

# Design Science for Networks Designing: A Service-Dominant Logic Approach

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**Abstract:** This research explores the dynamics of coopetition among Small and Medium Enterprises (SMEs) during digital transformation, using Design Science Research (DSR) anchored in Service-Dominant (S-D) Logic. It examines the integration challenges of manufacturing SMEs into digital supply chains, highlighting the critical role of coopetition—a blend of competition and collaboration—in driving sustainable growth in this essential sector. Prompted by a consensus on reducing SME vulnerabilities, the study underscores the need for a resilient framework, especially given an 85% attrition rate in digital networks where only a minority, often supported by giants like Amazon and Microsoft, succeeds long-term. The proposed framework focuses on leveraging technology to enhance SMEs' competitiveness, innovation, and growth. This study contributes to academic discourse by suggesting future research directions, such as defining value creation in coopetition networks and assessing the impact of innovative artefacts, but also reveals the potential of coopetition networks as platforms for mutual value creation. This research enriches scholarly discussions on coopetition in the digital age and offers strategic guidance for SMEs navigating digital transformation, aiming to prepare European SMEs for upcoming challenges and opportunities.

**Keywords:** Coopetition, Networks, Small and medium enterprises, Design science research, Service-Dominant logic

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## 1. Introduction

In the digital transformation era, the rapid pace of technological evolution has launched the global economy into a new epoch and fundamentally altered the fabric of business operations (Hernandez *et al.*, 2017). This transformative shift, driven by digital innovation, carries significant repercussions for procurement practices, revolutionizing traditional business methodologies. Within this evolving landscape, Small and Medium Enterprises (SMEs) play an indispensable role; they are the cornerstone of the European economy. European Commission (Di Bella *et al.*, 2023) reported that the EU27 saw over twenty million SMEs operational within the non-financial business sector in 2020, accounting for 99.8% of all businesses and generating upwards of 65% of total employment. This highlights their critical role in bolstering employment and fostering wealth creation, especially within the manufacturing sector—a key component of developed economies (Radicic, Pugh and Douglas, 2020).

However, as SMEs strive to integrate into global digital supply chains, they encounter substantial challenges and opportunities crucial for economic robustness. Scholarly research and policy analysis reveal that optimal integration is achieved within networks that promote cooperation—a synergy of competition and collaboration (Borchert and Bonefeld-Dahl, 2018).

Despite the consensus in business literature and official strategies aimed at mitigating SME vulnerabilities through the generalization of coopetition networks, the BCG Henderson Institute's research, published in the MIT Sloan Management Review (Reeves *et al.*, 2019), reveals concerning trends regarding the "rise and often fall" of these ecosystems. Analysing multiple cases across eleven different sectors, the study uncovered a staggering short-term death rate of over 85%, with less than 15% achieving their long-term goals. The outcomes were categorized as follows: (1) ecosystems that failed at inception, (2) those that quickly gained but then lost market share, (3) ones that saw a gradual decline to non-viability, and (4) a mere 15% that sustained long-term success. In this successful minority, large corporations like Microsoft and Amazon played pivotal roles, securing dominant positions and profit margins exceeding 29%. These thriving ecosystems largely depended on the central, keystone companies, with secondary participants relying more on these leaders than the ecosystem itself.

This study aims to fill a critical void in the existing research on coopetition among SMEs, focusing on the challenges posed by the lack of keystone entities in these networks - a known determinant of network dissolution (Iansiti and Levien, 2004). A question guides this research: How can methodologies be developed to enrich knowledge and fortify coopetition networks among manufacturing SMEs?

Through a comprehensive review of both product-centric and service-centric network theories (Moore, 1998) (Peltoniemi and Vuori, 2004) (Jabbour *et al.*, 2018), alongside empirical insights into the successes and failures of digital networks (Reeves *et al.*, 2019), this paper endeavours to provide an exploration of SMEs' navigation through the intricate dynamics of coopetition technology-enabled networks. Grounded in Design Science Research (Patkar, 2018) and Service-Dominant (S-D) Logic foundations (Vargo and Lusch, 2017), it seeks to establish a structured methodology for designing and validating coopetition networks, thereby informing the development of research proposals.

## **2. Enhancing Methodologies for Coopetition Networks**

As Peffers *et al.* (2007) defined, a methodology provides a comprehensive framework comprising principles, practices, and procedures meticulously crafted for a specific knowledge domain. It is thoughtfully designed to steer the development and execution of varied research initiatives, representing a disciplined approach anchored in research design logic (Patkar, 2018). Such a structured foundation ensures the diligent application of academic methods, promoting the pursuit of knowledge and fostering scholarly advancement within distinct areas of inquiry.

Coopetition is often addressed through Game Theory (Devece, Ribeiro-Soriano and Palacios-Marqués, 2019), which delineates the strategic decision-making dynamics when enterprises engage in simultaneous cooperation and competition (Dagnino and Padula, 2002). Complementing this, the resource-based view (Barney, Wright and Ketchen, 2001) posits that coopetition facilitates firms' access to and sharing of unique resources, securing a competitive advantage (Crick, 2019). The Dynamic Capabilities Framework broadens this perspective (Prasertsakul, 2013), highlighting firms' capacity to adapt resources in response to the evolving market demands swiftly, a critical aspect in the agile digital ecosystem (Teece, Pisano and Shuen, 1997).

Network theory illuminates the strategic significance of inter-firm relationships and connections, particularly for SMEs (Tsujiimoto *et al.*, 2018). It suggests that networks are instrumental in granting access to otherwise inaccessible resources, information, and markets (Granovetter, 1990). Within these networks, keystone firms are indispensable, establishing standards and nurturing an environment conducive to innovation and growth for smaller entities (Iansiti and Levien, 2004). The emphasis on network positioning and the exploitation of social capital underscores the potential for achieving competitive superiority.

The discourse on networks has evolved, revealing a dichotomy between tangible, product-focused views and intangible, service-oriented perspectives (Vargo, 2011). The traditional view of equating value with physical goods is increasingly seen as inadequate for encapsulating the complexities of modern economic exchanges (Vargo, Wieland and Akaka, 2015). This critique has paved the path for the S-D Logic, which revolutionizes the marketing and business strategy landscape by positioning service, not goods, as the essence of economic exchange. S-D Logic community argues that goods serve merely as conduits for service delivery (Edvardsson and Tronvoll, 2013), spotlighting the application of specialized competencies for the benefit of others (Matthies *et al.*, 2016). This paradigm shift redirects focus towards the processes and performances that foster mutual value creation, challenging the conventional goods-centric economic classification (Lusch and Vargo, 2007). It elevates customers to active participants in value co-creation, fundamentally altering traditional consumer behaviour and business strategy perceptions (Joiner and Lusch, 2016; Vargo, Wieland and O'Brien, 2023).

S-D Logic's foundations resonate with a range of theoretical frameworks, including resource-based theory and the dynamic capabilities concept, highlighting its efficacy in elucidating how evolving competencies contribute to value proposition delivery (Akwei, Peppard and Hughes, 2010) (Lindström *et al.*, 2016). Additionally, S-D Logic introduces the notion of service ecosystems, environments where actors create mutual value through service exchange (Bettencourt, Lusch and Vargo, 2014). Drawing inspiration from biological ecosystems, S-D Logic emphasizes the interplay of competitive and cooperative dynamics essential for survival and growth (Peltoniemi and Vuori, 2004) (Vargo and Lusch, 2017).

In the context of SMEs striving for integration into digital supply chains, S-D Logic offers a promising avenue to overcome historical collaboration barriers, thus enhancing digital engagement (Appian, 2021). By adopting a coopetition strategy that harmonizes competition with cooperation, SMEs can more effectively traverse the complexities of digital supply chains, leveraging the foundational principle of mutual value creation to foster innovation, resilience, and growth.

This nuanced approach to understanding and refining coopetition networks among SMEs suggests a departure from the traditional goods versus services dichotomy, advocating for a richer engagement with the intricacies of service exchange and value co-creation. It positions SMEs to unlock innovative pathways for development

and expansion in the digital era, underscoring the transformative potential of embracing service-oriented strategies within coopetition frameworks.

### **3. Navigating Coopetition in SMEs through DSR**

Inspired by Herbert Simon's (1988) vision of a predominantly artificial world, DSR champions a proactive stance towards comprehending and sculpting the constructed environments (Simon, 1988). In addressing the intricate dynamics of SMEs' digital transformation and their engagement in coopetition, Design Science Research (DSR) stands out as a critical methodological approach (Hevner *et al.*, 2004). DSR transcends conventional research paradigms by marrying artefact creation and analytical examination to resolve practical dilemmas and enrich theoretical insights (Peffer *et al.*, 2007).

#### **3.1 DSR's Role in Service Ecosystems and Coopetition Dynamics**

DSR's foundational belief is that progress in knowledge is optimally achieved via the design, crafting, and analytical assessment of artefacts aimed at tackling precise challenges (vom Brocke, Hevner and Maedche, 2020). Its application spans various disciplines, such as engineering, computing, and education, highlighting its adaptability and relevance to a broad spectrum of research inquiries. By prioritizing artefact creation - from constructs and models to methods and implementations - DSR offers a concrete research strategy, empowering scholars to address real-world issues while contributing to academic discourse (March and Smith, 1995). The methodology integrates design science and research design principles, advocating for iterative solution development that bridges the existing state with preferred outcomes (Sun, 2020). Within a triadic cycle of relevance, rigour, and design (Hevner, 2007), DSR ensures that research is anchored in tangible problems, leverages existing knowledge, and persistently seeks innovative solutions. This approach solves immediate challenges, stimulates innovation, and enriches scholarly discussions (Peffer *et al.*, 2007).

DSR is especially pertinent in the realms of networks and SME coopetition. Viewing technology as a dynamic asset and business models as established solutions (Peffer *et al.*, 2007), DSR lays the groundwork for discovering novel paths for value co-creation within intricate networks (Arthur, 2009) (Lusch and Vargo, 2013). This perspective is vital for unravelling the complexities of coopetition, where competitive and cooperative interactions coalesce to drive growth and innovation.

#### **3.2 Technological Artifacts and Institutional Integration in DSR**

Within DSR, technology surpasses its conventional role, emerging as a crucial ecosystem element enabling actor interactions and guiding market institutions' evolution (March and Smith, 1995). As both artefact and value creation catalysts, this expanded interpretation of technology accentuates DSR's significance in exploring the intricacies of coopetition networks and service ecosystems (Akaka, Vargo and Schau, 2015).

Building on Morgan and Hunt's 1994 framework, institutions are portrayed as composites of organizations and regulatory frameworks, which are crucial in shaping the architectures of business models within ecosystems (Morgan and Hunt, 1994). This view emphasizes the importance of dynamic resources and collaborative value generation, suggesting ecosystem interactions mirror and actively sculpt market institutions (Akaka, Vargo and Schau, 2015). Furthermore, the tangible manifestation of intelligence in tools and artefacts (March and Smith, 1995) underscores technology's critical role in the ongoing dialogue on value creation and DSR, affirming DSR's utility in examining coopetition ecosystems for collaborative innovation (vom Brocke, Hevner and Maedche, 2020).

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Moreover, recognizing technology as pivotal artefacts that integrate ecosystems aligns with the institutional perspective on value creation within the DSR framework (Kartemo, Akaka and Vargo, 2017). This viewpoint highlights a self-regulating system of resource-integrating actors united by shared institutional logic and facilitating mutual value creation through service exchange (Lusch, Vargo and Gustafsson, 2016). Thus, DSR emerges as an appropriate methodology to confront the challenges highlighted (Figure 1).

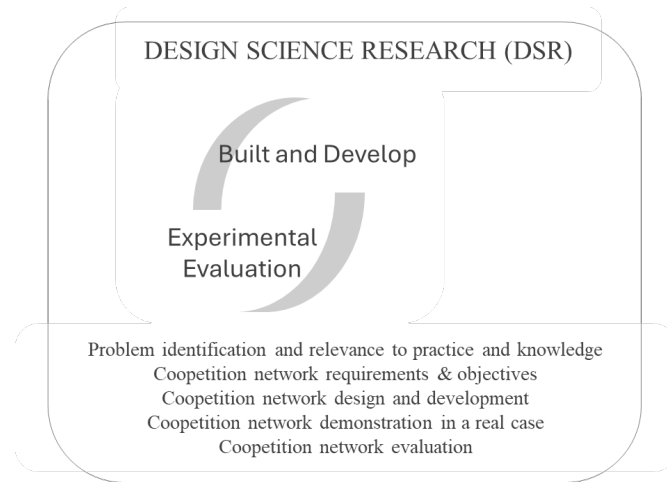


Figure 1: Design Science Research process (adapted from Peffers, 2007)

By spotlighting the critical contribution of manufacturing SMEs to Europe's employment and economic prosperity and underscoring their digital adaptability as essential for survival, the DSR view presents itself as a promising strategy to deepen the understanding and spur innovation within coopetition networks. This structured approach addresses the challenges manufacturing SMEs face in the digital realm. It promotes the development of tangible, inventive solutions to enhance their competitive edge and ensure their long-term viability.

#### 4. Leveraging Design Science Research to Design and Evaluate Coopetition Networks

Drawing from Peffers et al.'s (2007) foundational insights in DSR, and acknowledging the critical role of digital supply chain integration in sustaining manufacturing SMEs as noted by Haleem et al. (2018), this paper introduces a comprehensive framework (Haleem et al., 2018).

This framework is designed to steer academic inquiries within coopetition networks, laying down robust principles and practices. The imperative to consistently exceed customer expectations highlights the risk of providers being rapidly marginalized or excluded from the digital supply chain at the slightest indication of dissatisfaction. This critical requirement resonates with the tenets of Service-Dominant Logic, which posits that value is co-created through persistent service exchanges within ecosystems, fostering innovation as an inherent outcome of these co-creation processes (Akter et al., 2020). The objective is to address the complexities of manufacturing SMEs as they integrate into coopetition networks by (1) Identifying Solutions - exploring knowledge-driven models or constructs to enhance the robustness of manufacturing SME networks. This strategy advocates for a harmonious blend of collaboration and competition, eliminating dependence on any dominant entity; (2) Evaluating Feasibility - conducting thorough assessments of these solutions' practicality and impact within real-world contexts to verify their effectiveness in facilitating manufacturing SMEs' smooth transition into digital supply chains.

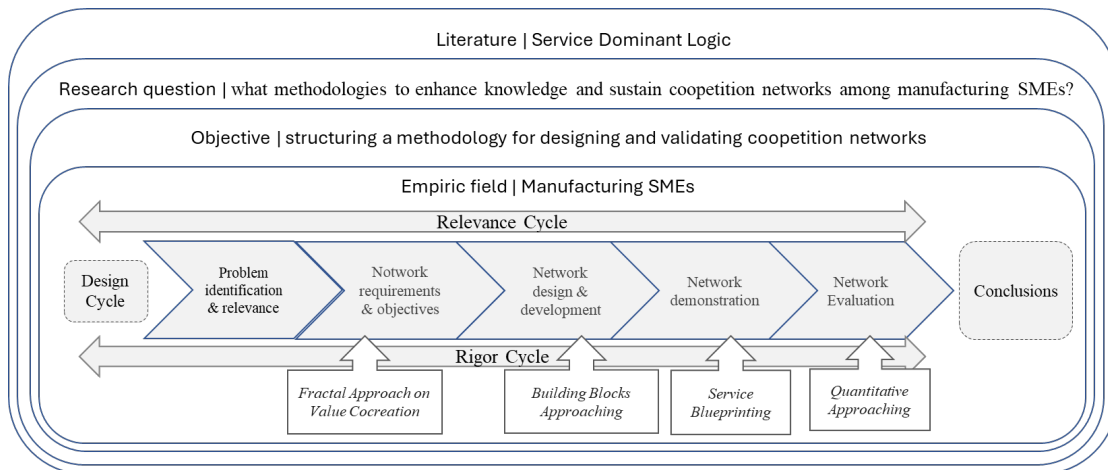


Figure 2: Strategic Framework for Academic Exploration in Coopetition Networks

As represented in Figure 2, the Design Science Research, articulated by Peffers (2007), underscores the importance of engaging in relevance, rigour, and design cycles within research endeavours. This methodological approach demands a comprehensive strategy that includes: (1) defining value creation objectives by pinpointing the necessary advancements within service ecosystems to promote coopetition and value cocreation; (2) tailoring a framework that maximizes value creation opportunities for manufacturing SMEs; (3) validating the framework's applicability and effectiveness by demonstrating practical utility employing case studies focused on manufacturing SMEs; and (4) evaluating impact by assessing the framework's capacity to address and alleviate the digital supply chain vulnerabilities faced by manufacturing SMEs.

This methodical approach aims to systematically cultivate and scrutinise coopetition networks dedicated to value creation, ensuring the strategic development of manufacturing SME resilience and operational efficiency in the digital landscape.

#### **4.1 Research Priority 1**

Building upon the methodological insights of Peffers (2007) and the strategic importance of digital supply chain integration identified by Haleem et al. (2018), a structured framework was proposed. This framework is poised to direct the scholarly investigation within coopetition networks, establishing a robust suite of principles and practices. The imperative of surpassing customer expectations underscores the risk providers face of being rapidly sidelined from the digital supply chain due to dissatisfaction. This underscores the alignment with S-D Logic, which posits value as cocreated through persistent service exchanges within ecosystems, fostering innovation as an intrinsic result of these co-creation activities (Gummesson, Mele and Polese, 2014). The objectives are to address the integration challenges of manufacturing SMEs into coopetition networks by (1) identifying solutions - and exploring knowledge-driven models or constructs to enhance the resilience of manufacturing SME networks. It includes fostering a balance of collaboration and competition, independent of a leading entity; and (2) evaluating feasibility - assessing the practicality and impact of these solutions in real-world scenarios, ensuring they effectively support manufacturing SMEs' integration into digital supply chains. These considerations lead to essential research questions aimed at (1) articulating the performative framework for a coopetition network for value creation, (2) delineating the technical requirements for a system that enables competition in SME networks, and (3) identifying the expected improvements for manufacturing SMEs from a Coopetition network.

#### **4.2 Research Priority 2**

Peffers (2007) emphasizes the design and development phase as critical for defining the desired functionalities, architecture, and artefact creation. Innovative and valuable artefacts must contribute to research, with resources bridging objectives to design and development encompassing relevant theoretical knowledge (Hevner, 2007). Among the DSR methodology's artefact types, models serve as utilities, elucidating processes and outcomes related to focal constructs (MacInnis, 2011). Key inquiries include the design of coopetition technology-enabled network models for value cocreation and the technological artefacts necessary for enabling coopetition in SME networks. Leveraging S-D logic, a foundational approach includes (1) identifying actors involved in resource integration, (2) detailing resource integration and service exchange processes, (3) understanding institutions and institutional arrangements within ecosystems, and (4) developing a technological system to facilitate Coopetition throughout the service process.

#### **4.3 Research Priority 3**

A proof of concept for coopetition networks for value cocreation is paramount (Hevner *et al.*, 2004). It involves demonstrating the coopetition technology-enabled network viability for value creation, particularly its capacity to foster coopetition interactions among manufacturing rivals SMEs. Essential questions include identifying instances where coopetition is enabled by technology within networks. To execute this priority, a proof of concept involves utilizing a technological artefact in manufacturing SMEs, employing service blueprinting to document coopetition interactions, and comparing Coopetition dynamics before and after technology enablement.

#### **4.4 Research Priority 4**

This priority focuses on observing and quantifying the artefact's effectiveness in addressing identified problems (Peffers *et al.*, 2007). The evaluation phase is crucial for assessing the benefits of Coopetition networks for value cocreation concerning manufacturing SMEs' digital supply chain vulnerabilities. The goal is to utilize the developed technological artefact in a specific manufacturing SME case, evaluating their operational

improvements when transitioning to coopetition technology-enabled networks. Research questions revolve around the innovation outcomes attributable to a coopetition network. It involves conceptualizing a framework for assessing manufacturing SMEs' performance improvements, benchmarking quantitative KPIs, collecting data from SMEs transitioning to technology-enabled networks, and evaluating the impact on innovation outcomes. Should the coopetition network not yield expected improvements, a redesign will be considered, adhering to DSR guidelines (Peffer et al., 2007).

## 5. Conclusions

Guided by the research question, "How can methodologies be developed to enrich knowledge and fortify cooperation networks among manufacturing SMEs?", this study systematically addresses the complexities of cooperation in the digital transformation era. Utilizing DSR and the foundational principles of S-D Logic, a comprehensive framework has been developed to enhance the understanding and effectiveness of cooperation networks. These conclusions underscore the necessity for resilient methodologies that foster knowledge enrichment and strengthen the structural and operational aspects of coopetition among SMEs. The proposed framework highlights the indispensable role of technology as both a facilitator and a critical component of these networks, enabling SMEs to achieve competitive advantages, drive innovation, and sustain economic growth.

Furthermore, the research revealed a significant attrition rate within digital networks, indicating a stark survival challenge for SMEs not backed by industry leaders. This finding emphasizes the urgent need for methodologies that promote equitable benefits and ensure the long-term sustainability of coopetition networks.

Looking forward, future research must continue exploring innovative approaches that define value creation, develop and test new artefacts, and assess their practical applications within the ecosystem. Such efforts will advance theoretical understandings and provide actionable strategies for SMEs to navigate and thrive in the evolving digital landscape. Finally, this research contributes to the strategic discourse on cooperation, offering SMEs a pathway to effectively harness the potential of digital transformation and cooperation strategies.

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