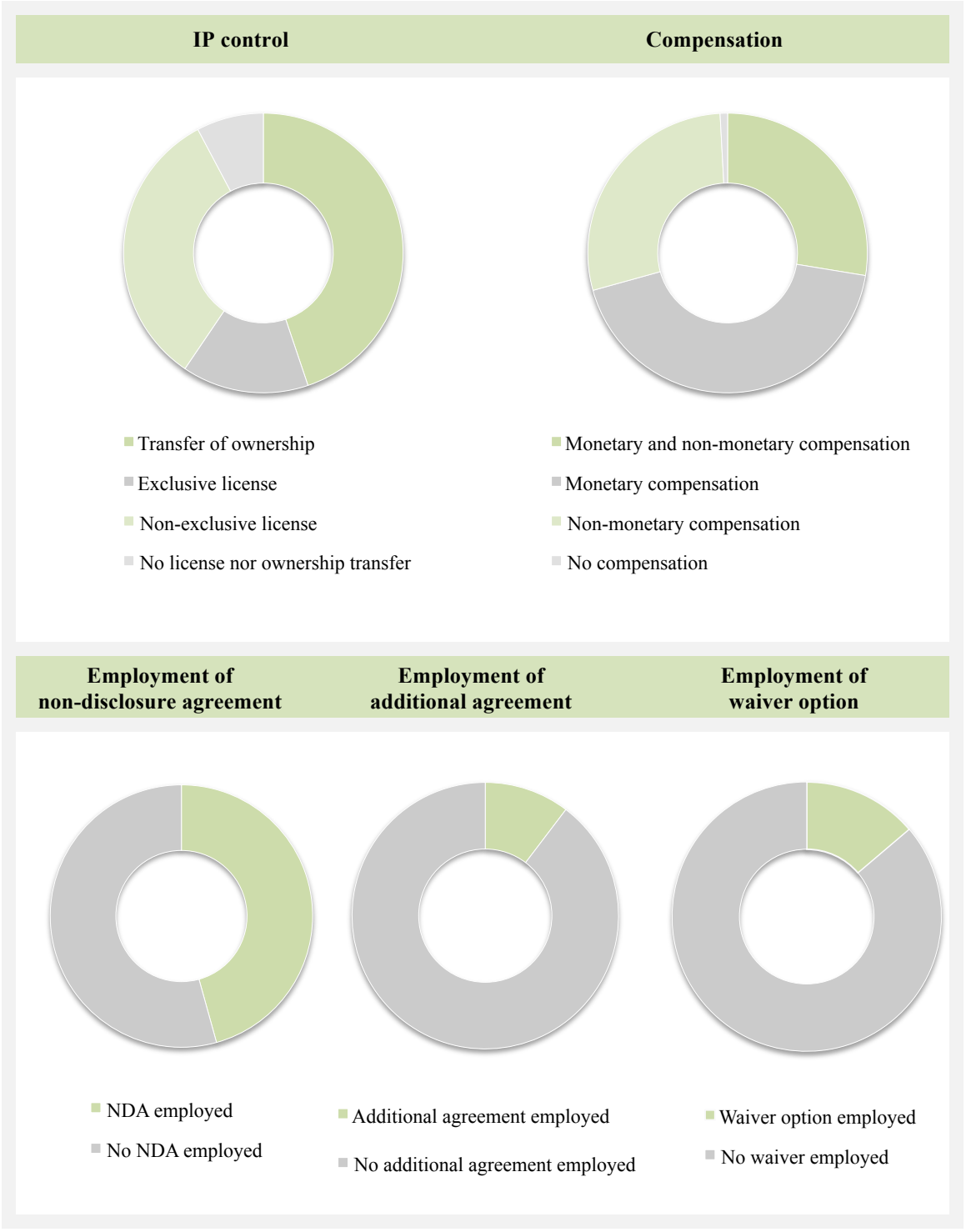


Figure 4.3 Proportion of cases for QCA condition sets

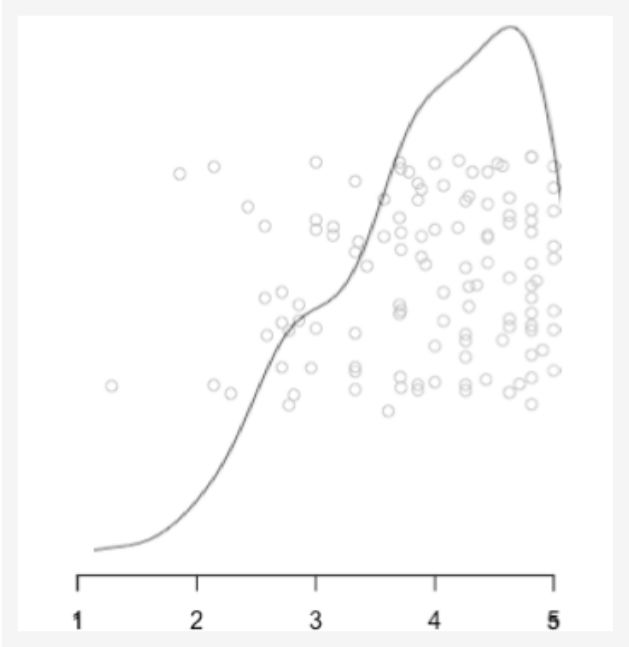


Figure 4.4 Project performance distribution
(with minimum performance score at 1.29 and maximum at 5;
standard deviation of 0.82)

4.1.4.2 Calibration of measures

The process of data analysis using fsQCA continues with the *calibration of measures*, a fundamental operation in QCA (Dusa, 2019), which supports transformation of raw numerical data into fuzzy-set membership scores that express the degree to which cases belong to a set.

The basic idea behind fuzzy sets is to permit the scaling of membership scores and thus allow partial membership, addressing the varying degrees to which different cases belong to a set (Fiss, 2011; Ragin, 2008; Schneider & Wagemann, 2012). For each variable, qualitative anchors need to be specified, determining full membership (1), full non-membership (0) and crossover point of maximum ambiguity regarding membership in a set of interest (0.5). In this way, fuzzy set membership scores do not simply rank cases relative to each other, but pinpoint qualitative states while at the same time assessing varying degrees of membership between full inclusion and full

exclusion. Such calibration is possible only through the use of an external standard, as well as theoretical and substantive knowledge (Ragin, 2008; Rihoux & Marx, 2013). In this manner, fsQCA allows calibration of partial membership in sets using values in the interval between (0) and (1), without abandoning the subset relation as a core set-theoretic principle, which is central to the analysis of causal complexity (Ragin, 2008).

There are two main methods of calibration in fsQCA (Ragin, 2008). The first one is a "direct" method that requires specification of values that correspond to qualitative anchors that structure a fuzzy set, namely full membership (1), full non-membership (0) and crossover point (0.5), which are used in transformation of original data into fuzzy-set membership scores. The second one is an "indirect" method of calibration that requires a researcher to develop a scale for qualitative assessment of the degree to which cases are members of the given set, and then use an estimation technique to rescale the original data to conform to the qualitative assessment. Both methods of calibration apply only to fuzzy sets, producing calibrated "0 to 1" scores.

In this study the direct method of calibration is used. Table 4.2 shows how the three qualitative anchors for calibrating fuzzy sets are specified.

Table 4.2 Specification of qualitative anchors

	Set type	Threshold Full Non-Membership	Crossover Point	Threshold Full Membership
QCA outcome sets				
High performance projects	Fuzzy	3.33 (25th percentile)	3.92 (average)	4.63 (75th percentile)
Low performance projects	Fuzzy	4.63 (75th percentile)	3.92 (average)	3.33 (25th percentile)
QCA condition sets				
IP control	Fuzzy	0 (minimum)	1.5 (average)	3 (maximum)
Compensation	Fuzzy	0 (minimum)	1.5 (average)	3 (maximum)
Employment of NDA	Crisp	0 (minimum)	-	1 (maximum)
Employment of additional agreement	Crisp	0 (minimum)	-	1 (maximum)
Employment of waiver option	Crisp	0 (minimum)	-	1 (maximum)

With regards to the outcome of interest in this study, co-creation project performance, the qualitative anchors for the two fuzzy sets of "high performance projects" and "low performance projects" are defined based on the percentile and average scores. Membership in the set of high performance projects is coded 0 if project performance shows a score lower or equal to 3.33 (i.e., 25th percentile) and is coded 1 if project performance shows a score higher or equal to 4.63 (i.e., 75th percentile). As the crossover point, a score of 3.92 (i.e., average score of the whole sample) is chosen. Membership in the set of low performance projects is coded as the negation of the measure of high performance described above (1 for low performance and 0 for high performance). In sum, the calibrated data for the two outcome sets cover a full spectrum of raw performance data (Figure 4.5).

To calibrate the condition sets of "IP control" and "compensation," the following thresholds are used: 3 as a maximum value for full membership, 0 as a minimum value for full non-membership, and the midpoint of 1.5 as an average value

for the crossover point. Taking into account that they show the characteristics of crisp sets, there was no need for calibration of the condition sets of "employment of NDAs," "employment of additional agreements" and "employment of waiver option." The value of 1 is used for full membership, and the value of 0 is used for full non-membership; no value was defined for the crossover point.

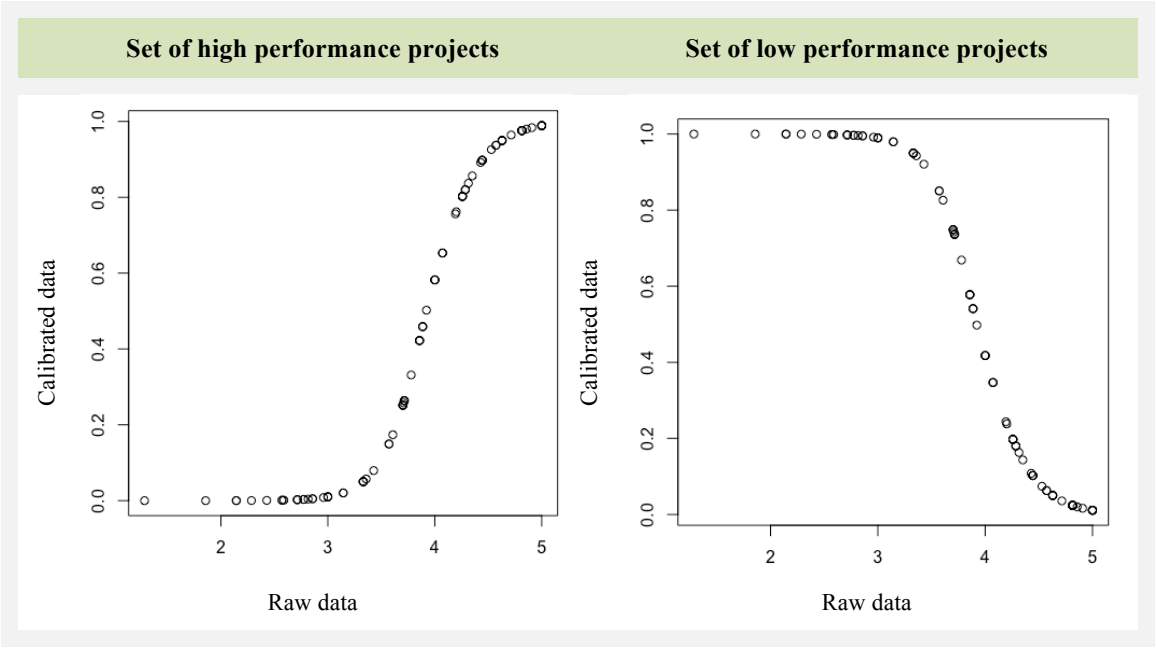


Figure 4.5 Calibration of project performance data

With the aim of identifying which IP management strategies represent best practices in IP management across co-creation contexts, subsequent steps of fsQCA are conducted separately for each of the four co-creation contexts, namely (1) online company-to-one co-creation, (2) online company-to-many co-creation, (3) offline company-to-one co-creation, and (4) offline company-to-many co-creation.

4.1.4.3 Analysis of necessity

Within complex causal structures, a condition or a combination of conditions (X) may be so important that the outcome (Y) does not happen in their absence. Such conditions are defined as necessary conditions (X⇐Y). Even though necessary conditions might not be enough to produce the outcome on their own, they are always present when the outcome is present. In other words, X is a necessary condition for Y if Y is a subset of X.

In fuzzy sets, each case's membership score in X must be equal to or greater than its membership score in Y, i.e., a condition is necessary, if $X \geq Y$ for all cases. Graphically presented, as X is a superset of Y, all cases fall below or onto the main diagonal of an XY plot (Figure 4.6).

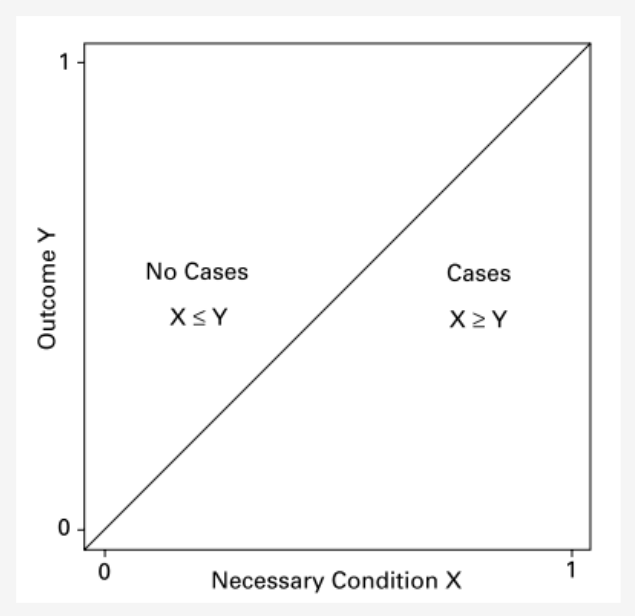


Figure 4.6 XY plot – distribution of cases for necessary condition X

To assess the quality of necessary conditions three parameters of fit are used: consistency, coverage and relevance of necessity (Table 4.3).

In analysis of necessity, *consistency* (ConN) quantifies how close a perfect superset relation (X⇐Y) is approximated. A condition X is necessary for the outcome Y when the fuzzy values of X are consistently higher than the fuzzy scores of Y across all cases. The parameter takes into account both how many cases deviate from the pattern of necessity and how strongly they deviate. The consistency threshold should not be set below 0.9.

Conversely, *coverage* (CovN) is a measure of the degree to which a condition accounts for the outcome, showing how trivial or relevant is a necessary condition for the outcome. Coverage should be calculated only for conditions with consistency that is higher than the specified threshold.

The parameter of *relevance of necessity* (RoN) supports identification of necessary conditions that are truly relevant for the outcome of interest. The lower the relevance of necessity, the more trivial a necessary condition is; the higher the relevance of necessity, the greater the importance of that necessary condition for the outcome. The threshold for relevance of necessity should be set over 0.6.

Table 4.3 Parameters of fit in necessity analysis

Parameters of fit	Equations
Consistency	$\mathrm{ConN(X)} = \frac{\sum_{i=1}^{n} \min(x_i, y_i)}{\sum_{i=1}^{n} y_i}$
Coverage	$\mathrm{CovN(X)} = \frac{\sum_{i=1}^{n} \min(x_i, y_i)}{\sum_{i=1}^{n} x_i}$
Relevance of necessity	$\mathrm{RoN(X)} = \frac{\sum_{i=1}^{n}(1 - x_i)}{\sum_{i=1}^{n}(1 - \min(x_i, y_i))}$

4.1.4.4 Analysis of sufficiency

When studying an outcome of interest, necessity relations are important but sufficiency relations resemble more closely what is usually conceptualized in terms of causes and effects. A condition or a combination of conditions (X) is defined as sufficient if it leads to the outcome of interest (Y). In other words, X is a sufficient condition for Y, if X does not occur in the absence of Y and when X is present, Y is also present (X⇒Y), i.e., X is a sufficient condition for Y if X is a subset of Y.

In fuzzy sets, each case's membership score in Y must be equal to or greater than its membership score in X, i.e., a condition is sufficient if $Y \geq X$ for all cases. Graphically presented, as X is a subset of Y, all cases fall above or onto the main diagonal of an XY plot (Figure 4.7).

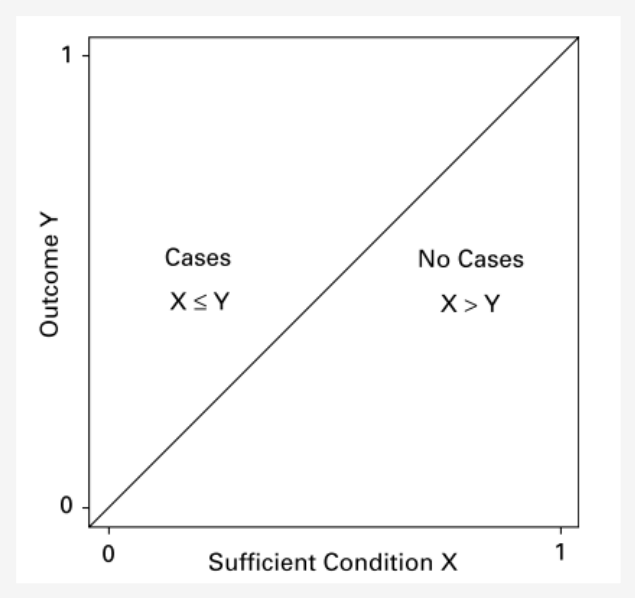


Figure 4.7 XY plot – distribution of cases for sufficient condition X

Taking into account that Y is a bigger set than X, it is usually the case that there is an indication that there is no single sufficient condition or a combination of conditions, i.e., the so-called "solution." There are probably other solutions that are

related to the outcome of interest. The only possible way for X to explain all of Y is that X is both necessary and sufficient condition for Y, i.e., a situation when both sets are equally large.

To assess the quality of sufficient conditions two main parameters of fit are used: consistency and coverage (Table 4.4).

Similarly to the consistency parameter used in the analysis of necessity, in the analysis of sufficiency, *consistency* (ConS) provides a numerical expression for the degree to which the empirical data deviate from a perfect subset relation (X⇒Y). A condition X is sufficient for the outcome Y when the fuzzy values of X are consistently lower than the fuzzy scores of Y across all cases. The threshold for consistency of sufficient conditions should not be set below 0.75.

Conversely, *coverage* expresses how much of the outcome Y is explained by the sufficient condition X. There are two types of coverage: *raw coverage* (CovS) and *unique coverage* (CovU). Raw coverage indicates how much of the outcome is covered by a single solution (i.e., sufficient condition or a combination of conditions). When more than one solution is related to the outcome, unique coverage is different from raw coverage, showing how much a single solution uniquely covers. The coverage score does not express the theoretical importance of a solution. Thus, bearing in mind that low-coverage solutions might still be of great theoretical importance, there is no lower threshold for coverage.

Table 4.4 Parameters of fit in sufficiency analysis

Parameters of fit	Equations
Consistency	$\mathrm{ConS}(X) = \frac{\sum_{i=1}^{n} \min(x_i, y_i)}{\sum_{i=1}^{n} x_i}$
Coverage	$\mathrm{CovS}(X) = \frac{\sum_{i=1}^{n} \min(x_i, y_i)}{\sum_{i=1}^{n} y_i}$
	$\mathrm{CovU}(X) = \mathrm{CovS}(X + Z) - \mathrm{CovS}(Z)$

Analysis of sufficiency relations is supported by the truth table analysis and logical minimization algorithms that are required to identify the minimal configurations of conditions that are sufficient for the outcome of interest.

4.1.4.5 Truth table analysis

Truth table is the key analytical tool needed to perform the logical minimization process. It was invented at MIT as an engineering procedure using Boolean logic to represent circuits by Claude Shannon (1916-2001), an American mathematician, electrical engineer and cryptographer. Charles Ragin later adapted truth tables for social sciences.

The truth table is a data matrix that sorts cases into k-dimensional property space resembled in 2^k truth table rows, where k represents the number of conditions included in the analysis. In this analysis, the truth table offers the list of 32 possible configurations of the five included conditions. This data matrix treats each configuration as an ideal type of cases. With crisp sets, cases are either full members or full non-members of a configuration. With fuzzy sets, cases can have partial membership in various configurations, but only in one a membership higher than 0.5, provided that none of the individual fuzzy scores are equal to exactly 0.5 (Schneider

& Wagemann, 2012). In this way, truth table simplifies a very complex reality.

The truth table algorithm uses the empirical information on cases represented in the matrix and classifies the configurations as sufficient for the outcome (Outcome = 1), not sufficient (Outcome = 0) or a logical remainder (Outcome = ?).

To decide which configurations can be interpreted as sufficient for the outcome and can thus be included in the logical minimization process, setting of the frequency and the consistency thresholds is required. Taking into account the exploratory character of this study and the interest in all possible solutions, the frequency threshold is set to 1, while the consistency threshold is set to the minimum recommended value of 0.75. Logical remainders are logically possible configurations of condition but with no empirically unobserved evidence due to the issue of limited diversity that characterizes the reality.

4.1.4.6 Logical minimization

Logical minimization is the summary of the empirical evidence contained in a truth table, applying the rules of Boolean algebra. It seeks to find the simplest possible solutions that are related to the outcome, based on the Quine-McCluskey algorithm. The algorithm consists of first logically minimizing those configurations that are sufficient for the outcome and similar to each other, and then of excluding logically redundant prime implicants that can be omitted from the solution without leaving any sufficient configuration uncovered.

By the means of the *Standard Analysis*, introduced by (Ragin, 2008), three types of minimized solutions sufficient for the outcome in question may be produced, namely conservative, parsimonious and intermediary solutions. *Conservative*

solutions are produced through the logical minimization of configurations with a positive outcome, i.e., configurations that are classified as sufficient in the truth table, making no assumptions about logical remainders. To reach *parsimonious solutions*, all logical remainders are included in the minimization process, with an assumption that, if those configurations would be observed, they could contribute in the minimization process to obtain a more parsimonious solution. In comparison with conservative solutions, parsimonious solutions are more simplified but equivalent expressions. Finally, *intermediate solutions* lie in the middle between conservative and parsimonious solutions. They are less complex than conservative solutions, but more complex in with parsimonious ones, due to the fact that less remainders end up being used in the minimization process, as a result of being filtered out by directional expectations. Directional expectations are theoretically derived and justified on the assumption that a single condition is expected to contribute to the occurrence of the outcome when it is present rather than absent (or vice versa).

Nevertheless, the Standard Analysis does not allow elimination of impossible remainders (e.g., the rich poor country or pregnant men) or contradictory assumptions (i.e., relation of the same remainder to both the outcome and its negation) from the minimization process. *Enhanced Standard Analysis*, introduced by Schneider & Wagemann (2012), extends the features of the Standard Analysis by overcoming these limitations of the logical minimization. It ensures that no solution rests on impossible remainders nor on contradictory assumptions.

Even though all possible configurations of the five defined conditions, namely IP control, compensation, NDAs, additional agreements and the waiver option, may be part of the basis of an IP management strategy, it is possible that the same

configurations may be related to both high and low project performance. Thus, to be able to exclude contradictory assumptions from the logical minimization process, the fsQCA applied in this main empirical study relies on the features of the Enhanced Standard Analysis in simplifying the information from the truth table.

The Enhanced Standard Analysis generated the conservative and the parsimonious solutions related to high performance and low performance projects across four co-creation contexts. Taking into account the exploratory character of this study, no directional expectations are specified. In other words, each of the defined five conditions, both present and absent, are allowed to contribute to both high and low project performance. The extant literature does not offer a theory that suggests otherwise. Thus, as no directional expectations are specified, the intermediate solutions and the conservative solutions produced are identical in this study.

Further comparison of the parsimonious and conservative/intermediary solutions enables definition of the core and peripheral conditions in each of the final solutions. Core conditions are those that are part of both parsimonious and conservative/intermediary expressions, and peripheral conditions are those that are eliminated in the parsimonious expression and thus only appear in the conservative/intermediary expression (Fiss, 2011). In other words, the core conditions are the essential elements of QCA solutions for which the empirical evidence indicates strong relationship with the outcome of interest, and the peripheral conditions are the surrounding and elaborating elements that reinforce the central features of the core (Fiss, 2011).

4.1.4.7 Case classification

The R studio SetMethods package (Oana & Schneider, 2018) supports the classification of cases into four main groups, namely typical cases, deviant cases for consistency, deviant cases for coverage and individually irrelevant cases (Schneider & Rohlfing, 2013). The cases are differentiated by a case's membership score in the sufficient solution (X) and the outcome (Y), in respect to the qualitative anchor of 0.5 that displays the qualitative difference between cases (Figure 4.8).

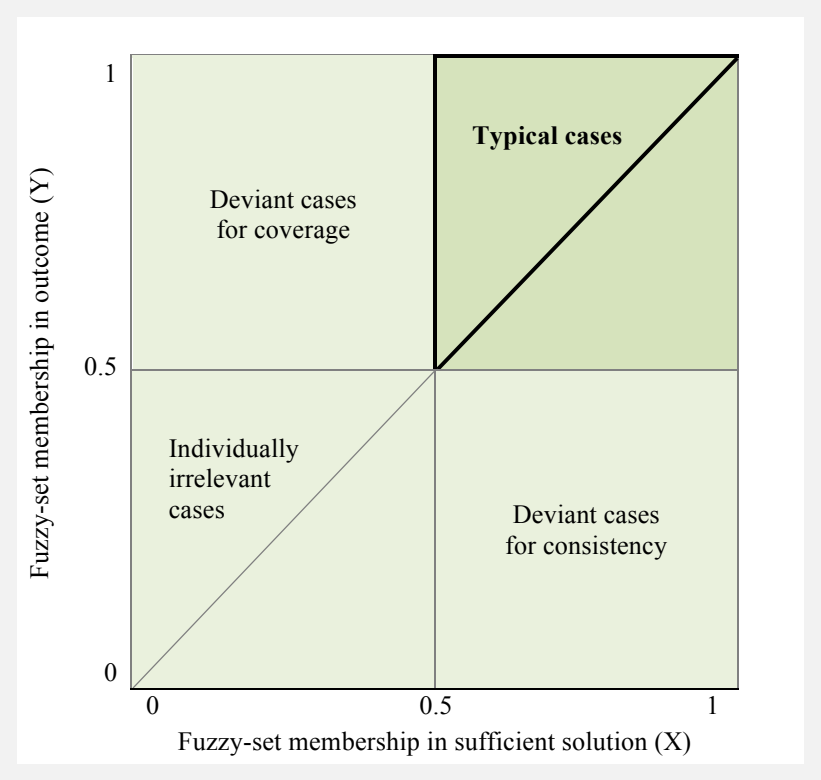


Figure 4.8 XY plot – case classification

Following the logical minimization process, the cases are classified into different groups for each of the solutions consistently related to high and low performance projects for the four co-creation contexts. Aiming to find the best illustrative cases for different IP management strategies based on these solutions, special interest is given to the cases that are in line with the statement of sufficiency

(above the main diagonal) and have high membership scores in both the solution (X≥o.5) and the outcome in question (Y≥o.5).

Being located closest to the main diagonal, the *most typical cases* represent the best empirical examples that may serve to illustrate specific IP management strategies based on the identified solutions.

4.1.4.8 Robustness tests

To assess the robustness of the results generated by fsQCA, two different tests are conducted involving changes of consistency thresholds and modifications in calibration strategy, following recommendations of Schneider & Wagemann (2012).

Taking into account the exploratory nature of this study, the minimum recommended value of 0.75 was set for fsQCA. The first robustness test involves lifting up the consistency threshold from 0.75 to more rigorous value of 0.8. By increasing the consistency threshold, the generated solutions are expected to be with lower coverage, but more consistent and perfect subset of the solutions generated based on a lower consistency threshold (Schneider & Wagemann, 2012).

The second robustness test involves modifications in calibration of data related to the outcome of interest in this study, namely co-creation projects performance. Instead of the percentile-based approach that is typically used for calibration of interval data (Fiss, 2011; Hofman et al., 2017), to test the robustness of the results, qualitative breakpoints required for direct method of calibration are defined based on points of the Likert scale used in collection of data about project performance. Even though the half-way point on a 5-point Likert scale is 3 (with minimum in 1 and maximum in 5), it cannot be considered as a qualitative crossover point between high

performance and low performance projects. In other words, the score of 3 on a Likert scale—meaning "neither, nor"—is considered to be more out of the set, along with the scores of 1 and 2, while the scores of 4 and 5 are considered to be more inside the set; the crossover point is considered to be between the scores of 3 and 4 in this case (Dusa, 2019). Such an approach is already used in assessing the robustness of QCA results (Emmenegger, Schraff, & Walter, 2014). Thus, in this robustness test, membership in the set of high performance projects with is coded 0 if project performance shows a score lower or equal to 3 and is coded 1 if project performance shows a score higher or equal to 4. As the crossover point, a score of 3.5 is chosen. Conversely, membership in the set of low performance projects is coded as the negation of the measure of high performance described above (1 for low performance and 0 for high performance).

4.2 Results

This section presents the results of the fsQCA applied to analyze IP management strategies separately in each of the four different co-creation contexts, namely online company-to-one, offline company-to-one, online company-to-many and offline company-to-many co-creation.

For each of the four contexts the most frequently adopted IP management strategies are described, followed by the in-depth analysis of IP management strategies, i.e., specific configurations of the five conditions (IP control, compensation, NDAs, additional agreement and the waiver option), consistently related to the outcome in question, namely high and low performance of co-creation projects.

4.2.1 IP management strategies in online company-to-one co-creation

4.2.1.1 Most frequently adopted IP management strategies

In each of the four co-creation contexts companies employ a variety of IP management strategies. Nevertheless, there is always a strategy that is more prominent than others and more frequently used by companies than others in each specific co-creation context.

There are nine different IP management strategies adopted by companies in online company-to-one co-creation projects (Table 4.5). The most frequently adopted IP management strategy in this co-creation context is based on high degree of control of the IP related to co-creation outcomes, ensured through full transfer of ownership or exclusive licensing arrangements, complemented by monetary compensation, while excluding the employment of NDAs, additional agreements and the waiver option. This strategy is adopted by companies in 29 co-creation projects, i.e., in almost the half of the sample of 63 online company-to-one co-creation projects.

With regards to the individual discrete IP dimensions, high degree of IP control (i.e., transfer of ownership or exclusive licensing arrangements) and monetary compensation are most frequently used as building blocks of the six out of nine IP management strategies in the context of online company-to-one co-creation. The IP dimensions of additional agreement and the waiver option are employed in only three strategies. Finally, the IP dimension of NDAs is never implemented as part of an IP management strategy in the set of online company-to-one co-creation projects.

Table 4.5 IP management strategies in online company-to-one co-creation

No.	IPCTRL	COMP	NDA	ADD	WAIV	Number of cases
1	1	1	0	0	0	**29**
2	1	0	0	0	0	**10**
3	0	0	0	0	0	**7**
4	1	1	0	1	1	**6**
5	0	1	0	0	0	**6**
6	1	0	0	0	1	**2**
7	0	1	0	1	0	**1**
8	1	1	0	1	0	**1**
9	1	1	0	0	1	**1**
10-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**0**

4.2.1.2 IP management strategies adopted in high performance projects

Based on the results of the necessity and sufficiency analyses, one QCA solution is identified as the backbone of the IP management strategies related to high-performance online company-to-one co-creation projects. In this subset of 63 cases, 25 co-creation projects have performance score that is higher than average score of the whole set of projects in the final sample.

Setting the consistency threshold at the minimal suggested value of 0.9 in the analysis of necessity relations between the condition sets (i.e. IP control, compensation, NDAs, additional agreement and the waiver option) and the outcome set (i.e. high performance projects), there is no condition or a combination of conditions identified to be so important that the outcome does not happen in their

absence. Necessity analysis (Table 4.6) yielded twelve necessary relations with consistency value over 0.9, among which there is no truly relevant necessary relation with the high relevance of necessity (RoN>0.6).

Table 4.6 Analysis of necessity relations (context 1; high performance)

No.	Necessary conditions	ConN	CovN	RoN	Truly relevant necessity relations (RoN > 0.6)	Completely irrelevant necessity relations (RoN = 0.0)
1	**nda**	1.00	0.40	0.00	-	✓
2	**IPCTRL+comp**	0.91	0.44	0.30	-	-
3	**IPCTRL+COMP**	0.93	0.43	0.23	-	-
4	**IPCTRL+add**	0.96	0.39	0.05	-	-
5	**IPCTRL+ADD**	0.91	0.46	0.34	-	-
6	**IPCTRL+waiv**	0.99	0.40	0.02	-	-
7	**COMP+add**	0.99	0.40	0.02	-	-
8	**COMP+waiv**	0.98	0.40	0.05	-	-
9	**add+WAIV**	0.92	0.38	0.05	-	-
10	**ADD+waiv**	0.96	0.40	0.08	-	-
11	**ipctrl+comp+waiv**	0.91	0.40	0.16	-	-
12	**ipctrl+add+waiv**	0.91	0.39	0.13	-	-

Non-employment of NDAs is identified as a condition with completely irrelevant necessary relation to high performance projects (RoN=0.0). This necessity relation is shown on Figure 4.9, where all cases are located vertically on the right side of the XY plot, where X is constantly equal to 1. The set of projects not employing NDAs as a part of an IP management strategy is a superset of the set of high performance projects, and thus a necessary condition. However, the fact that this

condition is omnipresent in the context of online company-to-one co-creation, the necessity relation between non-employment of NDAs and high performance projects is entirely trivial.

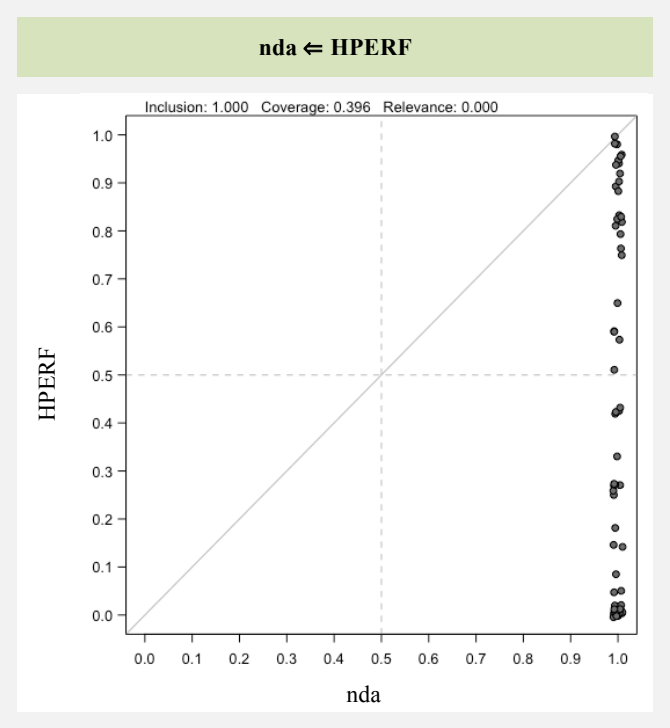


Figure 4.9 Completely irrelevant necessity relation (context 1; high performance)

The first step of the analysis of sufficiency relations, truth table analysis (Table 4.7), enables identifying which IP management strategies have the consistency score higher than the set threshold of 0.75 in the set of high performance co-creation projects. In other words, the results of the truth table analysis show which configurations of the five conditions are consistently related to the outcome in question.

Table 4.7 Truth Table Analysis (context 1; high performance)

No.	IPCTRL	COMP	NDA	ADD	WAIV	Outcome	ConS	Number of cases
1	1	1	0	0	0	**0**	0.47	**29**
2	1	0	0	0	0	**0**	0.56	**10**
3	0	0	0	0	0	**0**	0.45	**7**
4	1	1	0	1	1	**0**	0.51	**6**
5	0	1	0	0	0	**0**	0.43	**6**
6	1	0	0	0	1	**0**	0.62	**2**
7	0	1	0	1	0	**1**	1.00	**1**
8	1	1	0	1	0	**1**	1.00	**1**
9	1	1	0	0	1	**0**	0.48	**1**
10-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**?**	-	**0**

Having high consistency in the set of high performance projects (consistency scores equal to 1.00), two strategies are identified as sufficient for high performance of online company-to-one co-creation projects (Outcome = 1). Conversely, there are seven strategies that do not show consistent relation to high performance projects (consistency scores range from 0.43 to 0.62) and cannot be classified as sufficient for the outcome (Outcome = 0). Showing no empirical evidence, the remaining 23 logically possible configurations are classified as logical remainders (Outcome = ?). Figure 4.10 shows the results of the truth table analysis in a Venn diagram.

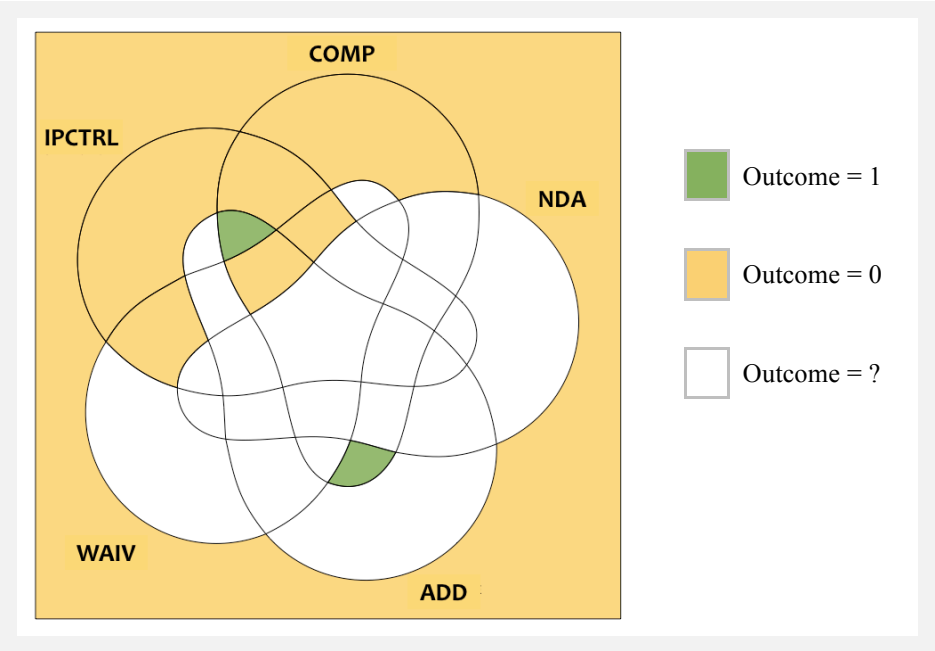


Figure 4.10 Venn diagram – Truth Table Analysis (context 1; high performance)

The second step of the analysis of sufficiency relations, Enhanced Standard Analysis, enables conducting logical minimization of the two configurations consistently related to the outcome and generate conservative / intermediary and parsimonious solutions that represent the backbone of IP management strategies adopted in high-performance online company-to-one co-creation projects (Table 4.8). Conservative and intermediary solutions are identical in this study, as no directional expectations are specified (see Section 4.1.4.6). No contradictory simplifying assumptions are identified in the process of the Enhanced Standard Analysis.

Table 4.8 Enhanced Standard Analysis (context 1; high performance)

QCA solutions		ConS	CovS	CovU
Overall conservative / intermediary solution		**0.99**	**0.07**	
Conservative / intermediary solution	COMP*nda*ADD*waiv	0.99	0.07	-
Overall parsimonious solution		**0.95**	**0.08**	
Parsimonious solution	ADD*waiv	0.95	0.08	-

Results of the enhanced standard analysis reveal that, in the context of online company-to-one co-creation, there is one single QCA solution that shows sufficiency relation to high performance co-creation projects (Figure 4.11).

Conservative / intermediary solution (COMP*nda*ADD*waiv) emphasizes the importance of configuring an IP management strategy in a way that it involves monetary compensation and additional agreements, while excluding NDAs and the waiver option from the configuration. IP control appears in this solution as a condition of irrelevance; in other words, both high degree of IP control (i.e., transfer of ownership and exclusive licensing arrangements) and low degree of IP control (i.e. non-exclusive and no licensing arrangements) may be a part of IP management strategies related to high performance in online company-to-one co-creation. Conversely, parsimonious solution (ADD*waiv) emphasizes employment of additional agreement and exclusion of waiver option as the core conditions of this QCA solution. The conditions that are part of conservative / intermediary solution, but not part of parsimonious solution, namely monetary compensation and non-employment of NDAs, are considered to be the solution's peripheral conditions.

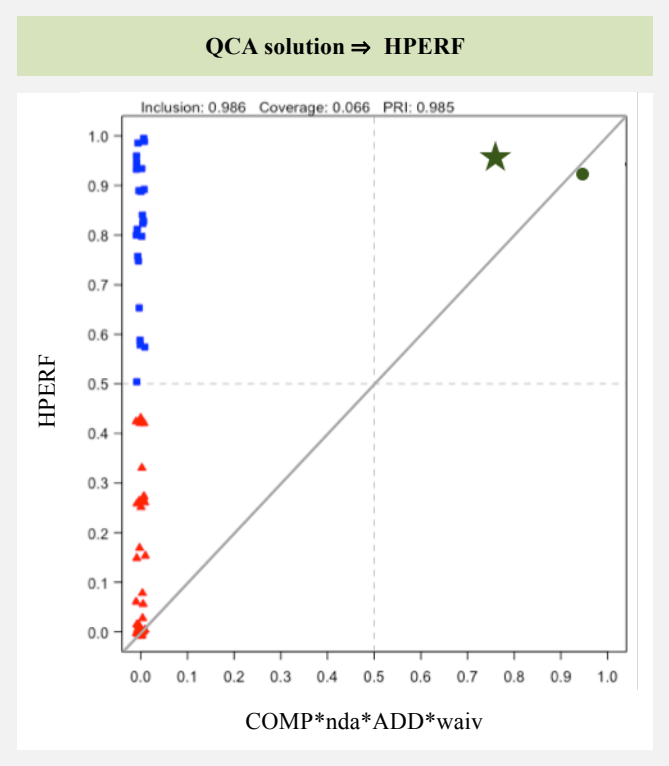


Figure 4.11 Sufficiency relation between QCA solution and high-performance projects (context 1)

This QCA solution lies at the basis of two IP management strategies adopted in the context of online company-to-one co-creation. While both employing monetary compensation and additional agreements, and excluding NDAs and the waiver option, the two strategies differ only with regards to the degree of IP control imposed. One strategy is based on high degree of IP control while the other is based on low degree of IP control, offering an explanation why the condition of IP control is characterized as a condition of irrelevance of this QCA solution. These IP management strategies are adopted in two out of 25 high-performance online company-to-one co-creation projects, within the set of 63 projects in this co-creation context (Table 4.9).

Table 4.9 IP management strategies and high performance cases covered by the QCA solution (context 1)

No.	QCA solution	IP management strategy	Number of cases
1	**COMP*nda*ADD*waiv**	ipctrl*COMP*nda*ADD*waiv	1
		IPCTRL*COMP*nda*ADD*waiv	1

4.2.1.3 IP management strategies adopted in low performance projects

Based on the results of the necessity and sufficiency analyses, two QCA solutions are identified as the backbone of the IP management strategies related to low performance online company-to-one co-creation projects. In this subset of 63 cases, 38 co-creation projects have performance score that is lower than average score of the whole set of projects in the final sample.

In the analysis of necessity relations between the condition sets (i.e., IP control, compensation, NDAs, additional agreement and the waiver option) and the outcome set (i.e., low performance projects), there is no condition or a combination of conditions identified to be necessary for the outcome. Setting the consistency threshold at the minimal suggested value of 0.9, necessity analysis (Table 4.10) yielded seven necessary relations above the consistency threshold, among which there is no truly relevant necessary relation with the high relevance of necessity (RoN>0.6).

Table 4.10 Analysis of necessity relations (context 1; low performance)

No.	Necessary conditions	ConN	CovN	RoN	Truly relevant necessity relations (RoN > 0.6)	Completely irrelevant necessity relations (RoN = 0.0)
1	**nda**	1.00	0.60	0.00	-	✓
2	**add**	0.91	0.63	0.28	-	-
3	**nda * add**	0.91	0.63	0.28	-	-
4	**IPCTRL + waiv**	0.99	0.61	0.04	-	-
5	**comp + waiv**	0.91	0.61	0.24	-	-
6	**COMP + waiv**	0.98	0.61	0.08	-	-
7	**ADD + waiv**	0.95	0.60	0.11	-	-

Similar to the results of the analysis of necessary conditions for high performance of the co-creation projects, non-employment of NDAs is identified as a condition with completely irrelevant necessary relation to low performance projects (RoN=0.0). It is identified as a necessary condition as the set of projects not employing NDAs is a superset of the set of low performance projects. However, the fact that this condition is omnipresent in the context of online company-to-one co-creation, the necessity relation between non-employment of NDAs and low performance projects is entirely trivial.

The first step of the analysis of sufficiency relations, truth table analysis (Table 4.11), enables identifying which IP management strategies have the consistency score higher than the set threshold of 0.75 in the set of low performance co-creation projects. In other words, the results of the truth table analysis show which configurations of the five conditions are consistently related to the outcome in question.

Table 4.11 Truth Table Analysis (context 1; low performance)

No.	IPCTRL	COMP	NDA	ADD	WAIV	Outcome	ConS	Number of cases
1	1	1	0	0	0	**0**	0.69	**29**
2	1	0	0	0	0	**0**	0.74	**10**
3	0	0	0	0	0	**1**	0.83	**7**
4	1	1	0	1	1	**0**	0.56	**6**
5	0	1	0	0	0	**1**	0.87	**6**
6	1	0	0	0	1	**0**	0.72	**2**
7	0	1	0	1	0	**0**	0.11	**1**
8	1	1	0	1	0	**0**	0.11	**1**
9	1	1	0	0	1	**1**	0.98	**1**
10-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**?**	-	**0**

Having high consistency in the set of low performance projects (consistency scores range from 0.83 to 0.98), three strategies are identified as sufficient for low performance of online company-to-one co-creation projects (Outcome = 1). Conversely, there are six strategies that do not show consistent relation to low performance projects (consistency scores range from 0.11 to 0.74) and cannot be classified as sufficient for the outcome (Outcome = 0). Showing no empirical evidence, the remaining 23 logically possible configurations are classified as logical remainders (Outcome = ?). Figure 4.12 shows the results of the truth table analysis in a Venn diagram.

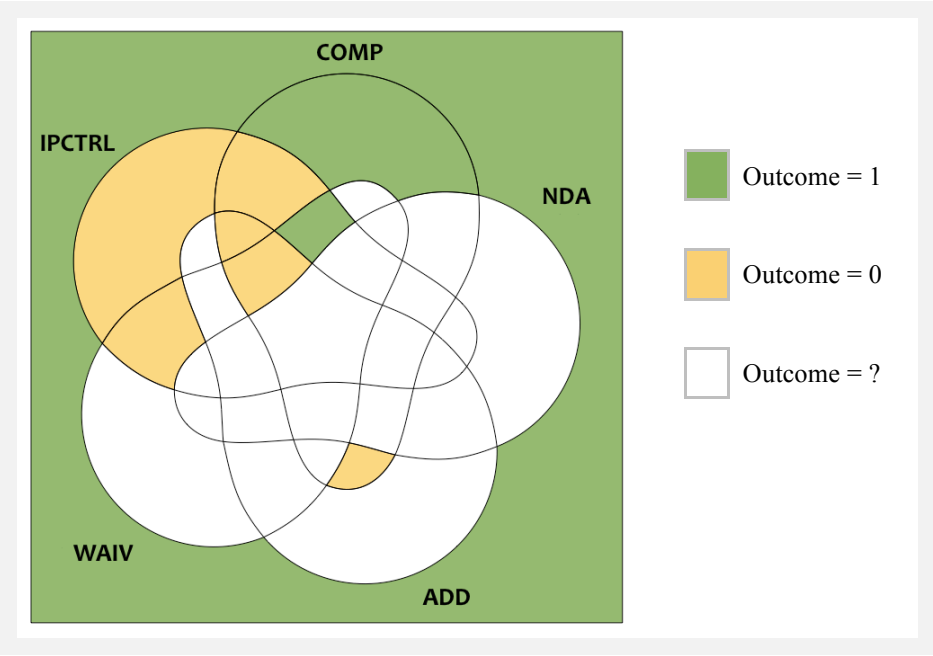


Figure 4.12 Venn diagram – Truth Table Analysis (context 1; low performance)

The second step of the analysis of sufficiency relations, Enhanced Standard Analysis, enables conducting logical minimization of the three configurations consistently related to the outcome and generate conservative / intermediary and parsimonious solutions that represent the backbone of IP management strategies adopted in low performance online company-to-one co-creation projects (Table 4.12). Conservative and intermediary solutions are identical in this study, as no directional expectations are specified (see Section 4.1.4.6). No contradictory simplifying assumptions are identified in the process of the Enhanced Standard Analysis.

Table 4.12 Enhanced Standard Analysis (context 1; low performance)

QCA solutions		ConS	CovS	CovU
Overall conservative / intermediary solution		**0.85**	**0.34**	
Conservative / intermediary solution 1	ipctrl*nda*add*waiv	0.84	0.30	0.30
Conservative / intermediary solution 2	IPCTRL*COMP*nda*add*WAIV	0.98	0.03	-
Overall parsimonious solution		**0.85**	**0.33**	
Parsimonious solution 1	ipctrl*add	0.84	0.30	0.30
Parsimonious solution 2	COMP*add*WAIV	0.98	0.03	0.03

Results of the enhanced standard analysis reveal that, in the context of online company-to-one co-creation, there are two QCA solutions that show sufficiency relation to low performance co-creation projects (Figure 4.13).

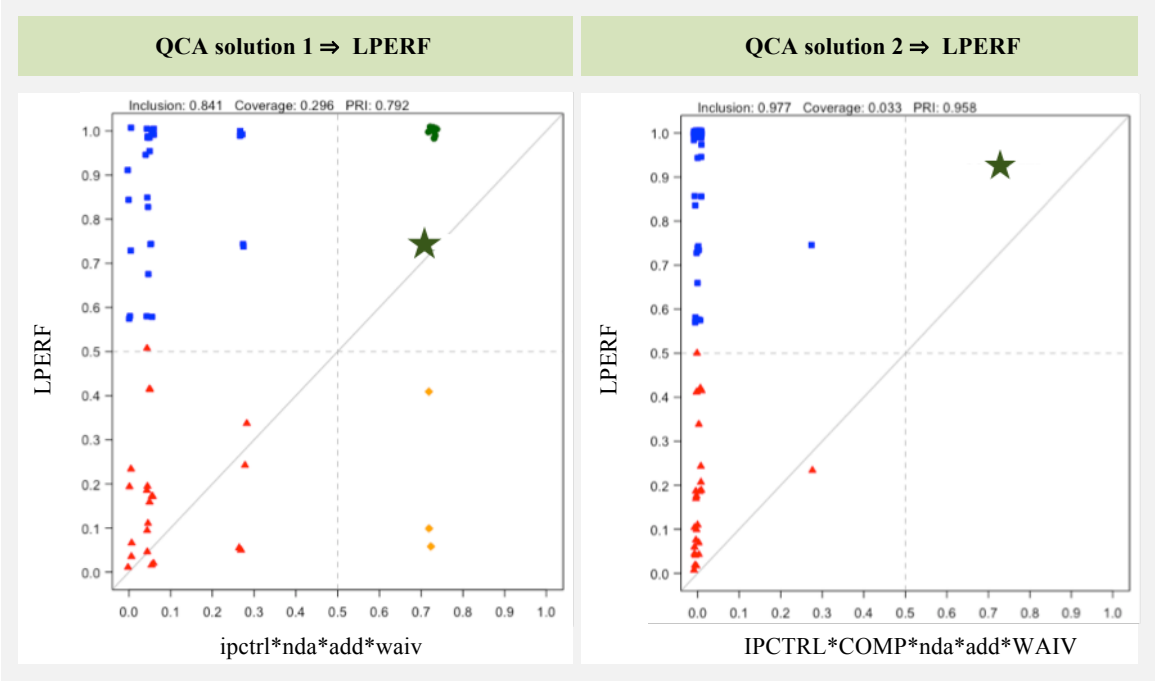


Figure 4.13 Sufficiency relation between QCA solutions and low performance projects (context 1)

The first conservative / intermediary solution (ipctrl*nda*add*waiv) represents IP management strategies based on low degree of IP control, typically established through non-exclusive licensing arrangements, while excluding NDAs, additional agreements and waiver option from the configuration. Compensation appears in this solution as a condition of irrelevance; in other words, both monetary and non-monetary compensation may be a part of IP management strategies related to low performance in online company-to-one co-creation. Conversely, the associated parsimonious solution (ipctrl*add) emphasizes low IP control and omission of additional agreement as the core conditions of this QCA solution. The conditions that appear only in the conservative / intermediary solution, and are not part of parsimonious solution, namely non-employment of both NDAs and the waiver option, are considered to be the solution's peripheral conditions. This QCA solution lies at the basis of two IP management strategies adopted in ten cases of low-performance online company-to-one co-creation projects in the final sample (Table 4.13). While both employ low degree of IP control, and exclude NDAs, additional agreements and the waiver option, the two strategies differ only with regards to the compensation offered to co-creators by initiating companies. One strategy involves monetary compensation, sometimes complemented by non-monetary rewards, while the other involves solely non-monetary compensation, offering an explanation for why the condition of compensation structure is characterized as a condition of irrelevance of this QCA solution.

The second conservative / intermediary solution (IPCTRL*COMP*nda*add*WAIV) represents an IP management strategy based on high degree of IP control, typically established through full transfer of ownership or exclusive licensing arrangements, monetary compensation and employment of waiver option, while excluding NDAs

and additional agreements from the configuration. The associated parsimonious solution (COMP*add*WAIV) emphasizes monetary compensation, waiver option and omission of additional agreement as the core conditions of this QCA solution. The conditions that are part of conservative / intermediary solution, but not part of parsimonious solution, namely high degree of IP control and non-employment of NDAs, are considered to be the solution's peripheral conditions. This QCA solution is the basis of a single IP management strategy adopted in one case of low-performance online company-to-one co-creation projects in the final sample (Table 4.13).

In total, these two QCA solutions represent the backbone of the three IP management strategies adopted in 11 of 38 low-performance online company-to-one co-creation projects, in the set of 63 projects in this context (Table 4.13). There are no multiple-covered cases by the two solutions.

Table 4.13 IP management strategies and low performance cases covered by the QCA solution (context 1)

No.	QCA solution	IP management strategy	Number of cases
1	**ipctrl*nda*add*waiv**	ipctrl*comp*nda*add*waiv	5
		ipctrl*COMP*nda*add*waiv	5
2	**IPCTRL*COMP*nda*add*WAIV**	IPCTRL*COMP*nda*add*WAIV	1

4.2.1.4 Summary and illustration of the results

This section summarizes the results of fsQCA, focusing especially on illustrating the most frequently adopted IP management strategy in the context of online company-to-one co-creation, as well as the strategies that are consistently related to high and low performance of the co-creation projects in this context, covered by the generated QCA solutions.

Adopted in almost half of the online company-to-one co-creation projects, the most frequently adopted IP management strategy ("FREQ") in this context is based on high degree of IP control, complemented by monetary compensation, while excluding the employment of NDAs, additional agreements and the waiver option (Table 4.14). This IP management strategy will be illustrated by excerpts from the terms and conditions of the project with the highest performance score in which such a strategy is adopted, namely the *Project A3* (see Appendix 3). In this case the company adopts a restrictive IP management strategy by employing transfer of ownership, and compensates the winning co-creators with the monetary awards (6000 EUR in total) for their effort and IP. If their solutions are selected by the jury, the co-creator "assigns legally possible, irrevocable and unlimited rights of ownership to the company" and "is fully and irrevocably once and forever compensated for such assignment." The project's terms and conditions do not involve an NDA and an additional agreement or the waiver option.

Table 4.14 Most frequent IP management strategy in online company-to-one co-creation

	IPCTRL	COMP	NDA	ADD	WAIV	Number (%) of cases
FREQ	●	●	⊙	⊙	⊙	29 (46%)
●	Present conditions					
⊙	Absent conditions					

Further fsQCA did not identify any necessary condition or combination of conditions relevant for neither high performance nor low performance of the co-creation projects. Sufficiency analysis, supported by truth table analysis and enhanced standard analysis, enabled generation of one high performance QCA solution ("HPERF solution") and two low performance QCA solutions ("LPERF solutions") in online company-to-one co-creation (Figure 4.14).

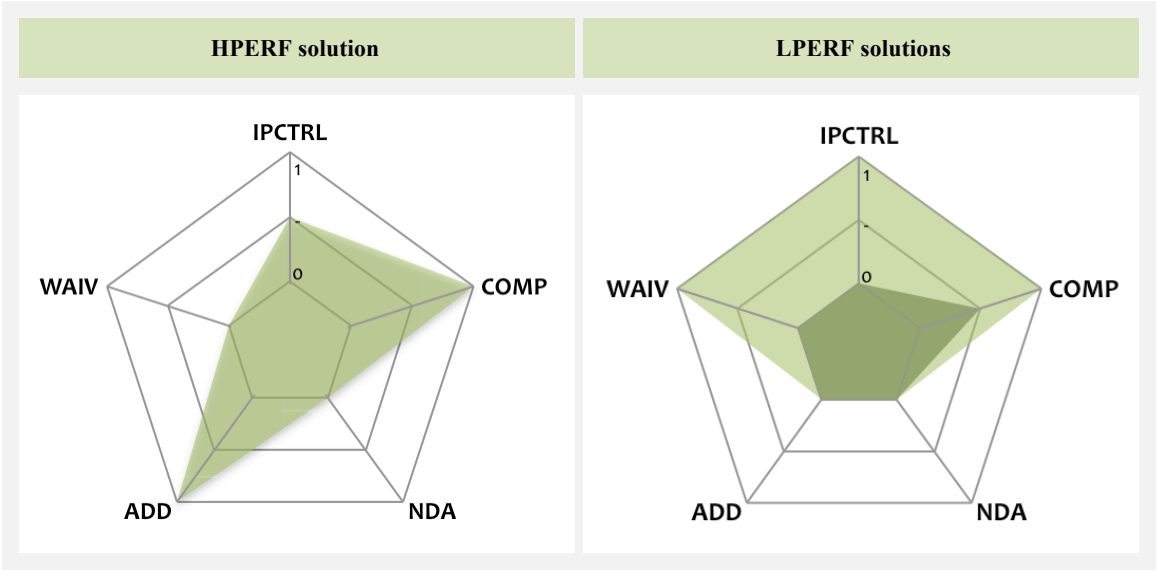


Figure 4.14 QCA solutions (context 1)

None of the identified QCA solutions covers the most frequently adopted strategy in this co-creation context. This strategy is one of the four IP management strategies that are insufficient for both high and low performance of the co-creation projects (Table 4.15).

Table 4.15 IP management strategies inconsistently related to both outcome sets

No.	IPCTRL	COMP	NDA	ADD	WAIV	HPERF ConS	LPERF ConS	Number of cases
1	●	●	⊙	⊙	⊙	0.47	0.69	**29**
2	●	⊙	⊙	⊙	⊙	0.56	0.74	**10**
4	●	●	⊙	●	●	0.51	0.56	**6**
6	●	⊙	⊙	⊙	●	0.62	0.72	**2**
●	Present conditions							
⊙	Absent conditions							

The most typical cases covered by high performance and low performance QCA solutions are identified through the means of case classification by using the R Studio SetMethods package (Oana & Schneider, 2018). IP management strategies adopted in the most typical cases are used as illustrative examples for the QCA solutions.

Table 4.16 shows the classification of cases for the high performance QCA solution in online company-to-one co-creation. There are two cases classified as typical cases, having high membership scores in both the outcome (high performance projects) and the solution (COMP*nda*ADD*waiv). There are no deviant cases for consistency that show high membership score in the solution but low membership in the outcome set. With regards to the cases that are not covered by the solution, there are 23 high performance cases that represent deviant cases for coverage, and 38 low performance cases that represent irrelevant cases for the solution. The most typical case covered by the QCA solution is the *Project A19* (see Appendix 3; the project indicated by the star in Figure 4.11). Thus, the selected excerpts from this project's terms and conditions are used to illustrate the IP management strategies covered by the high performance solution generated by the fsQCA.

Table 4.16 Classification of cases in relation to QCA solution (context 1; high performance)

Types of cases	Number of cases – HPERF solution
Typical cases HPERF>0.5 and Solution>0.5	2
Deviant cases for consistency HPERF<0.5 and Solution >0.5	0
Deviant cases for coverage HPERF>0.5 and Solution <0.5	23
Irrelevant cases HPERF<0.5 and Solution <0.5	38

Adopting a strategy based on the employment of monetary compensation and additional agreements, and the exclusion of NDAs and the waiver option from the configuration as indicated by the solution, the company (in addition to cash prizes in the total amount of 5000 EUR) promises the co-creators a supplementary one-time reimbursement of 1500 EUR "if and when a submitted solution will be commercially retailed by the company or one of its affiliates." Also, the terms and conditions of the *Project A19* do not involve an NDA and a waiver clause in the case that co-creator's solution is not implemented. Having IP control as a condition of irrelevance, the high performance QCA solution indicates that both high and low degree of IP control may be a part of IP management strategies related to high performance in online company-to-one co-creation. In this specific project, the company chooses to employ a restrictive IP management strategy based on high degree of IP control, established through obtaining an exclusive license to "produce and if needed modify the winning solutions in prototype format."

Conversely, Table 4.17 shows the classification of cases for two low performance QCA solutions in online company-to-one co-creation. With regards to the first solution (ipctrl*nda*add*waiv), there are 10 typical cases, 3 deviant cases for

consistency, 28 deviant cases for coverage and 22 irrelevant cases. On the other hand, with regards to the second QCA solution (IPCTRL*COMP*nda*add*WAIV), there is only 1 typical case, no deviant cases for consistency, 37 deviant cases for coverage and 25 irrelevant cases. For the first QCA solution the most typical case covered is the *Project A18*, and the *Project A46* for the second solution (see Appendix 3; projects indicated by the stars in Figure 4.13). The selected excerpts from these projects' terms and conditions are used to illustrate the IP management strategies covered by the low performance solutions generated by the fsQCA.

Table 4.17 Classification of cases in relation to QCA solutions (context 1; low performance)

Types of cases	**Number of cases**	
	LPERF solution 1	**LPERF solution 2**
Typical cases LPERF>0.5 and Solution>0.5	10	1
Deviant cases for consistency LPERF<0.5 and Solution>0.5	3	0
Deviant cases for coverage LPERF>0.5 and Solution<0.5	28	37
Irrelevant cases LPERF<0.5 and Solution<0.5	22	25

Adopting a strategy based on the employment of low degree of IP control, and the exclusion of NDAs, additional agreements and the waiver option from the configuration as indicated by the first solution, the initiating company employs a permissive IP management strategy by obtaining a non-exclusive license to use all the submitted solutions. Also, the terms and conditions of the *Project A18* do not involve an NDA, additional agreement and the waiver option. Having compensation as a condition of irrelevance, the first low performance QCA solution indicates that both

monetary and non-monetary compensation may be a part of IP management strategies related to low performance in online company-to-one co-creation. In this specific project, the company chooses to offer non-monetary awards, such as an invitation to visit the company, products, promo-sets, to creators of the best solutions, selected by the jury.

On the other hand, a single case covered by the second low performance QCA solution, namely the *Project A46*, is an example of a strategy based on high degree of IP control, monetary compensation and employment of the waiver option. The company adopts a restrictive IP management strategy by employing the transfer of ownership of the co-creation outcomes. In addition to cash prizes in the total amount of 7000 EUR, which are complemented by non-monetary awards in the form of products or vouchers, co-creators are promised to be re-assigned their IP "after a period of 24 months starting with the end of the competition and the company's decision not to implement the solutions." The project's terms and conditions do not involve an NDA and an additional agreement as indicated by the solution.

Table 4.18 shows the solutions covering IP management strategies in online company-to-one co-creation related to both high and low performance projects. All solutions have a consistency of 0.84 and above, while the solution coverage ranges from 0.03 to 0.29. For each solution the number of covered and uncovered cases is reported. Table 4.17 also shows overall solution consistency, overall solution coverage, the number of cases covered, as well as uncovered, by the overall solution related to both high and low performance projects.

Table 4.18 Summary of fsQCA results:
IP management strategies in online company-to-one co-creation

QCA solutions	HPERF 1	LPERF 1	LPERF 2
Conditions:			
IP control		⊙	●
Compensation	●		⬤
Employment of NDA	⊙	⊙	⊙
Employment of additional agreement	⬤	⊙	⊙
Employment of waiver option	⊙	⊙	⬤
Solution consistency and coverage:			
Consistency	0.99	0.84	0.98
Raw coverage	0.07	0.29	0.03
Unique coverage	-	0.29	-
No. of cases covered by a single solution	2	10	1
No. of cases not covered by a single solution	23	28	37
Overall solution consistency and coverage:			
Overall solution consistency	0.99	0.85	
Overall solution coverage	0.07	0.33	
No. of cases covered by the overall solution	2	11	
No. of cases not covered by the overall solution	23	27	

⬤	Core present conditions	⊙	Core absent conditions
●	Peripheral present conditions	⊙	Peripheral absent conditions

None of the single conditions, namely IP control, compensation, NDAs, additional agreements and the waiver option are sufficient for the outcome in question on their own. They all represent INUS conditions, i.e. insufficient conditions that are a necessary part of a solution which is unnecessary but sufficient for the outcome (Schneider & Wagemann, 2012).

Nevertheless, comparison of the high performance solution to the low performance solutions allows identification of conditions that may be more important than others in configuring an IP management strategy in the context of online company-to-one co-creation. Namely, with regards to the conditions of IP control, compensation and the waiver option, high performance solution does not show a clear contrast when compared to low performance solutions. As the non-employment of NDAs is omnipresent across the whole sample of online company-to-one co-creation, it appears as an INUS condition in all of the solutions, regardless of the outcome in question. It is also an irrelevant necessary condition. Nevertheless, there is a single condition that shows a clear contrast in comparison between high and low performance solutions. Namely, while the employment of additional agreement appears as a core condition of the high performance solution, the absence of this condition, i.e., exclusion of additional agreements from a strategy configuration, appears to be a common core condition for both, even though quite different, low performance solutions.

The two tests are conducted to analyze the robustness of these results related to IP management strategies in online company-to-one co-creation.

Increasing the consistency threshold from 0.75 to more rigorous value of 0.8 in the first robustness test leads to no changes in the solutions related both high and low performance co-creation projects. The results shown in Table 4.18 remain completely unchanged.

The second robustness test involving modifications in calibration of data related to the outcome of interest in this study (i.e., co-creation projects performance), generates slight changes in the solutions covering IP management strategies in online

company-to-one co-creation. Namely, modified fsQCA generates three solutions related to the high performance projects. Two of these solutions offer a very strong confirmation to HPERF 1. By showing the increase in coverage of the solutions with additional agreements as core conditions to 0.17, they confirm the importance of additional agreements in configuring IP management strategies. No other condition is identified as a core condition in any of the two solutions. The third solution offers a novel insight by exposing a supplementary IP management configuration related to high performance projects, namely a strategy based on high degree of IP control, complemented with the core conditions of non-monetary compensation and employment of waiver option. No solution is identified as related to low performance co-creation projects.

4.2.2 IP management strategies in offline company-to-one co-creation

4.2.2.1 Most frequently adopted IP management strategies

There are three different IP management strategies adopted by companies in offline company-to-one co-creation projects (Table 4.19). The most prominent one is a permissive strategy based on low degree of control of the IP related to co-creation outcomes, complemented by monetary compensation, while employing NDAs and excluding additional agreements and the waiver option. This strategy is adopted by companies in two co-creation projects, i.e., in half of the sample of 4 offline company-to-one co-creation projects.

Table 4.19 IP management strategies in offline company-to-one co-creation

No.	IPCTRL	COMP	NDA	ADD	WAIV	Number of cases
1	0	1	1	0	0	**2**
2	1	0	1	0	0	**1**
3	1	1	1	0	0	**1**
4-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**0**

With regards to the separate IP dimensions, NDAs are implemented as a part of all IP management strategies identified in the set of offline company-to-one co-creation projects. High degree of IP control (i.e., transfer of ownership or exclusive licensing arrangements) and monetary compensation are used as building blocks of the two out of three strategies in online company-to-one co-creation. Finally, IP dimensions of additional agreements and the waiver option are never employed in IP management strategies in this context.

4.2.2.2 IP management strategies adopted in high performance projects

Based on the fsQCA results, two solutions are identified as the backbone of the IP management strategies related to high-performance offline company-to-one co-creation projects. In this subset of four cases all of the co-creation projects have a high performance score.

The analysis of necessity relations between the condition of IP control, compensation, NDAs, additional agreement and the waiver option, and the outcome of high performance projects yielded eight necessary conditions with consistency value over 0.9 (Table 4.20).

Table 4.20 Analysis of necessity relations (context 2; high performance)

No.	Necessary conditions	ConN	CovN	RoN	Truly relevant necessity relations (RoN > 0.6)	Completely irrelevant necessity relations (RoN = 0.0)
1	**NDA**	1.00	0.91	0.00	-	✓
2	**add**	1.00	0.91	0.00	-	✓
3	**waiv**	1.00	0.91	0.00	-	✓
4	**NDA * add**	1.00	0.91	0.00	-	✓
5	**NDA * waiv**	1.00	0.91	0.00	-	✓
6	**add * waiv**	1.00	0.91	0.00	-	✓
7	**NDA * add * waiv**	1.00	0.91	0.00	-	✓
8	**IPCTRL + COMP**	0.93	1.00	1.00	✓	-

Nevertheless, among the eight conditions, only disjunction IPCTRL+COMP is identified to be a truly relevant necessary condition with the high relevance of necessity (RoN>0.6). This disjunction represents the union set of high degree of IP control and monetary compensation, indicating that either of the two conditions is necessary for the outcome (Figure 4.15).

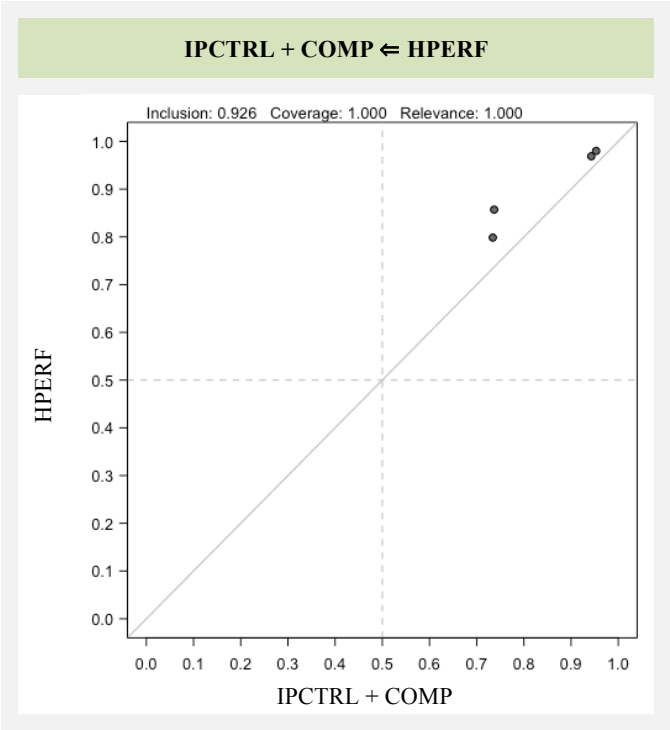


Figure 4.15 Truly relevant necessity relation (context 2)

On the other hand, non-employment of NDAs, non-employment of additional agreements and non-employment of the waiver option, as well as all the conjunctions of the three conditions, are identified to have completely irrelevant necessary relation to high performance projects (RoN=0.0). The fact that these conditions are omnipresent in the context of offline company-to-one co-creation, their necessity relation to high performance projects is entirely trivial.

The first step of the analysis of sufficiency relations, truth table analysis (Table 4.21), enables identifying which IP management strategies have the consistency score higher than the set threshold of 0.75 in the set of high-performance offline company-to-one co-creation projects. In other words, the results of the truth table analysis show which configurations of the five conditions are consistently related to the outcome in question.

Table 4.21 Truth Table Analysis (context 2; high performance)

No.	IPCTRL	COMP	NDA	ADD	WAIV	Outcome	ConS	Number of cases
1	0	1	1	0	0	**1**	1.00	**2**
2	1	0	1	0	0	**1**	1.00	**1**
3	1	1	1	0	0	**1**	1.00	**1**
4-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**?**	-	**0**

Having high consistency in the set of high performance projects (consistency scores equal to 1.00), all three strategies are identified as sufficient for high performance of offline company-to-one co-creation projects (Outcome = 1). There are no strategies that do not show consistent relation to high performance projects. Showing no empirical evidence, the remaining 29 logically possible configurations are classified as logical remainders (Outcome = ?). Figure 4.16 shows the results of the truth table analysis in a Venn diagram.

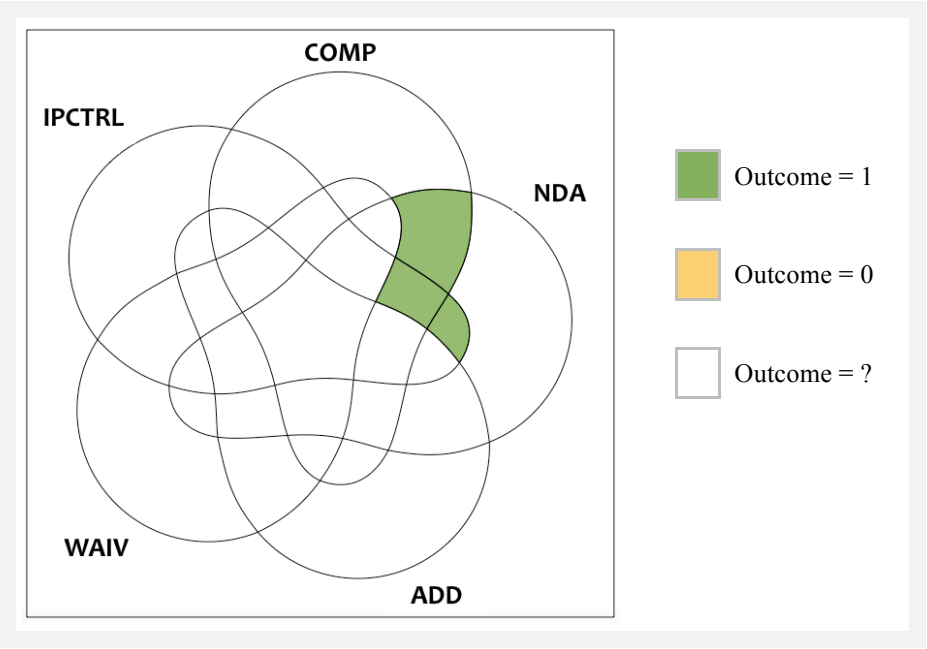


Figure 4.16 Venn diagram – Truth Table Analysis (context 2; high performance)

The second step of the analysis of sufficiency relations, Enhanced Standard Analysis, enables conducting logical minimization of the three configurations consistently related to the outcome and generate conservative / intermediary and parsimonious solutions that represent the backbone of IP management strategies adopted in high-performance offline company-to-one co-creation projects (Table 4.22).

Table 4.22 Enhanced Standard Analysis (context 2; high performance)

QCA solutions		ConS	CovS	CovU
Overall conservative / intermediary solution		**1.00**	**0.93**	
Conservative / intermediary solution 1	IPCTRL*NDA*add*waiv	1.00	0.55	0.25
Conservative / intermediary solution 2	COMP*NDA*add*waiv	1.00	0.68	0.37
Overall parsimonious solution		**0.91**	**1.00**	
Parsimonious solution 1	NDA	0.91	1.00	-
Parsimonious solution 2	add	0.91	1.00	-
Parsimonious solution 3	waiv	0.91	1.00	-

Conservative and intermediary solutions are identical in this study, as no directional expectations are specified (see Section 4.1.4.6). No contradictory simplifying assumptions are identified in the process of the Enhanced Standard Analysis, as expected, taking into account that there are no configurations showing inconsistent relation to the outcome.

Results of the enhanced standard analysis reveal that, in the context of offline company-to-one co-creation, there are two QCA solutions that show sufficiency relation to high performance co-creation projects – all of the cases lie above the main diagonal of the XY plots (Figure 4.17).

The first conservative / intermediary solution (IPCTRL*NDA*add*waiv) represents IP management strategies based on high degree of IP control, established through transfer of ownership or exclusive licensing arrangements, while employing NDAs and excluding additional agreements and waiver option from the configuration. Compensation appears in this solution as a condition of irrelevance; in other words, both monetary and non-monetary compensation may be a part of IP management strategies related to high performance in offline company-to-one co-creation. Conversely, the three parsimonious solutions (NDA, add and waiv) emphasize employment of NDAs and omission of additional agreements and the waiver option as the core conditions of this QCA solution. The condition that appears only in the conservative / intermediary solution, and is not part of parsimonious solutions, namely high degree of IP control, is considered to be the solution's peripheral condition. This QCA solution lies at the basis of two IP management strategies adopted in two cases of high-performance offline company-to-one co-creation projects in the final sample (Table 4.23). While employing a high degree of IP control

and NDAs, and excluding additional agreements and the waiver option, the two strategies differ only with regards to the compensation offered to co-creators by initiating companies. One strategy involves monetary compensation, while the other involves solely non-monetary compensation, offering an explanation why the condition of compensation structure is characterized as a condition of irrelevance of this QCA solution.

The second conservative / intermediary solution (COMP*NDA*add*waiv) represents IP management strategies based on monetary compensation and employment of NDAs, while excluding additional agreements and the waiver option from the configuration. Similar to the first solution, the three parsimonious solutions (NDA, add and waiv) emphasize employment of NDAs and omission of additional agreements and the waiver option as the core conditions of this QCA solution. Conversely, monetary compensation is considered to be the solution's peripheral condition. This solution is the basis of two IP management strategies adopted in three cases of high-performance offline company-to-one co-creation projects in the final sample (Table 4.23). While employing monetary compensation and NDAs, and excluding additional agreements and the waiver option, the two strategies differ only with regards to the degree of IP control imposed by the initiating companies. One strategy implements high degree of IP control, while the other implements low degree of IP control, offering an explanation why the condition of IP control is characterized as a condition of irrelevance of this QCA solution.

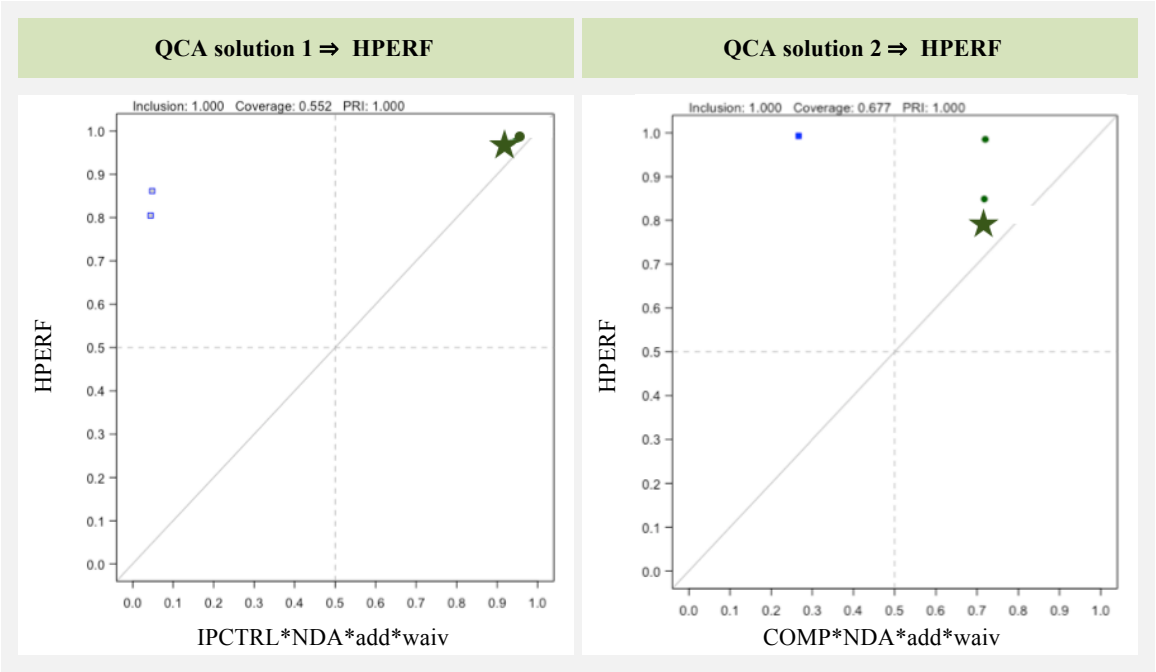


Figure 4.17 Sufficiency relation between QCA solutions and high performance projects (context 2)

In total, these two QCA solutions represent the backbone of the three IP management strategies adopted in all four high-performance offline company-to-one co-creation projects, which represent the whole the set of projects in this context (Table 4.23). As one configuration is covered by both solutions, there is one multiple-covered case.

Table 4.23 IP management strategies and high performance cases covered by the QCA solution (context 2)

No.	QCA solution	IP management strategy	Number of cases
1	**IPCTRL*NDA*add*waiv**	IPCTRL*comp*NDA*add*waiv	1
		IPCTRL*COMP*NDA*add*waiv	1
2	**COMP*NDA*add*waiv**	ipctrl*COMP*NDA*add*waiv	2
		IPCTRL*COMP*NDA*add*waiv	1

4.2.2.3 IP management strategies adopted in low performance projects

Based on the results of the necessity and sufficiency analyses, there are no QCA solutions identified as the backbone of the IP management strategies related to low-performance offline company-to-one co-creation projects. There are no cases with low performance score in this set of projects. The results of the truth table analysis show inconsistent relation of the three configurations to the outcome in question (Table 4.24).

Table 4.24 Truth Table Analysis (context 2; low performance)

No.	IPCTRL	COMP	NDA	ADD	WAIV	Outcome	ConS	Number of cases
1	0	1	1	0	0	**0**	0.24	**2**
2	1	0	1	0	0	**0**	0.12	**1**
3	1	1	1	0	0	**0**	0.12	**1**
4-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**?**	-	**0**

Having low consistency in the set of low performance projects (consistency scores range from 0.12 to 0.24), all three strategies are identified as insufficient for low performance of offline company-to-one co-creation projects (Outcome = 0). There are no strategies that show consistent relation to low performance projects. Showing no empirical evidence, the remaining 29 logically possible configurations are classified as logical remainders (Outcome = ?). Figure 4.18 shows the results of the truth table analysis in a Venn diagram.

Taking into account the fact that there are no configurations consistently related to the outcome, no low performance QCA solution exists in the context of offline company-to-one co-creation.

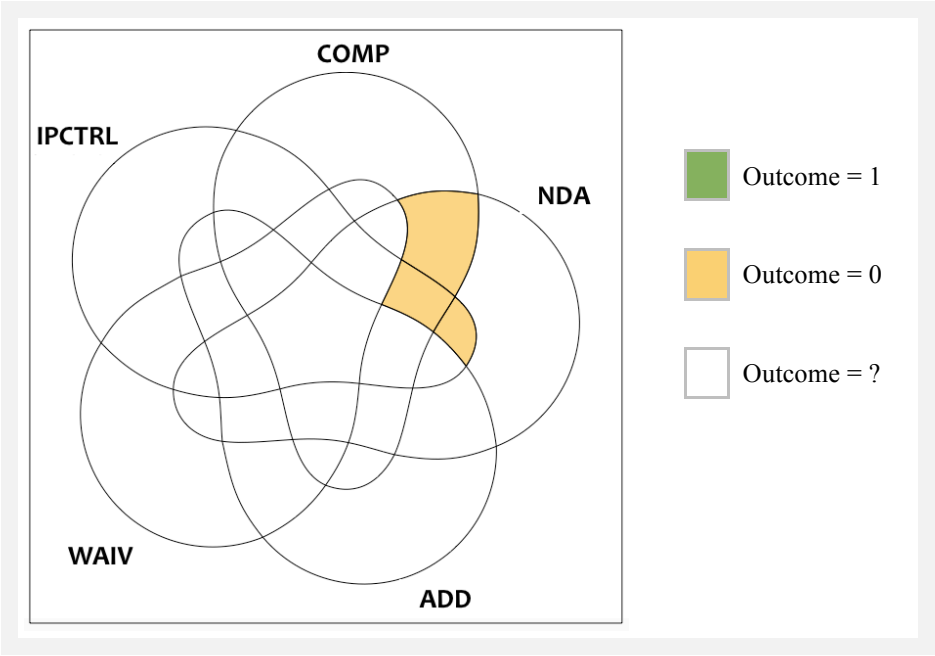


Figure 4.18 Venn diagram – Truth Table Analysis (context 2; low performance)

4.2.2.4 Summary and illustration of the results

This section summarizes the results of fsQCA, focusing especially on illustrating the most frequently adopted IP management strategy in the context of offline company-to-one co-creation, as well as the strategies that are consistently related to high performance of the co-creation projects in this context, covered by the generated QCA solutions. No solution was identified as a low performance solution for IP management in offline company-to-one co-creation.

Adopted in half of the offline company-to-one co-creation projects, the most prominent IP management strategy ("FREQ") in this context is based on low degree of IP control, complemented by monetary compensation, while employing NDAs and excluding additional agreements and the waiver option (Table 4.25).

Table 4.25 Most frequent IP management strategy in offline company-to-one co-creation

	IPCTRL	COMP	NDA	ADD	WAIV	Number (%) of cases
FREQ	⊙	●	●	⊙	⊙	2 (50%)
●	Present conditions					
⊙	Absent conditions					

This IP management strategy will be illustrated by selected excerpts from the terms and conditions of the offline company-to-one co-creation project with the highest performance score in which such a strategy is adopted, namely the *Project B3* (see Appendix 4). Namely, in this case the company adopts a permissive IP management strategy by completely avoiding ownership transfer or any kind of licensing arrangements with the co-creators. All the inputs to the projects "remain the property of the disclosing party." Nevertheless, the co-creators agree to keep all the information confidential and not to disclose it to any third party. In return for their participation in the project, each co-creator is compensated with the monetary prize of 400 EUR. The project's terms and conditions do not involve an additional agreement nor the waiver option as indicated by the solution.

Further fsQCA identified two high performance QCA solutions ("HPERF solutions"), but no low performance solutions ("LPERF solutions") in offline company-to-one co-creation (Figure 4.19). The most frequently adopted IP management strategy in this context is covered by both of the high performance solutions.

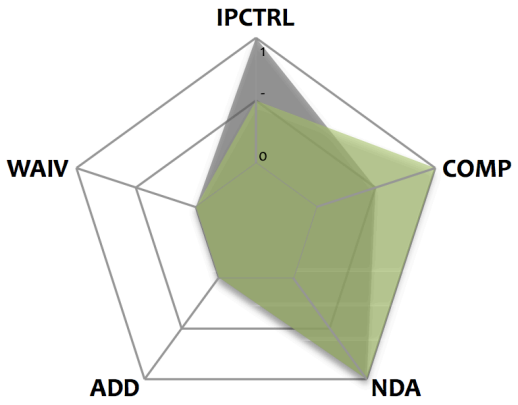
HPERF solutions	LPERF solutions
	No solutions

Figure 4.19 QCA solutions (context 2)

The most typical cases covered by high performance QCA solutions are identified through the means of case classification by using the R Studio SetMethods package (Oana & Schneider, 2018). IP management strategies adopted in these cases are used as illustrative examples for the QCA solutions.

Table 4.26 shows the classification of cases for two high performance QCA solutions for IP management in offline company-to-one co-creation. With regards to the first solution (IPCTRL*NDA*add*waiv), there are 2 typical cases, no deviant cases for consistency, 2 deviant cases for coverage and no irrelevant cases. On the other hand, with regards to the second solution (COMP*NDA*add*waiv), there are 3 typical cases, no deviant cases for consistency, 1 deviant cases for coverage and no irrelevant cases. For the first QCA solution the most typical case covered is the *Project B1*, and the *Project B4* for the second solution (see Appendix 4; projects indicated by the stars in Figure 4.17). The selected excerpts from these projects' terms and conditions are used to illustrate the IP management strategies covered by the high performance QCA solutions.

Table 4.26 Classification of cases in relation to QCA solution (context 2; high performance)

Types of cases	Number of cases	
	HPERF solution 1	HPERF solution 2
Typical cases LPERF>0.5 and Solution>0.5	2	3
Deviant cases for consistency LPERF <0.5 and Solution >0.5	0	0
Deviant cases for coverage LPERF >0.5 and Solution <0.5	2	1
Irrelevant cases LPERF <0.5 and Solution <0.5	0	0

Adopting a strategy based on the employment of high degree of IP control and NDAs, and the exclusion of additional agreements and the waiver option from the configuration as indicated by the first solution, the initiating company employs a restrictive IP management strategy by obtaining the ownership of the co-creation outcomes. Namely, all resulting "ideas, discoveries and inventions are the property of the company, and the company is entitled to all IP rights, including patents." Also, the terms and conditions of the *Project B1* also involve an NDA, by which the company ensures that no information with regards to the project is disclosed to third parties, but exclude any kind of additional agreements with co-creators and the waiver option in the case that co-creation outcomes are not implemented. Having compensation as a condition of irrelevance, the first high performance QCA solution indicates that both monetary and non-monetary compensation may be a part of IP management strategies related to high performance in offline company-to-one co-creation. In this specific project, all the co-creators are entitled for the monetary compensation of 100 EUR in return for their participation and effort in the co-creation project.

On the other hand, in the most typical case covered by the second high performance QCA solution, namely the *Project B4*, the company offers the monetary compensation of 150 EUR to all co-creators, and asks them to sign NDAs. The project's terms and conditions do not involve additional agreements nor a waiver option. Having IP control as a condition of irrelevance, the second high performance QCA solution indicates that both high degree and low degree of IP control may be a part of IP management strategies related to high performance in offline company-to-one co-creation. Nevertheless, in this specific project, the company chooses to adopt a permissive IP management strategy, by completely eschewing any kind of licensing arrangements.

Table 4.27 shows the solutions covering IP management strategies in offline company-to-one co-creation. All solutions have a consistency of 1.00, while the solution coverage ranges from 0.55 to 0.68. For each solution the number of covered and uncovered cases is reported. Table 4.27 also shows overall solution consistency, overall solution coverage, the number of cases covered, as well as uncovered, by the overall solution related to both high and low performance projects.

None of the single conditions, namely IP control, compensation, NDAs, additional agreements and the waiver option are sufficient for the outcome in question on their own. They all represent INUS conditions, i.e., insufficient conditions that are a necessary part of a solution which is unnecessary but sufficient for the outcome (Schneider & Wagemann, 2012). Employment of NDAs, and non-employment of additional agreements and the waiver option are identified as core conditions of both of the high performance QCA solutions. Nevertheless, being omnipresent in this co-creation context they represent irrelevant necessary conditions, and appear as INUS

conditions in all of the solutions. Conversely, the two QCA solutions also suggest that high degree of IP control and monetary compensation allow neutral permutations in the context of offline company-to-one co-creation, when combined with the three core conditions. Being parts of the truly relevant necessary condition, namely disjunction IPCTRL+COMP, high degree of IP control and monetary compensation also represent SUIN conditions, i.e. sufficient conditions that are a unnecessary part of a solution which is insufficient but necessary for the outcome. Thus, taking into account that they are simultaneously INUS and SUIN conditions, the result of fsQCA emphasize the importance of high degree of IP control and monetary compensation in configuring an IP management strategy in the context of offline company-to-one co-creation.

Two tests are conducted to analyze the robustness of the results related to IP management strategies in offline company-to-one co-creation. Increasing the consistency threshold from 0.75 to more rigorous value of 0.8 in the first robustness test leads to no changes in the solutions related both high and low performance co-creation projects. The results shown in Table 4.27 remain completely unchanged. Similarly, the second test involving calibration modifications, generates no changes in the solutions covering IP management strategies in offline company-to-one co-creation.

Table 4.27 Summary of fsQCA results:
IP management strategies in offline company-to-one co-creation

Solution	HPERF 1	HPERF 2	LPERF
Conditions:			
IP control	●		No solution
Compensation		●	
Employment of NDA	⬤	⬤	
Employment of additional agreement	⊙	⊙	
Employment of waiver option	⊙	⊙	
Solution consistency and coverage:			
Consistency	1.00	1.00	-
Raw coverage	0.55	0.68	
Unique coverage	0.25	0.37	
No. of cases covered by a single solution	2	3	
No. of cases not covered by a single solution	2	1	
Overall solution consistency and coverage:			
Overall solution consistency	1.00		-
Overall solution coverage	0.93		
No. of cases covered by the overall solution	4		
No. of cases not covered by the overall solution	0		

⬤	Core present conditions
●	Peripheral present conditions
⊙	Core absent conditions
⊙	Peripheral absent conditions

4.2.3 IP management strategies in online company-to-many co-creation

4.2.3.1 Most frequently adopted IP management strategies

There are three different IP management strategies adopted by companies in online company-to-many co-creation projects (Table 4.28). The most prominent one is a permissive strategy based on low degree of control of the IP related to co-creation outcomes, complemented by monetary compensation, while employing NDAs and excluding additional agreements and the waiver option. This strategy is adopted by companies in 15 co-creation projects, i.e. in more than three quarters of the sample of 19 online company-to-many co-creation projects.

Table 4.28 IP management strategies in online company-to-many co-creation

No.	IPCTRL	COMP	NDA	ADD	WAIV	Number of cases
1	0	1	1	0	0	**15**
2	0	0	1	0	0	**3**
3	1	1	1	0	0	**1**
4-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**0**

With regards to the separate IP dimensions, NDAs are implemented as a part of all IP management strategies identified in the set of offline company-to-one co-creation projects. Low degree of IP control (i.e., non-exclusive licenses or complete avoidance of any kind of licensing arrangements) and monetary compensation are used as building blocks of the two out of three strategies in online company-to-one co-creation. Finally, IP dimensions of additional agreements and the waiver option are never employed in IP management strategies in this context.

4.2.3.2 IP management strategies adopted in high performance projects

Based on the fsQCA results, two solutions are identified as the backbone of the IP management strategies related to high-performance online company-to-many co-creation projects. In this subset of 19 cases, 15 co-creation projects have performance score that is higher than average score of the whole set of projects in the final sample.

The analysis of necessity relations between the condition of IP control, compensation, NDAs, additional agreement and the waiver option, and the outcome of high performance projects yielded seven necessary conditions with consistency value over 0.9 (Table 4.29). Nevertheless, no condition is identified as a truly relevant necessary condition with the high relevance of necessity (RoN>0.6).

Table 4.29 Analysis of necessity relations (context 3; high performance)

No.	Necessary conditions	ConN	CovN	RoN	Truly relevant necessity relations (RoN > 0.6)	Completely irrelevant necessity relations (RoN = 0.0)
1	**NDA**	1.00	0.79	0.00	-	✓
2	**add**	1.00	0.79	0.00	-	✓
3	**waiv**	1.00	0.79	0.00	-	✓
4	**NDA * add**	1.00	0.79	0.00	-	✓
5	**NDA * waiv**	1.00	0.79	0.00	-	✓
6	**add * waiv**	1.00	0.79	0.00	-	✓
7	**NDA * add * waiv**	1.00	0.79	0.00	-	✓

On the other hand, non-employment of NDAs, non-employment of additional agreements and non-employment of the waiver option, as well as all the conjunctions of the three conditions, are identified as having a completely irrelevant necessary

relation to high performance projects (RoN=0.0). The fact that these conditions are omnipresent in the context of online company-to-many co-creation, their necessity relation to high performance projects is entirely trivial.

The first step of the sufficiency analysis, truth table analysis (Table 4.30), enables identifying which IP management strategies have the consistency score higher than the set threshold of 0.75 in the set of high-performance online company-to-many co-creation projects. In other words, the results of this analysis show which configurations are consistently related to the outcome.

Table 4.30 Truth Table Analysis (context 3; high performance)

No.	IPCTRL	COMP	NDA	ADD	WAIV	Outcome	ConS	Number of cases
1	0	1	1	0	0	**1**	0.83	**15**
2	0	0	1	0	0	**1**	0.96	**3**
3	1	1	1	0	0	**1**	0.95	**1**
4-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**?**	-	**0**

Having high consistency in the set of high performance projects (consistency scores range from 0.83 to 0.96), all three strategies are identified as sufficient for high performance of online company-to-many co-creation projects (Outcome = 1). There are no strategies that do not show consistent relation to high performance projects. Showing no empirical evidence, the remaining 29 logically possible configurations are classified as logical remainders (Outcome = ?). Figure 4.20 shows the results of the truth table analysis in a Venn diagram.

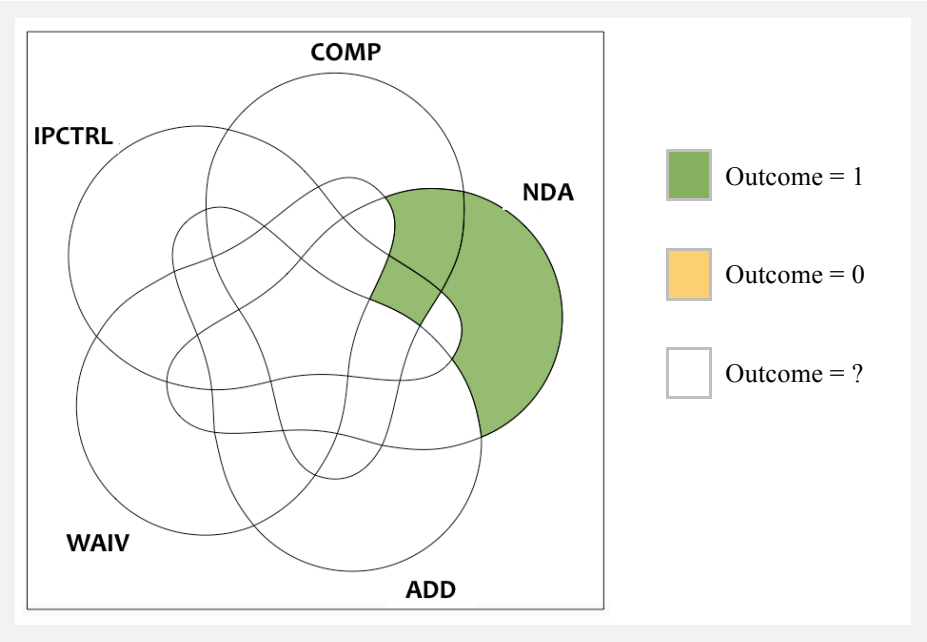


Figure 4.20 Venn diagram – Truth Table Analysis (context 3; high performance)

The second step of the analysis of sufficiency relations, Enhanced Standard Analysis, enables conduction of logical minimization of the three configurations consistently related to the outcome and generate conservative / intermediary and parsimonious solutions that represent the backbone of IP management strategies adopted in high-performance online company-to-many co-creation projects (Table 4.31). Conservative and intermediary solutions are identical in this study, as no directional expectations are specified (see Section 4.1.4.6). No contradictory simplifying assumptions are identified in the process of the Enhanced Standard Analysis, as expected, taking into account that there are no configurations showing inconsistent relation to the outcome.

Table 4.31 Enhanced Standard Analysis (context 3; high performance)

QCA solutions		ConS	CovS	CovU
Overall conservative / intermediary solution		**0.84**	**0.80**	
Conservative / intermediary solution 1	ipctrl*NDA*add*waiv	0.84	0.75	0.09
Conservative / intermediary solution 2	COMP*NDA*add*waiv	0.82	0.71	0.05
Overall parsimonious solution		**0.79**	**1.00**	
Parsimonious solution 1	NDA	0.79	1.00	-
Parsimonious solution 2	add	0.91	1.00	-
Parsimonious solution 3	waiv	0.91	1.00	-

Results of the enhanced standard analysis reveal that, in the context of online company-to-many co-creation, there are two QCA solutions that show sufficiency relation to high performance co-creation projects – all of the cases lie above the main diagonal of the XY plots (Figure 4.21).

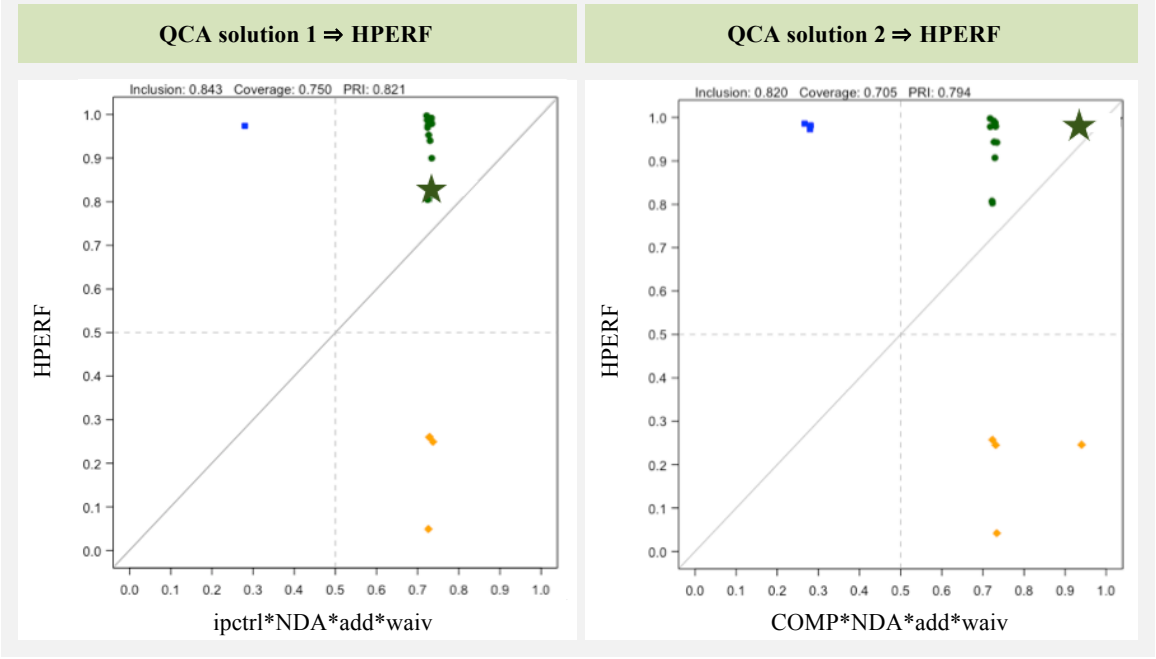


Figure 4.21 Sufficiency relation between QCA solutions and high performance projects (context 3)

The first conservative / intermediary solution (ipctrl*NDA*add*waiv) represents IP management strategies based on low degree of IP control, produced through non-exclusive licenses or complete avoidance of any kind of licensing arrangements, while employing NDAs and excluding additional agreements and waiver option from the configuration. Compensation appears in this solution as a condition of irrelevance; in other words, both monetary and non-monetary compensation may be a part of IP management strategies related to high performance in offline company-to-one co-creation. Conversely, the three parsimonious solutions (NDA, add and waiv) emphasize employment of NDAs and omission of additional agreements and the waiver option as the core conditions of this QCA solution. The condition that appears only in conservative / intermediary solution, and is not part of parsimonious solutions, namely low degree of IP control, is considered to be the solution's peripheral condition. This QCA solution lies at the basis of two IP management strategies adopted in 14 cases of low-performance online company-to-many co-creation projects in the final sample (Table 4.32). While employing low degree of IP control and NDAs, and excluding additional agreements and the waiver option, the two strategies differ only with regards to the compensation offered to co-creators by initiating companies. One strategy involves monetary compensation, while the other involves solely non-monetary compensation, offering an explanation why the condition of compensation structure is characterized as a condition of irrelevance of this QCA solution.

The second conservative / intermediary solution (COMP*NDA*add*waiv) represents IP management strategies based on monetary compensation and employment of NDAs, while excluding additional agreements and the waiver option

from the configuration. Similar to the first solution, the three parsimonious solutions (NDA, add and waiv) emphasize employment of NDAs and omission of additional agreements and the waiver option as the core conditions of this QCA solution. Conversely, monetary compensation is considered to be the solution's peripheral condition. This solution is the basis of two IP management strategy adopted in 12 cases of high-performance online company-to-many co-creation projects in the final sample (Table 4.32). While employing monetary compensation and NDAs, and excluding additional agreements and the waiver option, the two strategies differ only with regards to the degree of IP control imposed by the initiating companies. One strategy implements high degree of IP control, while the other implements low degree of IP control, offering an explanation why the condition of IP control is characterized as a condition of irrelevance of this QCA solution.

In total, these two QCA solutions represent the backbone of the three IP management strategies adopted in online company-to-many co-creation projects (Table 4.32). As one configuration is covered by both solutions, there are eleven multiple-covered cases that are covered by this configuration.

Table 4.32 IP management strategies and high performance cases covered by the QCA solution (context 3)

No.	QCA solution	IP management strategy	Number of cases
1	**ipctrl*NDA*add*waiv**	ipctrl*comp*NDA*add*waiv	3
		ipctrl*COMP*NDA*add*waiv	11
2	**COMP*NDA*add*waiv**	ipctrl*COMP*NDA*add*waiv	11
		IPCTRL*COMP*NDA*add*waiv	1

4.2.3.3 IP management strategies adopted in low performance projects

Based on the results of the necessity and sufficiency analyses, there are no QCA solutions identified as the backbone of the IP management strategies related to low-performance online company-to-one co-creation projects. In this subset of 19 cases, four co-creation projects have performance score that is lower than average score of the whole set of projects in the final sample.

The analysis of necessity relations between the condition of IP control, compensation, NDAs, additional agreement and the waiver option, on one hand, and the outcome of high performance projects, on the other hand, yielded 31 necessary conditions with consistency value over 0.9 (Table 4.33). Nevertheless, no condition is identified as a truly relevant necessary condition with the high relevance of necessity (RoN>0.6).

On the other hand, non-employment of NDAs, non-employment of additional agreements and non-employment of the waiver option, as well as all the conjunctions of the three conditions, are identified to have completely irrelevant necessary relation to low performance projects (RoN=0.0). The fact that these conditions are omnipresent in the context of online company-to-many co-creation, their necessity relation to low performance projects is entirely trivial.

Table 4.33 Analysis of necessity relations (context 3; low performance)

No.	Necessary conditions	ConN	CovN	RoN	Truly relevant necessity relations (RoN > 0.6)	Completely irrelevant necessity relations (RoN = 0.0)
1	**ipctrl**	0.93	0.28	0.37	-	-
2	**COMP**	0.93	0.29	0.40	-	-
3	**NDA**	1.00	0.21	0.00	-	✓
4	**add**	1.00	0.21	0.00	-	✓
5	**waiv**	1.00	0.21	0.00	-	✓
6	**ipctrl*COMP**	0.93	0.31	0.46	-	-
7	**ipctrl*NDA**	0.93	0.28	0.37	-	-
8	**ipctrl*add**	0.93	0.28	0.37	-	-
9	**ipctrl*waiv**	0.93	0.28	0.37	-	-
10	**COMP*NDA**	0.93	0.29	0.40	-	-
11	**COMP*add**	0.93	0.29	0.40	-	-
12	**COMP*waiv**	0.93	0.29	0.40	-	-
13	**NDA*add**	1.00	0.21	0.00	-	✓
14	**NDA*waiv**	1.00	0.21	0.00	-	✓
15	**add*waiv**	1.00	0.21	0.00	-	✓
16	**ipctrl*COMP*NDA**	0.93	0.31	0.46	-	-
17	**ipctrl*COMP*add**	0.93	0.31	0.46	-	-
18	**ipctrl*COMP*waiv**	0.93	0.31	0.46	-	-
19	**ipctrl*NDA*add**	0.93	0.28	0.37	-	-
20	**ipctrl*NDA*waiv**	0.93	0.28	0.37	-	-
21	**ipctrl*add*waiv**	0.93	0.28	0.37	-	-
22	**COMP*NDA*add**	0.93	0.29	0.40	-	-
23	**COMP*NDA*waiv**	0.93	0.29	0.40	-	-
24	**COMP*add*waiv**	0.93	0.29	0.40	-	-
25	**NDA*add*waiv**	1.00	0.21	0.00	-	✓
26	**ipctrl*COMP*NDA*add**	0.93	0.31	0.46	-	-
27	**ipctrl*COMP*NDA*waiv**	0.93	0.31	0.46	-	-
28	**ipctrl*COMP*add*waiv**	0.93	0.31	0.46	-	-
29	**ipctrl*NDA*add*waiv**	0.93	0.28	0.37	-	-
30	**COMP*NDA*add*waiv**	0.93	0.29	0.40	-	-
31	**ipctrl*COMP*NDA*add*waiv**	0.93	0.31	0.46	-	-

The first step of the analysis of sufficiency relations, truth table analysis, confirms that there are no IP management strategies have the consistency score higher than the threshold of 0.75 in the set of low-performance online company-to-many co-creation projects. In other words, the results of the truth table analysis show inconsistent relation of the three configurations to the outcome in question (Table 4.34).

Table 4.34 Truth Table Analysis (context 3; low performance)

No.	IPCTRL	COMP	NDA	ADD	WAIV	Outcome	ConS	Number of cases
1	0	1	1	0	0	**0**	0.31	**15**
2	0	0	1	0	0	**0**	0.27	**3**
3	1	1	1	0	0	**0**	0.34	**1**
4-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**?**	-	**0**

Having low consistency in the set of low performance projects (consistency scores range from 0.27 to 0.34), all three strategies are identified as insufficient for low performance of online company-to-many co-creation projects (Outcome = 0). There are no strategies that show consistent relation to low performance projects. Showing no empirical evidence, the remaining 29 logically possible configurations are classified as logical remainders (Outcome = ?). Figure 4.22 shows the results of the truth table analysis in a Venn diagram.

Taking into account that there are no configurations consistently related to the outcome, no low performance QCA solution exists in the context of offline company-to-one co-creation.

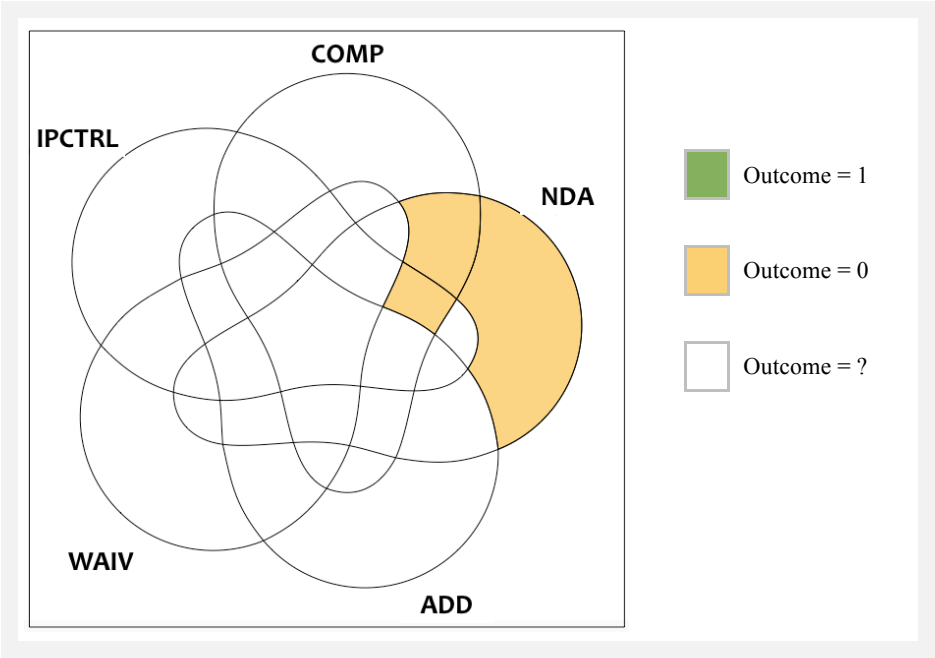


Figure 4.22 Venn diagram – Truth Table Analysis (context 3; low performance)

4.2.3.4 Summary and illustration of the results

This section summarizes the results of fsQCA, focusing especially on illustrating the most frequently adopted IP management strategy in online company-to-many co-creation, as well as the strategies that are consistently related to high performance of the co-creation projects in this context, covered by the generated QCA solutions. No solution was identified as a low performance solution for IP management in online company-to-many co-creation.

Adopted in more than three quarters of the online company-to-many co-creation projects, the most frequently adopted IP management strategy ("FREQ") in this context is based on low degree of IP control, complemented by monetary compensation, while employing NDAs and excluding additional agreements and the waiver option (Table 4.35). This IP management strategy will be illustrated by

selected excerpts from the terms and conditions of one of the online company-to-many co-creation projects with the highest performance score in which such a strategy is adopted, namely the *Project C5* (see Appendix 5). In this case the company adopts a permissive IP management strategy by obtaining the non-exclusive license from the co-creators to use the outcomes of the project. The co-creators agree to keep all the information confidential and not to disclose it to any third party. In return for their participation and input, each co-creator is compensated with the monetary prize of 40 USD. The project's terms and conditions do not involve an additional agreement nor the waiver option as indicated by the solution.

Table 4.35 Most frequent IP management strategy in online company-to-many co-creation

	IPCTRL	COMP	NDA	ADD	WAIV	Number (%) of cases
FREQ	⊙	●	●	⊙	⊙	15 (79%)
●	Present conditions					
⊙	Absent conditions					

Further fsQCA identified two high performance QCA solutions ("HPERF solutions"), but no low performance solutions ("LPERF solutions") in online company-to-many co-creation (Figure 4.23). The most frequently adopted IP management strategy in this context is covered by both of the high performance solutions.

The most typical cases covered by high performance QCA solutions are identified through the means of case classification by using the R Studio SetMethods package (Oana & Schneider, 2018). IP management strategies adopted in these cases are used as illustrative examples for the QCA solutions.

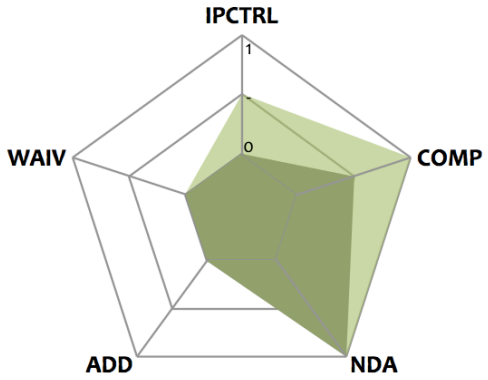
HPERF solutions	LPERF solutions
	No solutions

Figure 4.23 QCA solutions (context 3)

Table 4.36 shows the classification of cases for two high performance QCA solutions for IP management in online company-to-many co-creation. With regards to the first solution (ipctrl*NDA*add*waiv), there are 14 typical cases, 4 deviant cases for consistency, 1 deviant case for coverage and no irrelevant cases. On the other hand, with regards to the second solution (COMP*NDA*add*waiv), there are 12 typical cases, 4 deviant cases for consistency, 3 deviant cases for coverage and no irrelevant cases. For the first QCA solution there are two most typical cases, namely the *Project C18* and the *Project C19* (see Appendix 5; the projects indicated by the star in Figure 4.21). For the second solution, there is one single most typical case, namely the *Project C4* (see Appendix 5; the project indicated by the stars in Figure 4.21). The selected excerpts from these projects' terms and conditions are used to illustrate the IP management strategies covered by the high performance QCA solutions.

Table 4.36 Classification of cases in relation to QCA solution (context 3; high performance)

Types of cases	Number of cases	
	HPERF solution 1	HPERF solution 2
Typical cases HPERF>0.5 and Solution>0.5	14	12
Deviant cases for consistency HPERF<0.5 and Solution >0.5	4	4
Deviant cases for coverage HPERF >0.5 and Solution <0.5	1	3
Irrelevant cases HPERF <0.5 and Solution <0.5	0	0

Adopting a strategy based on the employment of low degree of IP control and NDAs, and the exclusion of additional agreements and the waiver option from the configuration as indicated by the first solution, in the *Project C18* and the *Project C19* the initiating companies employ a permissive IP management strategy by obtaining the non-exclusive license to the co-creation outcomes. The co-creators agree to keep all the information confidential and not to disclose it to any third party. The project's terms and conditions do not involve an additional agreement nor the waiver option as indicated by the solution. Having compensation as a condition of irrelevance, the first high performance QCA solution indicates that both monetary and non-monetary compensation may be a part of IP management strategies related to high performance in online company-to-many co-creation. Nevertheless, in return for their participation and input, in the *Project C18* and the *Project C19* each co-creator is compensated with the monetary prize (i.e. 75 and 15 USD, respectively).

On the other hand, in the most typical case covered by the second high performance QCA solution, namely the *Project C4*, the company offers the monetary compensation of 30 GBP, complemented by the non-monetary reward (i.e. company's

product), to all co-creators, who are asked to sign NDAs. The project's terms and conditions do not involve additional agreements nor the waiver option. Having IP control as a condition of irrelevance, the second high performance QCA solution indicates that both high degree and low degree of IP control may be a part of IP management strategies related to high performance in online company-to-many co-creation. In this specific project, the company chooses to adopt a permissive IP management strategy, by employing a non-exclusive license.

Table 4.37 shows the solutions covering IP management strategies in online company-to-many co-creation. The solutions have consistency scores ranging from 0.82 to 0.84, while the solution coverage ranges from 0.71 to 0.75. For each solution the number of covered and uncovered cases is reported. Table 4.37 also shows overall solution consistency, overall solution coverage, the number of cases covered, as well as uncovered, by the overall solution related to both high and low performance projects.

None of the single conditions, namely IP control, compensation, NDAs, additional agreements and the waiver option are sufficient for the outcome in question on their own. They all represent INUS conditions, i.e., insufficient conditions that are a necessary part of a solution which is unnecessary but sufficient for the outcome (Schneider & Wagemann, 2012). Employment of NDAs, and non-employment of additional agreements and the waiver option are identified as core conditions of both of the high performance QCA solutions. Nevertheless, being omnipresent in this co-creation context they represent irrelevant necessary conditions, and appear as INUS conditions in all of the solutions. Conversely, the two QCA solutions also suggest that low degree of IP control and monetary compensation allow neutral permutations in the context of online company-to-many co-creation, when combined with the three core conditions.

Table 4.37 Summary of fsQCA results:
IP management strategies in online company-to-many co-creation

Solution	HPERF 1	HPERF 2	LPERF
Conditions:			
IP control	⊙		No solution
Compensation		●	
Employment of NDA	⬤	⬤	
Employment of additional agreement	⦿	⦿	
Employment of waiver option	⦿	⦿	
Solution consistency and coverage:			
Consistency	0.84	0.82	-
Raw coverage	0.75	0.71	
Unique coverage	0.09	0.05	
No. of cases covered by a single solution	14	12	
No. of cases not covered by a single solution	1	3	
Overall solution consistency and coverage:			
Overall solution consistency	0.84		-
Overall solution coverage	0.80		
No. of cases covered by the overall solution	15		
No. of cases not covered by the overall solution	0		

⬤	Core present conditions
●	Peripheral present conditions
⦿	Core absent conditions
⊙	Peripheral absent conditions

Two tests are conducted to analyze the robustness of the results related to IP management strategies in online company-to-many co-creation. Increasing the consistency threshold from 0.75 to more rigorous value of 0.8 in the first robustness test leads to no changes in the solutions related both high and low performance co-creation projects. The results shown in Table 4.27 remain completely unchanged. Similarly, the second robustness test involving modifications in calibration of data related to the outcome of interest in this study (i.e., co-creation projects performance), generates no changes in the solutions covering IP management strategies in online company-to-many co-creation.

4.2.4 IP management strategies in offline company-to-many co-creation

4.2.4.1 Most frequently adopted IP management strategies

Finally, within the sub-sample of 30 offline company-to-many co-creation projects, there are nine different IP management strategies adopted by companies (Table 4.38). The most frequently used IP management strategy is a permissive strategy with regards to control of the IP related to co-creation outcomes, based either on non-exclusive licenses or on the complete avoidance of any kind of licensing arrangements. It also includes monetary compensation and employment of NDAs, while excluding employment of additional agreements and waiver option.

Table 4.38 IP management strategies in offline company-to-many co-creation

No.	IPCTRL	COMP	NDA	ADD	WAIV	Number of cases
1	0	1	1	0	0	**7**
2	1	1	1	0	0	**6**
3	1	1	1	0	1	**4**
4	1	0	1	0	0	**4**
5	0	0	1	0	0	**3**
6	0	1	1	1	0	**2**
7	1	0	1	0	1	**2**
8	0	0	1	1	0	**1**
9	1	0	1	1	1	**1**
10-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**0**

With regards to the separate IP dimensions, high degree of IP control (i.e., transfer of ownership or exclusive licensing arrangements) and non-monetary compensation are most frequently used as a building block of IP management strategies (in five out of nine configurations) in the context of offline company-to-many co-creation. IP dimensions of additional agreement and the waiver option are employed in only three strategies. Finally, the IP dimension of NDAs is implemented as a part of each IP management strategy in the set of offline company-to-many co-creation projects.

4.2.4.2 IP management strategies adopted in high performance projects

Based on the results of the fsQCA, three solutions are identified as the backbone of the IP management strategies related to high-performance offline company-to-many co-creation projects. In this subset of 30 cases, 19 co-creation projects have performance score that is higher than average score of the whole set of projects in the final sample.

Necessity analysis yielded seven necessary relations between the condition sets (i.e. IP control, compensation, NDAs, additional agreement and the waiver option) and the outcome set (i.e. high performance projects) with consistency value over 0.9 (Table 4.39), among which there is no truly relevant necessary relation with the high relevance of necessity (RoN>0.6). Employment of NDAs is identified as a condition with completely irrelevant necessary relation to high performance projects (RoN=0.0). The fact that this condition is omnipresent in the context of offline company-to-many co-creation, the necessity relation between employment of NDAs and high performance projects is entirely trivial.

Table 4.39 Analysis of necessity relations (context 4; high performance)

No.	Necessary conditions	ConN	CovN	RoN	Truly relevant necessity relations (RoN > 0.6)	Completely irrelevant necessity relations (RoN = 0.0)
1	**NDA**	1.00	0.63	0.00	-	✓
2	**ipctrl+add**	0.99	0.65	0.09	-	-
3	**IPCTRL+waiv**	0.99	0.64	0.05	-	-
4	**comp+add**	0.94	0.63	0.16	-	-
5	**COMP+add**	0.95	0.64	0.17	-	-
6	**COMP+waiv**	0.95	0.67	0.27	-	-
7	**add+waiv**	0.99	0.65	0.09	-	-

The first step of the analysis of sufficiency relations, truth table analysis (Table 4.40), enables identifying which IP management strategies have the consistency score higher than the set threshold of 0.75 in the set of high performance co-creation projects. In other words, the results of the truth table analysis show which configurations of the five conditions are consistently related to the outcome in question.

Having high consistency in the set of high performance projects (consistency scores range from 0.75 to 1.00), six strategies are identified as sufficient for high performance of offline company-to-many co-creation projects (Outcome = 1). Conversely, there are three strategies that do not show consistent relation to high performance projects (consistency scores range from 0.03 to 0.73) and cannot be classified as sufficient for the outcome (Outcome = 0). Showing no empirical evidence, the remaining 23 logically possible configurations are classified as logical remainders (Outcome = ?). Figure 4.24 shows the results of the truth table analysis in a Venn diagram.

Table 4.40 Truth Table Analysis (context 4; high performance)

No.	IPCTRL	COMP	NDA	ADD	WAIV	Outcome	ConS	Number of cases
1	0	1	1	0	0	**1**	0.75	**7**
2	1	1	1	0	0	**1**	0.80	**6**
3	1	1	1	0	1	**1**	0.92	**4**
4	1	0	1	0	0	**0**	0.64	**4**
5	0	0	1	0	0	**0**	0.73	**3**
6	0	1	1	1	0	**1**	0.85	**2**
7	1	0	1	0	1	**1**	0.76	**2**
8	0	0	1	1	0	**1**	1.00	**1**
9	1	0	1	1	1	**0**	0.03	**1**
10-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**?**	-	**0**

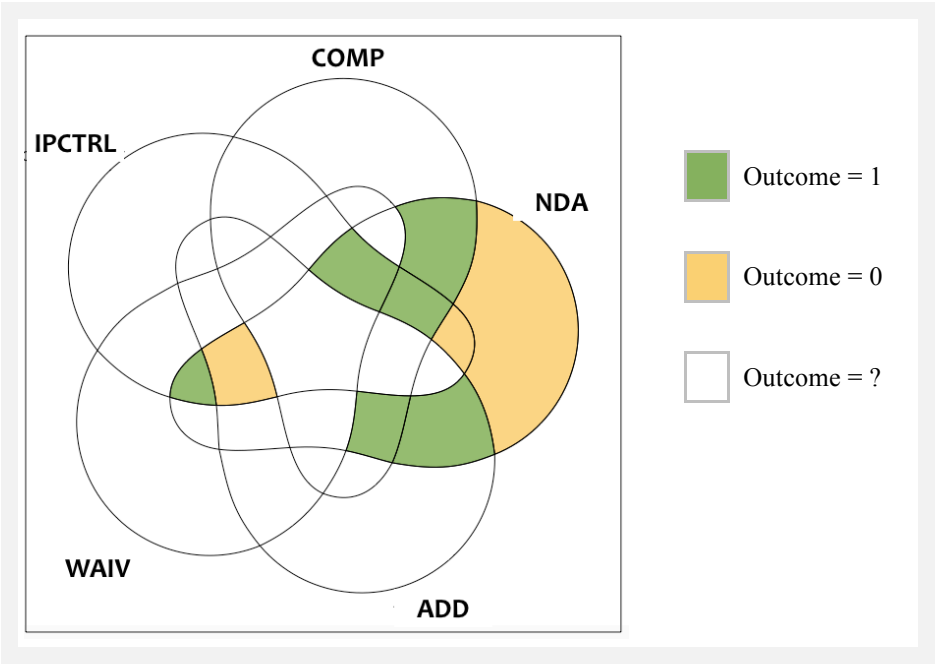


Figure 4.24 Venn diagram – Truth Table Analysis (context 4; high performance)

The second step of the analysis of sufficiency relations, Enhanced Standard Analysis, enables conducting logical minimization of the six configurations consistently related to the outcome and generate conservative / intermediary and parsimonious solutions that represent the backbone of IP management strategies adopted in high-performance offline company-to-many co-creation projects (Table 4.41). Conservative and intermediary solutions are identical in this study, as no directional expectations are specified (see Section 4.1.4.6). There are 10 logical remainders identified as contradictory simplifying assumptions. Following the rules of the Enhanced Standard Analysis (Schneider & Wagemann, 2012), these configurations are excluded from the minimization process.

Table 4.41 Enhanced Standard Analysis (context 4; high performance)

QCA solutions		ConS	CovS	CovU
Overall conservative / intermediary solution		0.76	0.81	
Conservative / intermediary solution 1	ipctrl*NDA*ADD*waiv	0.83	0.13	0.13
Conservative / intermediary solution 2	IPCTRL*NDA*add*WAIV	0.75	0.22	0.22
Conservative / intermediary solution 3	COMP*NDA*add*waiv	0.75	0.47	0.47
Overall parsimonious solution		0.74	0.81	
Parsimonious solution 1	ipctrl*ADD*waiv	0.83	0.13	0.13
Parsimonious solution 2	add*WAIV	0.69	0.22	0.05
Parsimonious solution 3	COMP*add	0.78	0.64	0.47

Results of the Enhanced Standard Analysis reveal that, in the context of offline company-to-many co-creation, there are three QCA solutions that show sufficiency relation to high performance co-creation projects (Figure 4.25).

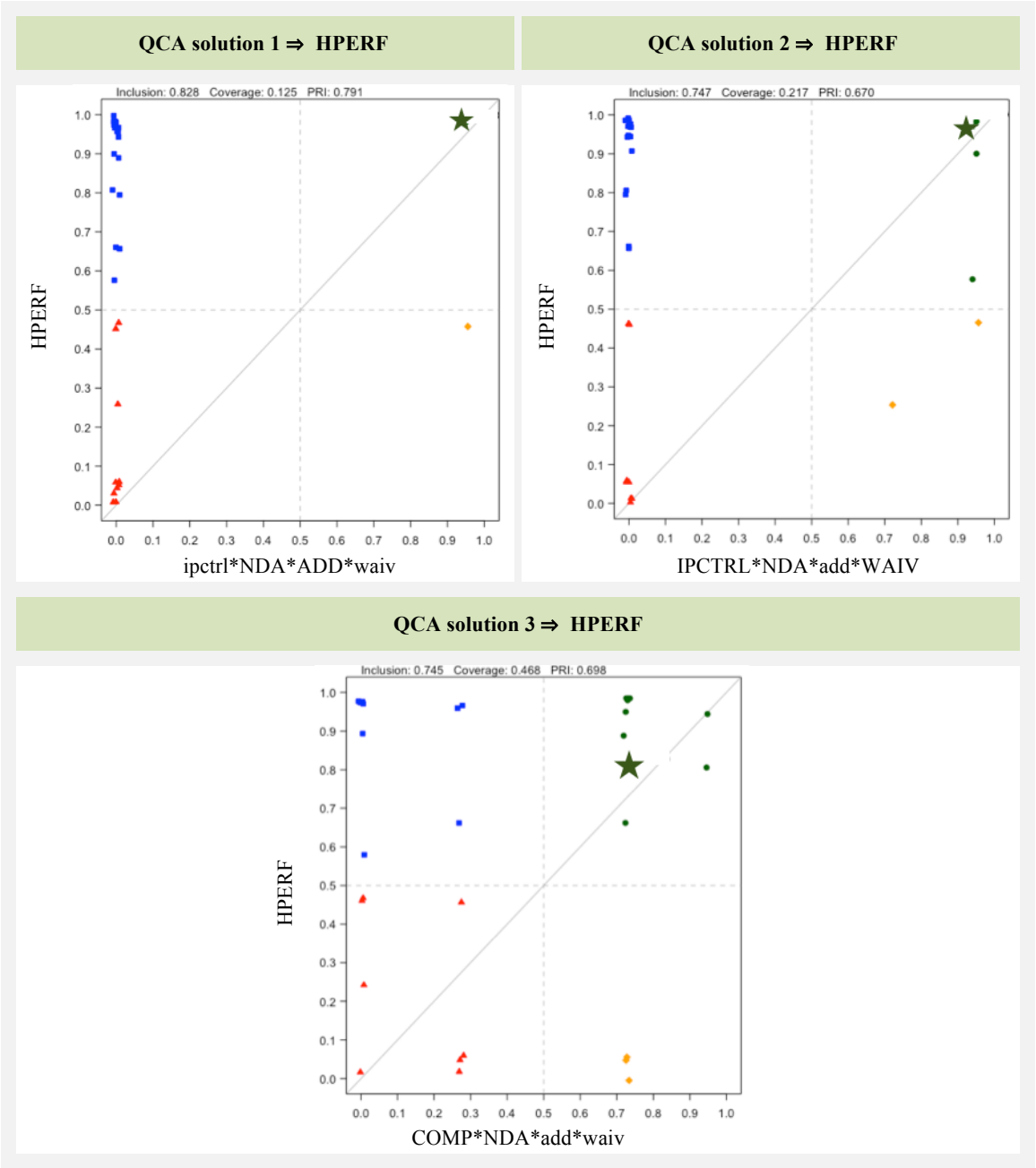


Figure 4.25 Sufficiency relation between QCA solution and high performance projects (context 4)

The first conservative / intermediary solution (ipctrl*NDA*ADD*waiv) emphasizes the importance of configuring an IP management strategy in a way that it involves low degree of IP control, NDAs and additional agreements, while excluding the waiver option from the configuration. Compensation appears in this solution as a condition of irrelevance; in other words, both monetary and non-monetary compensation

may be a part of IP management strategies related to high performance in offline company-to-many co-creation. Conversely, parsimonious solution (ipctrl*ADD*waiv) emphasizes employment of low IP control, additional agreement and exclusion of waiver option as the core conditions of this QCA solution. The condition that is a part of conservative / intermediary solution, but not part of parsimonious solution, namely employment of NDAs, is considered to be the solution's peripheral condition.

The second conservative / intermediary solution (IPCTRL*NDA*add*WAIV) emphasizes the importance of configuring an IP management strategy in a way that it involves high degree of IP control (i.e., transfer of ownership and exclusive licensing arrangements), NDAs and the waiver option, while excluding additional agreements from the configuration. Similar to the previous solution, compensation appears as a condition of irrelevance. Conversely, parsimonious solution (add*WAIV) emphasizes employment of the waiver option and exclusion of additional agreements as the core conditions of this QCA solution. The conditions that are a part of conservative / intermediary solution, but not part of parsimonious solution, namely employment of high degree of IP control and NDAs, are considered to be the solution's peripheral conditions.

Finally, the third conservative / intermediary solution (COMP*NDA*add*waiv) emphasizes the importance of configuring an IP management strategy in a way that it involves monetary compensation, NDAs and the waiver option, while excluding additional agreements from the configuration. IP control appears in this solution as a condition of irrelevance; in other words, both high degree of IP control (i.e., transfer of ownership or exclusive licensing arrangements) and low degree of IP control (i.e., non-exclusive licenses or complete avoidance of any kind of licensing arrangements)

may be a part of IP management strategies related to high performance in offline company-to-many co-creation. Conversely, the parsimonious solution (COMP*add) emphasizes employment of monetary compensation and exclusion of additional agreements as the core conditions of this QCA solution. Employment of NDAs and exclusion of the waiver option represent the solution's peripheral conditions.

In total, the three QCA solutions represent the backbone of six IP management strategies adopted in 16 of 19 high-performance offline company-to-many co-creation projects, in the set of 30 projects in this context (Table 4.42). There are no multiple-covered cases by the three solutions.

Table 4.42 IP management strategies and high performance cases covered by the QCA solution (context 4)

No.	QCA solution	IP management strategy	Number of cases
1	**ipctrl*NDA*ADD*waiv**	ipctrl*COMP*NDA*ADD*waiv	1
		ipctrl*comp*NDA*ADD*waiv	1
2	**IPCTRL*NDA*add*WAIV**	IPCTRL*COMP*NDA*add*WAIV	3
		IPCTRL*comp*NDA*add*WAIV	1
3	**COMP*NDA*add*waiv**	ipctrl*COMP*NDA*add*waiv	5
		IPCTRL*COMP*NDA*add*waiv	5

4.2.4.3 IP management strategies adopted in low performance projects

Based on the results of the necessity and sufficiency analyses, a single QCA solution is identified as the backbone of the IP management strategies related to low-performance offline company-to-many co-creation projects. In this subset of 30 cases, 11 co-creation projects have performance score that is lower than the average score of the whole set of projects in the final sample.

Setting the consistency threshold at the minimal suggested value of 0.9, necessity analysis (Table 4.43) yielded ten necessity relations above the consistency threshold, among which there is no truly relevant necessity relation with the high relevance of necessity (RoN>0.6).

Table 4.43 Analysis of necessity relations (context 4; low performance)

No.	Necessary conditions	ConN	CovN	RoN	Truly relevant necessity relations (RoN > 0.6)	Completely irrelevant necessity relations (RoN = 0.0)
1	**NDA**	1.00	0.37	0.00	-	✓
2	**ipctrl+add**	0.92	0.36	0.06	-	-
3	**IPCTRL+add**	0.95	0.39	0.15	-	-
4	**IPCTRL+waiv**	0.99	0.38	0.03	-	-
5	**comp+add**	0.95	0.38	0.10	-	-
6	**COMP+add**	0.94	0.37	0.10	-	-
7	**comp+waiv**	0.95	0.41	0.19	-	-
8	**add+waiv**	0.91	0.35	0.05	-	-
9	**add+WAIV**	0.95	0.39	0.16	-	-
10	**COMP+ADD+waiv**	0.94	0.39	0.13	-	-

Similar to the results of the analysis of necessary conditions for high performance of the co-creation projects, employment of NDAs is identified as a condition with completely irrelevant necessity relation to low performance projects (RoN=0.0). It is identified as a necessary condition as the set of projects employing NDAs is a superset of the set of high performance projects. However, the fact that this condition is omnipresent in the context of offline company-to-many co-creation, the necessity relation between employment of NDAs and low performance projects is entirely trivial.

The first step of the analysis of sufficiency relations, truth table analysis (Table 4.44), enables identifying which IP management strategies have the consistency score higher than the set threshold of 0.75 in the set of low performance co-creation projects. In other words, the results of the truth table analysis show which configurations of the five conditions are consistently related to the outcome in question.

Table 4.44 Truth Table Analysis (context 4; low performance)

No.	IPCTRL	COMP	NDA	ADD	WAIV	Outcome	ConS	Number of cases
1	0	1	1	0	0	**0**	0.46	**7**
2	1	1	1	0	0	**0**	0.42	**6**
3	1	1	1	0	1	**0**	0.36	**4**
4	1	0	1	0	0	**0**	0.61	**4**
5	0	0	1	0	0	**0**	0.55	**3**
6	0	1	1	1	0	**0**	0.34	**2**
7	1	0	1	0	1	**0**	0.62	**2**
8	0	0	1	1	0	**0**	0.25	**1**
9	1	0	1	1	1	**0**	1.00	**1**
10-32	Logical remainders (Problem of limited diversity - no observed empirical evidence)					**?**	-	**0**

Having high consistency in the set of low performance projects (consistency score equal to 1.00), one strategy is identified as sufficient for low performance of offline company-to-many co-creation projects (Outcome = 1). Conversely, there are eight strategies that do not show consistent relation to low performance projects (consistency scores range from 0.25 to 0.62) and cannot be classified as sufficient for the outcome (Outcome = 0). Showing no empirical evidence, the remaining 23 logically possible configurations are classified as logical remainders (Outcome = ?). Figure 4.26 shows the results of the truth table analysis in a Venn diagram.

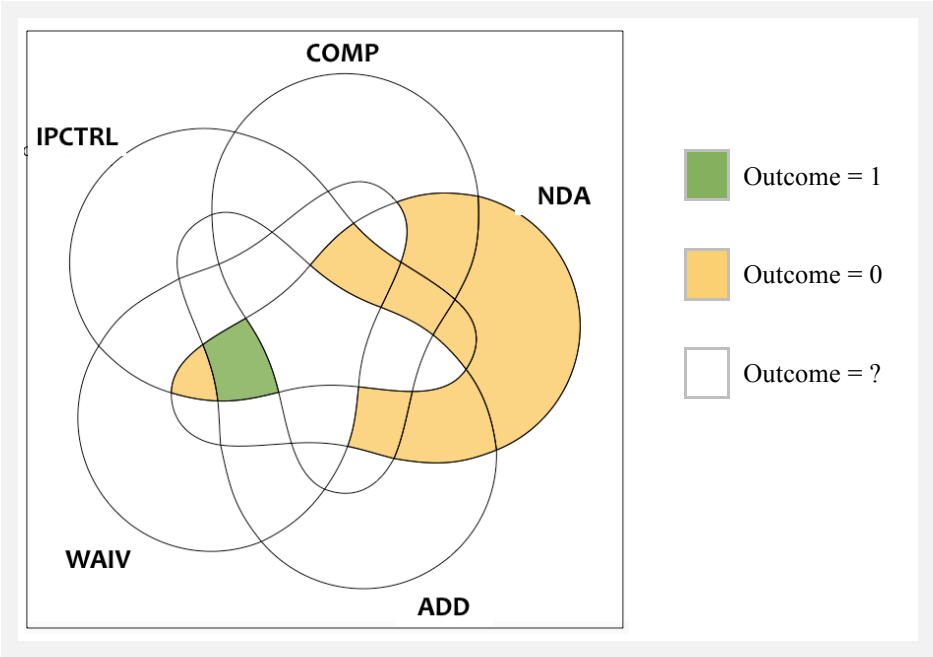


Figure 4.26 Venn diagram – Truth Table Analysis (context 4; low performance)

The second step of the analysis of sufficiency relations, Enhanced Standard Analysis, enables production of conservative / intermediary and parsimonious solutions that represent the backbone of IP management strategies adopted in low-performance offline company-to-many co-creation projects (Table 4.45). Conservative and intermediary solutions are identical in this study, as no directional

expectations are specified (see Section 4.1.4.6). There are ten logical remainders identified as contradictory simplifying assumptions. Following the rules of the Enhanced Standard Analysis (Schneider & Wagemann, 2012), these configurations are excluded from the minimization process.

Table 4.45 Enhanced Standard Analysis (context 4; low performance)

Solution		ConS	CovS	CovU
Overall conservative / intermediary solution		1.00	0.07	
Conservative / intermediary solution	IPCTRL*comp*NDA*ADD*WAIV	1.00	0.07	-
Overall parsimonious solution		1.00	0.07	
Parsimonious solution	IPCTRL*comp*ADD*WAIV	1.00	0.07	-

Results of the enhanced standard analysis reveal that, in the context of offline company-to-many co-creation, there is one QCA solution that shows sufficiency relation to low performance co-creation projects (Figure 4.27).

The conservative / intermediary solution (IPCTRL*comp*NDA*ADD*WAIV) represents IP management strategies based on high degree of IP control, established through transfer of ownership or exclusive licensing arrangements, and non-monetary compensation, while employing NDAs, additional agreements and the waiver option. Conversely, the associated parsimonious solution (IPCTRL*comp*ADD*WAIV) emphasizes high degree of IP control, non-monetary compensation, additional agreements and the waiver option as the core conditions of this QCA solution. Appearing only in conservative / intermediary solution, employment of NDAs is considered to be the solution's peripheral condition.

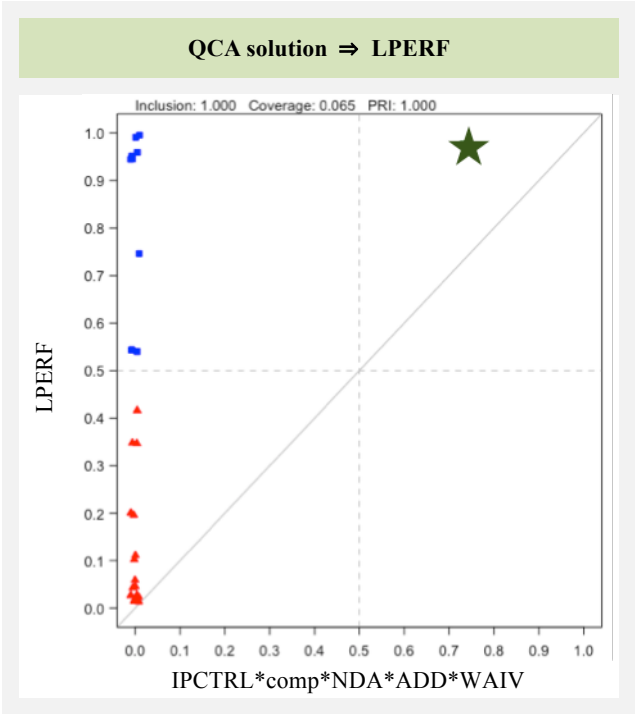


Figure 4.27 Sufficiency relation between QCA solution and low performance projects (context 4)

This QCA solution is the basis of one IP management strategy adopted in one of 11 low-performance offline company-to-many co-creation projects in the subsample of 30 cases in this co-creation context (Table 4.46).

Table 4.46 IP management strategies and low performance cases covered by the QCA solution (context 4)

No.	QCA solution	IP management strategies	Number of cases
1	**IPCTRL*comp*NDA*ADD*WAIV**	IPCTRL*comp*NDA*ADD*WAIV	1

4.2.4.4 Summary and illustration of the results

This section summarizes the results of fsQCA, focusing especially on illustrating the most frequently adopted IP management strategy in the context of offline company-to-many co-creation, as well as the strategies that are consistently related to high and low performance of the co-creation projects in this context, covered by the generated QCA solutions.

The most frequently adopted IP management strategy ("FREQ") in this context is based on low degree of IP control, complemented by monetary compensation, while employing the employment of NDAs and excluding additional agreements and the waiver option (Table 4.47). This IP management strategy will be illustrated by excerpts from the terms and conditions of the project with the highest performance score in which such a strategy is adopted, namely the *Project D2* (see Appendix 6). Namely, in this case the company adopts a permissive IP management strategy by completely avoiding ownership transfer or any kind of licensing arrangements with the co-creators. All the inputs to the projects "remain the property of the disclosing party." Nevertheless, the co-creators agree to keep all the information confidential and not to disclose it to any third party. In return for their participation in the project, each co-creator is compensated with the monetary prize of 500 EUR. The project's terms and conditions do not involve an additional agreement nor the waiver option as indicated by the solution.

Table 4.47 Most frequent IP management strategy in offline company-to-many co-creation

	IPCTRL	COMP	NDA	ADD	WAIV	Number (%) of cases
FREQ	⊙	●	●	⊙	⊙	7 (23%)
●	Present conditions					
⊙	Absent conditions					

Further fsQCA did not identify any necessary condition or combination of conditions relevant for neither high performance nor low performance of the co-creation projects. Sufficiency analysis, supported by truth table analysis and enhanced standard analysis, enabled generation of two high performance QCA solutions ("HPERF solutions") and one low performance QCA solution ("LPERF solution") in offline company-to-many co-creation (Figure 4.28). The most frequently adopted IP management strategy in this context is covered by one of the high performance solutions.

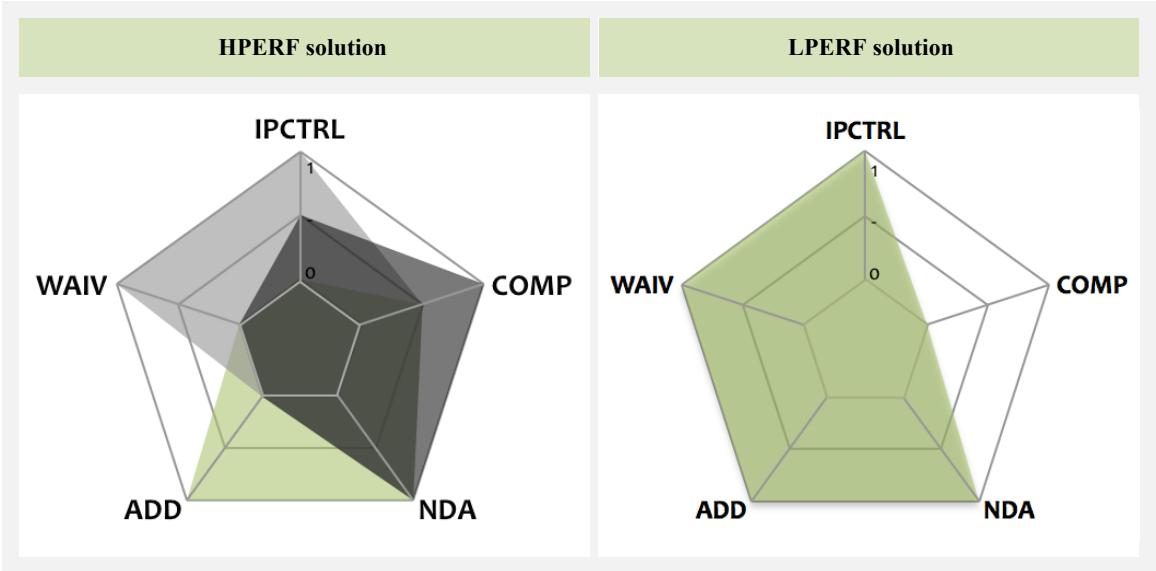


Figure 4.28 QCA solutions (context 4)

There are two IP management strategies that are identified to be insufficient for both high and low performance of the co-creation projects (Table 4.48).

The most typical cases covered by high performance QCA solutions are identified through the means of case classification by using the R Studio SetMethods package (Oana & Schneider, 2018). IP management strategies adopted in the most typical cases are used as illustrative examples for the QCA solutions.

Table 4.48 IP management strategies inconsistently related to both outcome sets

No.	IPCTRL	COMP	NDA	ADD	WAIV	HPERF ConS	LPERF ConS	Number of cases
1	⊙	⊙	●	⊙	⊙	0.73	0.55	3
2	●	⊙	●	⊙	⊙	0.64	0.61	4
●	Present conditions							
⊙	Absent conditions							

Table 4.49 shows the classification of cases for three high performance QCA solutions in offline company-to-many co-creation. For the first QCA solution (ipctrl*NDA*ADD*waiv) the most typical case covered is the *Project D18*; for the second solution (IPCTRL*NDA*add*WAIV) there are two most typical cases, namely the *Project D28* and the *Project D29*; and for the third solution (COMP*NDA*add*waiv) the most typical case is the *Project D17* (see Appendix 6; the projects indicated by the stars in Figure 4.25). The selected excerpts from these projects' terms and conditions are used to illustrate the IP management strategies covered by the high performance solutions generated by the fsQCA.

As indicated by the first solution, in the *Project D18* the company employs a permissive IP management strategy by completely avoiding any kind of licensing arrangements. Co-creators are only asked to sign NDAs. Nevertheless, in the case of future endeavors requiring the use of the outcomes of co-creation, licensing

arrangements are part of an additional agreements. Finally, as there are no transfer of ownership nor licensing arrangements in place, the project's terms and conditions exclude the waiver option. Finally, having compensation as a condition of irrelevance, the first high performance QCA solution indicates that both monetary and non-monetary compensation may be a part of IP management strategies related to high performance in offline company-to-many co-creation. In this specific project, the company chooses not to offer rewards to the co-creators; the main incentive for their participation lies in the opportunity for networking with other experts in the field.

Further, both most typical cases covered by the second high performance QCA solution, namely the *Project D28* and the *Project D29*, are the examples of an IP management strategy based on high degree of IP control, established through transfer of ownership of the co-creation outcomes. Namely, all resulting "ideas, discoveries and inventions are the property of the company, and the company is entitled to all IP rights, including patents." The project's terms and conditions also involve an NDA and the waiver option in the case that co-creation outcomes are not implemented, but exclude any kind of additional agreements. Finally, having compensation as a condition of irrelevance, the second high performance QCA solution indicates that both monetary and non-monetary compensation may be a part of IP management strategies related to high performance in offline company-to-many co-creation. In these specific projects, the companies offer the monetary compensation of 100 EUR to all the co-creators in return for their participation and effort in the co-creation project.

Finally, in the most typical case for the third solution the company offers a monetary compensation to participating co-creators, while asking them to sign NDAs and keep the project confidential. The terms and conditions of the *Project D17*

exclude additional agreements and the waiver option. Having IP control as a condition of irrelevance, the QCA solution indicates that both high and low degree of IP control may be a part of IP management strategies related to high performance in offline company-to-many co-creation. In this specific project, the company avoids any kind of licensing arrangements as a part of its IP management strategy, choosing to employ a permissive IP management strategy. Namely, the terms and conditions contain "nothing that shall be construed, by implication or otherwise, as a grant of license by any party hereto to the other to use any Information disclosed other than for discussions."

Table 4.49 Classification of cases in relation to QCA solution (context 4; high performance)

Types of cases	Number of cases		
	QCA solution 1	QCA solution 2	QCA solution 3
Typical cases HPERF>0.5 and Solution>0.5	2	4	10
Deviant cases for consistency HPERF<0.5 and Solution >0.5	1	2	3
Deviant cases for coverage HPERF>0.5 and Solution <0.5	17	15	9
Irrelevant cases HPERF<0.5 and Solution <0.5	10	9	8

Conversely, Table 4.50 shows the classification of cases for the low performance QCA solution (IPCTRL*comp*NDA*ADD*WAIV) in offline company-to-many co-creation. There is one case covered by this solution, namely the *Project D20* (see Appendix 6; the project indicated by the star in Figure 4.27), and thus it is used to illustrate the IP management strategy covered by the low performance solution generated by the fsQCA.

Table 4.50 Classification of cases in relation to QCA solutions (context 4; low performance)

Types of cases	Number of cases
Typical cases LPERF>0.5 and Solution>0.5	1
Deviant cases for consistency LPERF<0.5 and Solution >0.5	0
Deviant cases for coverage LPERF>0.5 and Solution <0.5	10
Irrelevant cases LPERF<0.5 and Solution <0.5	19

The *Project D20* is an example of a restrictive strategy based on high degree of IP control. Namely, co-creators are asked to agree that "all IP rights, title and interest in and to results generated in connection with co-creation project shall belong to the company." In return, the initiating company offers non-monetary compensation (i.e., its products) to the co-creators. Nevertheless, in case that the company decides to apply for a patent or a utility model to protect the invention co-created in the project, the co-creators involved will be compensated by the reward of maximum 2000 EUR. The company will also waive any rights to the invention and return them to co-creators if it will not be implemented. Finally, the terms and conditions also involve an NDA, as a requirement for a participation in the project.

Table 4.51 shows the solutions covering IP management strategies in offline company-to-many co-creation related to both high and low performance projects. All solutions have a consistency of 0.75 and above, while the solution coverage ranges from 0.07 to 0.47. For each solution the number of covered and uncovered cases is reported. Table 4.51 also shows overall solution consistency, overall solution coverage, the number of cases covered, as well as uncovered, by the overall solution

related to both high and low performance projects.

None of the single conditions, namely IP control, compensation, NDAs, additional agreements and the waiver option are sufficient for the outcome in question on their own. They all represent INUS conditions, i.e. insufficient conditions that are a necessary part of a solution which is unnecessary but sufficient for the outcome (Schneider & Wagemann, 2012). Nevertheless, comparison between the high performance solutions and the low performance solution allows identification of conditions that may be more important than others in configuring an IP management strategy in the context of offline company-to-many co-creation.

With regards to the conditions of compensation, the low performance solution shows a clear contrast when compared to high performance solutions, i.e. non-monetary compensation appears as a core condition of the low performance solution. As the employment of NDAs is omnipresent across the whole sample of offline company-to-many co-creation, it appears as an INUS condition in all of the solutions, regardless of the outcome in question. It is also an irrelevant necessary condition. With regards to the waiver option, comparison between the solutions does not yield any strong contrast. The same appears for the conditions of IP control and additional agreements. Nevertheless, taking the perspective on the conjunctions between the two conditions, it appears that low degree of IP control complemented by the employment of additional agreements and high degree of IP control complemented by the exclusion of additional agreements, which are related to the high performance co-creation projects, show a contrast in comparison to the low performance solution including high degree of IP control complemented by the employment of additional agreements.

Two tests are conducted to analyze the robustness of these results related to IP management strategies in offline company-to-many co-creation.

Increasing the consistency threshold from 0.75 to more rigorous value of 0.8 as a part of the first robustness test leads to slight modifications in solutions covering IP management strategies in offline company-to-many co-creation related only to high performance projects. Namely, while the solution HPERF 1 stays unaffected, the solutions HPERF 2 and HPERF 3 are integrated into a single solution. This solution has previously indifferent conditions for its core conditions, increasing the emphasis on the importance of high degree of IP control and monetary compensation for IP management in offline company-to-many co-creation. The waiver option, as the differentiating condition between the two solutions is identified as the condition of indifference.

The second robustness test involving modifications in calibration of data related to the outcome of interest in this study (i.e. co-creation projects performance), generates slight changes in the high performance solutions covering IP management strategies in offline company-to-many co-creation. Namely, similarly to the original results, modified fsQCA generated the solutions based on both high (HPERF 1) and low degree of IP control (HPERF 2) are identified. The solution with the indifferent condition of IP control (HPERF 3) is not identified as a part of the results of this robustness test. Solutions related to low performance projects in the context of offline company-to-many co-creation remain completely unchanged.

Table 4.51 Summary of fsQCA results:
IP management strategies in offline company-to-many co-creation

Solution	HPERF 1	HEPRF 2	HPERF 3	LPERF 1
Conditions:				
IP control	⊙	•		●
Compensation			●	⊙
Employment of NDA	•	•	•	•
Employment of additional agreement	●	⊙	⊙	●
Employment of waiver option	⊙	●	⊙	●
Solution consistency and coverage:				
Consistency	0.83	0.75	0.75	1.00
Raw coverage	0.13	0.22	0.47	0.07
Unique coverage	0.13	0.22	0.47	-
No. of cases covered by a single solution	2	4	10	1
No. of cases not covered by a single solution	17	15	9	10
Overall solution consistency and coverage:				
Overall solution consistency		0.76		1.00
Overall solution coverage		0.81		0.07
No. of cases covered by the overall solution		16		1
No. of cases not covered by the overall solution		3		10

●	Core present conditions
•	Peripheral present conditions
⊙	Core absent conditions
⊙	Peripheral absent conditions

4.3 Discussion of results: Towards the concept of contextualized IP management in co-creation

Integration of the contextual and configurational perspectives in this study enables us to understand more deeply the relation between different IP management strategies and project performance across a variety of co-creation contexts. Based on the argument that different co-creation contexts, discerned in terms of co-creation types and co-creation settings, ask for specific configurations of IP management strategies that correspond to existing contextual conditions, fsQCA generated novel and original insights that serve as the foundation for developing the concept of contextualized IP management in co-creation.

Results of the fsQCA support the creation of a polythetic typology of IP management strategies, which can be formed from different configurations of IP dimensions. Because they allow the grouping of cases that are similar though perhaps not identical in terms of their attributes, polythetic typologies are considered superior for research actually intended to identify specimens as part of a type (Fiss, 2011).

By comparing generated fsQCA solutions that cover IP management strategies related to high and low performance co-creation projects (Table 4.52), the best practices in IP management are proposed for the four co-creation contexts.

Table 4.52 Summary of fsQCA results: IP management strategies across the co-creation contexts

	IPCTRL	COMP	NDA	ADD	WAIV
1 Online company-to-one co-creation					
Most frequently adopted strategy (FREQ 1)	●	●	⊙	⊙	⊙
Adopted in HPERF projects (HPERF 1)		●	⊙	⬤	⦿
Adopted in LPERF projects (LPERF 1.1)	⦿		⊙	⦿	⊙
Adopted in LPERF projects (LPERF 1.2)	●	⬤	⊙	⦿	⬤
2 Offline company-to-one co-creation					
Most frequently adopted strategy (FREQ 2)	⊙	●	●	⊙	⊙
Adopted in HPERF projects (HPERF 2.1)	●		⬤	⦿	⦿
Adopted in HPERF projects (HPERF 2.2)		●	⬤	⦿	⦿
Adopted in LPERF projects (LPERF 2)	No solution				
3 Online company-to-many co-creation					
Most frequently adopted strategy (FREQ 3)	⊙	●	●	⊙	⊙
Adopted in HPERF projects (HPERF 3.1)	⊙		⬤	⦿	⦿
Adopted in HPERF projects (HPERF 3.2)		●	⬤	⦿	⦿
Adopted in LPERF projects (LPERF 3)	No solution				
4 Offline company-to-many co-creation					
Most frequently adopted strategy (FREQ 4)	⊙	●	●	⊙	⊙
Adopted in HPERF projects (HPERF 4.1)	⦿		●	⬤	⦿
Adopted in HPERF projects (HPERF 4.2)	●		●	⦿	⬤
Adopted in HPERF projects (HPERF 4.3)		⬤	●	⦿	⊙
Adopted in LPERF projects (LPERF 4)	⬤	⦿	●	⬤	⬤

⬤	Core present conditions
●	Peripheral present conditions
⦿	Core absent conditions
⊙	Peripheral absent conditions

First of all, the results of fsQCA show that the best practice in IP management in all of the co-creation contexts is strongly related to the employment of monetary compensation. All of the solutions covering IP management strategies adopted in high performance co-creation projects in each of the contexts either emphasize monetary compensation as an important ingredient of the configuration or represent it as a condition of indifference. These insights concur with the most frequently adopted strategies across the contexts—they all involve monetary compensation as one of their building blocks. Thus, the following proposition is offered:

Proposition 1: *Effective IP management strategies employ monetary compensation in all of the co-creation contexts.*

With regards to the context of online company-to-one co-creation, typically taking the form of crowdsourcing contests, results of fsQCA suggest that the best practice lies in IP management strategies primarily based on employment of additional agreements. The benefits of additional agreements are not discussed in previous research. Along with the waiver option, additional agreements are considered to be the most rarely used IP dimension in configuring an IP management strategy in co-creation (Tekic & Willoughby, 2019). Also, the results of this study show that additional agreements are not used as a building block of the most frequently adopted strategy in this co-creation context. Even though their employment appears as the core condition in the QCA solution covering very small number of high performing projects, their exclusion appears as the core condition in the two solutions covering around one third of low performing online company-to-one co-creation projects. Also, robustness tests offer a very strong confirmation of these results. By showing a significant increase in coverage of the solutions that include additional

agreements as their only core conditions, they confirm the importance of additional agreements in configuring IP management strategies. Additional agreements may empower a company's approach to IP management in online company-to-one co-creation. Namely, they may give a company freedom not to necessarily impose high degree of IP control through co-creation project's terms and conditions to be able to ensure appropriation of value from co-creation outcomes. In case of the interest to realize co-creation outcomes, further arrangements with co-creators may be subsequently specified. Such an approach also offers to co-creators a promise of their more serious engagement in the following stages of product innovation, as well as a promise of greater benefits from further collaboration. The results of fsQCA actually show that additional agreements are an important ingredient of both restrictive and permissive IP management strategies adopted in the context of online company-to-one co-creation; both high and low degrees of IP control are attached to additional agreements in high performance projects, and to their exclusion in low performance projects. Thus, the following proposition is offered:

Proposition 2: *In the context of online company-to-one co-creation, effective IP management strategies are based on the employment of additional agreements, complemented by high or low degree of IP control.*

The analysis of IP management strategies adopted in offline company-to-one co-creation projects, typically taking the form of expert sessions, suggests that the best practice for IP management lies primarily in employment of NDAs, complemented by high degree of IP control, even though such an approach does not correspond to the most frequently adopted strategy in this context. Both QCA solutions related to high performance projects emphasize NDAs as their core

condition. Even though not discussed in the previous research on IP management in collaborative innovation with individual external contributors, NDAs may bring along significant benefits for projects in the context of offline company-to-one co-creation. They ensure that all information shared between the co-creators and the initiating company remains confidential. The results of fsQCA also emphasize the importance of establishing high degree of IP control, in addition to monetary compensation that appears as an important ingredient of IP management strategies across all co-creation contexts. High degree of IP control, ensured through transfer of ownership or exclusive licensing arrangements, allows companies to fully control the co-creation outcomes and exploit them in further stages of product innovation process. QCA does not offer a solution related to IP management in low performance co-creation projects. Robustness tests offer a very strong confirmation to these results. Thus, the following proposition is offered:

Proposition 3: *In the context of offline company-to-one co-creation, effective IP management strategies are based on the high degree of IP control and employment of NDAs.*

In contrast to the context of offline company-to-one co-creation, the results of fsQCA suggest that the best practice for IP management in the context of online company-to-many co-creation lies in the employment of NDAs, complemented by low degree of IP control. Such an approach corresponds to the most frequently adopted strategy in this context. Both QCA solutions related to high performance co-creation projects emphasize NDAs as their core condition. NDAs indeed represent the crucial element of an IP management strategy in the context of online company-to-many co-creation, taking into account that the projects within the data set typically

take the form of closed online communities. Companies aim to keep the content confidential, so NDAs are an irreplaceable tool for such arrangements. In addition to monetary compensation that appears as an important ingredient of IP management strategies across all co-creation contexts, the results of fsQCA also emphasize the importance of establishing low degree of IP control, by employing non-exclusive licensing arrangements or completely avoid the transfer of any kind of rights from co-creators to the initiating company. QCA does not offer a solution related to low performance co-creation projects. Robustness tests offer a very strong confirmation to these results. Thus, the following proposition is offered:

Proposition 4: *In the context of online company-to-many co-creation, effective IP management strategies are based on the low degree of IP control and employment of NDAs.*

Finally, with regards to the context of offline company-to-many co-creation, where projects typically take form of lead user workshops, the results of fsQCA suggest two very different types of strategies that represent best practices for IP management in this context. Companies may choose between strategies based on low degree of IP control, accompanied by additional agreements, and strategies based on high degree of IP control, which exclude employment of additional agreements. Namely, employment of additional agreements along with the low degree of IP control appears as a core condition in one of the IP management solutions related to high performance projects; conversely, the remaining two solutions related to high performance projects suggest that companies may also establish high degree of IP control, but exclude additional agreements in that case. These results are confirmed by the solution related to low performance projects, which emphasizes combination of a

high degree of IP control and employment of additional agreements as its core conditions. Employment of NDAs is identified as a peripheral condition in all three solutions related to high performance projects, complementing the core conditions of these solutions. Both types of strategies (i.e. the type based on low degree of IP control, accompanied by additional agreements, and the type based on high degree of IP control, which exclude employment of additional agreements) give the initiating company the opportunity to ensure appropriation of value from co-creation outcomes. Companies may choose to impose high degree of IP control straightforwardly through co-creation project's terms and conditions, or choose to establish low IP control at the beginning and specify further arrangements with co-creators in case of the interest to realize co-creation outcomes. None of the two practices correspond to the most frequently adopted strategy in this co-creation context. However, by consistently maintaining both approaches in the core of the high performing solutions, robustness tests offer a very strong confirmation to the original QCA results. Thus, the following propositions are offered:

Proposition 5a: *In the context of offline company-to-many co-creation, effective IP management strategies are based on the low degree of IP control and employment of additional agreements, complemented by employment of NDAs.*

Proposition 5b: *In the context of offline company-to-many co-creation, effective IP management strategies are based on the high degree of IP control and exclusion of additional agreements, complemented by employment of NDAs.*

Based on the insights from the fsQCA conducted in this main empirical study, the concept of *contextualized IP management in co-creation* (Figure 4.29) is developed, providing the overview of best practices for IP management across a variety of co-creation contexts.

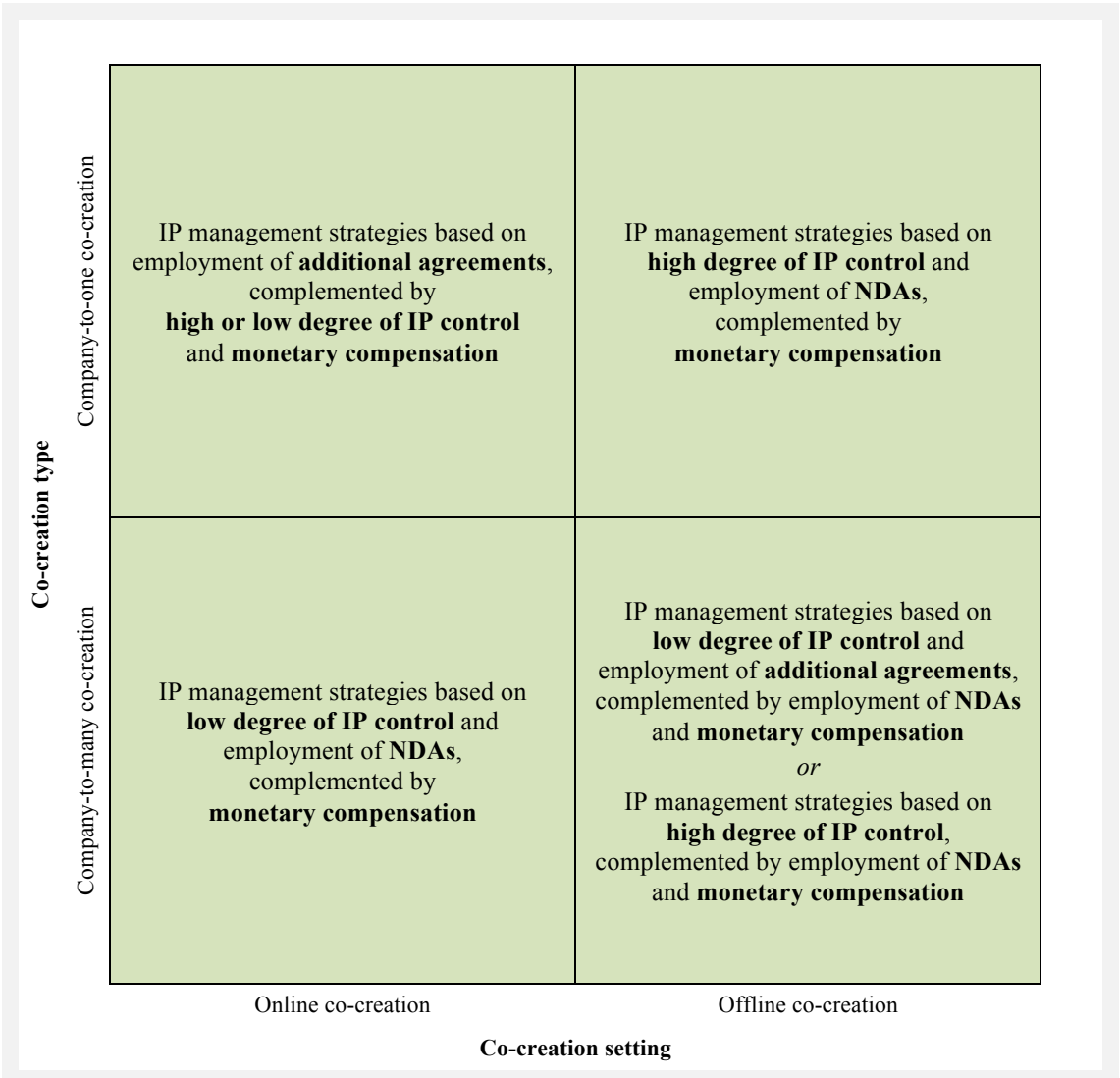


Figure 4.29 The concept of contextualized IP management in co-creation: overview of best practices for IP management across a variety of co-creation contexts

4.4 Conclusions

The main empirical study provides the answers to the core question of this PhD research (see Section 1.2)—namely, *what are best practices for configuring IP management strategies across a variety of co-creation contexts determined by the specific characteristics of a company's projects of collaborative innovation with individual external contributors?*—confirming the value of adopting both the contextual perspective and the configurational perspective in the analysis IP management strategies in co-creation. By comparing IP management strategies, related to both high and low project performance, the study has generated insights about the most important IP dimensions that form the basis of the best practices for IP management in four different co-creation contexts, namely online company-to-one, offline company-to-one, online company-to-many and offline company-to-many co-creation.

The main empirical study responds to the limitations faced by the preliminary empirical study (see Chapter 3), with regards to the research framework, data collection and research methodology.

Being based on the refined research framework, the insights of this study verify the utility and value of differentiating the co-creation contexts in more complex terms of both co-creation types (company-to-one vs. company-to-many) and co-creation settings (online vs. offline). Similarly to the preliminary empirical study, the main empirical study demonstrates that companies adopt a variety of different strategies in different co-creation contexts of, for example, crowdsourcing competitions, single expert sessions, innovation communities, as well as lead user workshops.

Further, by going beyond an Internet-based search, the main empirical study overcomes the restraints of the data collection procedure employed in the preliminary empirical study. The study is based on the data collected from multiple sources, such as project documentation and direct inputs from project managers. Also, the sample of co-creation projects embraces a substantial variety of co-creation projects initiated by great number of different companies, operating within distinctive industries.

Finally, considering IP management strategies as configurations of different IP dimensions—namely transfer of ownership and licensing arrangements that define the degree of IP control established, compensation structure, NDAs, additional agreement and the waiver option—adoption of the QCA methodology in the main empirical study enabled generation of more sophisticated insights about the points of similarity as well as distinction among a great variety of IP management strategies. Creating the basis for development of the concept of contextualized IP management in co-creation, QCA results confirm the utility and value of the configurational approach to strategy development.

Detailed research contributions and managerial implications of this main empirical study, along with its limitations and propositions for future research directions, are discussed in the Chapter 5, offering the conclusions and critical discussion of the final results of this PhD research project.

Chapter 5

Conclusions and critical discussion

This PhD thesis argues that different co-creation contexts, construed as combinations of co-creation types and co-creation settings, call for specific configurations of IP management strategies corresponding to the characteristics of those contexts. The research results form the foundation for the development of the concept of *contextualized IP management in co-creation*, and provide answers to the main research question, namely, *what are best practices for configuring IP management strategies across a variety of co-creation contexts determined by the specific characteristics of a company's projects of collaborative innovation with individual external contributors?*

This chapter focuses on research contributions of this PhD thesis, its limitations and future research directions, as well as managerial implications, offering concluding remarks about the overall research project on IP management in co-creation.

5.1 Research contributions

Even though co-creation has attracted much attention in industry and in the academic world since the beginning of the 21st Century, research about IP issues in collaborative innovation between companies and individual external contributors has only recently gained momentum, raising many questions.

By uniquely combining contextual and configurational perspectives on IP

management in co-creation, this exploratory research is the first systemic empirical work focused on best practices in configuring IP management strategies across a variety of co-creation contexts. As such, it contributes to overcoming the four types of research limitations in the literature concerned with the intersection of the fields of co-creation and IP management, namely: weak conceptualization of co-creation; scarce research on IP management strategies in co-creation; limited consideration of the contextual perspective; and no consideration of the configurational perspective on IP management strategies in co-creation.

5.1.1 Conceptualization of co-creation

Despite its increasing popularity within innovation management scholarship, the concept of co-creation has been hampered until now by the lack of a coherent definition that clearly distinguishes it from a great variety of similar concepts in the field related to collaborative innovation between companies and external players, such as open innovation, co-creation, crowdsourcing, user innovation, community-based innovation, co-development, co-innovation or mass customization. Such as conceptual mess could not provide a robust basis for future research on the topic of co-creation.

Thus, by offering a lucid definition and practical taxonomy of co-creation, this PhD research contributes to the contemporary conversation in the literature about co-creation and, more generally, collaborative innovation between companies and individual external contributors. Based on insights from the critical literature review, co-creation is defined here as *a form of collaborative innovation initiated by a company, involving individual external contributors or co-creators who may provide valuable input to the company's innovation projects*, with the additional distinction

between two types of co-creation, namely *company-to-one* and *company-to-many co-creation types*.

In this way, co-creation is portrayed as a more narrow concept than the concept of open innovation, and as a broader concept than other concepts related to collaborative innovation between companies and individual external contributors, such as crowdsourcing, community-based innovation, etc. Going beyond the current state of the literature, this greater precision in the conceptualization of co-creation supports the advancement of empirical research in the field, avoiding confusion caused by the use of different terminology for the same practices, and vice versa. This in turn may help enhance the practical applications of academic research about co-creation.

5.1.2 Best practices in IP management in co-creation

Even though the innovation management literature widely recognizes the challenges of managing IP in co-creation projects, especially related to outcomes of these projects, empirical research focused on alternative IP management strategies that companies adopt to face these challenges is still sparse.

Embedded inside the terms and conditions of co-creation projects, specific IP arrangements between companies and co-creators have not garnered the attention of scholars until recently (de Beer et al., 2017; Mazzola et al., 2018). Concentrating on crowdsourcing, these recent studies offer valuable insights about how IP related to co-creation outcomes is managed in the context that is regarded here as "online company-to-one" co-creation. Nevertheless, the literature has so far not provided much evidence about IP management strategies adopted by companies beyond that particular co-creation context.

Based on the rigorous comparison of IP management strategies related to high performance co-creation projects with strategies related to low performance projects, the insights from this PhD research contribute to the innovation management literature by offering an overview of best practices in configuring IP management strategies across different co-creation contexts. These insights form the foundation for creation of a polythetic typology of IP management strategies that is the backbone of the concept of contextualized IP management in co-creation.

As such, the concept of contextualized IP management in co-creation is based on the synergistic patterns of internal relationships among the multiple dimensions of IP management strategies and their external relationships with the given co-creation context. By reducing the complexity of configurational and contingency statements with respect to co-creation project performance, the developed concept delineates the "ideal types" of IP management strategies across a variety of co-creation contexts.

5.1.3 Value of contextual perspective on IP management strategies in co-creation

The literature emphasizes that a "one size fits all" approach to IP management in co-creation is not viable, and that companies need to adapt their IP management strategies to the specificities of particular co-creation contexts (Alexy et al., 2009; Giannopoulou et al., 2011). Nevertheless, comprehensive studies that take contextual variety into account when discussing IP management in co-creation are very limited (Alexy et al., 2009; Boudreau & Lakhani, 2013; Felin & Zenger, 2014), leaving the issue of contextual dependence of IP management still largely unexplored in the co-creation literature. Researchers in the field to date have limited their attention to a

specific co-creation context of interest, excluding other co-creation contexts from the scope of the research.

This PhD research contributes to current research in the field by building on the foundations of contingency theory. It adopts a complex contextual perspective on IP management strategies in co-creation, considering the context in terms of both co-creation types and co-creation settings. Such an approach allowed comparative investigation of IP management strategies in the distinctive contexts of online crowdsourcing contests and innovation communities, as well as of offline single expert sessions and lead user workshops. Results confirmed that companies need to customize their IP management strategies to correspond to specific co-creation contexts, regardless of how those contexts differ from each other.

Previous research shows that companies tend to employ restrictive IP management strategies in the context of online company-to-one co-creation (Alexy et al., 2009; Boudreau & Lakhani, 2013; Felin & Zenger, 2014; Mazzola et al., 2018), where co-creation projects typically take the form of crowdsourcing contests. However, the insights from this PhD research show that this is not necessarily the best practice for IP management in this context. Namely, these insights suggest that a strategy adopted in this context needs to based on employment of additional agreements, complemented by monetary compensation, regardless of the degree of IP control established. In other words, both restrictive and permissive IP management strategies may represent the best practice in this context, as long as they employ monetary compensation and additional agreements between initiating companies and co-creators.

With regards to the context of offline company-to-one co-creation, the insights suggest that the best practice lies in restrictive IP management strategies based on

high degree of IP control and employment of NDAs, complemented by monetary compensation. This is the first evidence about IP management in this context, where co-creation projects typically take the form of expert sessions, as there are no insights on this issue identified from the literature.

On the other hand, permissive IP management strategy based on a low degree of IP control and employment of NDAs, complemented by monetary compensation, is identified as the best practice in the context of online company-to-many co-creation. These insights concur with the previous research that shows that virtual community-based innovation tends to be associated with more permissive IP management strategies, because to cultivate collective creativity and recombination of contributions in this context, companies need to avoid imposing high degree of IP control (Boudreau & Lakhani, 2013; Felin & Zenger, 2014; Tekic & Willoughby, 2019). Similar evidence is found in the literature on Open Source, commons-based peer production and the networked economy (Belenzon & Schankerman, 2015; Benkler, 2016, 2017; Parmentier & Mangematin, 2014), dealing with the contexts analogous to online company-to-many co-creation.

Finally, typically taking the form of lead user workshops, projects in the context of offline company-to-many co-creation need to involve a permissive strategy based on a low degree of IP control that includes additional agreements, or a restrictive strategy based on high degree of IP control that excludes additional agreements between companies and co-creators. These insights only partially concur with the insight from the literature that companies need to employ high degree of IP control in this context, by obtaining ownership rights or exclusive licenses over co-creation outcomes (Brem et al., 2018).

By generating the concept of contextualized IP management in co-creation on the grounds of these insights, this PhD research has demonstrated the appropriateness of contingency theory to explore the relationship between the IP management strategies, co-creation context and project performance.

5.1.4 Value of configurational perspective on IP management strategies in co-creation

The need for harmonizing control and openness of the IP in collaborative innovation, exacerbated by the tension between dynamic innovation activities and conventional static methods of IP protection, pushes companies to cultivate new approaches to IP management that facilitate rather than obstruct involvement of multiple external actors into corporate innovation (Alexy et al., 2009; Laursen & Salter, 2014; Lee, 2009; O'Hern & Rindfleisch, 2010). This challenge is recognized in both the co-creation and general open innovation literatures (Bogers, 2011; de Beer et al., 2017; Henkel et al., 2013; Miozzo, Desyllas, Lee, & Miles, 2016). Too open and permissive an approach to IP management in collaborative innovation leads to difficulties in IP management, such as troublesome IP protection and difficulties in appropriating benefits from innovation. Conversely, too controlling and restrictive an approach to IP management has the potential of obstructing or even killing collaborative innovation, by demotivating external actors from contributing their ideas and solutions due to their perception of being treated unfairly with regards to IP. Nevertheless, even though the literature discusses a variety of dimensions that may be used as building-blocks of IP management strategies, until now it has not identified the employment of a configurational approach in development of these strategies as

an appropriate vehicle for reducing the tension between control and openness of the IP in co-creation.

This PhD research closes this gap by pointing to the value of employing a *configurational perspective* on IP management strategies in co-creation, to complement the contextual perspective. Seeing IP management strategies as configurations of different IP dimensions allows identification of distinctive elements among ostensibly similar IP management strategies, and allows identification and articulation of empirically verified best practices, as called for by scholars in the open and collaborative innovation literature (Laursen & Salter, 2014; Lee, 2009; O'Hern & Rindfleisch, 2010).

Taking into account six different IP dimensions in the analysis of IP management strategies—namely, transfer of ownership, licensing arrangements, compensation structure, NDAs, additional agreement and the waiver option—this PhD research broadens our understanding of the relevant building-blocks used by companies in development of an IP management strategy. The extant literature emphasizes the importance only of adoption of the transfer of ownership and different licensing arrangements (Benkler, 2017; Chatterji & Fabrizio, 2014; de Beer et al., 2017; Mazzola et al., 2018; Pitkänen & Lehto, 2012), by which companies establish distinctive degrees of IP control, as well as compensation (Bonabeau, 2009; Boudreau & Lakhani, 2013; Füller, 2010; Mortara et al., 2013), by which companies reward or remunerate co-creators for their contribution to corporate innovation projects. Thus, by introducing NDAs, additional agreements and the waiver option, this PhD research extends the array of the important IP dimensions, thereby contributing to the variety of potential configurations upon which a company may build an IP management strategy.

The adoption of transfer of ownership, different licensing arrangements, NDAs

and additional agreements as a part of best practice in configuring IP management strategies varies across co-creation contexts. The waiver option is not identified as a part of best practices in any of the co-creation contexts. Conversely, monetary compensation is identified as an essential ingredient of best practices across all of the co-creation contexts, concurring with previous research showing a clear proclivity of companies for employing monetary compensation as a part of their IP management strategies that allows companies to actually "pay" the co-creators for their effort and IP, and avoid the problems associated with exploiting co-creators as the free labor-force (Schaarschmidt & Kilian, 2014; Tekic & Willoughby, 2019).

While building upon configurational theory, the present PhD research provides empirical evidence about the multifaceted character of IP management strategies in co-creation. By proposing best practices in configuring IP management strategies that fit specific co-creation contexts, the developed concept of contextualized IP management in co-creation confirms the appropriateness of applying a configurational approach to the development of IP management strategies in co-creation.

5.2 Limitations and future research directions

Even though they do not influence the rigor of this PhD research, there are certain limitations that are worth mentioning, as they may inspire future research on IP management in co-creation.

Focusing on the development of the concept of contextualized IP management in co-creation, the main empirical study considers only two types of factors—*co-creation types* (company-to-one vs. company-to-many) and *co-creation settings* (online vs. offline)—as factors that are potentially significant in differentiating

relevant co-creation contexts. Such an approach has its limitations, as it excludes other potentially relevant contextual factors, such as stage of the product life cycle, stage of the product innovation process, type and degree of innovation, or even industry sector (Alexy et al., 2009; Lakhani & Panetta, 2007; Mazzola et al., 2018; Zobel et al., 2017). However, the two contextual elements were adopted here partly due to the need to be prudent in the scope of the inquiry, but also because the insights from the literature (e.g., Boudreau & Lakhani, 2013; Felin & Zenger, 2014) as well as conducted preliminary empirical research point to varying conditions prevailing across these contexts that may influence the effectiveness of an IP management strategy. *Company-to-one* and *company-to-many co-creation* may be contrasted according to differences in at least three characteristics, namely, the volume of existing relationships among co-creators in a project, the level of recombination of co-creators' contributions, and the potential for control of IP by the initiating company. Such project-specific conditions, engendered by the number of individual external contributors involved in the co-creation of a single solution, arguably create distinctive contexts for IP management in co-creation. Conversely, based on the different means of integration of individual external contributors in co-creation projects, *online* and *offline co-creation settings* are characterized by diverse potential for IP control and differences in depth and breadth of search for external sources of innovation, which may produce additional distinctive contexts for IP management in co-creation. Nevertheless, future research may benefit from adoption of a more complex contextual perspective. For example, the stage of the product innovation process may be a potentially relevant context for IP management. Projects in the final sample of the main empirical study are related to co-creation from the research stage,

over ideation and concept development, to concept and product testing. Sometimes co-creation type and co-creation settings themselves are chosen based on the requirements of a specific stage of product innovation.

Further, employment of fsQCA as a data analysis technique restricts the number of configurational elements analyzed simultaneously, because of the exponential growth of the number of possible configurations. Thus, this research is limited to the analysis of the six IP dimensions identified from the projects' terms and conditions, determining how companies manage IP related to outcomes of the co-creation projects, namely transfer of ownership, licensing arrangements, compensation structure, NDAs, additional agreements and the waiver option. Thus, future research may benefit from extension of the scope of analysis of IP management strategies, by moving the focus of the inquiry from management of the IP related to co-creation outcomes to management of the IP related to the inputs to co-creation projects, such as limiting liabilities (de Beer et al., 2017) or acquiring rights to such IP.

In addition to contextual elements and configurational elements, project performance as the outcome measure represents the final core segment of the main empirical study, conducted with the purpose of identifying best practices in configuring IP management strategies across a variety of co-creation contexts. Namely, these best practices are proposed based on the rigorous comparison of strategies adopted in high and low performance co-creation projects. Being based on the subjective project assessment by the project managers, this performance measure is affected by the managers' bias. This limitation may be overcome in future research by introducing more objective performance measures, such as number of co-creators involved in a co-creation project, number of co-creation inputs / outcomes, etc.

Nevertheless, as these more objective measures differ across co-creation contexts, such future studies would need to focus exclusively on a single context.

Also, taking into account that the main empirical study is based on a sample of co-creation projects from a single intermediary company, future research may benefit from examining IP management strategies adopted in co-creation projects run directly by the initiating companies or by various intermediary companies. Nevertheless, this limitation does not significantly influence the generalizability of the research insights, as the final sample embraces a substantial variety of co-creation projects initiated by great number of different companies, coming from distinctive industries. Also, even though the intermediary company offers the preliminary terms and conditions to the company starting a co-creation project, the final terms and conditions are decided by the legal department of each client company individually.

Finally, as the results of both the preliminary and the main empirical studies indicate that a single company actually adopts different IP management strategies not only across the co-creation contexts, but also within a single context, future research may focus to determine what are the drivers for this strategic variety, e.g. changing organizational policy, some other project-specific characteristics, or different strategic intent (i.e. IP as a defensive mechanism or IP as a commercialization mechanism). These issues are out of the scope of the present research, which is focused on identifying best practices in this great variety of IP management strategies adopted within and across co-creation contexts.

5.3 Managerial implications

Built on the foundations of contingency theory and configurational theory, the concept of contextualized IP management in co-creation developed and articulated here may be useful for co-creation project managers in multiple ways, putting forward strong implications for practice.

On one hand, the contextual perspective employed in this research generated results that may be a source of guidance for project managers wishing to hone their IP management strategies across a variety of co-creation contexts. The concept of contextualized IP management in co-creation may support managers in navigating within the realm of different kinds of co-creation projects, such as crowdsourcing contests, community-based innovation, co-creation workshop and expert interviews, by helping them to understand how project's characteristics actually create different contexts for IP management. Developing strategies on the basis of the identified best practices may help avoid potential difficulties and enable taking advantage of specific contingencies, while effectively managing IP outcomes emanating from co-creation projects. Being significantly different from the most frequently adopted IP management strategies in most of the co-creation contexts, these best practices also provide valuable directions for project managers about how to alter and modify their current IP management strategies.

On the other hand, project managers who aspire to enhance their IP management strategies in co-creation may get useful insights from applying the configurational perspective adopted in this PhD research. The proposed concept of contextualized IP management in co-creation provides a tool for guided configuration of multiple IP dimensions, i.e. transfer of ownership, licensing arrangements,

compensation structure, NDAs, additional agreements and the waiver option, providing support to managers in dealing with complexities of development of IP management strategies in co-creation. Understanding IP management strategies in co-creation as configurations of different IP dimensions may support customization of contractual terms and conditions for the purpose of harmonizing control and openness of the IP in specific contexts. In this way, adoption of a configurational approach in building an IP management strategy may help managers to create mutually beneficial arrangements, ensuring proper, fair and transparent treatment of IP. Finally, the concept of contextualized IP management in co-creation provides a specific guidelines for project managers, highlighting which IP dimensions are the most important among the ones they currently take into account when developing their IP management strategies in particular co-creation contexts, as well as which important IP dimensions they actually do not take into account and neglect.

5.4 Final thoughts

The insights about best practices in configuring IP management strategies across a variety of co-creation contexts, which lie at the core of the developed concept of contextualized IP management in co-creation, contribute to the emerging debate on IP management in collaborative innovation between companies and individual external contributors, influencing the creation of new research agenda in innovation management studies, while also being useful for project managers in making decisions about their IP management strategies in co-creation.

The exploratory research reported in this PhD thesis reveals—in contradistinction to the assertions of those who may believe that IP belongs to the era

before the emergence of co-creation—that companies that engage in co-creation in fact deal intensively with the management of IP. The existence of a great variety of IP management strategies adopted by companies in co-creation indicates that involvement of individual external contributors in corporate innovation projects amplifies, rather than lessens, the need for prowess in the management of intellectual property. Thus, this research has potential for a great impact in building awareness of the importance of the IP management in co-creation in the era of open and collaborative innovation with external parties.

Finally, it is important to note that an effective IP management strategy is not a sufficient condition for a successful co-creation project; there are many other factors that need to complement the winning configurational puzzle. Nevertheless, there is no successful co-creation project if a company failed to manage the co-created IP. In this sense, it may be said that an effective IP management strategy is a necessary condition for success.

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Appendices

Appendix 1 Preliminary empirical study:
Complete sample of 79 company-to-one co-creation projects

Project label / Project name	Year	Company	Country	Setting
IP management strategy: Full transfer of ownership, combined with monetary compensation				
*SKODA EXPERIENCE / A customer experience to fall in love with	2018	Škoda Auto	Czech Rep.	Online - jovoto
*LM AUTONOMOUS / #AccessibleOlli challenge	2017	Local Motors	USA	Online - LM Launch Forth
LM ALLIANZ CHALLENGE / The future of mobility concept design	2018	Local Motors	USA	Online - LM Launch Forth
LM BERLIN / Urban Mobility: Berlin 2030	2015	Local Motors	USA	Online - LM Launch Forth
LM CAR SKIN / Challenge: RF custom car skins	2013	Local Motors	USA	Online - LM Launch Forth
LM CARGO / Air Force cargo transporter challenge	2018	Local Motors	USA	Online - LM Launch Forth
LM ESSENCE / Essence of autonomy	2016	Local Motors	USA	Online - LM Launch Forth
LM ISLAND / Island EV challenge	2018	Local Motors	USA	Online - LM Launch Forth
LM LITECAR / Litecar challenge	2015	Local Motors	USA	Online - LM Launch Forth
LM MLV / Modular logistics vehicle design challenge	2018	Local Motors	USA	Online - LM Launch Forth
LM MLV REFINED / MLV refined challenge	2018	Local Motors	USA	Online - LM Launch Forth
LM REDACTED / Project [Redacted]	2015	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL ACTIVE / Sketchwall challenge: Active lifestyle vehicle	2013	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL RACE / Sketchwall challenge: Legends race car wrap	2014	Local Motors	USA	Online - LM Launch Forth
LM SPORTS CAR / Sports car challenge	2014	Local Motors	USA	Online - LM Launch Forth
IP management strategy: Full transfer of ownership, combined with monetary compensation and NDA				
*VW BUZZ 2 / VW ID Buzz part 2	2018	Volkswagen AG	Germany	Online - jovoto
CONF LUXURY / Follow up experience for a luxury car manufacturer	2018	Confidential	Unknown	Online - jovoto
*CITROEN DESIGN / Citroën DS3 design contest	2012	Peugeot S.A.	France	Online - eYeka
BMW STORY / Tell the BMW story	2011	BMW AG	Germany	Online - eYeka
FIAT 500 / Fiat 500	2013	Fiat Automobiles	Italy	Online - eYeka
HYUNDAI EURO / Hyundai EURO 2012	2012	Hyundai Motor Company	South Korea	Online - eYeka

Appendix 1 (continued)

Project label / Project name	Year	Company	Country	Setting
IP management strategy: Full transfer of ownership, combined with monetary compensation and NDA				
HYUNDAI EXPERIENCE / Hyundai brilliant experience	2013	Hyundai Motor Company	South Korea	Online - eYeka
HYUNDAI I40 / Hyundai i40	2013	Hyundai Motor Company	South Korea	Online - eYeka
HYUNDAI VELOSTER / Hyundai Veloster	2011	Hyundai Motor Company	South Korea	Online - eYeka
KIA VIBRANT / How a vibrant challenging spirit makes life fun	2012	KIA Motors	South Korea	Online - eYeka
MAZDA FAMOUS / Make Mazda famous	2015	Mazda Motor Corp.	Japan	Online - eYeka
PEUGEOT MOTION / What is your expression of Motion & Emotion?	2011	Peugeot S.A.	France	Online - eYeka
SUZUKI ALLGRIP / AllGrip	2017	Suzuki Motor Corp.	Japan	Online - eYeka
SUZUKI CHALLENGE / Extraordinary challenge	2014	Suzuki Motor Corp.	Japan	Online - eYeka
TOYOTA FEELING / Oh What a Feeling!	2013	Toyota Motor Corp.	Japan	Online - eYeka
TOYOTA MOBILITY / Connected mobility	2013	Toyota Motor Corp.	Japan	Online - eYeka
TOYOTA OFFER / Toyota contest	2013	Toyota Motor Corp.	Japan	Online - eYeka
TOYOTA WAKUDOKI / Showcase Toyota's amazing "Waku-doki"	2012	Toyota Motor Corp.	Japan	Online - eYeka
VW SERVICES / Volkswagen after-sales services	2018	Volkswagen AG	Germany	Online - eYeka
CONF ACTIVE / Active aging	2016	Confidential	Unknown	Online - eYeka
CONF CLEAN / Embracing a cleaner way to travel	2018	Confidential	Unknown	Online - eYeka
CONF DOWNTOWN / Downtown mobility	2016	Confidential	Unknown	Online - eYeka
CONF DRIVERLESS / Driverless transport services in 2030	2018	Confidential	Unknown	Online - eYeka
CONF FOOD / Food meets mobility	2017	Confidential	Unknown	Online - eYeka
CONF FUTURE / How we would like to move around in 10 years?	2011	Confidential	Unknown	Online - eYeka
CONF HEROES / Real heroes	2014	Confidential	Unknown	Online - eYeka
CONF INSIDE / Inside the car in 2020	2012	Confidential	Unknown	Online - eYeka
CONF INTERDEPENDENT / Interdependent mobility	2017	Confidential	Unknown	Online - eYeka
CONF LIFE / Exciting yet stable life	2016	Confidential	Unknown	Online - eYeka
CONF MOBILITY / Meaningful mobility experience	2015	Confidential	Unknown	Online - eYeka

Appendix 1 (continued)

Project label / Project name	Year	Company	Country	Setting
IP management strategy: Full transfer of ownership, combined with monetary compensation and NDA				
CONF NATURE / Engaging with nature	2017	Confidential	Unknown	Online - eYeka
CONF SENIOR / Senior fitness - smart mobility in 2030	2016	Confidential	Unknown	Online - eYeka
CONF TRAVEL / Time travel journalism	2018	Confidential	Unknown	Online - eYeka
CONF UNIVERSAL / Universal free transportation	2017	Confidential	Unknown	Online - eYeka
CONF UPCYCLING / Upcycling 1.1 billion vehicles	2018	Confidential	Unknown	Online - eYeka
IP management strategy: Full transfer of ownership, combined with non-monetary compensation				
*CONF PKW / The future of data transfer in commercial vehicles	2018	Confidential	Unknown	Online - HYVE Crowd
IP management strategy: Exclusive license, combined with monetary compensation				
*BMW TRUNK / Trunk idea contest	2013	BMW AG	Germany	Online - BMW Co-creation Lab
BMW INTERIOR / Interior idea contest	2010	BMW AG	Germany	Online - BMW Co-creation Lab
BMW URBAN / Urban mobility services idea contest	2010	BMW AG	Germany	Online - BMW Co-creation Lab
*AUDI LIGHT / Light follows function	NA	Audi AG	Germany	Online - jovoto
AUDI ENTERTAINMENT / Turn Audi into an entertainment palace	NA	Audi AG	Germany	Online - jovoto
AUDI FAMILY / Family on Board	NA	Audi AG	Germany	Online - jovoto
AUDI NAVIGATION / Navigate Audi into 2015	NA	Audi AG	Germany	Online - jovoto
MERCEDES GAMIFY / Gamify me	2017	Daimler AG	Germany	Online - jovoto
MERCEDES TOMORROW / Mercedes-Benz: Destination tomorrow	2016	Daimler AG	Germany	Online - jovoto
OPEL ENERGY / Energy redefined	NA	Opel Auto-mobile GmbH	Germany	Online - jovoto
RENAULT TRUCKNROLL / TrucknRoll!	NA	Renault S.A.	France	Online - jovoto
VW BUZZ 1 / Design 3D-printable elements for the VW ID Buzz	2018	Volkswagen AG	Germany	Online - jovoto
IP management strategy: Exclusive license, combined with monetary compensation and NDA				
*AUDI SOUND / The sound of motors	NA	Audi AG	Germany	Online - jovoto
CONF COMPLETE / Complete the car	NA	Confidential	Unknown	Online - jovoto

Appendix 1 (continued)

Project label / Project name	Year	Company	Country	Setting
IP management strategy: Exclusive license, combined with monetary compensation and additional agreement				
*DAIMLER SMART / Style your Smart design contest	2010	Daimler AG	Germany	Online - single-project platform
IP management strategy: Exclusive license, combined with monetary compensation, additional agreement and waiver option				
*VW APP / App my Ride - Volkswagen App contest	2011	Volkswagen AG	Germany	Online - single-project platform
*VW ENGINEERING / Engineering the future - car body manufacturing	2017	Volkswagen AG	Germany	Online - HYVE Crowd
IP management strategy: Exclusive license, combined with non-monetary compensation				
*FORD INNENRAUM / Ford Interieur - Deine Ideen für den Innenraum	2012	Ford Motor Company	USA	Online - single-project platform
IP management strategy: Open Source / Creative Commons license, combined with monetary compensation				
*LM BOTBOX / Bot Box concept blast	2015	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL XPEL / Sketchwall: XPEL active lifestyle vehicle	2014	Local Motors	USA	Online - LM Launch Forth
IP management strategy: Open Source / Creative Commons license, combined with non-monetary compensation				
*LM SKETCHWALL RACER / Sketchwall challenge: Café Racer	2014	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL FLECHE / Sketchwall challenge: Bugatti fleche	2014	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL FLY / Sketchwall challenge: Flying car industries	2016	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL LEMANS / Sketchwall challenge: LeMans Redux	2014	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL P51 / Sketchwall challenge: P-51 Mustang	2014	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL PLAY / Sketchwall: Playing with proportions	2016	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL RALLYE / Sketchwall challenge: Group B Rallye	2014	Local Motors	USA	Online - LM Launch Forth
IP management strategy: No transfer of ownership nor licensing arrangement; monetary compensation, combined with additional agreement				
*MERCEDES DIGITAL / Mercedes-Benz digital challenge	2017	Daimler AG	Germany	Online - single-project platform

An asterisk (*) indicates representative cases used to illustrate each of the identified IP management strategies in co-creation.

Appendix 2 Preliminary empirical study:
Complete sample of 32 company-to-many co-creation projects

Project label / Project name	Year	Company	Country	Setting
IP management strategy: Full transfer of ownership, combined with monetary compensation				
*JAGUAR DEVELOPER / Jaguar Land Rover developer challenge	2017	Jaguar Land Rover	UK	Offline
*TOYOTA CONNECTED / Toyota connected vehicle ideathon	2014	Toyota Motor Corporation	Japan	Offline
*CONF DIGITAL / Digitale Lösungen im Automobilbereich	2018	Confidential	Uknown	Online - HYVE Crowd
IP management strategy: Non-exclusive license, combined with monetary compensation				
*AUDI ADC / Autonomous Driving Cup 2018	2018	Audi AG	Germany	Offline
IP management strategy: Non-exclusive license, combined with monetary compensation and additional agreement				
*LM MODULAR / Modular logistics vehicle	2018	Local Motors	USA	Online - LM Launch Forth
LM ALLIANZ BRAINSTORM / Brainstorm: Emergent mobility	2018	Local Motors	USA	Online - LM Launch Forth
LM SKETCHWALL / SketchWall brainstorm	2018	Local Motors	USA	Online - LM Launch Forth
IP management strategy: Non-exclusive license, combined with non-monetary compensation				
*AUDI SMART FACTORY / Smart Factory Hackathon	2016	Audi AG	Germany	Offline
IP management strategy: Open Source / Creative Commons license, combined with monetary compensation				
*AUDI HACKOVATION / Hackovation	2017	Audi AG	Germany	Offline
*LM STRATI / Strati: the world's first 3D-printed car	2016	Local Motors	USA	Online - LM Launch Forth
LM 3D / Road ready 3D-printed car	2015	Local Motors	USA	Online - LM Launch Forth
LM ACCESSIBLE OLLI / #AccessibleOlli brainstorm	2016	Local Motors	USA	Online - LM Launch Forth
LM ARIEL / Ariel Cruiser	2014	Local Motors	USA	Online - LM Launch Forth
LM ASU / ASU eProject	2015	Local Motors	USA	Online - LM Launch Forth
LM AXION / Axion use cases	2016	Local Motors	USA	Online - LM Launch Forth
LM CORVETTE / Corvette C7 rear harness bar	2013	Local Motors	USA	Online - LM Launch Forth
LM DARPA / Darpa XC2V: Flypmode	2011	Local Motors	USA	Online - LM Launch Forth

Appendix 2 (continued)

Project label / Project name	Year	Company	Country	Setting
IP management strategy: Open Source / Creative Commons license, combined with monetary compensation				
LM EINS / Eins.Plus - Pro	2015	Local Motors	USA	Online - LM Launch Forth
LM IMTS / 3D printed car for IMTS	2014	Local Motors	USA	Online - LM Launch Forth
LM IOT / Connected car project (Internet of Things)	2014	Local Motors	USA	Online - LM Launch Forth
LM MOTORCYCLE / Modular motorcycle	2014	Local Motors	USA	Online - LM Launch Forth
LM OLLI / Olli: self-driving, cognitive electric shuttle	2016	Local Motors	USA	Online - LM Launch Forth
IP management strategy: Open Source / Creative Commons license, combined with monetary compensation				
LM PARDO / Camilo Pardo 3E concept	2016	Local Motors	USA	Online - LM Launch Forth
LM RALLY / Rally Fighter	2009	Local Motors	USA	Online - LM Launch Forth
LM SF / LM SF-01	2014	Local Motors	USA	Online - LM Launch Forth
LM TANDEM / Open tandem	2013	Local Motors	USA	Online - LM Launch Forth
LM URBAN / Solutions for urban mobility	2014	Local Motors	USA	Online - LM Launch Forth
LM VERADO / Verado drift trike	2012	Local Motors	USA	Online - LM Launch Forth
IP management strategy: Open Source / Creative Commons license, combined with monetary compensation, NDA and additional agreement				
*BMW AI / Cross-Industry AI Hack	2018	BMW AG with Siemens AG	Germany	Offline
IP management strategy: No transfer of ownership nor licensing arrangement; monetary compensation, combined with additional agreement				
*MERCEDES HACK / Mercedes-Benz hackathon	2015	Daimler AG	Germany	Offline
IP management strategy: No transfer of ownership nor licensing arrangement; monetary compensation, combined with NDA and additional agreement				
*INMOTION HACKATHON / Inmotion hackathon	2016	Jaguar Land Rover	UK	Offline
IP management strategy: No transfer of ownership nor licensing arrangement; non-monetary compensation, combined with additional agreement				
*DAIMLER HACK.LA / Hack.LAMobility	2018	Daimler AG	Germany	Offline

An asterisk (*) indicates representative cases used to illustrate each of the identified IP management strategies in co-creation.

Appendix 3 Main empirical study:
Complete sample of 63 online company-to-one co-creation projects

Project code	Year	Country	Industry
Project A1	2016	Germany	Biopharma
Project A2	2015	Germany	Biopharma
Project A3	2015	Germany	Biopharma
Project A4	2017	Germany	Apparel
Project A5	2018	Germany	Social Initiative
Project A6	2018	Germany	Aerospace
Project A7	2016	Austria	Logistics
Project A8	2013	Germany	Consumer products
Project A9	2017	Austria	Education
Project A10	2017	Austria	Government
Project A11	2017	Austria	Government
Project A12	2010	Germany	Automotive
Project A13	2010	Germany	Automotive
Project A14	2013	Germany	Automotive
Project A15	2016	Germany	Government
Project A16	2016	Germany	Government
Project A17	2015	Germany	Government
Project A18	2014	Germany	Optics and optoelectronics
Project A19	2010	Germany	Automotive
Project A20	2015	Germany	Transportation & Logistics
Project A21	2011	Italy	Retail
Project A22	2012	Germany	Automotive
Project A23	2012	Germany	Tele-communications
Project A24	2015	Austria	Jewelry
Project A25	2012	Germany	Automotive

Appendix 3 (Continued)

Project code	Year	Country	Industry
Project A26	2016	Germany	Marketing
Project A27	2016	Germany	Transportation & Logistics
Project A28	2014	Germany	Computer hardware / IT
Project A29	2011	Germany	Consumer products
Project A30	2015	Germany	Consulting
Project A31	2014	Germany	Consulting
Project A32	2018	Germany	Consulting
Project A33	2017	Germany	Pharmaceutical
Project A34	2012	Switzerland	Food processing
Project A35	2016	Switzerland	Food processing
Project A36	2011	Germany	Transportation & Logistics
Project A37	2012	Germany	Transportation & Logistics
Project A38	2011	Germany	Consumer products
Project A39	2014	Austria	Automotive
Project A40	2015	USA	Education
Project A41	2009	Germany	Household products
Project A42	2009	Germany	Household products
Project A43	2016	Germany	Aerospace
Project A44	2015	Germany	Beauty product distribution
Project A45	2016	Austria	Transportation & Logistics
Project A46	2009	Germany	Lighting
Project A47	2013	Austria	Machinery
Project A48	2011	Germany	Machinery
Project A49	2017	Denmark	Energy
Project A50	2012	Germany	Conglomerate

Appendix 3 (Continued)

Project code	Year	Country	Industry
Project A51	2011	Germany	Conglomerate
Project A52	2011	Germany	Conglomerate
Project A53	2013	Germany	Conglomerate
Project A54	2011	Germany	Conglomerate
Project A55	2009	Austria	Food retail
Project A56	2011	Austria	Jewelry
Project A57	2014	Germany	Tele-communications
Project A58	2014	Austria	Food processing
Project A59	2015	Austria	Food processing
Project A60	2016	Germany	Tele-communications
Project A61	2011	Germany	Automotive
Project A62	2017	Germany	Automotive
Project A63	2016	Austria	Construction

Appendix 4 Main empirical study:
Complete sample of 4 offline company-to-one co-creation projects

Project code	Year	Country	Industry
Project B1	2018	Germany	Home & Office Products
Project B2	2018	Austria	Baby Products
Project B3	2017	Germany	Automotive
Project B4	2016	Switzerland	Health-care

Appendix 5 Main empirical study:
Complete sample of 19 online company-to-many co-creation projects

Project code	Year	Country	Industry
Project C1	2017	Germany	Automotive
Project C2	2018	Austria	Baby Products
Project C3	2017	Austria	Baby Products
Project C4	2016	Austria	Baby Products
Project C5	2013	Germany	Consumer products
Project C6	2016	Germany	Consumer products
Project C7	2013	Germany	Home appliances
Project C8	2015	Germany	Home appliances
Project C9	2018	France	Consulting
Project C10	2018	Italy	Energy
Project C11	2015	The Netherlands	Vaping technology
Project C12	2016	Germany	Chemicals
Project C13	2013	UK	Semiconductors
Project C14	2018	Germany	Dairy Products
Project C15	2016	USA	Tobacco
Project C16	2014	The Netherlands	Home appliances
Project C17	2015	Germany	Media
Project C18	2015	Switzerland	Health-care
Project C19	2018	Germany	Tele-communications

Appendix 6 Main empirical study:
Complete sample of 30 offline company-to-many co-creation projects

Project code	Year	Country	Industry
Project D1	2017	Germany	Apparel
Project D2	2017	Germany	Automotive
Project D3	2016	Germany	Automotive
Project D4	2018	Austria	Baby Products
Project D5	2015	Germany	Consumer products
Project D6	2006	Germany	Automotive
Project D7	2017	Germany	Home appliances
Project D8	2018	Germany	Home appliances
Project D9	2011	Germany	Consumer products
Project D10	2012	Germany	Tele-communications
Project D11	2013	Germany	Energy
Project D12	2014	The Netherlands	Vaping technology
Project D13	2017	France	Dairy Products
Project D14	2016	Switzerland	Pharmaceutical
Project D15	2016	Germany	Household products
Project D16	2016	Germany	Insurance
Project D17	2015	France	Animal Health
Project D18	2016	Germany	Aerospace
Project D19	2008	Finland	Tele-communications
Project D20	2010	Finland	Tele-communications
Project D21	2014	Austria	Automotive
Project D22	2011	Germany	Tele-communications
Project D23	2015	UK	Consumer products
Project D24	2012	UK	Consumer products
Project D25	2015	UK	Consumer products

Appendix 6 (continued)

Project code	Year	Country	Industry
Project D26	2008	Germany	Energy
Project D27	2016	Germany	Tele-communications
Project D28	2017	Germany	Home appliances
Project D29	2017	Germany	Home appliances
Project D30	2011	Germany	Automotive