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# Configurations of Resilience in Inter-Organizational Networks

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**Abstract:** This study examines how inter-organizational business networks build resilience in the face of crises. Prior research has mainly treated structural characteristics and coordination mechanisms as separate explanations of resilience. However, we still lack a clear understanding of how these elements combine to influence resilience outcomes across networks with varying characteristics. We adopt a configurational perspective and investigate how these elements jointly shape networks' time to recovery after disruption. Using survey data on 224 Italian formal business networks ("contratti di rete") and fuzzy-set Qualitative Comparative Analysis (fsQCA), we identify configurations associated with both resilience and non-resilience. The findings show that resilience consistently depends on the joint presence of resource complementarity and relational coordination, while the role of formal coordination varies across network configurations. More specifically, we develop a scale-contingent view of inter-organizational resilience: in small, vertically organized networks, resource complementarity and relational coordination can sustain fast recovery, whereas in large, horizontally organized networks, fast recovery requires formal coordination alongside relational practices. Overall, this study advances a configurational understanding of network resilience by showing that fast recovery depends on distinct combinations of network structure and coordination mechanisms, rather than on any one-size-fits-all network design.

**Keywords:** business networks; resilience; formal coordination; fsQCA

**JEL Classification Numbers:** O32

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# 1 Introduction

Studies on how networks of organizations react to crisis – such as supply chains, innovation ecosystems, humanitarian networks, and trans-organizational systems (Chesley & D’Avella, 2020; Kim et al., 2024; Toufaily & Zalan, 2023) – reveal that inter-organizational resilience cannot be understood as a single capability possessed by individual organizations but as a patterned, collective capacity that allows networks of interdependent firms to sustain or restore functioning when facing external and internal threats.

Within this literature, a central debate concerns how such resilience is achieved. One stream emphasizes network design, highlighting structural features such as size, structure, and resources as key determinants of resilience (Carnovale et al., 2025; Cobben et al., 2026). A second stream foregrounds collaborative and relational practices, arguing that trust, shared understanding, and coordination routines enable collective recovery even under severe disruption (Kim et al., 2021; Guo et al., 2025). These perspectives are often treated as competing explanations, framing resilience as the outcome of either “more structure” or “more collaboration.”

We contend that this opposition may be misleading. Studies on resilient practices and paradoxical organizing show that stability and flexibility, structure and agency, often coexist and interact rather than substitute for one another (Majoer, 2015; Van den Berg, 2021). Similarly, research on ecosystem and supply chain resilience suggests that different combinations of conditions can generate comparable resilience outcomes (Fornasiero & Tolio, 2025; Naderpajouh et al., 2018). Yet, empirical evidence specifying which combinations matter, and under what conditions, remains limited.

Adopting an fsQCA approach for exploring an original dataset of 224 Italian business networks of organizations that signed formal alliances (labelled “contratti di rete”), we identify configurations of network structure and coordination mechanisms that enable networks to recover from crises. Our results show that relational coordination may turn into a liability when it substitutes for resource complementarity or for coordination arrangements suited to larger networks. In doing so, we advance a scale-contingent, configurational theory of inter-organizational resilience: in small, vertically coupled networks, relational and informal coordination can sustain fast recovery, whereas in large, horizontally organized networks, fast recovery requires formal coordination alongside relational practices. By specifying how different configurations of network structure and coordination mechanisms jointly produce resilience, this study contributes to debates on agentic resilience (Kok et al., 2021) and resilient practices (Majoer, 2015) and extends research on inter-organizational systems by moving beyond one-best-way explanations of network resilience.

## 2 Theoretical background

This study aims to explain how inter-organizational business networks build resilience in the face of crisis. Specifically, we examine how structural characteristics and coordination mechanisms combine to produce fast recovery, focusing on configurations of network size, verticality, resource complementarity and overlap, and formal and relational coordination. In doing so, we develop a configurational understanding of network resilience. To motivate this objective, we review the literature and identify the gap this study addresses.

Prior research has highlighted the multiple benefits firms derive from participation in inter-organizational business networks, including enhanced learning and innovation, access to complementary resources, legitimacy, and improved performance outcomes (e.g., Cabigiosu et al., 2024; Provan et al., 2007). Building on this stream, recent research has increasingly shifted attention toward how such networks respond when confronted with disruptive events and crisis conditions (e.g. Chesley & D’Avella, 2020; Kim & Doerfel, 2024). In this emerging literature, crises are understood not merely as episodic shocks affecting individual organizations, but as disturbances that propagate through interdependencies, making network-level characteristics particularly salient (Ilseven & Puranam, 2021). In this instance, relevant network attributes are, on the one hand, structural and compositional features that affect the extent to which disturbances can be absorbed without systemic breakdown and, on the other hand, coordination and collaboration mechanisms that influence the network’s capacity to mobilize resources and support collective recovery. Accordingly, network performance in times of crisis is increasingly conceptualized in terms of resilience, defined as the ability of the network to maintain core functions under stress and to recover its performance trajectory—returning to pre-crisis levels or achieving improved outcomes within a limited time horizon (Hernes et al., 2025).

Concerning the structural characteristics of business networks, resource complementarity—that is, the extent to which partners possess distinct yet interdependent and mutually reinforcing resources—is generally found to be positively associated with network performance (Jin & Wang, 2021). In the context of crises, resource complementarity may be particularly valuable because it enlarges the network’s collective repertoire of resources, thereby increasing its capacity to respond to unexpected disruptions through recombination and redeployment. When shocks undermine established routines or render specific resources temporarily unavailable, networks characterized by complementary resource endowments are better positioned to reconfigure activities and sustain functioning (Duchek, 2020; Williams et al., 2017).

Several scholars emphasize that complementarity does not necessarily imply the absence of similarity between partners. Organizations may simultaneously exhibit complementarity in some resource domains and similarity in others, giving rise to resource-based synergies (Tanriverdi & Venkatraman, 2005). Building on this insight, some studies introduce the notion of resource overlap, which captures the extent to which organizations with different resource endowments may nonetheless share similarities in markets, suppliers, processes, or technological domains (Wang & Zajac, 2007). While prior research offers mixed arguments regarding whether such overlap enhances performance by facilitating coordination and mutual understanding or instead generates competitive tensions, in periods of crisis resource overlap may play a distinct role by supporting network resilience. Specifically, overlap can provide a degree of redundancy and substitutability that allows networks to absorb shocks, compensate for temporarily impaired partners, and reduce dependence on single points of failure. At the same time, shared knowledge bases and overlapping operational domains may facilitate rapid coordination and collective sensemaking (Tasic et al., 2019).

A second relevant aspect in defining the structure of a business network is its degree of verticality, defined as the extent to which network partners are positioned at different stages of the value chain. Whereas some studies (e.g. Runge et al. 2022) argue that vertical relatedness may reduce partners' willingness to share valuable knowledge due to concerns over opportunism and the risk of backward integration, others (e.g., Dyer et al. 2018) suggest that many alliances—particularly buyer–supplier relationships—create value precisely through the combination of complementary tangible assets and specialized capabilities. In periods of crisis, vertical ties can facilitate continuity of operations by securing access to key inputs, coordinating production and distribution activities, and reducing exposure to supply-side disruptions. At the same time, verticality may also introduce vulnerabilities. Power asymmetries and dependency relationships can amplify the impact of disruptions if dominant actors prioritize their own survival or if bottlenecks emerge at specific stages of the value chain. Consequently, the effect of network verticality on resilience is likely to be contingent on how vertical relationships are governed.

A third and final structural characteristic concerns the size of the business network, defined as the number of organizations involved. While a larger number of partners may facilitate risk sharing and increase the pool of available resources and capabilities, prior studies examining the relationship between network size and performance report mixed and inconclusive findings (Heidl et al., 2014). Similarly, in periods of crisis, larger networks can enhance resilience by providing access to a wider range of resources and by increasing the likelihood that at least some partners retain operational capacity when others are disrupted. At the same time, an increase in network size can generate coordination challenges that become particularly salient under crisis conditions. As the number of partners grows, decision-making processes may slow down, communication costs may increase, and the alignment of interests may become more difficult, potentially undermining coherent collective responses. Moreover, large networks may experience difficulties in mobilizing collective action when rapid responses are required, especially in the absence of effective coordination mechanisms (Hillmann, 2021).

The second perspective on network and resilience considers the role of formal and informal coordination mechanisms. As informal coordination mechanisms are concerned, relational coordination theory emphasizes the importance of high-quality relationships and communication in managing interdependencies within and across organizations (Bolton et al., 2021). Relational coordination is likely to significantly improve resilience capabilities, helping networks to reduce the negative effects of environmental adversities. In particular, timely communication ensures that information is shared as soon as it becomes available, reducing delays in decision-making and action. Accurate communication involves sharing precise and reliable information, which is critical for making informed decisions during a crisis. Problem-solving communication focuses on addressing issues collaboratively. This approach fosters a culture of teamwork and collective problem-solving, which is essential to anticipate and manage adversities.

As formal coordination mechanisms are concerned, short- and long-term planning plays a key role in coping with crises as they provide information that helps actors make sense of disruptions, detect anomalies, and reframe assumptions. In addition, they shape behavioral and organizational responding by guiding action through revised procedures, prioritising recovery interventions, and by (re)defining responsibilities. However, plans and organizational structures may also narrow attention and reinforce rigid responses if over-emphasised and not complemented by a more interactively use in the subsequent phases (Malmi et al., 2023).

Overall, while extant research has disentangled the distinct implications of structural characteristics and coordination mechanisms for business network performance and (more limitedly) for resilience, it has predominantly examined these dimensions in isolation. As a result, we still lack a comprehensive understanding of how resilient business networks are characterized by the joint configuration of these multiple dimensions. This gap is particularly salient in light of the renewed relevance of resilience as a performance variable, as the increasing frequency of high-impact, low-probability events—such as the coronavirus pandemic, geopolitical conflicts, and raw material shortages—is increasingly threatening firms.

### **3 Methodology**

We used the Infocamere register of network contracts to identify all network contracts active as of July 3, 2023. On that date, 8,633 networks were recorded, of which 7,493 were neither bankrupt nor dissolved. Contact information was available for approximately 63% of the potential target population (4,720 networks). The effective sample was further reduced by 35% due to compliance with data protection regulations (EU Regulation No. 2016/679, GDPR).

Data were collected using a mixed-mode design combining CAWI (Computer Assisted Web Interview) and CATI (Computer Assisted Telephone Interview) between mid-September and mid-November 2023. Among firms reached by telephone, approximately 90% agreed to provide an email address to receive the survey link, together with the privacy notice and a cover letter describing the study objectives. By the end of the fieldwork, approximately 18% of the initial population of 7,493 networks had completed the questionnaire. Overall, the survey yielded 224 completed questionnaires, corresponding to about 3% of the initial target population.

The survey was administered to a key informant within each network (e.g., network manager, representative of the lead firm, or member of the governing body), asking respondents to refer to the most recent year of network activity. The survey instrument included multiple sections; for the purposes of this study, we focused on items capturing network structural characteristics, coordination mechanisms, and resilience outcomes.

Network size was measured as the total number of member firms. Network verticality was derived from respondents' classification of the network as vertical, horizontal, or mixed, and calibrated to distinguish predominantly vertical versus horizontal configurations. Resource complementarity was measured through a multi-item, 5-point Likert scale assessing the perceived complementarity of tangible resources, managerial experience, and intangible knowledge among partners. Resource overlap was captured using items evaluating similarity in products/services, strategic positioning, and overlap in distributors, clients, and suppliers. Relational coordination was operationalized through items capturing informal interaction, collaborative problem-solving, timely and accurate communication, and overall coordination quality. Formal coordination was measured through items assessing the presence of formal governance mechanisms, structured planning processes, operational plans, formal agreements, and organizational structures.

Finally, resilience was operationalized as time to recovery after major disruptive events, where respondents indicated how long the network took to fully recover from the most severe crisis experienced in the previous three years. This measure was used to distinguish networks characterized by fast versus slow recovery.

To analyze the data, we employed fuzzy-set Qualitative Comparative Analysis (fsQCA; Fiss, 2011) to examine how network characteristics combine to shape resilience, operationalized as (short) time to recovery after disruption (DesJardine et al., 2019). FsQCA is a configurational, set-theoretic approach that allows researchers to move beyond estimating the net effects of independent variables and instead identify how multiple conditions jointly combine into configurations that are (not) sufficient for an outcome. The method is particularly well suited to capturing conjunctural causation (i.e., outcomes resulting from specific combinations of conditions), equifinality (the possibility that multiple pathways lead to the same outcome), and causal asymmetry (the idea that the configurations leading to the presence of an outcome may differ from those leading to its absence).

In line with this approach, we calibrated fuzzy sets for network size, network verticality (vertical vs. horizontal structure), resource overlap, resource complementarity, relational coordination, and formal coordination using theoretically informed thresholds. Calibration transformed raw survey data into set membership scores ranging from full non-membership (0) to full membership (1), enabling the assessment of whether a given network belongs to the set of “large networks,” “high complementarity networks,” or “high relational coordination networks,” and so forth. We then constructed truth tables and applied established consistency and coverage thresholds to identify configurations sufficient for fast recovery and, separately, for the negated outcome (not fast recovery), allowing us to assess asymmetric causal patterns.

In Tables 1 and 2, in which we report our main results, black circles (●) indicate the presence of a condition within a configuration, while crossed circles (⊗) indicate its absence. Blank cells represent “don’t care” conditions, meaning that the presence or absence of that element is not decisive in that specific pathway. Following Fiss (2011), core conditions (large symbols) are those appearing in both the parsimonious and intermediate solutions, whereas peripheral conditions (smaller symbols) appear only in the intermediate solution and play a supporting role within configurations. Consistency values indicate the degree to which networks sharing a given configuration display the outcome (fast or slow recovery), whereas coverage reflects the empirical relevance of each configuration in explaining the observed cases.

As a first step, we conducted the analysis of necessary conditions to identify conditions that are required for the occurrence of the outcome. In fsQCA, a condition is considered necessary (or almost always necessary) when its consistency exceeds the conventional threshold of 0.90. The results show that only the relational coordination index exceeds the 0.90 consistency threshold (consistency = 0.92), indicating that this condition can be considered necessary for the occurrence of the outcome. As a second step, we conducted the analysis of sufficient conditions.

## 4. Results

Table 1 reports the configurations sufficient for resilience (short time to recovery). The analysis identifies three distinct solutions. Across all resilient configurations, two conditions are consistently present: high resource complementarity and strong relational coordination. Differences across configurations concern network scale, network verticality, and the role of formal coordination.

Table 1: Sufficient configurations leading to resilience

|                                     | Configurations |              |             |
|-------------------------------------|----------------|--------------|-------------|
|                                     | 1              | 2            | 3           |
| Network Size                        | $\emptyset$    | $\emptyset$  | ●           |
| Network Verticality                 | ●              | ●            | $\emptyset$ |
| Resource Overlap                    |                | $\emptyset$  |             |
| Resource Complementary Index        | ●              | ●            | ●           |
| Relational Coordination Index       | ●              | ●            | ●           |
| Formal Coordination Index           | $\emptyset$    |              | ●           |
| Raw coverage                        | 0.223          | 0.192        | 0.241       |
| Unique coverage                     | 0.070          | 0.054        | 0.191       |
| Consistency                         | 0.786          | 0.836        | 0.839       |
| <b>Overall Solution coverage</b>    |                | <b>0.469</b> |             |
| <b>Overall Solution consistency</b> |                | <b>0.810</b> |             |

The first configuration describes small, vertically organized networks. In this setting, fast recovery is achieved when high resource complementarity is combined with strong relational coordination, while formal coordination is absent or irrelevant. This solution suggests that in tightly coupled vertical chains, informal coordination is sufficient to enable rapid adjustment, provided that actors' resources and capabilities are well aligned. In such contexts, complementarity enlarges the collective action space of the network, enabling rapid recombination and redeployment of resources when disruptions occur. Relational coordination, in turn, facilitates timely communication and shared problem-solving allowing actors to respond without relying on formalized structures. The absence of formal coordination does not undermine resilience here; rather, it appears functional in small, vertically organized networks where interdependencies are clear and coordination can be achieved through direct relational ties.

The second configuration also applies to small, vertically organized networks but with higher diversity among members. Here again, fast recovery depends on the presence of resource complementarity and relational coordination, without the need for formal coordination structures. Diversity does not undermine resilience in this context: it appears compatible with fast recovery when informal coordination operates on a shared material base. This finding suggests that heterogeneity does not necessarily hinder collective responses during crises, as long as actors share complementary resources and maintain strong relational ties that mitigate the potential coordination costs associated with diversity.

The third configuration pertains to large, horizontally organized networks. In contrast to the small-network solutions, resilience in this context depends on the joint presence of both relational and formal coordination mechanisms, alongside high resource complementarity. Informal coordination alone proves insufficient at this scale. As network size and horizontal complexity increase, formal coordination structures become necessary to clarify responsibilities and manage interdependencies across a larger number of actors. Formal coordination provides a shared reference framework that supports collective action, while relational coordination complements it by enabling flexibility and problem-solving in the face of unforeseen disruptions. This configuration highlights that, in large networks, resilience emerges not from replacing informal coordination with formal mechanisms, but from their mutual reinforcement.

Table 2 reports the configurations sufficient for the negated outcome, non-resilience (long time to recovery). The first configuration concerns small, vertically organized networks characterized by strong relational coordination but low resource complementarity and no formal coordination. Despite high levels of informal coordination, these networks fail to recover quickly, suggesting that relational strength can mask underlying capability misalignment. The second configuration applies to large, horizontally organized and diverse networks lacking both resource complementarity and formal coordination, even when relational coordination is present. In this setting, diversity combined with weak coordination structures generates fragmentation and inhibits effective recovery. The third configuration describes small, horizontally organized and relatively homogeneous networks in which formal coordination is present, but resource complementarity is absent. Here, formal rules and resource overlap among actors do not compensate for misaligned or insufficient capabilities, resulting in rigid responses and slow recovery.

Table 2: Sufficient configurations leading to non-resilience

|                                     | Configurations |              |       |
|-------------------------------------|----------------|--------------|-------|
|                                     | 1              | 2            | 3     |
| Network Size                        | ∅              | ●            | ∅     |
| Network Verticality                 | ●              | ∅            | ∅     |
| Resource Overlap                    |                | ∅            | ●     |
| Resource Complementary Index        | ∅              | ∅            | ∅     |
| Relational Coordination Index       | ●              | ●            | ●     |
| Formal Coordination Index           | ∅              | ∅            | ●     |
| Raw coverage                        | 0.192          | 0.118        | 0.175 |
| Unique coverage                     | 0.123          | 0.051        | 0.073 |
| Consistency                         | 0.797          | 0.830        | 0.877 |
| <b>Overall Solution coverage</b>    |                | <b>0.469</b> |       |
| <b>Overall Solution consistency</b> |                | <b>0.810</b> |       |

## **5. Research limitations**

The present study is not without limitations, which open up avenues for future research. First, our analysis is based on cross-sectional data collected at a single point in time. Although resilience is conceptualized as the capacity to recover from disruption, our design does not allow us to fully capture its temporal unfolding or to observe how configurations may evolve before, during, and after crises. Future research could adopt longitudinal designs to trace how network structures and coordination mechanisms co-evolve over time, shedding light on whether certain configurations are stable or whether networks shift from one resilience pathway to another as disruptions unfold.

Second, the empirical setting is limited to 224 Italian business networks formalized through network contracts. While this context offers a unique opportunity to examine formally recognized inter-organizational arrangements, the sample may not be fully representative of the broader population of Italian networks, nor of networked organizations in other institutional environments. Comparative studies across countries, industries, or governance forms could test the robustness of the identified configurations and explore how institutional frameworks and policy regimes shape resilience pathways.

## **6. Managerial implications**

This study offers practical guidance for managers and entrepreneurs involved in inter-organizational networks facing turbulent environments. Our findings suggest that resilience requires deliberate alignment between network structures and coordination practices. Managers should therefore avoid replicating governance models across different network structures. In smaller and more tightly coupled networks, investing in strong relational coordination, through trust-building, shared problem-solving, and open communication, may be sufficient to sustain adaptive responses. In larger and more complex networks, however, relational embeddedness must be complemented by clearer formal structures, defined roles, and structured decision-making processes to prevent fragmentation and delays during crises. Moreover, resilience is not only a matter of maintaining relationships but of ensuring that partners bring strategically complementary capabilities. Entrepreneurs entering or designing network contracts should therefore carefully assess how resource interdependencies can be mobilized under adverse conditions. Our results also have implications for policy makers, highlighting the importance to respond to crises with differentiated support strategies. Rather than promoting uniform coordination interventions or providing undirected subsidies, policy makers should help networks strengthen governance arrangements and capability alignment according to their structural characteristics. By supporting both coordination capacity and strategic complementarity, policy initiatives can enhance the systemic resilience of business networks exposed to recurring shocks.

## 7. Originality of the paper

In this paper, we explored configurations of inter-organizational business networks (*contratti di rete*) associated with high and low resilience. Structural characteristics and coordination mechanisms of a network are distinct but interdependent aspects that combine in configurations to jointly affect network's capacity to recover from crises. Despite this general wisdom in the resilience literature, studies that explore the combination of those aspects are scant. Consistent with a configurational logic, network resilience does not stem from single optimal design choices, but from distinct combinations of network structure and coordination mechanisms, in which some elements are central while others are absent.

Drawing on research on inter-organizational networks and resilience, this study advances our understanding of how resilience emerges from the joint configuration of network structure and coordination mechanisms, rather than from isolated structural or relational features. While prior research has emphasized either structural characteristics (e.g., size, verticality, resource composition) or coordination mechanisms in explaining network performance and resilience, our findings demonstrate that neither dimension is sufficient on its own.

First, our findings contribute to resilience studies that conceptualize resilience as a dynamic and multifaceted phenomenon, rather than as a single capability or outcome (e.g., Su & Junge, 2023). While prior studies have identified a wide array of resilience-related capabilities and mechanisms—often emphasizing that resilience entails the development of multiple, sometimes overlapping capacities (Duchek, 2020; Hillmann, 2021)—our configurational results show that resilience does not require the simultaneous presence of all such elements. Instead, fast recovery can emerge from distinct combinations of structural characteristics and coordination mechanisms, reinforcing the idea of equifinality in resilience outcomes (Shepherd & Williams, 2023).

Second, by focusing on inter-organizational business networks, this study extends predominantly organization-centric models of resilience to a level where interdependencies, coordination, and collective action become central. Our findings empirically substantiate calls to conceptualize resilience as a system-level property that emerges from interactions among actors, resources, and governance arrangements (Chesley, 2020; Naderpajouh et al., 2018). In doing so, we complement multilevel frameworks of resilience by showing how network-level configurations shape recovery trajectories independently of individual organizational attributes.

Third, our results refine capability-based views of resilience (Duchek, 2020) by demonstrating that the effectiveness of resilience-related capabilities is contingent on network structure. Resource complementarity consistently appears as a core condition across resilient configurations, yet its contribution materializes only when embedded within appropriate coordination arrangements. This finding nuances prior claims that emphasize complementarity as universally beneficial, showing instead that its resilience-enhancing role depends on how resources are mobilized and coordinated across the network.

Fourth, the study contributes to ongoing debates on formal versus informal coordination in resilience processes. Our configurational findings reconcile these perspectives by showing that relational and formal coordination are neither universally substitutive nor universally complementary. In small, vertically organized networks, relational coordination alone can sustain fast recovery, whereas in large, horizontally organized networks, resilience requires the joint presence of relational and formal coordination mechanisms. This insight advances a contingency-based understanding of coordination for resilience, aligned with recent work on balancing risk and resilience in complex networks (Carnovale et al., 2025).

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