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Designing cross-sector collaboration to foster technological innovation: Empirical insights from eHealth partnerships in five countries

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Abstract

This article examines the impact of partnership design on technological innovation in public-private innovation partnerships. It develops two competing hypotheses on how specific partnership characteristics lead to innovation in health care services. The study compares 19 eHealth partnerships across five European countries and uses fuzzy-set qualitative comparative analysis to test the hypotheses. The findings show that small, centralized, and homogeneous partnerships are most successful at achieving technological innovation. The study highlights the importance of partnership design in spurring innovation and calls for a reconsideration of some of the underlying assumptions of collaborative innovation theory.

Evidence for practice

- Public-private innovation partnerships (PPIs) are increasingly used to innovate public services through new technology.
- The results from this study demonstrate the importance of partnership design, showing that small, centralized, and homogenous PPIs generate technological innovations.
- The presence of high levels of interpersonal trust among participants is necessary to create technological innovations.

INTRODUCTION

Public administration scholars increasingly emphasize the potential benefits of cross-sector collaboration for innovating public services (Lindsay et al., 2020; Torfing, 2019). Developing new ways of producing and delivering public services calls for a broad range of stakeholders and their complementary resources, including government agencies, private contractors, nonprofit organizations, and users (Di Meglio, 2013). Consequently, governments engage in public-private arrangements to innovate their services, often referred to as public-private innovation partnerships or PPIs (Alonso & Andrews, 2022; Brogaard, 2021). Such partnerships pose important opportunities for transformative learning, joint ownership, and empowered participation, which can stimulate innovation processes (Lindsay et al., 2020).

Despite a recent increase in public administration studies on innovation partnerships (Alonso & Andrews, 2022; Lindsay et al., 2020), the important role of partnership design for spurring *technologically sophisticated* service innovation has been largely overlooked. This oversight is surprising for two reasons. First, recent empirical studies demonstrate that effective partnership governance is vital for positive outcomes in PPIs (Alonso & Andrews, 2022). Second, advanced digital technology such as artificial intelligence (AI) has become a central vehicle for transforming public services, which calls for more research on technologically sophisticated service innovations (Mergel et al., 2019).

Koen Verhoest and Chesney Callens both contributed equally to this work.

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A recent systematic review of PPIs demonstrates that the impact of collaborative innovation on the digital transformation of public services is particularly visible in the health care sector (Brogaard, 2021). According to Kraus et al. (2021), the health care sector functions as an intricate ecosystem in which various health care actors interact with each other in their use of digital eHealth technologies. eHealth technologies can be defined as digital technologies which have the purpose to monitor, track, and inform health, to efficiently communicate between health stakeholders, and to collect, manage, and use health data sources (Shaw et al., 2017). Examples of such technologies are AI-based technologies that use pattern recognition software and big data to identify illnesses, electronic health records that facilitate the exchange of important health data, and mobile health apps that assist people in their daily activities.

This article investigates the partnership features of PPIs responsible for producing technologically sophisticated eHealth innovations. Using theories on collaborative innovation and network governance, we develop two competing hypotheses and test them on a dataset comprising 19 eHealth partnerships in five European countries. The study utilizes survey and interview data from over 130 respondents, analyzed through fuzzy-set qualitative comparative analysis (fsQCA). Surprisingly, the findings show that small, centralized, and homogeneous partnerships are most successful at achieving technological innovation, contrary to theoretical expectations. These results challenge some of the underlying assumptions of contemporary collaborative innovation in theory and practice, calling for further consideration and testing.

The article is organized as follows. First, the theoretical section introduces our theoretical framework and develops the two hypotheses. Subsequently, we elaborate on the case selection, methodology and operationalization, and present our QCA results. Finally, we discuss the results, address the implications for theory and practice, and suggest opportunities for future research.

TECHNOLOGICALLY SOPHISTICATED SERVICE INNOVATION THROUGH COLLABORATION

Technologically sophisticated service innovation

Although there is no universal definition of innovation, most scholars agree that innovation is something that is perceived as new and is implemented in a real-life context (Rogers, 2003). Public innovation is often conceptualized into several categories, including service innovation (i.e., new ways to provide services) and product innovation (i.e., new products/technology) (Hartley, 2005, 28). However, public service innovation often entails the development and/or use of new technology such as digital tools, systems, or applications (Torugsa & Arundel, 2016). eHealth, which is the focus of this study, exemplifies this entanglement of service and product innovation, as new digital technology changes how a service is provided to health care users. For instance, introducing a new way to extract and communicate important user information (e.g., patient information) requires the introduction of a new information-sharing system.

Such technologically sophisticated service innovations have become central in the digital transformation of the health care sector, as they can significantly improve outcomes, decrease process complexities, and reduce administrative burdens (Klinker et al., 2020). Technological sophistication refers to the functional diversity and internal complexity of the used technologies (Alexander & Wakefield, 2009; Paréa & Sicotte, 2001). Indeed, technologies that introduce multiple functionalities are more impactful as they can be deployed more broadly (Shaw et al., 2017). Likewise, increasing the internal complexity of the technologies by introducing advanced technologies (e.g., AI) and extensively integrating the used technologies enables novel usage, process integration, and interoperability (Alexander & Wakefield, 2009).

Collaborative innovation and public-private innovation partnerships (PPIs)

Introducing technologically sophisticated innovations in complex service environments such as the health care sector is challenging. The required knowledge to generate these services and the needed capacity to implement them are often spread across multiple actors and sectors. Recent developments in innovation research have addressed these complex environments by adopting a "collaborative governance" perspective on the innovation process (Sørensen & Torfing, 2011). Theories of "collaborative innovation" propose that a close collaboration between public and private actors (e.g., in PPIs) is a viable innovation strategy for these complex service environments, as it stimulates partnership synergies out of which novel ideas and shared commitment can arise (Torfing, 2019). Through collaboration, a wide range of ideas and perspectives can be accessed and connected, and the involvement of various actors can help support the implementation and diffusion of newly created services (Sørensen & Torfing, 2011).

Public-private innovation partnerships are partnerships between public and private actors, where the main goal is to innovate public services (e.g., through incomplete contracts that provide space for creative thinking, Alonso & Andrews, 2022). In comparison to highly contractual, long-term, procurement-based public-private partnerships (PPPs) (Grimsey & Lewis, 2007), PPIs often have a shorter life span, are less formalized, and represent a multiplicity of organizational forms (Alonso & Andrews, 2022; Di Meglio, 2013). Because of these specific features, and as we are particularly interested in how partnership design leads to innovation, we focus our study on PPIs. Furthermore, a recent literature review shows that the vast majority of PPIs take place in health care, eldercare, and social services (Brogaard, 2021). In such human capital-intensive environments, new services are often too specialized or technically advanced to allow service organizations to procure them from the market or to create them on their own (Brogaard, 2021).

Collaborative innovation and partnership design

Public sector collaborative innovation is thoroughly embedded in the New Public Governance (NPG) paradigm (Lindsay et al., 2020), which encompasses several theories on cross-sector collaboration, including theories on network governance (Provan & Kenis, 2007), collaborative governance (Ansell & Gash, 2007), and network management (Agranoff, 2007). For a general overview of this literature, we refer to Bryson et al. (2015). Roughly speaking, these theories distinguish between conditions related to the partnership design (e.g., size, types of involved partners, governance structure, etc.) and process-related conditions (e.g., trust-building, process management, dialogue, commitment, etc.).

Contemporary collaborative innovation theories have emphasized the process components of collaborative innovation, as innovation is often regarded as a process in which collaboration-related process conditions can interfere. For instance, Sørensen and Torfing (2011) provide distinct process conditions such as empowered participation, mutual learning, and joint ownership, which are in line with process conditions in collaborative governance models (cf. Ansell & Gash, 2007). Moreover, the effectiveness of the collaboration dynamics is often ascribed to the presence of *interpersonal trust* (Provan et al., 2009), which has also been empirically demonstrated to have a positive relationship with innovation (Torvinen & Ulkuniemi, 2016). The innovation process is inherently risky, which requires commitment among the partners and willingness to invest time and resources with no guarantee of a successful outcome (Brogaard, 2021).

However, although trust has proven a vital component of partnership success, recent studies on cross-sector innovation partnerships highlight the impact of *partnership design* on innovative outcomes (Alonso & Andrews, 2022; Torfing et al., 2020). For instance, partnership design defines which collaborative interactions are possible by establishing interaction and decision arenas (Klijn & Koppenjan, 2016), and centralizing or decentralizing these arenas (Provan & Kenis, 2007), thus directly interfering in the collaboration process. These design choices not only influence the collaborative dynamics in PPIs, they may also directly affect the creative expressions of actors in the partnership. Indeed, contemporary views on collaborative innovation perceive partnerships as *creative arenas*, where a multitude of actors openly engage with each other and share perspectives and ideas, thus providing a foundation for innovative solutions to emerge (Torfing, 2019).

The presence of a high degree of *diversity in ideas and perspectives* is central to these creative arenas. Diversity at the start of the innovation process fosters an increase in the variation of ideas (Milliken et al., 2003), which may prevent tunnel vision and encourage groupthink among the innovators (Sørensen & Torfing, 2017), and optimize the quality of idea creation and selection (Sørensen & Torfing, 2011). Moreover, a diversity of ideas and perspectives throughout the collaboration process may also encourage the participants to elaborate and build on the information and knowledge of others, which increases group creativity (van Knippenberg et al., 2004). Two design conditions may stimulate these creative processes: the *number of involved partners* and the level of *centralization of authority* in the partnership. These design conditions are closely connected and carry important trade-offs that lead us to develop two competing hypotheses regarding their combined influence on generating technologically sophisticated service innovation.

First, as PPIs typically involve a broad range of different types of actors (Brogaard, 2021), increasing the number of actors in the partnership should support the diversity in ideas and perspectives. This is especially important for the level of technological sophistication, as this diversity might generate new combinations of different technologies, which may provide the basis for sophisticated technological innovations (Davis & Eisenhardt, 2011). There is, however, a trade-off. The large number of actors may also create more transaction costs and managerial challenges (Vivona et al., 2022), which may complicate the already complex integration of these technologies. Because of these challenges, the decision-making/authority should be more centralized in large partnerships (Provan & Kenis, 2007). According to Provan and Kenis (2007), more centralized partnerships should be particularly effective in large partnerships where interpersonal trust is often relatively low, as the centralization of authority allows dyadic interactions between a lead actor and individual participants. In other words, the partnership design allows the partnerships to generate innovation, despite having relatively low levels of trust. These assumptions lead us to the following hypothesis:

> **H1.** Large, centralized partnerships that include diverse ideas and perspectives, and have low to moderate levels of interpersonal trust, generate technologically sophisticated eHealth innovations.

Second, while centralized authority can help manage the diversity that leads to innovation in large partnerships with low levels of trust, partnership designs with decentralized authority can support the initial diversity of ideas. Specifically, decentralized authority might reduce the risk that one actor will force its decisions and opinions on the other partners, which can inhibit the creative expression of the involved actors (Hirst et al., 2011). Moreover, it also allows partners to self-organize by removing restricting interaction barriers (e.g., enforced interaction patterns), from which access to and recombination of diverse technologies can be enhanced (Davis & Eisenhardt, 2011). Such decentralization of authority might be very hazardous in large partnerships with relatively low levels of interpersonal trust, as many actors have decision-making power that might inhibit the collaboration process (Provan & Kenis, 2007). However, in small, trust-based partnerships, the benefits of successful collaboration are concentrated around only a few actors rather than being dispersed across many, which provides a strong incentive to share knowledge and ideas to produce innovative outcomes (Brogaard, 2019). Moreover, high levels of trust can foster more innovative and risky ideas in the perceived absence of opportunistic behavior from others (Brogaard, 2021). Hence, we propose our second, alternative hypothesis:

> **H2.** Small, decentralized partnerships that include diverse ideas and perspectives and have high levels of interpersonal trust generate technologically sophisticated eHealth innovations.

CASES AND METHODOLOGIES

Case selection

Digital transformation in the health care sector is one of the European Union's most important priorities (European Commission, 2018), which makes the European countries an ideal empirical context for testing our hypotheses. A total of 19 public-private innovation partnerships in eHealth were selected in five European countries. The detailed features of these cases are illustrated in the Annex (Table A1). To ensure the comparability and representativeness of the selected cases, we used a purposeful sampling of the cases by adopting specific case selection criteria on three levels.

At the country level, we selected cases from five European countries, representing the two dominant health care systems (i.e., National Health Services and Etatist Social Health Insurance System) (Böhm et al., 2013). In the former, government is responsible for regulation, finance, and provisioning of health care, while in the latter system, government is responsible for regulation, finance is societally controlled (e.g., societal, para-fiscal funds), and provisioning is conducted by private actors (i.e., for-profit/nonprofit actors). Because both health care systems are regulated by government, the four most dominant administrative traditions in continental Europe were selected. Pollitt and Bouckaert (2017) make a distinction between different administrative traditions along five criteria: (1) state structure, (2) executive government, (3) minister/mandarin relations, (4) administrative culture, (5) diversity of policy advice. Based on these criteria, the following countries were selected: Belgium (Etatist Social Health Insurance System, mixed Napoleonic tradition), the Netherlands (Etatist Social Health Insurance System, Continental tradition), Denmark (National Health Services, Nordic tradition), Estonia (Etatist Social Health Insurance System, Eastern European tradition), and Spain (National Health Services, Napoleonic tradition). By including these countries in the study, we believe that we can infer insights on PPI-enabled technological eHealth innovations in Europe.

At the partnership level, we applied three selection criteria. First, as PPIs are partnerships between public actors and private actors, which often involve users to innovate services, all the included cases were eHealth partnerships between public actors (e.g., governments, agencies, public hospitals, etc.), private actors (e.g., nonprofit organizations, firms, etc.), and service users (e.g., GPs, medical professionals, patients, residents of nursing homes, etc.). Second, as PPIs can be coordinated by the public actor or the private actor, these two "types" of PPIs were included in our sample. Third, as PPIs can vary in size, we included both smaller (i.e., less than 10 partners) and larger (i.e., more than 10 partners) PPIs. The two latter features were equally distributed among the selected cases.

At the service innovation level, we selected cases which produced the two most commonly recognized types of eHealth services: (1) eHealth technologies related to the innovation of digital information flows between stakeholders, and (2) eHealth technologies related to telehealth, mobile health, and smart devices (Shaw et al., 2017). Examples of the former are central patient registration platforms, and central communication systems for monitoring patients, while examples of the latter are health technologies using motion sensors, mobile apps, and security systems. Because of our interest in the technological sophistication of the implemented services, only cases that implemented or at least extensively tested the developed services in the last 5 years were selected.

Fuzzy-set qualitative comparative analysis

This article employs fsQCA. QCA is known for its configurational causation (Ragin, 2008), which means that multiple conditions can have a combined effect on a certain outcome. As both of our hypotheses claim a combined effect of specific conditions, QCA allows us to test these hypotheses. In essence, QCA uses sets of conditions (e.g., large partnerships) and an outcome (e.g., technological sophistication) to determine patterns between these conditions and the outcome (Ragin, 2008). Each of our empirical cases is assigned to these sets. Cases can be present in a set (e.g., case A is a large partnership, typically indicated as a 1) or absent in a set (e.g., case B is a small partnership, indicated as a 0), which means that they show low or high levels of a certain condition or outcome. Sets of conditions can overlap with the set of the outcome to a greater or lesser extent. The greater the fit between the sets of the condition(s) and the set of the outcome, the stronger the pattern between these sets. QCA uses *consistency* as a measure of fit between sets, and *coverage* as a measure for the number of cases that are covered by the overlapping sets. For a thorough introduction to QCA, we refer to Schneider and Wagemann (2012).

As we use *fuzzy set* QCA, the boundaries of these sets can be fuzzy, which means that some cases may also be partially in a set (indicated in this article as 0.67) or partially out of a set (indicated as 0.33). The case membership scores for each set are assigned during the calibration procedure, which we return to. The crossover point[1] of 0.50 represents a point of maximal indifference of a case for the presence or absence in a particular set. The crossover point is thus an important reference when assigning case membership scores (Schneider & Wagemann, 2012). If the outcome is always present when a condition is present, we call this condition a *necessary condition*. When a condition or a combination of conditions consistently leads to a certain outcome, we call this condition/these conditions *sufficient conditions*.

Data collection

To test our hypotheses, we gathered data using varied methods by five country-specific research teams. The interviews involved 132 participants, including project coordinators, public and private partners, and users. Each research team provided standardized interview reports for their cases. Prior to the interviews, centralized Qualtrics surveys were conducted with 124 of these respondents. Additionally, contextual case summaries were offered by the research teams for each case, detailing project backgrounds, partners, collaboration, and innovation dynamics.

The interviews, surveys, and case reports represent a robust comparable dataset spanning the five countries. Yet, relying on perception-based data entails risks of common-source and positive response biases (Andersen et al., 2016). We countered this by triangulating our methods, diversifying respondents, and avoiding evaluative questions. The coordination by a central research team ensured data consistency (e.g., in constructing questions, translations, case selection, and calibration), by aligning methodological decisions. Interviews and case insights also deepened our QCA results. For further details on respondents and methods, we refer to the Annex (Table A2).

Operationalization and calibration

Outcome: Technological sophisticated innovations

Our outcome variable is measured and calibrated using survey and interview data, and focuses on the two features of technologically sophisticated innovations: (1) the *functional diversity* of the used technologies in the innovation, and (2) the *internal complexity* of these technologies (Alexander & Wakefield, 2009; Paréa & Sicotte, 2001). Functional diversity was measured by asking project coordinators, public actors, private actors, and service users about the presence of three different types of eHealth technologies in the service innovations: (1) monitoring and health information technologies, (2) communication technologies, and (3) health data management technologies (Shaw et al., 2017) (see Annex, Table A3). The percentage of present eHealth technologies was calculated for calibration, and a case score was determined based on the mean of responses from all respondents. A crossover point of 0.50 was used (see Table A6 for calibration rules).

The internal complexity of the used technologies is composed of survey items concerning (1) the level of integration of the technologies and (2) the use of new and advanced technologies. Fully integrated systems connect different processes, functions, and technologies together, which increases interoperability and ultimately stimulates technological sophistication (Alexander & Wakefield, 2009). The presence of highly advanced technologies coincides with the introduction of new technological inventions. Qualitative interviews were conducted to gather detailed information about technology newness, availability, importance, and impact of the technologies indicated in Table A3. The researchers used specific criteria to distinguish between different levels of technological integration and advancement and the calibration score that corresponded to these levels (see Annex, Tables A4 and A5). Finally, the mean of the three case scores was calculated and transformed to a case score of 0; 0.33; 0.67; or 1 (see Annex, Table A6).

Conditions

We measured four conditions corresponding to our hypotheses. Partnership size is the number of individual partners that were involved in each PPI. The PPIs in our dataset typically include three types of public actors (governments, hospitals, and public health insurance funds), three types of private actors (private health actors, consultants, and tech firms), and three types of user actors (citizens/patients, patient organizations, and health professionals) (which is similar to partnerships in other studies, Brogaard, 2019), which motivated our selection of a crossover point of 10. With these nine types of actors, and a coordinator as a separate actor, large partnerships should include at least 10 actors. A 0.33 anchor point was defined at four actors (i.e., public actors, private actor, user, coordinator). Applying a similar range of the number of actors above and below the crossover point, a score of 0 was assigned to PPIs with less than four actors, 0.33 for those with 4–10 actors, 0.67 for those with 10–15 actors, and one for PPIs with more than 15 actors.

The diversity of ideas and perspectives is measured through survey items and interview questions. We asked two bipolar survey questions corresponding to the diversity of ideas and perspectives *at the start* of the project to the coordinators, public actors, and private actors:

(1) there were no differences/a lot of differences in opinions or perspectives of the actors, and (2) the ideas and opinions of the respondent were very similar to/distinctive from the ideas and opinions of the other actors. Based on the seven-point scale, a crossover point of 4 was determined. Mean values were calculated over the different items per respondent (see factor loadings in Annex, Table A8). Additionally, qualitative interviews gathered examples of diversity in perspectives of the respondents *during* the project. Specific calibration rules were used to assign a *case membership* score from these values (see Annex, Table A6).

(De)centralization of authority was operationalized based on the conceptualization of Provan and Kenis (2007). Through interview data, each partnership was categorized as lead organization-governed partnerships (centralized governance and decision-making, i.e., centralization of authority), shared participant-governed partnerships (governance and decision-making shared among the participants, i.e., decentralization of authority), or network administrative organizations (NAOs). In NAOs, the governance might be centralized, but the decision-making depends on the represented actors in the NAO, meaning that individual actors are usually unable to dominate the entire collaboration process. Using these considerations (see Table A6 for more details), we assigned lead organizations with a single lead actor a 0, lead organizations with a few lead actors or NAOs with a single lead actor a 0.33, shared-participant partnerships with a single lead actor or NAOs with a few lead actors a 0.67, and shared-participant partnerships with a few lead actors or a shared collective and NAO's with a shared collective a 1.

Interpersonal trust was operationalized through the three frequently used aspects of trust, that is, ability, benevolence (taking the other actor's interest into account), and integrity (good intentions) (Mayer et al., 1995). We based our survey items and scales on the trust process of Dietz (2011) and the widely acknowledged operationalization of trust by Mayer et al. (1995), which has been used in previous studies (Brogaard, 2017). Project coordinators, public actors, and private actors were presented with six seven-point Likert items (see Table A7). As we are interested in "considerable levels of trust" as opposed to "low to moderate levels of trust," we selected a relatively high crossover point of 5 based on the survey scale. Mean values were calculated over the different items per respondent (see factor loadings in Annex, Table A9). Specific calibration rules were used to arrive at a case membership score (see Annex, Table A6).

RESULTS

QCA results

The QCA analyses were performed with fsQCA software, version 3.1b (Ragin & Davey, 2017). The calibrated dataset appears in the Annex (Table A10). Table 1 illustrates the distribution of cases above and below the crossover point for technological sophistication and innovativeness. Nine of the cases show high levels of technological sophistication of the created services, while 10 of the cases show low levels of technological sophistication. There is a relatively even distribution between the different countries for high and low levels of technological sophistication.

We follow standards of QCA practice and first report the results of the analysis of necessary conditions (Schneider & Wagemann, 2012), which are illustrated in Table 2. Schneider and Wagemann (2012) suggest a consistency threshold of 0.90 to determine if a condition is necessary. Although we did not expect a condition to be necessary, the analysis demonstrates that the presence of considerable levels of interpersonal trust is necessary for the creation of technologically sophisticated innovations. Due to the asymmetric nature of QCA (Ragin, 2008), the necessity of a condition for the presence of the outcome does not mean that this condition should always be absent when the outcome is absent. This is confirmed by the analysis for the absence of technologically sophisticated services, where the absence of the conditions is not necessary for the absence of the outcome (see Annex, Table A11).

Next, we performed the analysis of sufficient conditions. A (combination of) condition(s) is sufficient when it consistently leads to the outcome (Schneider & Wagemann, 2012). Table 3 presents a truth table with all the logically possible combinations of conditions, where at least one case is covered. A consistency threshold of 0.80 is advised to select truth table rows for the next step in the analysis (Ragin, 2009). Although the first four truth table rows exceed the consistency threshold, only the first row exhibits a satisfactory proportional reduction in inconsistency (PRI)[2] value, which drops very quickly from row 1 onward.[3] Furthermore, the raw consistency score also rapidly drops from row 1 to row 2, which also indicates that the consistency threshold is reached (Schneider & Wagemann, 2012).

Next, the rows are logically minimized and the consistency and coverage values of the solution are calculated through the Standard Analysis (Schneider & Wagemann, 2012). Because of our theoretical expectations (see hypotheses), we pay special attention to the intermediate solution path (parsimonious and complex solutions are reported in Table A13 and Table A14), which is illustrated in Table 4. Because of the solution consistency and coverage of respectively 0.900 and 0.601, we can conclude that *small PPIs that possess a low diversity of ideas and perspectives, a centralization of authority, and considerable levels of interpersonal trust generate technologically sophisticated eHealth innovations*. The five cases that are covered by this solution path are relatively well distributed over the five countries. The analysis for sufficiency for the absence of the outcome is reported in the Annex (Table A12), and shows that large, decentralized PPIs with high diversity of ideas and perspectives lead to an absence of

TABLE 1 Set membership of the cases for the outcomes.

Outcome			Cases
Technological sophisticated innovations	High tech. soph.	Above 0.50	C1, C4, C6, C8, C12, C13, C16, C17, C18
	Low tech. soph.	Below 0.50	C2, C3, C5, C7, C9, C10, C11, C14, C15, C19

TABLE 2 Analysis of necessary conditions.

Presence of technologically sophisticated innovations		
Conditions	**Consistency**	**Coverage**
Large partnerships	.533	.533
Small partnerships	.680	.655
High diversity of perspectives and ideas	.426	.518
Low diversity of perspectives and ideas	.787	.647
Decentralization of authority	.249	.499
Centralization of authority	.893	.580
Considerable levels of trust	**.928**	**.649**
Low to moderate levels of trust	.390	.643

technologically sophisticated eHealth innovations. Thus, our results do not fully support either of our two hypotheses, which we return to in the discussion.

In-depth qualitative analysis

QCA results are best interpreted using qualitative case information (Schneider & Wagemann, 2012). All cases in the solution path had early agreement among actors on problem definition, project scope, and required features, which increased the interpersonal trust. For instance, in case C17, the small, centralized structure, low level of diversity, and high levels of trust allowed a tight combination of technical expertise that was needed to create AI-driven solutions for visual disorders. We see something similar in partnership C12 which needed to be small, centralized, and homogeneous in order to tackle technically complex issues related to constructing a mobile application that would enable patients of osteoporosis to receive and interpret their results from bone scans.

The central position of the lead actor was also crucial for the early alignment of the actors' perspectives. The lead actors determined and protected the boundaries of the project, sometimes by using a written contract, which reduced process complexity and smoothened the collaboration. This leadership profile has strong similarities with the role of "steward" formulated by Ansell and Gash (2012, p. 8), who establishes and protects the integrity of the collaboration process.

While the covered cases exhibit tensions between public and commercial interests, the central position of the lead actor helped overcome these tensions and maintain the trust between the partners. Several cases exemplify the influence of the lead actors. For instance, the strong position of the lead actor and the small scale of the partnership in case C12 prevented that the private actor unilaterally commercialized the created product, as the lead actor had the power to replace the private partner by another actor and restore trust. In case C18, the lead actor constructed an elaborated accountability structure to consolidate its influence over the partnership, which helped to mediate conflicts and facilitate shared understanding. This leadership role has similarities with a "mediator" (Ansell and Gash 2012), who serves as broker to smoothen the relationships between the involved actors. The following quote from the lead actor of case C18 illustrates this:

> We wanted to prevent accountability issues by establishing hierarchical ties between the contractors. This means that partner A is

TABLE 3 Truth table.

	Partnership size	Diversity of perspectives and ideas	Decentralization of authority	Interpersonal trust	Tech. soph.[a]	#Cases	Raw consist.	PRI consist.
1	**0**	**0**	**1**	**1**	**1**	**5**	**.900**	**.821**
2	0	1	1	0	0	1	.853	.493
3	1	1	1	0	0	2	.798	.500
4	0	1	1	1	0	1	.798	0.596
5	1	1	1	1	0	1	0.767	0.497
6	1	0	1	1	0	3	0.748	0.553
7	1	1	0	0	0	1	0.596	.330
8	1	1	0	1	0	1	0.569	0.248
9	0	0	0	1	0	3	0.557	0.432
10	0	0	0	0	0	1	0.496	0.330

Note: Bold indicates the truth table row that is retained in the next step of the analyses.
[a]The 1 in the columns indicates that row 1 consistently and unambiguously (i.e., high PRI) leads to the outcome.

TABLE 4 Analysis of sufficiency for the presence of technologically sophisticated innovations.

	Consistency	Raw coverage	Unique coverage	Cases in path
Small partnerships * low diversity of ideas and perspectives * centralization of authority * considerable interpersonal trust	.942	.607	.607	C1, C8, C12, C17, C18
Solution consistency	.900			
Solution coverage	.607			

> the contractor of partner B, and partner B is the contractor of partner C, etc. We also worked with a network broker who only had a hierarchical tie with us, but who was responsible for aligning the different systems with each other.

Having this degree of control over the involved partners enabled the lead actor to directly stimulate the contractors to pursue bold, technologically sophisticated solutions, even when this was not commercially beneficial for the private actors in the short term. Cautious, incremental steps through compromise and pragmatism were not necessary as the lead actor was able to impose its wishes on the contractors, hence taking the role of a "catalyst," who identifies and creates opportunities for value-creation (i.e., innovation in our case) (Ansell & Gash, 2012). The following quote from the lead actor in case C18 illustrates this:

> Because our residents need to wear bracelets with Bluetooth trackers at all times, they need to be comfortable and client friendly, which was not the case with the initial bracelets. [The private contractor] complained that they were not a supplier of bracelets, but in the end, they will have to provide us with a suitable product.

Furthermore, interaction dynamics such as learning, experimentation, and trial-and-error behavior are also visible in the covered cases. For instance, case C8 shows that informal meetings between the involved actors were essential to develop ideas and manage the collaboration. In case C12, workshops were organized with all partners from which new ideas were generated, and in cases C1 and C18, a separated space for experimentation was established in which ideas and prototypes could be tested. In other words, the small size, low diversity of ideas and perspectives, and centralized nature of the partnerships did not stifle creative exploration within the overall design boundaries of the project.

DISCUSSION

The results show that, surprisingly, none of our two hypotheses are confirmed by the QCA analyses. We obtain only one solution that differs from our hypothesized paths, and, moreover, has a very high consistency value. This finding offers strong evidence that small PPIs with centralized authority, low diversity of ideas and perspectives, and high levels of trust generate technologically sophisticated eHealth innovations. Furthermore, an opposite solution path (i.e., large, decentralized partnerships with high diversity) is found for the absence of technologically sophisticated eHealth innovation, which further supports our results (see Annex, Table A12).

Three important theoretical implications arise from these findings. First, we find that partnerships that limit the diversity of ideas and perspectives in the innovation process seem to produce technologically sophisticated service innovations. This observation is tied to the small size of the partnerships and their centralized authority. A possible explanation is that a high degree of diversity impedes the innovation process through an "overload" of conflicting ideas, goals, and interests, which can result in conflict and deadlock, whereas limited diversity creates a more focused innovation process early on. While current collaborative innovation literature places a large emphasis on the advantages of diversity for enhancing creative expression, partnership synergies, and 'reducing tunnel vision and groupthink' (Milliken et al., 2003; Sørensen & Torfing, 2017; Torfing et al., 2020), our results suggest that the required level of diversity might be contingent on the type of partnership design.

Second, we find that small partnerships with a centralization of authority produce technologically sophisticated service innovations. According to creativity literature, highly centralized and hierarchically organized settings inhibit the creative expression of individuals (Hirst et al., 2011). However, insights from our qualitative data indicate that the typical interaction dynamics of collaborative innovation (e.g., learning, experimentation, and trial-and-error behavior) are still present, and even promoted, in these partnerships. These findings suggest the presence of lead actors who adopt the three principal collaborative leadership roles, suggested by Ansell and Gash (2012): steward, mediator, and catalyst. This finding is also supported by recent research by Torfing et al. (2020), who discovered the same three leadership roles in innovation partnerships in several policy domains, including the health care sector. We extend these findings by showing that these leadership roles also have an impact on the level of technological sophistication of the created innovation.

Third, we obtained convincing evidence from our observations that considerable levels of interpersonal trust should *always* be present to create technologically sophisticated services. In other words, PPIs with only low to moderate levels of trust, even centralized ones, are unable to create technologically sophisticated innovations. This finding questions Provan and Kenis' (2007) assumption that the importance of trust for network outcomes varies depending on the governance structure, at least in the case of innovation partnerships. Our evidence does, however, match the general emphasis on trust for achieving innovation in the collaborative and network governance theory and as demonstrated by empirical research (Torvinen & Ulkuniemi, 2016). Considering the other conditions, small, homogenous, and centralized partnerships might be especially suitable for achieving high levels of trust, which potentially facilitates intensive interactions between the involved actors, from which technologically sophisticated innovation emerges.

These results suggest that partnerships that focus on the generation of technological sophisticated innovations can also be seen as *arenas of complexity*. In a context of complexity, small, homogeneous, centralized, and trust-based partnerships would be better able to produce innovative services because they can reduce their coordination costs and simplify decision-making (Vivona et al., 2022). Indeed, complexities related to differences in partners' knowledge, perspectives and backgrounds (substantive complexities), interests and agendas (strategic complexities), and institutional and cultural realities (institutional complexities) (Klijn & Koppenjan, 2016) may lead to intergroup biases and conflicts (van Knippenberg et al., 2004), opportunistic behavior (Ostrom, 2007), and cultural clashes (Vangen, 2016). In partnerships that pursue highly technical and complicated innovations, these complexities might increase the risk of becoming trapped in collaborative inertia, which can impede collaborative advantages and synergies (Huxham, 1996). These findings seem to be confirmed by recent, tentative empirical findings on innovation partnerships, in which lead organization networks are better at generating a variety of high-quality and low-cost innovations than partnerships with a decentralization of authority (Lam & Li, 2018). The findings also echo organizational innovation literature, in which organizational cohesiveness has been connected to the creation of innovation cultures (Xie et al., 2021), increased organizational learning (Montes et al., 2005), and increased commitment to adopt the innovation (Hirunyawipada et al., 2015).

CONCLUSION

In this article, we analyzed which combination of partnership design conditions leads to technologically sophisticated service innovation in PPIs. Different from what we initially expected, our results show that small, centralized, homogeneous, and trust-based partnerships are best at achieving technologically sophisticated eHealth innovations, as they are able to reduce the complexities inherent to collaborative innovation processes (Vivona et al., 2022). PPIs reduce these complexities by designing compact and manageable partnerships, with considerable levels of interpersonal trust, and an explicit lead actor, who protects, supports, and propels the collaborative innovation process by combining steward, mediator, and catalyst leadership roles (Ansell & Gash, 2012).

This practical implication is highly relevant in demanding and intricate service environments such as health care, in which highly specialized technical expertise is necessary, and the prevalence of specialized users (e.g., physicians, medical specialists, etc.) requires the generated solutions to comply to high user standards. Moreover, these particular design features of health care PPIs are likely relevant for collaborative innovation in other human service areas, thus broadening the applicability of our results. Specifically, our results might be relevant to similar services that are human capital intensive and/or increasingly driven by technological innovation such as eldercare (Lassen et al., 2015) and to some degree specialized social services (Alonso & Andrews, 2022; Desmarchelier et al., 2020).

Our results provide rich insights for theory and practice, which may be instructive for future research. The value of this study lies in its ability to explain which combinations of partnership characteristics and governance lead to technologically sophisticated innovations in PPIs. This perspective provides new insights and explanatory power to the emerging literature on PPIs. We used data from 19 partnerships in five different European countries, which allows us to (cautiously) generalize these results to similar projects in Europe. By using QCA, we were also able to look deeper into the qualitative data and discover some clues as to how the studied conditions cause technological sophistication.

However, our study also has limitations. Due to our research design, our study is largely based on perception data, and we were only able to look at the influence of partnership design in specific partnerships (PPIs), countries (European countries), and policy sector (health care sector) on the presence of specific types of technological innovations (eHealth innovations). Further research is needed in other types of partnerships (e.g., interagency partnerships) and other policy sectors (e.g., infrastructure sector) to shed more light on the possible generalization of these results to other empirical setting, and to better understand the causal mechanisms that are responsible for our results. Future research can also benefit from developing measures of partnership conditions and/or innovative outcomes using administrative and register data, while in-depth qualitative case studies, process-tracing studies, and quasi-experimental designs (see Alonso & Andrews, 2022) can solidify potential causal inferences.

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ENDNOTES

[1] Both the terms crossover point and cutoff-point are used in QCA, but here we adhere to "crossover point" because we use a fuzzy set QCA logic, in which the boundaries between the presence and absence in sets are more blurred (i.e., cases cross over from being (partially) out of the set into the set) (see also Schneider & Wagemann, 2012).

[2] The proportional reduction in inconsistency (PRI) expresses the degree to which a condition (or combination of conditions) is a subset of both the presence of the outcome ánd the absence of the outcome (Schneider & Wagemann, 2012, p. 242). A low PRI value (i.e., < 0.600) means that the truth table row might not only produce the presence of the outcome but also the absence of the outcome.

[3] Following Schneider and Wagemann (2012, p. 243), we also considered the product of the raw consistency and the PRI consistency, which was, for the four truth table rows above the 0.80 threshold resp. 0.858; 0.000; 0.498; 0.407. The large deviation between the products and low values of the three latter products shows that only row 1 should be retained.

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ANNEX A

TABLE A1 Selected cases.

Case code	Case description
C1	Tracking technologies in a nursing home, created through the collaboration between a semi-private association, software developer, and patient organization
C2	Platform which brings people with health/social care demands together with volunteers, created through municipalities, communal network, private hospitals, private ICT companies, consultant companies, citizens, and health professionals
C3	Centralized patient registration system, created through a collaboration between the ministry, government agencies and public authorities, ICT companies, private health care providers, physician associations, hospital associations, individual physicians
C4	Voice command app to guide health care providers, created through a collaboration between a ministry, public health insurance authority, colleges, network of health care providers, ICT companies, several health care organizations
C5	E-learning program regarding dysphagia, created through a collaboration between a regional government, municipalities, public hospitals, ICT company, representatives of health professionals
C6	A way of creating, validating, and disseminating official evidence-based guidelines for health care providers, created through a collaboration between universities, private health organizations, national and regional government agencies, red cross organizations, knowledge organizations, ICT suppliers, and individual health professionals
C7	"Smart diaper" for elderly people, created through the collaboration between a semi-private association, ICT company, consultant company
C8	Digital platform designed to foster neighborhood collaborations between clients and consultants, created through the collaboration between a municipality, private health care provider, neighborhood teams, citizens
C9	Web application for computerized cognitive behavior therapy (CCBT), created through the collaboration between public hospitals and health care services, public research institute, private technology center, several health professionals (e.g., psychiatrist, psychologists, physicians, etc.)
C10	National portal website which provides information for all the citizens, created through a collaboration between government agencies, ministerial cabinets, hospital networks, regional governments, private health suppliers, and insurance organizations, and user organizations
C11	Patient information sharing tool for GPs and home care organizations, created through a collaboration between private nursing organizations and federation, ministerial cabinets, national government agencies, hospital networks, individual GPs, and several private health organizations
C12	Smartphone app that helps convey the results of bone scans to patients with osteoporosis, created through a collaboration between a public hospital, university, ICT and health service companies, patient associations, health professionals
C13	Home health ICT tools for chronic patients, created through the collaboration between a public hospital/health service, regional government, ICT companies, consultancy companies, several other private companies, universities, health professionals, and patients
C14	Integration of application processes for rehabilitation, disabilities, aids, created through a collaboration between ministries, public health insurance authority, government agencies, physician association, interest groups
C15	Smartphone app for patient reported outcomes, created through a collaboration between a public hospital, ICT company, health professionals
C16	Electronic prescription system, patient appointment system, robot for automatic storage and dispensing, created through the collaboration between several public hospitals, private ICT companies, several patient organizations, university
C17	AI used to diagnose uncooperative patients, created through the collaboration between public hospitals, ICT and telecom companies, physicians
C18	Several technologies in a nursing home (wearables, smart cameras, etc.), created through a collaboration between a public nursing home (local government), private construction companies and contractors, consultant companies, nurses, and patients
C19	ICT platform which facilitates the exchange of health information between partners and patients, created through the collaboration between a municipality, public hospital, and several private health organizations

TABLE A2 Data collection.

Case code	Surveys (124)			Interviews (132)		
	Coordinator	**Public and private partners**	**Users**	**Coordinator**	**Public and private partners**	**Users**
C1	Manager/project coordinator (1)	Public service provider (2), ICT company (1)	Representative user organization (1), nurse (1), physician (1)	Project coordinator (1)	Public service provider (1), ICT company (1)	Representative user organization (1), nurse (1), physician (1)
C2	Project coordinator municipality (1)	Employee municipality (1), ICT company (1)	Citizens (2)	Project coordinator municipality (1)	Employee municipality (1), ICT company (1)	Citizens (3)
C3	Project coordinator (1)	Ministry (1), ICT company (1)	ICT technicians (3)	Project coordinator (1)	Ministry (1), ICT company (1)	ICT technicians (3)
C4	Project coordinator (1)	Ministry (1), private health network (1)	Representatives users (1), nurse (1)	Project coordinator (1)	Ministry (1), private health network (1)	Representatives users (2), nurse (1)
C5	Program manager (1)	Public hospital (1), ICT company (1)	Health professionals (3)	Program manager (1)	Public hospital (1), ICT company (1)	Health professionals (3)
C6	Chairman and CEO network (2)	Representative government steering committee (1), private service providers (1), ICT company (1)	GPs (3)	Chairman and CEO network (2)	Representative government steering committee (1), private service providers (2), ICT company (1)	GPs (3)
C7	Manager/project coordinator (1)	Public service provider (1)	/	Manager/project coordinator (1)	Public service provider (1)	Nurses (2)
C8	Project coordinator municipality (1)	Coordinator private service provider (1), employee municipality (4)	Social workers and other professional users (4)	Project coordinator municipality (1)	Coordinator private service provider (1), employee municipality (4)	Social workers and other professional users (5)
C9	Public hospital (1)	Public hospitals/health care organization (3), ICT company (1)	Physicians (4), nurse (1) and technician (1)	Public hospital (1)	Public hospitals/health care organization (2), ICT company (1)	Physicians (4), nurse (1) and technician (1)
C10	Government agency (1) and ministerial cabinet (1)	Public hospital (1) and private ICT company (1)	Representatives of patient organizations (2), physician association (2), and user groups (1)	Government agency (1) and ministerial cabinet (1)	Public hospital (1) and private ICT company (2)	Representatives of patient organizations (2), physician association (2), and user groups (1)
C11	Project coordinator (1)	Government agency (1), private service provider (1), ICT company (1)	GPs (3)	Project coordinator (1)	Government agency (1), private service provider (1), ICT company (1)	GPs (3)
C12	Project coordinator (1)	Public hospital (1) and ICT company (1)	Health professional (1), social worker (1), user representative (1)	Project coordinator (1)	Public hospital (1) and ICT company (1)	Health professional (1), social worker (1), user representative (1)
C13	Innovation director ICT company (1)	Public hospital (1), private service organization (1)	Patient (1), physician (1), social worker (1)	Innovation director ICT company (1)	Public hospital (1), private service organization (1)	Patient (1), physician (1), social worker (1)

(Continues)

TABLE A2 (Continued)

Case code	Surveys (124)			Interviews (132)		
	Coordinator	**Public and private partners**	**Users**	**Coordinator**	**Public and private partners**	**Users**
C14	Project coordinator (1)	Ministry (1), physicians association (1)	Representatives of users (2) and individual user (1)	Project coordinator (1)	Ministry (1), physicians association (1)	Representatives of users (2) and individual user (1)
C15	Project coordinator (1)	Public hospital (1)	Physician (1), nurse (3)	Project coordinator (1)	Public hospital (1)	Physician (1), nurse (3)
C16	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (4)	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (4)
C17	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (3)	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (3)
C18	Manager nursing home (1)	Municipality (1)	Nurses (3)	Manager nursing home (1)	Municipality (1), external private consultant (1)	Nurses (3)
C19	Project coordinator (1)	Public service organization (1), ICT company (1)	Service organization (1), physicians (3)	Project coordinator (1)	Public service organization (1), ICT company (1)	Service organization (1), physicians (3)

TABLE A3 Types of eHealth technologies.

	Innovations in the way…
eHealth technologies to monitor, track, and inform health	Mobile devices, mobile sensors, and wearables are used to increase the health and well-being of users
	Apps, social media, and online information are used to increase the health and well-being of users
	The user can access and control their health and health care services
eHealth technologies to communicate between health care actors	The communication and overall interaction between the user and the health care provider is organized
	The service choices for personalized care services users have because of eHealth technologies
	eHealth technologies support health professionals by providing interprofessional collaboration
eHealth technologies to collect, manage, and use health data sources	Personal health data is collected, stored, and communicated between relevant stakeholders (consider also innovations regarding data protection)
	(Big) data is used to provide more precise and personalized health care (e.g., personalized interventions, predicting and preventing diseases, etc.)

Note: Based on Shaw et al., 2017.

TABLE A4 Level of technological integration.

Present technologies	Description	Calibration score
Absence of integrated systems	The individual technological components are not connected with each other, or with the functionalities of each other. They are fully independent of each other.	0
Weakly integrated systems	The individual technological components are connected with each other, or with the functionalities of each other, but function independent of each other.	0.33
Strongly integrated systems	The individual technological components are connected with each other, or with the functionalities of each other, and function dependent of each other. Individual technological components will be (de) activated because of other individual technological components.	0.67
Fully integrated systems	The individual technological components function as one technology. Each technological component acts with the input of the other components. Technological components have no individual functionalities (they dependent on the other components)	1

TABLE A5 Level of technological advancement.

Present technologies	Description	Calibration score
Basic technologies	Use of basic soft- and hardware components (e.g., databases, websites, basic communication technologies, etc.)	0
Weakly advanced technologies	Use of multifunctional technologies which have proven their functionalities for some time, but with low internal complexity (e.g., Bluetooth trackers, sensors, interconnected databases, etc.)	0.33
Advanced technologies	Use of technologies with a high internal complexity: a lot of integrated software/hardware components	0.67
Highly advanced technologies	High internal complexity of technologies with a lot of integrated software/hardware components. Autonomous decision-making based on input data (i.e., expert systems, AI/self-learning systems, etc.).	1

TABLE A6 Calibration rules for the outcome technological sophistication and the conditions decentralization of authority, diversity of ideas and perspectives, and interpersonal trust.

Technological sophistication	Decentralization of authority	Diversity of ideas and perspectives	Interpersonal trust
The following intervals for the mean scores were used to assign the calibration values: • [0–0.33[→ 0 • [0.33–0.5] → 0.33 •]0.50–0.67] → 0.67 •]0.67–1] → 1	• Lead organization-governed partnership + single lead actor → authority centralized in lead actor → full non-membership in set → 0 • Lead organization-governed partnership + multiple lead actors → authority not fully centralized → partial non-membership in set → 0.33 • NAO + single lead actor → authority not fully centralized because of characteristics NAO → partial non-membership in set → 0.33 • NAO + multiple lead actors → authority not fully decentralized because of lead actors → partial membership in set → 0.67 • Shared participant-governed partnership + single lead actor → authority not fully decentralized → partial membership in set → 0.67 • NAO + shared collective → authority fully decentralized because of shared collective and characteristics NAO → full membership in set → 1 • Shared participant-governed partnership + multiple lead actors or shared collective → authority fully decentralized → full membership in set → 1	Survey answers: • All of the answers of the respondents above the crossover point → 1 • More than half of the answers above the crossover point → 0.67 • Less than half of the answers above the crossover point → 0.33 • None of the answers above the crossover point → 0 • An equal number of answers above and below/on the crossover point, consider the distance of the answers toward the crossover point → larger distance is indicative Interview answers: • Listing of all the mentioned examples of diversity in perspective and ideas per respondent per case • Qualitative evaluation of the level of diversity (0; 0.33; 0.67; 1) based on the number of distinct examples per case and their content Final calibration score: • Mean of the scores if survey score and interview score are below and under cross-over point (e.g., 0.33 and 1 → 0.67) • If survey and interview scores are both below or under crossover point → interview score becomes final score • If survey and interview scores are exactly the same, this score becomes the final score	• All of the answers of the respondents above the crossover point → 1 • More than half of the answers above the crossover point → 0.67 • Less than half of the answers above the crossover point → 0.33 • None of the answers above the crossover point → 0 • An equal number of answers above and below/on the crossover point, consider the distance of the answers toward the crossover point → larger distance is indicative

TABLE A7 Operationalization of interpersonal trust.

Interpersonal trust								
At the start of [the project] there was no trust at all between the involved actors	1	2	3	4	5	6	7	At the start of [the project] there was a lot of trust between the involved actors
Throughout [the project], the trust between the involved actors decreased a lot	1	2	3	4	5	6	7	Throughout [the project], the trust between the involved actors increased a lot
The involved actors in [this project] were not at all willing to share relevant information with each other	1	2	3	4	5	6	7	The involved actors in [this project] were very much willing to share relevant information with each other
The involved actors in [this project] were not at all taking each other's interests into account	1	2	3	4	5	6	7	The involved actors in [this project] were very much taking each other's interests into account
The involved actors in [this project] lacked the capacities and skills necessary for this process	1	2	3	4	5	6	7	The involved actors in [this project] had the capacities and skills necessary for this process
Throughout [the project], I was very unsure if the intentions of the other involved actors were good	1	2	3	4	5	6	7	Throughout [the project], I was very sure that the intentions of the other involved actors were good

TABLE A8 Factor loadings diversity of ideas and perspectives.

Diversity of ideas and perspectives	
Survey items	**Factor loadings**
There were a lot of differences in opinions and perspectives of the actors	.839
My own ideas and opinions were very distinctive from the ideas and opinions of the other actors	.839

TABLE A9 Factor loadings interpersonal trust.

Interpersonal trust	
Survey items (only right hand side)	**Factor loadings**
At the start of [the project] there was a lot of trust between the involved actors	.509[a]
Throughout [the project], the trust between the involved actors increased a lot	.705
The involved actors in [this project] were very much willing to share relevant information with each other	.797
The involved actors in [this project] were very much taking each other's interests into account	.873
The involved actors in [this project] had the capacities and skills necessary for this process	.771
Throughout [the project], I was very sure that the intentions of the other involved actors were good	.643

[a]Note that we also did QCA analyses without this item because of the low factor loading. However, these analyses turned out to be exactly the same.

TABLE A10 Calibrated dataset.

Case	Partnership size	Diversity of perspectives and ideas	Decentralization of authority	Interpersonal trust	Technological sophisticated innovations
C1	0	0.33	0	0.67	0.67
C2	1	0.67	0	0.33	0
C3	1	0.67	0.33	1	0.33
C4	0.67	0.33	0	0.67	0.67
C5	0.67	0.67	0.33	1	0
C6	1	1	1	0.33	0.67
C7	0	0	0.67	1	0
C8	0	0	0	0.67	0.67
C9	0.67	0	0	0.67	0.33
C10	1	1	0.33	0.33	0.33
C11	0.67	0.33	0.33	0.67	0.33
C12	0.33	0.33	0	1	1
C13	0.33	0.33	0.33	0.67	1
C14	0.33	0.67	0	0.33	0.33
C15	0.33	0.67	0	0.67	0.33
C16	0.33	0	0.33	1	0.67
C17	0.33	0	0	1	1
C18	0.33	0.33	0	1	1
C19	0.33	0.33	1	0.33	0

TABLE A11 Analysis of necessary conditions—absence of technologically sophisticated services.

Absence of technologically sophisticated innovations		
Conditions	**Consistency**	**Coverage**
Large partnerships	.655	.679
Small partnerships	.550	.550
High diversity of perspectives and ideas	.586	.740
Low diversity of perspectives and ideas	.618	.527
Decentralization of authority	.377	.785
Centralization of authority	.759	.511
Considerable levels of interpersonal trust	.791	.573
Low to moderate levels of interpersonal trust	.516	.881

TABLE A12 Analysis of sufficiency—absence of technologically sophisticated services.

	Consistency	Raw coverage	Unique coverage	Cases in path
Large partnerships * high diversity of ideas and perspectives * decentralization of authority	0.876	0.241	0.241	C3, C10
Solution consistency	0.876			
Solution coverage	0.241			

TABLE A13 Parsimonious solution for the presence of technologically sophisticated innovation.

	Consistency	Raw coverage	Unique coverage	Cases in path
Small partnerships * low diversity of ideas and perspectives * centralization of authority	.851	.607	.607	C1, C8, C12, C17, C18
Solution consistency	.851			
Solution coverage	.607			

TABLE A14 Complex solution for the presence of technologically sophisticated innovation.

	Consistency	Raw coverage	Unique coverage	Cases in path
Small partnerships * centralization of authority * considerable interpersonal trust	.850	.607	.607	C1, C8, C12, C17, C18
Solution consistency	.850			
Solution coverage	.607			