



Decoding coopetition performance using impactful coopetition attributes: Evidence from manufacturing companies



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ABSTRACT

The concept of coopetition - simultaneous collaboration and competition between organizations to achieve mutually beneficial outcomes - plays a pivotal role in shaping business performance, particularly during periods of rapid technological advancements. This is especially evident in the manufacturing sector, where innovation and competitive dynamics intersect with economic and social forces. The current academic discourse predominantly focuses on the qualitative identification and analysis of coopetition attributes, leaving a significant gap for large-scale quantitative studies to enable empirical assessment. This study aims to examine the significance of three groups of coopetition attributes for coopetition performance classified into two strategic (*dynamics, paradoxicality*), six relational (*asymmetry, complexity, coopetition intensity, mutual dependence, strength, tensions*), and five behavioral attributes (*competition intensity, conflict, formality, investments, trust*). Using data from 1216 manufacturing firms in Poland and employing a generalized Covariance based Structural Equation Model (CB-SEM), this study offers nuanced insights to the global discourse at the intersection of technological change and social dynamics. The results indicate that the strategic attribute *paradoxicality*, the relational attribute *strength*, and most of the behavioral attributes (*trust, competition intensity, investments, formality*) positively impact coopetition performance. Additionally, a significant negative impact of the strategic attribute *dynamics* was demonstrated, while no significant influence was identified for the remaining relational attributes (*asymmetry, tensions*) as well as the behavioral attribute *conflict*. Diverging from prior qualitative approaches, this study offers data-driven insights for decision-makers navigating societal and technological change, highlighting which attributes should be stimulated to enhance coopetition performance while minimizing the level of dynamics within coopetition strategies.

1. Introduction

In times of rapid technological advancements coupled with profound societal transformations, businesses are increasingly navigating complex and interdependent environments. This evolving landscape has sparked growing interest in the phenomenon of coopetition, defined as "a dynamic and paradoxical relationship, which arises when two companies cooperate in some areas (such as strategic alliances), but simultaneously compete in other(s) [...]" [1, (Bengtsson and Kock, 2000, p.411)]. As technological progress reshapes industries and global markets,

coopetition has emerged as a critical strategy for driving innovation and achieving sustainable competitive advantages, particularly in fostering sustainable firm performance (Mwesiumo, Harun, & Hogset, 2023; Veiga, Herrera-Ballesteros, & Heras-Rosas, 2024). Regardless of organizational size, coopetition is widely recognized as essential for enhancing the performance of both large enterprises (Amata, Dagnino, Minà, & Picone, 2022; Czakon, Mucha-Kuś, & Rogalski, 2014) and SMEs (Garri, 2021), including family-owned businesses (Crick & Crick, 2021a). Furthermore, the role of coopetition for firms' profits (Deng, Guan, & Xu, 2021; Estrada & Dong, 2020; Liu, Li, & Li, 2015a),

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performance (Meena, Dhir, & Sushil, 2023), and success (Quintana-Garcia & Benavides-Velasco, 2004; Raza-Ullah, 2021; Ricciardi, Zardini, Czakon, Rossignoli, & Kraus, 2022) underscores the growing academic interest in understanding coopetition strategies (Dorn, Schweiger, & Albers, 2016).

Despite the growing recognition of coopetition as a strategy with a "performance-enhancing nature" (Crick & Crick, 2019, p.666), its outcomes are not without challenges. While many studies emphasize the positive impact of coopetition on firm performance (Amata et al., 2022; Chen, Luo, & Wang, 2019; Christ, Burritt, & Varsei, 2017; Pellegrin-Boucher, Le Roy, & Gurău, 2013), scholars also caution that the inherent tension between simultaneous cooperation and competition can lead to strategic failure (Bengtsson & Raza-Ullah, 2016). In some cases, results deviate significantly from the intended positive outcomes (Bouncken, Fredrich, Ritala, & Kraus, 2018; Raza-Ullah, 2020), underscoring the need for further research into the mechanisms of coopetition and their impact on performance.

Despite extensive research on coopetition's benefits and challenges, the field remains dominated by conceptual and qualitative studies (Garri, 2021). A significant gap persists in understanding the mechanisms linking coopetition to performance. As Mwesiumo et al. (2023), p.110) note, "*there is a lack of research-based explanations for the underlying mechanism linking these two variables*". In particular large-sample, quantitative studies are recommended (Akpinar & Vincze, 2016; Czakon & Rogalski, 2014).

Given the inherent complexity of coopetition, particularly in shaping performance through specific features attributed to it (Bouncken et al., 2018; Crick, 2019; Raza-Ullah & Kostis, 2020), advancing quantitative research is crucial. While specific environmental characteristics can influence the emergence and success of coopetition (Araujo & Franco, 2017; Klimas, Czakon, & Friedrich, 2022), the external environment is not the sole determinant of coopetition, competitive relationships, and their outcomes (Dorn et al., 2016; Monticelli, Silveira, & Silva, 2018). Internal factors are equally important (Klimas et al., 2022; Ritala & Hurmelinna-Laukkonen, 2013), including attributes assigned to the coopetition phenomena itself (Klimas, Sachpazidu, & Stanczyk, 2023; Kraus, Meier, Niemand, Bouncken, & Ritala, 2018), which are sometimes synonymously referred to as characteristics (Bengtsson & Raza-Ullah, 2016; Dorn et al., 2016; Meena et al., 2023) or features (Czakon & Rogalski, 2014; Klimas, Stańczyk, & Sachpazidu, 2024; Kraus et al., 2018; Tidström & Åhman, 2006). At the organizational level (rather than the environmental level), these coopetition-related attributes are recognized as critical in determining coopetition outcomes, including performance (Dorn et al., 2016; Raza-Ullah, 2021).

Given that coopetition attributes have been recognized as heterogeneous and categorizable into three groups – strategic, relational, and behavioral (Klimas, Stańczyk, & Sachpazidu, 2024; Klimas et al., 2025) – this study investigates the impact of 13 specific attributes on coopetition performance. A quantitative investigation was conducted using a large-sample study of Polish manufacturing companies. The data collection for this study was intentionally restricted to Poland, a choice driven by the recognition that coopetition is profoundly influenced by the specific context of a given country (Czakon et al., 2014; Meena et al., 2023). Firstly, the Polish context is particularly relevant for exploring coopetition due to its unique combination of economic, cultural, and structural factors. As one of the largest economies in Central and Eastern Europe, Poland represents a dynamic and evolving market. Notably, the uniqueness of macro conditions including the dynamics may justify the nationally limited context of research on coopetition (Garri, 2021). Secondly, Poland's unique status as a transition economy, marked by its transformation from a centrally planned to a market-oriented system, provides an ideal context for studying coopetition. Its integration into the European Union has intensified competitive pressures while offering new opportunities, making coopetition a critical strategy for firms (Czakon & Czernek, 2016; Mlody et al.). The country's diverse industrial landscape and systemic transitions further highlight its relevance for

exploring how coopetition attributes influence firm performance. To test and confirm theoretical assumptions, covariance-based structural equation modeling (CB-SEM), which is recommended for theory testing and confirmation (Hair, Matthews, Matthews, & Sarstedt, 2017), is employed.

This study advances coopetition theory and practice in three ways. First, as Crick and Crick (Crick & Crick, 2019) emphasize, the need for larger sample sizes in coopetition research is critical. Our study addresses this gap by empirically exploring the quantitative impact of coopetition attributes on performance with one of the largest datasets to date. Second, our study is one of the first to examine a comprehensive set of 13 coopetition attributes – spanning strategic, relational, and behavioral categories - in the context of coopetition performance. Lastly, this study offers practical, data-driven managerial insights for leaders navigating societal and technological change by identifying which attributes should be strengthened or minimized to optimize coopetition performance. By doing so, we provide actionable guidance for decision-makers to intentionally shape coopetition strategies and enhance business outcomes.

The remainder of the paper is structured as follows: Section two presents the theoretical framework, divided into three subsections of the literature review. These subsections address the polymorphism of attributes associated with the coopetition phenomena and the coopetition performance of competitors, concluding with the formulation of hypotheses. Section three outlines the methodological design, while section four presents the results of the data analysis. Section five discusses the findings, followed by conclusions in section six.

2. Theoretical background

2.1. Polymorphism of coopetition attributes

To gain a profound understanding of the interplay between coopetition and performance, it is crucial to examine the specific attributes that shape coopetition (Dorn et al., 2016; Raza-Ullah, 2020, 2021). The current academic discussion unveils that these attributes can be categorized into three main types: (1) strategic coopetition attributes (*dynamics and paradoxicality*) (Klimas, Stańczyk, & Sachpazidu, 2024), (2) relational coopetition attributes (*asymmetry, complexity, coopetition intensity, mutual dependence, strength, and tensions*) (Klimas, Stańczyk, & Sachpazidu, 2024), and (3) behavioral coopetition attributes (*competition intensity, conflict, formality, investments, and trust*) (Klimas et al., 2025).

In the literature, significant attention has been devoted to emotional (Gernsheimer et al., 2021, 2024a; Ricciardi et al., 2022; Xue, Liu, Geng, Yuan, & Chao, 2023) and strategic attributes (Crick & Crick, 2021b; Gernsheimer et al., 2021, 2024a) and their connections in the context of competitive performance (Raza-Ullah, 2020). While notable importance is placed on trust (Crick, 2019; Czakon & Czernek, 2016; Gernsheimer et al., 2021, 2024a; Raza-Ullah & Kostis, 2020) and the paradoxical nature of this relationship (Gernsheimer et al., 2021; Rai, Gnyawali, & Bhatt, 2023; Raza-Ullah, 2020; Xue et al., 2023), other attributes remain rarely investigated, systematized or ordered. Researchers have also highlighted the lack of quantitative research in this area (Crick & Crick, 2019; Gernsheimer et al., 2021; Klimas et al., 2023), particularly studies adopting a multidimensional approach considering a broader spectrum of attributes and its impact on coopetition performance.

Considering the literature on coopetition more broadly, the main focus is on the features attributed to coopetition, competitors and competitive relationships (Bouncken et al., 2018; Czakon et al., 2014, 2020; Garri, 2021; Gernsheimer et al., 2021, 2024a; Jakobsen, 2020; Lascaux, 2020; Osarenkhoe, 2010; Raza-Ullah & Kostis, 2020). This aligns with the findings of SLRs (Czakon et al., 2014; Gast, Filser, Gundolf, & Kraus, 2015), which emphasize that competitors' performance is determined by the adaptation of coopetition strategies (Le Roy & Czakon, 2016), competitive relationships (Gernsheimer, Gast, & Kanbach, 2024; Raza-Ullah,

2021), and coopetitive behaviors (Zhao, Renard, Elmoukhiss, & Bala-gue, 2016).

2.1.1. Strategic coopetition attributes

Environmental changes can generate and affect new strategies, creating coopetitive advantages (Padula & Dagnino, 2007). Being triggered by changes within the industry and business environment (Akpinar & Vincze, 2016), the simultaneous existence of cooperation and competition inherently makes the coopetition strategy dynamic (Akpinar & Vincze, 2016; Araujo & Franco, 2017; Chen et al., 2019; Crick & Crick, 2019; Gernsheimer, Gast, & Kanbach, 2024; Luo, 2004). These dynamics reveal coopetition as a strategic process in which actors create value through continuous cooperative interactions (Bouncken, Gast, Kraus, & Bogers, 2015; Cozzolino & Rothaermel, 2018; Gernsheimer et al., 2021, 2024a; Monticelli et al., 2018), evolving over time as firms build trust and develop routines. At the same time, coopetition causes paradoxes in the interaction process, and "strategies of managing paradoxical tension and balancing between competition and cooperation become crucial, determining the way rival partners can compete and cooperate simultaneously" (Peng et al., 2018, p. 352). Therefore, dynamics and paradoxicality are considered strategic attributes of coopetition (Klimas, Stańczyk, & Sachpazidu, 2024).

2.1.2. Relational coopetition attributes

The second group of attributes is related to coopetition relationships, referring to the actions of the parties involved (Klimas, Stańczyk, & Sachpazidu, 2024). First, scholars highlight that resource asymmetries can strengthen coopetition relationships (Jakobsen, 2020; Meena et al., 2023; Monticelli et al., 2018; Yoo, Roh, Cho, & Yang, 2022). Asymmetry implies unequal dependence between coopetitors often linked to power imbalances (Jakobsen, 2020; Lechner, Soppe, & Dowling, 2016; Munten, Vanhamme, Maon, Swaen, & Lindgreen, 2021), unequal benefits (Jakobsen, 2020; Monticelli et al., 2018), or differences in size between the parties (Quintana-Garcia & Benavides-Velasco, 2004; Yoo et al., 2019, 2022). Nonetheless, such asymmetries often lead to more cooperative actions (Kwon, Kang, Kim, & Choi, 2020; Osarenkhoe, 2010). Second, as noted by Czakon et al. (Czakon et al., 2014), 57% of papers on coopetition point to complexity when discussing coopetition attributes, rooted in the number and variety of individual actors involved (Geurts, Broekhuizen, Dolfsma, & Cepa, 2022), accounting for the contradictory results in coopetition relationships (Bouncken et al., 2018). The third attribute, intensity, shapes the interdependencies between coopetitors, strengthening and stabilizing relationships by reducing opportunism and conflicts (Lechner et al., 2016). It also reflects the potential benefits of cooperation within these relationships (Rai et al., 2023), while maintaining high levels of competition (Chen et al., 2019) across various products (Rai et al., 2023). Mutual dependence, the fourth attribute, is crucial for the longevity of coopetition relationships as it explains how firms "continue to cooperate over time" (Jakobsen, 2020, p. 257). It ensures balance, as the parties exert equal influence on each other (Muthusamy & Dass, 2021), both structurally and psychologically (Jakobsen, 2020). The fifth attribute, strength, refers to the combination of protective mechanisms in collaboration with competitors (Ritala & Hurmelinna-Laukkonen, 2013), often manifesting in close, informal relationships, such as defending a coopetitor against external threats and supporting their long-term success (Shi, Shi, Chan, & Wang, 2009). Finally, tensions inherent in the paradox of coopetition represent the sixth relational attribute (Jakobsen, 2020; Liu, Yang, & Zhang, 2021). These tensions arise from competing demands, such as balancing cooperation and competition, maintaining closeness while preserving distance, sharing knowledge while protecting it, or navigating the trade-off between value creation and value appropriation (Raza-Ullah, 2020).

2.1.3. Behavioral coopetition attributes

There remain individual layers of relational substance (Osarenkhoe,

2010), individual differences (Ritala & Hurmelinna-Laukkonen, 2013), internal behavioral mechanism (Czakon et al., 2020), and individual coopetitive behaviors (Corbo et al., 2023; Crick, 2021; Klimas et al., 2025) that initiate coopetition and influence its success (Garri, 2021). Behavioral attributes result from the actions and interactions of coopetitors within their relationships (Klimas et al., 2025).

First, since coopetition requires a balancing act between cooperation and competition, adopting an active competitive stance is vital (Bouncken et al., 2018, 2020; Chen & Miller, 2012). Increased cooperation positively correlates with innovation and coopetitive success, while competition can range from low to high in intensity. This attribute is critical, as individual actors' competitive attitude shape power dynamics (Arantes da Costa, Pascoli Bottura, Maurício Gama Boaventura, & Américo Fischmann, 2009).

Second, dependence can be a source of conflict at the individual level (Osarenkhoe, 2010; Tidström, 2014) particularly in role conflicts (Jakobsen, 2020) such as intra-partner, inter-role, inter-partner and personal conflicts (Bengtsson & Kock, 2014). Sharma et al. (Sharma, Young, & Wilkinson, 2015) observe: "lack of conflict (...) provides an environment for personal and social interactions to take place, leading to the development of mutual, positive sentiments, such as liking and respect" (Sharma et al., 2015, p. 49). Reduced conflict promotes harmonious and successful relationships (Leonidou, Katsikeas, & Hadjimarcou, 2002).

Third, formalization may serve as a mechanism to manage tensions in competitive relationships (Amata et al., 2022). Formal agreements become particularly important when the risk of coopetition is high, especially for weaker parties (Dorn et al., 2016). Such "formal safeguarding" (Dorn et al., 2016, p. 489) offers certainty and protection, which fosters innovation (Liu et al., 2021).

Fourth, the uncertainties of coopetition can be mitigated through mutual investment, which leading to greater efficiency (Liu, Li, & Li, 2015b) and enhanced performance (Jakobsen, 2020). These investments include efforts and resources directed towards learning about the systems, procedures, and products, as well as adapting offerings to complement the competitor's (Jap & Anderson, 2007; Kam & Lai, 2018; Klimas et al., 2023; Kusari, Hoefller, & Iacobucci, 2013).

Fifth, fostering trust through information and knowledge sharing is crucial (Bengtsson & Raza-Ullah, 2016; Dorn et al., 2016; Lascaux, 2020; Monticelli et al., 2018). As Jakobsen emphasizes, "trust can fill the gaps in the formal contracts and help to keep the relationship running" (Jakobsen, 2020, p. 253). It is a key attribute for coopetition success (Osarenkhoe, 2010), enabling joint risk-taking (Akpinar & Vincze, 2016), and driving innovation and performance (Lascaux, 2020).

However, it is worth noting that the simultaneous consideration of rational and behavioral aspects in coopetition literature is relatively uncommon. In some cases, coopetition strategies are reduced to behavioral dimensions (Crick, 2021). While such behaviors are inherent in every coopetitive relationship (Corbo et al., 2023), behavioral mechanisms often support rather than replace the strategic, rational decisions made by coopetiting firms (Czakon et al., 2020). Table 1 provides a summary of the three categories of coopetition attributes discussed.

2.2. Performance of coopetitors

Performance is consistently highlighted as a key outcome within the context of coopetition (Bouncken & Kraus, 2013; Crick, 2019; Dorn et al., 2016). Coopetition performance represents a unique and complementary dimension of organizational success, derived from adopting coopetition strategies, and it directly influences overall firm performance (Klimas, Gadomska-Lila, & Sachpazidu, 2024). In the literature, coopetition performance is examined through various perspectives, including functional (Gnyawali & Park, 2009; Ritala & Hurmelinna-Laukkonen, 2009), relational (Bengtsson & Kock, 2000; Peng, Yen, & Bourne, 2018), and temporal approaches (Raza-Ullah, 2020; Ricciardi et al., 2022), as well as paradoxical cooperation focused

Table 1
Ordered and systematized attributes of coopetition.

Categories of Attributes	Strategic Attributes	Relational Attributes	Behavioral Attributes
Level of Analysis Determinant	Organization/Strategic Distinguishing nature of coopetition and specificity of adopted coopetition strategy	Dyad/Tactical Specificity of relationship linking coopetitors	Action/Operational Specificity of coopetitors' behaviors
Specific Attributes	Dynamics Paradoxicality	Asymmetry Complexity Coopetition intensity Mutual dependence Strength Tensions	Competition intensity Conflict Formality Investments Trust

Source: Own illustration following (Klimas et al., 2023, Klimas, Stańczyk, & Sachpazidu, 2024, Klimas et al., 2025)

on financial performance (Bouncken & Kraus, 2013; Monticelli et al., 2018; Peng et al., 2018). It should be emphasized that coopetition performance is inseparable from the concept of coopetition itself and is attributed exclusively to those adopting respective strategies, engaging in coopetitive behaviors, or leveraging coopetitive relationships in an emergent manner (Bouncken & Fredrich, 2012; Klimas, Gadomska-Lila, & Sachpazidu, 2024; Rai et al., 2023; Raza-Ullah, 2020; Raza-Ullah & Kostis, 2020).

Consolidating insights from various scholars (Bouncken et al., 2015; Bouncken & Fredrich, 2012; Rai et al., 2023; Raza-Ullah, 2020, 2021; Ricciardi et al., 2022), Klimas et al. (2024) propose an integrative understanding of coopetition performance. They define it as management's assessment of a firm's success stemming from its cooperative and competitive interactions. Coopetition performance reflects a company's ability to achieve or exceed expected outcomes of coopetition, generating benefits in financial, market, innovation, customer, and resource aspects, thereby enhancing both the company's short- and long-term competitiveness. This conceptual framework is adopted in the present study.

2.3. Hypotheses development

Previous research has indicated that the success of coopetition, and thus its beneficial impact on firm performance, may depend on the specific attributes of coopetition itself (Bouncken et al., 2018; Crick, 2019; Raza-Ullah, 2021; Raza-Ullah & Kostis, 2020; Ricciardi et al., 2022; Veiga et al., 2024). Several studies have also identified certain attributes as critical success factors in coopetition (Dorn et al., 2016; Garri, 2021; Geurts et al., 2022; Osarenkhoe, 2010; Peng et al., 2018; Raza-Ullah, 2020). Moreover, it is essential to consider these attributes at different levels of competition, as individual actors influence organizational decision-making, which, in turn, co-creates value at the industry level (Garri, 2021). Therefore, the general hypothesis posited is that the attributes related to coopetition positively impact coopetition performance.

As Monticelli et al. (Monticelli et al., 2018) highlight, the strength of coopetition lies in its ability to generate success in response to external environmental changes. The coopetition strategy has garnered growing interest as it integrates both competition and cooperation, which are crucial for achieving positive coopetition outcomes such as value co-creation (Garri, 2021; Rai et al., 2023), superior value creation (Kostis, Albers, Vanderstraeten, Chinchanikar, & Bengtsson, 2024), effectiveness (Le Roy & Czakon, 2016), innovation (Czakon et al., 2014; Dorn et al., 2016), long-term success (Eriksson, 2008; Monticelli et al., 2018), longevity (Peng et al., 2018) and even survival (Vlaisavljevic, Gopalakrishnan, Zhang, Cabello-Medina, & Guilbault, 2022). A

coopetition strategy enables coopetitors to leverage both cooperation and competition to improve performance (Kwon et al., 2020).

The success of the coopetition strategy depends on balancing cooperation and competition (Christ et al., 2017; Eriksson, 2008; Garri, 2021; Kostis et al., 2024; Lado, Boyd, & Hanlon, 1997), particularly during the dynamic evolution of these relationships (Czakon & Rogalski, 2014; Luo, 2004; Peng et al., 2018). The strategic paradox of coopetition creates opportunities to achieve maximum performance when this balance is successfully maintained (Peng et al., 2018). Thus, the paradoxical nature of coopetition can have a positive impact (Bouncken et al., 2018), provided that the tension between cooperation and competition is managed effectively (Gernsheimer, Kanbach, Gast, & Le Roy, 2024; Jakobsen, 2020). Hence, we hypothesize as follows:

Hypothesis 1. (H1): Strategic coopetition attributes positively impact coopetition performance.

Peng et al. (Peng et al., 2018) state that the essence of coopetition is to maintain sustainable, long-term relationships that generate mutual benefits and value creation. Garri (Garri, 2021) adds that valuable coopetitive relationships are grounded in openness, ongoing communication, resource sharing, and trust-building activities for mutual benefits. These relationships can yield positive effects on performance through interaction (Monticelli et al., 2018; Park & Kim, 2021). Interestingly, asymmetry between coopetitors can be beneficial for coopetition success (Jakobsen, 2020), as it offers complementary strengths (Jakobsen, 2020; Kwon et al., 2020; Monticelli et al., 2018; Osarenkhoe, 2010), contributing to innovation and success. Additionally, the intensity and complexity of relationships reflect coopetition's advantages (Geurts et al., 2022; Mariani & Belitski, 2023), often driving innovative outcomes (Bouncken et al., 2018). However, the paradoxical nature of coopetitive relationships can result in tensions (Bouncken et al., 2018; Dorn et al., 2016; Gernsheimer, Kanbach, et al., 2024; Ritala & Hurmelinna-Laukkonen, 2009; Tidström, 2014), which, while challenging, may also in turn lead to positive consequences for efficiency and innovation (Jakobsen, 2020; Raza-Ullah, 2020). Dependence is frequently cited as the primary source of tension (Jakobsen, 2020; Rajala & Tidström, 2021; Tidström, 2014). Jakobsen (Jakobsen, 2020) posits that mutual dependence, facilitated by joint actions and high-quality information exchange, can influence knowledge distribution among partners and is vital for firm performance. Considering the impact of the relational attributes of coopetition, we hypothesize as follows:

Hypothesis 2. (H2): Relational coopetition attributes positively impact coopetition performance.

Individual attributes also shape coopetitive relationships as they stem from individuals' expectations "but differ markedly in the objects of the individuals' positive feelings" (Lascaux, 2020, p. 9). Some studies suggest that the dominance of competition over collaboration can hinder coopetition performance (Czakon et al., 2014). While cooperation may yield early-stage benefits in coopetition (Park & Kim, 2021), as relationships evolve, competition becomes more significant for achieving success (Peng et al., 2018) and plays a vital role in coopetition effectiveness (Bengtsson & Kock, 1999). Emerging tensions from coopetitive relationships can lead to role conflicts (Dorn et al., 2016), and generally, the absence of such conflicts fosters a positive atmosphere for coopetition success (Leonidou et al., 2002; Sharma et al., 2015). The absence of conflicts is directly linked to value-based commitment (Sharma et al., 2015), fostering trust in relationships (Lechner et al., 2016). Trust is a key driver of coopetition success (Christ et al., 2017; Czakon & Czernek, 2016; Dorn et al., 2016; Garri, 2021; Gernsheimer, Gast, & Kanbach, 2024; Lascaux, 2020; Osarenkhoe, 2010). Building trust and goodwill reduces tension, encourages interaction, and enhances innovation (Lascaux, 2020). Higher levels of trust in coopetition enhance (1) relational satisfaction, (2) inter-firm learning and innovation performance, and (3) the attainment of coopetitive goals (Lascaux, 2020). At the

individual level, tension-regulating mechanisms such as formalization (Amata et al., 2022) and investments (Liu et al., 2015a) are crucial. Formalization promotes the achievement of common goals (Osarenkhoe, 2010) and supports innovation (Liu et al., 2021). Joint investments directly enhance the effectiveness of coopetition (Liu et al., 2015b) and performance (Jakobsen, 2020). Hence, we hypothesize as follows:

Hypothesis 3. (H3): Behavioral coopetition attributes positively impact coopetiton performance.

Fig. 1 presents an integrated view of the hypotheses, illustrating the relationships between the three different types of coopetition attributes and coopetition performance.

3. Methodological design

This study investigates the significance of coopetition attributes for coopetition performance as part of a long-term research project. This project involved (1) identifying and categorizing coopetition attributes through a systematic literature review (Klimas et al., 2023), (2) verifying these attributes and proposing operationalizations through focus group interviews (Klimas, Gadomska-Lila, & Sachpazidu, 2024; Klimas, Sachpazidu, Stańczyk, Kawa, & Nadolny, 2025; Klimas, Stańczyk, & Sachpazidu, 2024), and (3) testing the developed operationalizations in a large-scale quantitative study to assess their impact on coopetition performance, with the latter being the focus of this research paper. In the quantitative phase, we examine how three groups of coopetition attributes - strategic, relational, and behavioral – influence coopetition performance.

3.1. Sampling and data collection

The study focuses on the manufacturing industry, given the high relevance and applicability of coopetition within this sector (Kraus, Schmid, & Gast, 2017; Pereira & Leitão, 2016), where innovation and competitive dynamics intersect with economic and social forces. Thus, Polish manufacturers with experience in implementing coopetition strategies were targeted, and additional filtering questions were used to identify past coopetition experiences and the duration of strategic cooperation with competitors. The gathered large sample consisted of 1231 manufacturing companies classified according to the Polish Classification of Business Activity.¹ In total, these comprise 13 sections of the Polish Classification of Activities: food products manufacturing, beverage manufacturing, tobacco products manufacturing, textile products manufacturing, clothing manufacturing, leather and leather products manufacturing, manufacturing of wood and cork products, excluding furniture; manufacturing of straw and woven material products, paper and paper products manufacturing, printing and reproduction of recorded media, furniture manufacturing, other products manufacturing, manufacturing of basic pharmaceutical substances and pharmaceutical products, manufacturing of computers, electronic and optical products.

Data was collected following the single-informant approach, with informants being individuals knowledgeable about the company's cooperation with direct and/or indirect competitors. This included personnel in managerial positions ($N = 600$), those responsible for executing cooperation at the operational level ($N = 626$), and others ($N = 5$). Data was gathered by a research agency using a mixed-mode approach, integrating three data collection techniques: computer-assisted telephone interviews (CATI), computer-assisted website interviews (CAWI) and computer-assisted website interviews supported by telephone. The data collection took place between January and February 2023.

¹ <https://www.biznes.gov.pl/pl/tabela-pkd>.

3.2. Measurement of variables

The independent variables in our study – strategic, relational, and behavioral coopetition attributes – were measured using theory-based multi-item scales verified through focus group interviews (Klimas, Stańczyk, & Sachpazidu, 2024; Klimas et al., 2025). First, strategic attributes were assessed using 14 items: *dynamics* (7 items) and *paradoxicality* (7 items). Second, relational attributes were measured using 41 items: *asymmetry* (6 items), *complexity* (5 items), *coopetition intensity* (12 items), *mutual dependence* (5 items), *strength* (8 items), and *tensions* (5 items). Third, behavioral attributes were measured using 28 items: *competition intensity* (6 items), *conflict* (6 items), *formality* (5 items), *investments* (5 items), and *trust* (6 items). The survey questionnaire with basic validity measures is provided in the appendix.

Coopetition performance as the dependent variable was measured using 9 items, including 6 items used by Raza-Ullah (Raza-Ullah, 2020, 2021) and Raza-Ullah and Kostis (Raza-Ullah & Kostis, 2020) and 3 additional items developed by Klimas et al. (Klimas, Gadomska-Lila, & Sachpazidu, 2024). However, during preliminary analyses, one of the items recommended by Klimas et al. (Klimas, Gadomska-Lila, & Sachpazidu, 2024), namely q0029_0009, was excluded from the analysis as it disrupted the structure of the measure model by generating unexpected negative results. Consequently, the dependent variable was measured using 8 indicators (see Appendix, Table A).

Most measurements took the form of positive statements. In some exceptions, reverse coding was applied. Typically, as for research in social sciences and those applying structural equation modelling, a 7-point Likert scale (ranging from 1 – "strongly disagree" to 7 – "strongly agree" with the central level of 4 – "neither agree nor disagree/I do not know") was used in our survey questionnaire.

3.3. Preliminary data analysis

Preliminary data analysis aimed at assessing the quality of raw data quality revealed no missing values. However, one duplicate and fourteen outliers were removed, leaving a final sample of 1216 observations for hypothesis testing. Tests for normality following Kolmogorov-Smirnov and Shapiro-Wilk indicated a non-normal distribution, but acceptable levels of kurtosis (kurtosis <2 ; the lowest absolute kurtosis value in the dataset = 0.009 while the highest = 1.405) and skewness (skewness <1 ; the lowest absolute skewness value in the dataset = 0.047 while the highest = 0.950) suggested the data approximated normality.

Reliability (using Cronbach's alpha), validity (using average variance extracted (AVE), and composite reliability (CR) were tested, showing that dependent and independent variables were reliable and valid, except for two relational attributes (coopetition intensity and mutual dependences). In general, they show that our independent and dependent variables are reliable (all considered variables) and valid (except for two relational attributes, namely coopetition intensity and mutual dependence).

3.4. Core data analysis

We employed structural equation modeling (SEM) to test our hypotheses (Hair, Black, Babin, Anderson, & Tatham, 2019). Specifically, we used Covariance-based SEM (CB-SEM), which is suitable for theory-driven research, not intended to make predictions. We used a reflective approach in measurement, and our sample was large (Hair et al., 2017). This approach allowed us to examine directional and complex relationships between the variables by comparing covariance matrices of theoretical and empirical measures and assessing the degree of fit of the model. Model fit was assessed and revised where necessary to meet the fit criteria. Once the model met the criteria, conclusions were drawn from the analysis. We conducted SEM using IBM SPSS Amos (ver. 24), integrated with the IBM SPSS Statistics package.

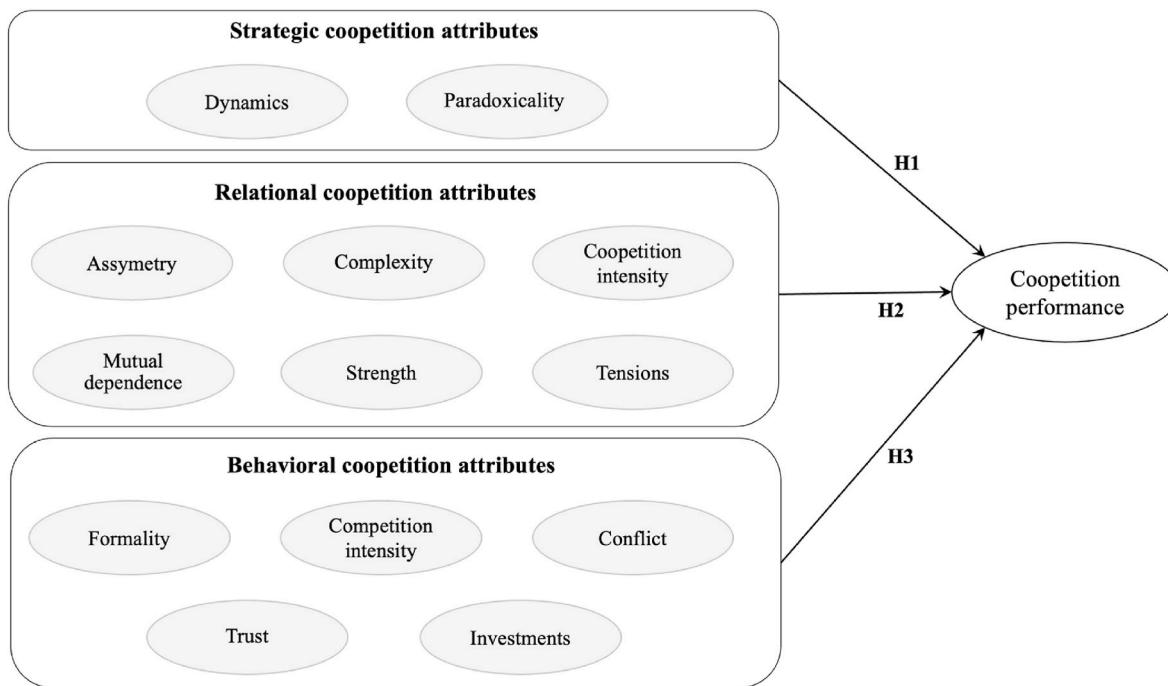


Fig. 1. Conceptual model.

Source: Own illustration

4. Results

Given that all three attributes of coopeetition strategy consist of latent variables, and each is assumed to impact coopeetition performance, we developed three structural models in IBM SPSS Amos, with each focusing on specific hypotheses formulated in our study. The results for each model are presented in the following section. All models were validated.

4.1. Strategic attributes

First, we analyzed reliability and tested for convergent and discriminant validity. Cronbach's alpha values for the variables were within the acceptable range of 0.7–0.95, confirming the reliability of the developed measures (Tavakol & Dennick, 2011). To assess convergent validity, we examined standardized factor loadings, composite reliability (CR), and average variance extracted (AVE). All standardized factor loadings, except for item q0024_0007 referring to paradoxicality, exceeded 0.5. This item was subsequently removed from the model. The CR values of both variables were greater than 0.7 (Bagozzi, Yi, & Phillips, 1991). The recommended AVE level (at or above 0.50) was achieved for dynamics. Although the AVE for paradoxicality was below 0.5, the construct's convergent validity is still considered adequate if the AVE is at least 0.40 and the CR is higher than 0.60 (Fornell & Larcker, 1981), thereby meeting the convergent validity criterion. Next, we tested for discriminant validity by comparing the squared correlations of each construct with AVE. The squared correlations were less than the AVE, discriminant validity was confirmed, which can be seen in Table 2.

Based on this positive model validation, we constructed a structural

model for the strategic attributes. To enhance the quality of the model fit, a modification index (MI) analysis is recommended (MacCallum, Roznowski, & Necowitz, 1992). If $MI > 4$, the covariance of errors within the given factor can be determined. In our model, we assumed a more restrictive criterion, where $MI > 10$. The model, including correlation strengths, standardized factor loadings, and associated errors is visualized in Fig. 2.

We assessed the model's goodness of fit, which demonstrated strong alignment with the observed data. The chi-square (χ^2) of 2.319, well below the acceptable maximum threshold of 5, and a significance level of $p < 0.001$ indicate that the model is statistically significant, robust and well-balanced, avoiding unnecessary complexity. The Goodness-of-Fit Index (GFI) of 0.971 and its adjusted counterpart, the Adjusted Goodness-of-Fit Index (AGFI) at 0.959, signify that the model explains a substantial proportion of variance, as both exceed the standard threshold of 0.9. Further, the Normed Fit Index (NFI) of 0.966, the Incremental Fit Index (IFI) of 0.980, and The Tucker-Lewis Index (TLI) of 0.974 provide evidence of strong comparative fit, as values near 1 are ideal. The Parsimony Goodness-of-Fit Index (PGFI) of 0.689 and the Parsimony Normed Fit Index (PNFI) of 0.754, exceeding the acceptable threshold of 0.6, highlight the model's balance between simplicity and explanatory power. The Root Mean Square Error of Approximation (RMSEA) is 0.033, with a 90% confidence interval ranging from 0.031 (LO 90) to 0.039 (HI 90), indicating minimal approximation error, as values below 0.05 represent an excellent fit. The Comparative Fit Index (CFI) of 0.980, nearly reaching the ideal value of 1, further confirms exceptional overall fit. Collectively, these indices demonstrate that the model is well-constructed, statistically sound, and highly effective in capturing the key dimensions of the data (Jannoo et al., 2014).

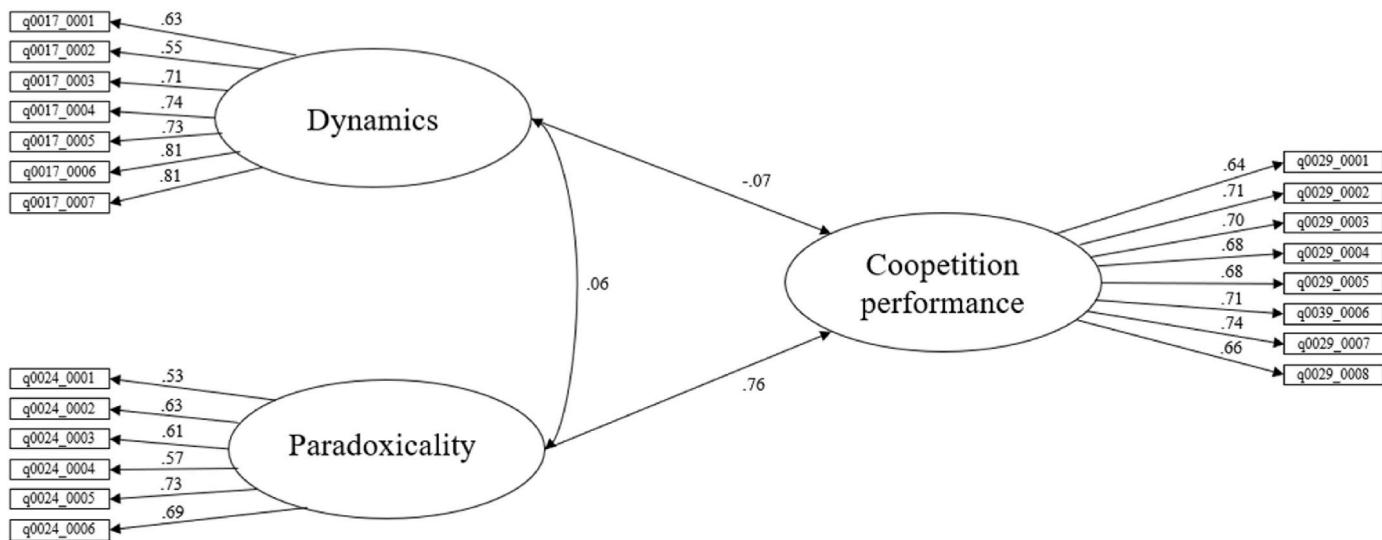
Moreover, we examined the relationships between variables in the strategic attributes model. Both correlations were statistically significant, which can be seen in Table 3.

Given the obtained results, it can be concluded that hypothesis H1: *Strategic coopeetition attributes positively impact coopeetition performance*, may be partially supported. While paradoxicality positively impacts coopeetition performance, dynamics exhibit statistically significant but very slightly negative effect.

Table 2

Reliability, convergent and discriminant validity for the strategic attributes model.

Parameter	α	CR	AVE	Dynamics	Paradoxicality
Dynamics	0.889	0.887	0.533	0.730	
Paradoxicality	0.805	0.796	0.397	0.056	0.630

**Fig. 2.** Structural model of strategic attributes (standardized estimates).

Source: Own illustration

Table 3
Relationship between constructs in the strategic attributes model.

Path	Standardized parameter
Dynamics → Coopetition performance	-0.067*
Paradoxicality → Coopetition performance	0.757***

***p < 0.001, *p < 0.05.

4.2. Relational attributes

For relational attributes (*asymmetry, complexity, coopetition intensity, mutual dependence, strength, and tensions*), all Cronbach's alpha values range between 0.7 and 0.95, confirming the reliability of the developed measures. Six standardized factor loadings (q0013_0001, q0013_0002, q0013_0003, q0013_0004, q0013_0006 and q0016_0004 – all related to coopetition intensity) were below 0.5, leading to their removal from the model. While all CR values were above 0.7, the AVE values were below 0.5. Despite this, the convergent validity of for tensions, asymmetry, complexity and strength was still deemed adequate, as their AVEs were at least 0.40 and CRs were higher than 0.60. However, coopetition intensity and mutual dependence did not meet the convergent validity criterion. Discriminant validity was confirmed for asymmetry, strength, and tensions, as their squared correlations were less than their respective AVEs. Only these three variables confirmed both reliability and validity of the developed measures, as shown in Table 4. The inability to meet the criteria for convergent validity suggests that the observed items for coopetition intensity and mutual dependence exhibit insufficient shared variance with their respective constructs. This issue may stem from inadequately defined items, measurement errors, or the inherent complexity of operationalizing these constructs. The exclusion of certain items and the failure of these two attributes to fulfill validity requirements could constrain the generalizability of findings associated

with coopetition intensity and mutual dependence. Nonetheless, the confirmed reliability and validity of the attributes asymmetry, strength, and tensions offer a robust basis for the interpretation of the structural of relational attributes, which is presented in Fig. 3.

The results of the assessment confirm a very good model fit [CMIN/DF = 2.111 and p < 0.001, GFI = 0.964, AGFI = 0.953, NFI = 0.956, IFI = 0.977, TLI = 0.972, PGFI = 0.752, PNFI = 0.804. RMSEA = 0.030, LO 90 = 0.027, HI 90 = 0.034, CFI = 0.976]. Finally, we examined the relationships between reliable and valid relational attributes and coopetition performance. All correlations were statistically significant (see Table 5). Given the obtained results, *H2: Relational cooperation attributes positively impact coopetition performance*, should be rejected as only strength had a positive and significant impact on coopetition performance. In contrast, asymmetry and tensions (reverse coded) indicated significant but negative impacts, assuming that we consider a set of these three as relational attributes of coopetition.

4.3. Behavioral attributes

For behavioral attributes, a formerly developed and multidimensionally validated measurement model was used. At the stage of validating the measurement model, all Cronbach's alpha values exceeded 0.7 and were below 0.95, all standardized factor loadings were above 0.5, AVE levels were higher 0.5, and all CRs were above 0.7 (Klimas et al., 2025). Using this valid measurement model for behavioral attributes, we examined the relationships between these attributes and coopetition performance. The structural model is shown in Fig. 4. The results of the evaluation indicate a very good model fit [CMIN/DF = 2.139 and p < 0.001, GFI = 0.947, AGFI = 0.938, NFI = 0.949, IFI = 0.972, TLI = 0.969, PGFI = 0.802, PNFI = 0.850. RMSEA = 0.031, LO 90 = 0.028, HI 90 = 0.033, CFI = 0.972].

The detailed results, depicted in Table 6, reveal that all the

Table 4
Reliability, convergent and discriminant validity for the relational attributes model.

Parameter	α	CR	AVE	Asymmetry	Complexity	Coopetition intensity	Mutual dependence	Strength	Tensions
Asymmetry	0.842	0.797	0.401	0.634					
Complexity	0.867	0.804	0.454	-0.167	0.674				
Coopetition intensity	0.865	0.797	0.374	-0.166	0.708	0.612			
Mutual dependence	0.780	0.712	0.311	-0.079	0.473	0.678	0.557		
Strength	0.880	0.870	0.432	-0.133	0.451	0.603	0.657	0.657	
Tensions	0.883	0.828	0.496	0.237	-0.108	-0.093	-0.159	-0.091	0.612

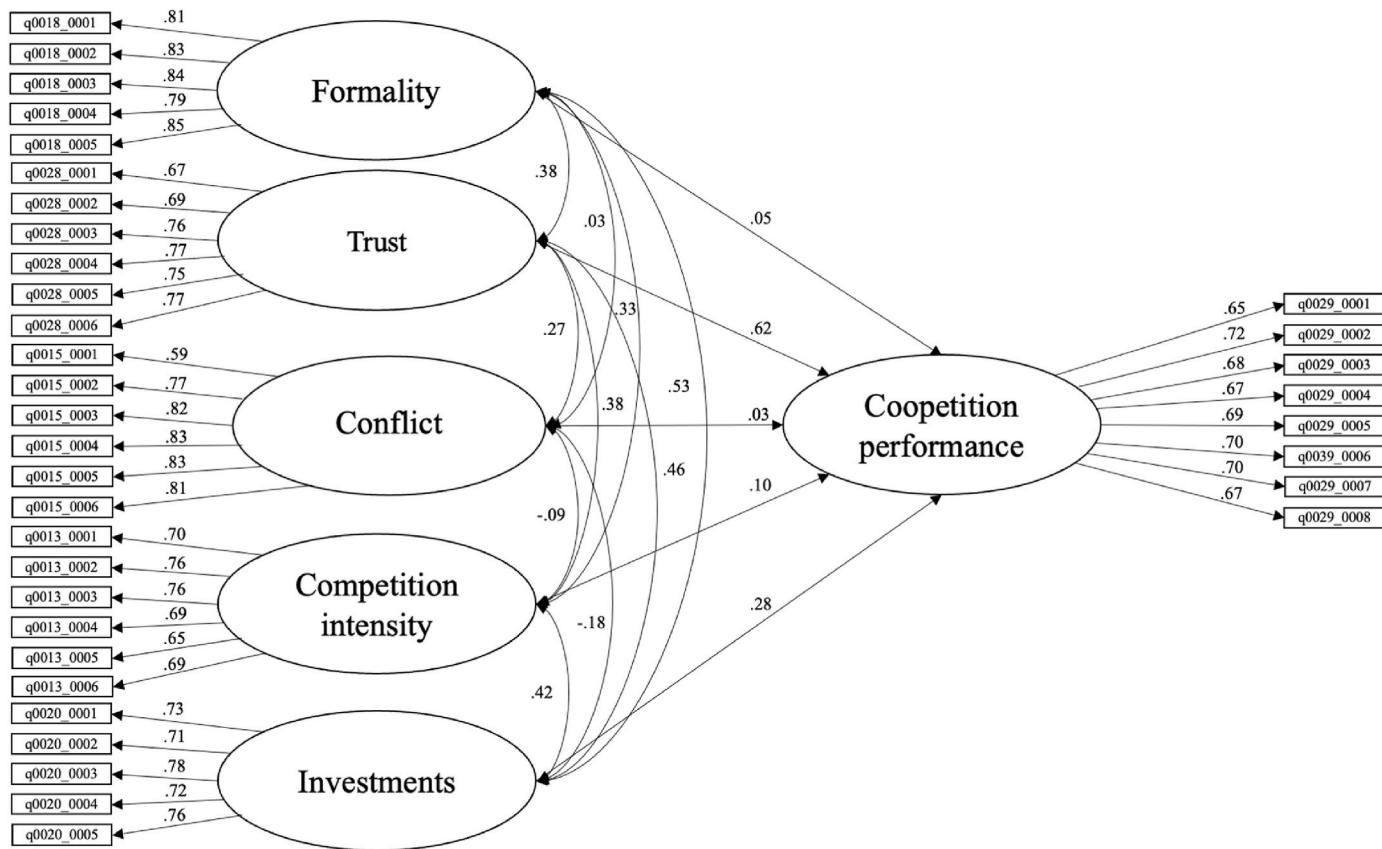


Fig. 3. Structural model of relational attributes (standardized estimates).

Source: Own illustration

Table 5
Relationship between constructs in the relational attributes model.

Path	Standardized parameter
Asymmetry → Coopetition performance	-0.062*
Strength → Coopetition performance	0.727***
Tensions (R) → Coopetition performance	-0.058*

***p < 0.001; *p < 0.05 (R) – reverse coding.

behavioral attributes positively impact coopetition performance, except for *conflict* (reverse coded), where the effect was not statistically significant. This leads us to conclude that our third hypothesis – *H3: Behavioral competition attributes positively impact coopetition performance* – is partially supported.

5. Discussion

In line with the role of coopetition attributes in influencing coopetition performance, as identified in the literature (Bengtsson & Raza-Ullah, 2016; Dorn et al., 2016; Klimas et al., 2023; Raza-Ullah, 2021; Tidström & Åhman, 2006), this study tests the assumed positive impact of these attributes. The results generally confirm the statistical significance of these attributes, though the direction of their influence is not uniformly positive across all strategic, relational, or behavioral attributes.

Regarding the attributes characterizing coopetition strategies, both paradoxicality and dynamism were found to significantly impact coopetition performance, with paradoxicality exhibiting a greater positive effect. This confirms the general assumption that coopetition strategies create value-generating opportunities (Bouncken et al., 2015; Chiambareto, Maurice, & Willinger, 2020; Garri, 2021; Peng et al., 2018; Rai

et al., 2023). However, the slightly negative impact of dynamism on coopetition performance is also justifiable. High variability in coopetition strategies, actions, and tasks may cause delays and hinder goal attainment (Bengtsson & Raza-Ullah, 2016; Bouncken et al., 2018; Bouncken & Kraus, 2013; Raza-Ullah, 2020). Nonetheless, given that coopetition is a favored strategy for dynamic and fast-growing industries, some degree of dynamism is necessary (Crick & Crick, 2019; Gernsheimer, Kanbach, et al., 2024; Telg, Lokshin, & Letterie, 2023), which can explain why the negative impact is minimal.

The results for relational attributes indicate that strong relationships, including a low propensity to change competitors, and good relationships – both formal and informal – lead to greater coopetition performance. This confirms previous findings regarding the importance of relational strength (Corbo et al., 2023; Dorn et al., 2016; Park, Srivastava, & Gnyawali, 2014). Conversely, asymmetry in resources, size, power imbalances, and high levels of tension, including issues related to sharing versus protecting knowledge and co-creation versus appropriation of value, decrease coopetition performance. These findings align with previous research indicating that while both asymmetry (Jakobsen, 2020; Kwon et al., 2020; Le Roy & Czakon, 2016; Lechner et al., 2016; Monticelli et al., 2018; Osarenkhoe, 2010) and tensions (Bouncken et al., 2018; Gernsheimer, Kanbach, et al., 2024; Jakobsen, 2020; Liu et al., 2021; Rai et al., 2023) are necessary to some extent, they should be closely monitored, as excessive levels are harmful, even destructive (Dorn et al., 2016; Meena et al., 2023) for coopetition relationships. Thus, as also prior research consistently suggests, excessive tension reduces coopetition performance but also hints at the potential for moderate tension to foster positive outcomes by stimulating innovation and problem-solving (Czakon et al., 2020; Munten et al., 2021). However, determining an optimal level of tension is challenging, as it depends on various contextual factors, such as industry characteristics, the nature of

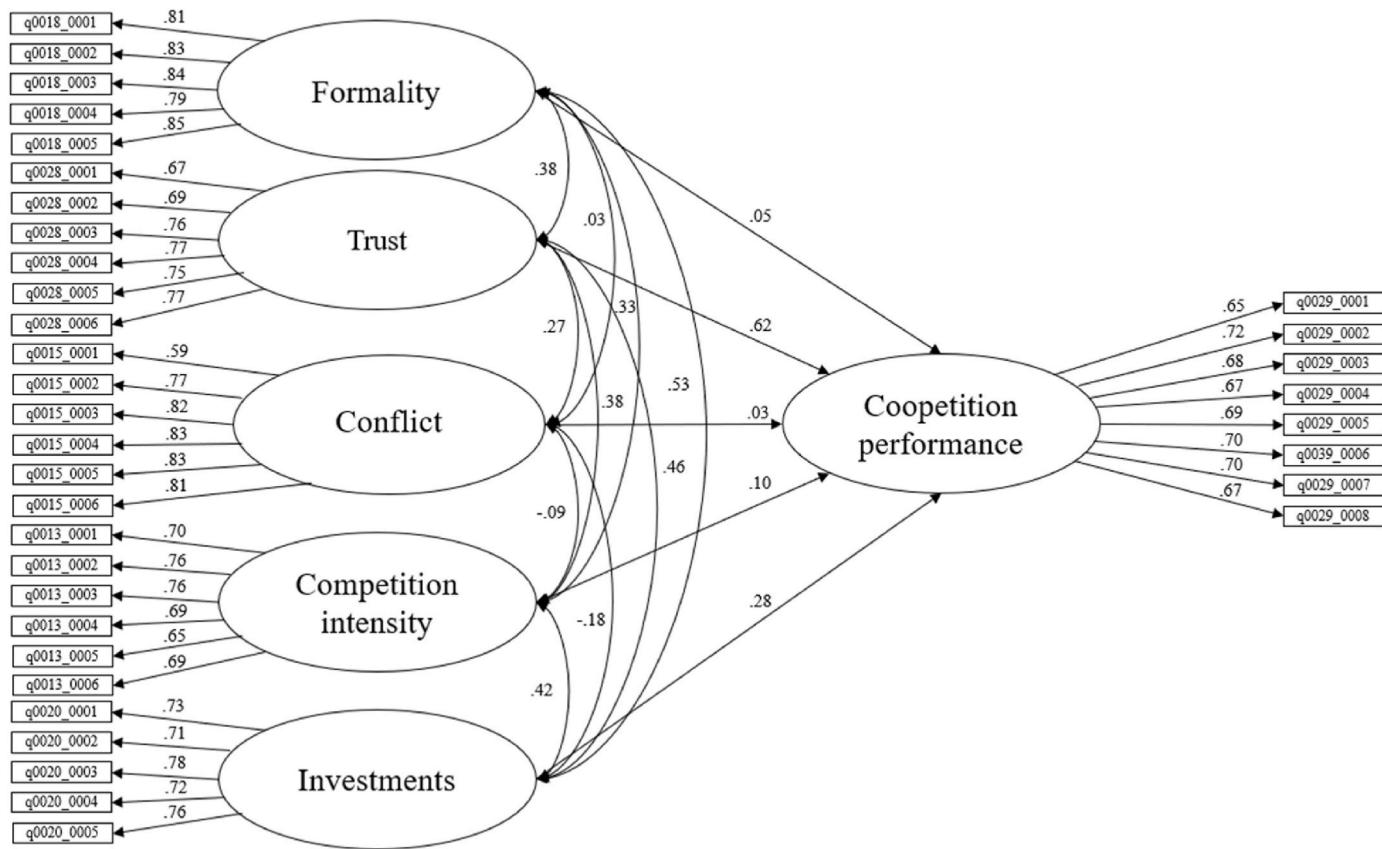


Fig. 4. Structural model of behavioral attributes (standardized estimates).

Source: Own illustration

Table 6
Relationship between constructs in the behavioral attributes model.

Path	Standardized parameter
Competition intensity → Coopetition performance	0.098***
Conflict (R)→ Coopetition performance	0.031
Formality → Coopetition performance	0.054*
Investments → Coopetition performance	0.276***
Trust → Coopetition performance	0.615***

***p < 0.001; *p < 0.05 (R) – reverse coding.

the partnership, and the specific goals of the firms involved. Measurement complexities arise due to these variations, making it difficult to define a one-size-fits-all metric for optimal tension.

Behavioral attributes, including competition intensity, formality, mutual investments, and trust, have all been identified as positively influencing coopetition performance. These results support earlier research indicating that intensity of competition (including, for example, overlapping markets, competencies, target customers, but also the importance of competition in terms of firm performance (Chen et al., 2019; Dorn et al., 2016)), formality (including precise specification of terms and operational actions within coopetition, significant legal constraints (Amata et al., 2022)), mutual investments (effort and time in mutual adjustments, learning from each other in terms of applied strategies, systems, implemented processes, internal procedures (Estrada & Dong, 2020; Klimas et al., 2023; Zhang, Li, Xue, Yang, & Li, 2024)), as well as trust (both at the organizational and interpersonal levels) (Bengtsson & Raza-Ullah, 2016; Czakon & Czernek, 2016; Lascaux, 2020; Monticelli et al., 2018)) stimulate coopetition performance.

Interestingly, our findings regarding the behavioral attribute *conflict* show that its absence does not significantly impact coopetition performance as it only shows a slightly positive effect (0.029), suggesting that

low levels of conflict do not harm coopetition performance. This aligns with previous research (Chai, Li, Tangpong, & Clauss, 2020; Leonidou et al., 2002; Rajala & Tidström, 2021), while also reflecting the real-world applications, where eliminating conflict entirely is unrealistic given that the competitive nature of the parties involved. However, our results indicate that this should not be a significant concern.

6. Conclusion

The concept of coopetition, characterized by the simultaneous collaboration and competition between organizations for mutually beneficial outcomes (Bengtsson & Kock, 2000), is crucial in shaping business performance (Bouncken & Fredrich, 2012; Crick, 2019; Estrada & Dong, 2020; Lechner et al., 2016; Mwesiumo et al., 2023; Ricciardi et al., 2022), particularly in times of rapid technological advancements (Bouncken et al., 2018; Quintana-Garcia & Benavides-Velasco, 2004; Veiga et al., 2024). This study addresses a research gap in the literature by quantitatively analyzing the impact of coopetition attributes on coopetition performance (Klimas et al., 2023; Raza-Ullah & Kostis, 2020) – a research area predominantly explored through qualitative research (Czakon & Czernek, 2016; Gernsheimer et al., 2021). By quantitatively examining strategic, relational, and behavioral coopetition attributes using data from 1216 manufacturing firms in Poland and applying a Covariance-Based Structural Equation Model (CB-SEM), our research provides significant insights for businesses operating in sectors where innovation and competitive dynamics intersect with economic and social forces. The results reveal that specific attributes significantly influence coopetition performance in a positive way, e.g., the strategic attribute of *paradoxicality*, the relational attribute of *strength*, and several behavioral attributes - *trust*, *competition intensity*, *investments*, and *formality*. Conversely, the strategic attribute of *dynamics* was found to

negatively impact performance, while relational attributes such as *asymmetry* and *tensions*, as well as the behavioral attribute of *conflict*, showed no significant influence.

6.1. Theoretical contributions

This study provides theoretical and empirical contributions to the field of coopetition research by addressing critical gaps in the literature and advancing the understanding of how coopetition attributes influence performance. While coopetition has emerged as a crucial strategy for driving innovation and achieving sustainable competitive advantages (Amata et al., 2022; Crick & Crick, 2021a; Czakon et al., 2014; Garri, 2021; Mwesiumo et al., 2023; Veiga et al., 2024), existing research largely emphasizes either its positive impacts (Amata et al., 2022; Chen et al., 2019; Christ et al., 2017; Pellegrin-Boucher et al., 2013) or the inherent tensions that can paradoxically lead to strategic failure (Bengtsson & Raza-Ullah, 2016; Bouncken et al., 2018; Raza-Ullah, 2020). Moreover, the field remains dominated by conceptual and qualitative studies (Garri, 2021), leaving a substantial gap in large-scale quantitative research to empirically explore the mechanisms linking coopetition to performance (Akpinar & Vincze, 2016; Czakon & Rogalski, 2014; Gernsheimer et al., 2021, 2024b; Klimas, Gadomska-Lila, & Sachpazidu, 2024; Mwesiumo et al., 2023). Addressing this gap, our study leverages one of the largest datasets in coopetition research to date to establish a quantitative foundation that builds upon and refines existing qualitative research, advancing the understanding of how specific coopetition attributes drive performance. By empirically testing a comprehensive set of 13 coopetition attributes (Klimas et al., 2025; Klimas, Stańczyk, & Sachpazidu, 2024), which have previously been studied either independently or in smaller combinations, this study not only tests the presumed positive impact of these attributes, extending previous research efforts, but also reveals the nuanced and complex ways in which they shape performance, tackling inconsistencies and ambiguities in the field, while reinforcing the theoretical framework of coopetition (Dorn et al., 2016; Garri, 2021).

Our findings underscore the statistical significance of these attributes, highlighting that although many positively influence performance, their effects are not uniformly positive across all categories. This nuanced understanding enriches the field by addressing calls for large-sample, quantitative studies (Akpinar & Vincze, 2016; Crick & Crick, 2019; Czakon & Rogalski, 2014) and providing robust insights into the mechanisms linking coopetition to its performance (Garri, 2021; Mwesiumo et al., 2023; Ricciardi et al., 2022), an area underexplored in previous studies (Bouncken et al., 2015; Dorn et al., 2016; Garri, 2021; Klimas, Gadomska-Lila, & Sachpazidu, 2024; Rai et al., 2023). Thus, by investigating the multidimensional aspects of coopetition performance across strategic, relational and behavioral attributes, we provide insights that were either inadequately covered or overlooked in earlier studies.

Given the importance of large sample sizes in coopetition studies (Crick & Crick, 2019), our large-scale quantitative approach paves the way for future studies to further explore the inherent complexity of coopetition and its multidimensional attributes, offering a deeper understanding of its strategic, relational, and behavioral dimensions and their varied impacts on performance.

6.2. Managerial implications

In addition to its theoretical contributions, this research offers valuable practical insights for managers aiming to optimize coopetition strategies as well as their results. Based on our analysis of coopetition attributes and their impact on performance, several key recommendations emerge. Generally, our research suggest that managers can enhance coopetition performance by focusing on the attributes that positively influence outcomes, while mitigating those having the negative effects, as shown in Tables 3, 5 and 6.

To improve the likelihood of success in coopetition, it is essential to focus on several critical dimensions. First, managers should foster an understanding of the paradoxical nature of coopetition, emphasizing the need for frameworks that encourage equitable and mitigate the risk of opportunism. Second, the strength of coopetitive relationships is pivotal. This involves cultivating strong attachment to partners and ensuring consistent, effective communication. Trust is equally indispensable, encompassing verbal commitments, transparent actions, reliability, and honesty. Third, fostering a willingness to invest in coopetition is crucial. This entails mutual dedication to learning from each other, allocating time, and committing resources.

While recognizing the competitive dynamics inherent in coopetition, it is important for managers to acknowledge competitive behaviors towards partners while simultaneously striving for shared goals. Formalization of actions is another vital element, with written agreements ensuring clarity and accountability. However, agreements should also allow for flexibility and adaptability to accommodate the dynamic nature of coopetitive relationships. On the other hand, proactive efforts should be made to mitigate specific challenges. Addressing asymmetry between partners, whether in terms of power dynamics and resource investments, can strengthen cooperation. Furthermore, managing tensions is essential, requiring active resolution of managerial and informational conflicts that arise during coopetition.

Strategically addressing these attributes enables managers to navigate the complexities of coopetition and optimize its performance. This research diverges from previous qualitative approaches by offering data-driven insights, specifically tailored for decision-makers operating at the intersection of technological change and social dynamics. The findings provide actionable guidance on strengthening coopetition attributes to enhance performance, while effectively managing challenges posed by excessive dynamism in coopetition strategies. To maximize coopetition performance, managers should prioritize attributes based on their varying impacts on success. Therefore, when enhancing these attributes, it is important to remember that their order in terms of stimulating coopetition success, ranked by their strength of impact, is as follows: paradoxicality, strength, trust, investments, competition intensity, formality, and dynamics (noting that this attribute was reverse-coded, meaning the negative effect observed reflects the detrimental impact of a lack of dynamism). Simultaneously, the leveraging effect on coopetition success can be achieved by limiting the level of both asymmetry and tensions, which have been found to be equally relevant in terms of their negative impact.

6.3. Limitations

In our study, we identified three main limitations: one related to the adopted approach to coopetition performance, second concerning the normality of the raw data, and third related to the chosen empirical context. First, we have considered coopetition performance as a coopetition success, following previous research (Raza-Ullah, 2021; Raza-Ullah & Kostis, 2020) and recent recommendations (Klimas, Gadomska-Lila, & Sachpazidu, 2024). However, this is not the only viable approach. Future research could replicate our study using a temporal perspective on coopetition performance, potentially applying measurement scales such as those proposed by Ricciardi et al. (Ricciardi et al., 2022), which might offer additional insights into the dynamic capture of coopetition outcomes over time.

Second, preliminary tests, including the Kolmogorow-Smirnow and Shapiro-Wilk tests, indicated that our data did not follow a normal distribution. This poses potential challenges when using CB-SEM for hypothesis testing, as non-normal data can lead to inaccurate confidence intervals, inflated model test statistics, and underestimated standard errors. However, our data's kurtosis and skewness parameters for our raw data suggest a distribution close to normal. Furthermore, our large sample size ($N = 1216$) helps mitigate these concerns, as the "rule of 10" ($N/\text{number of estimated parameters}$), which ensures sufficient accuracy

of the results (Bentler & Chou, 1987), was met in all three models. Additionally, we excluded 14 outliers from the final analysis, which is critical as they can disproportionately affect the data and analysis results when the raw data does not follow a normal distribution. Furthermore, as noted by Ainur et al. (Ainur, Sayang, Jannoo, & Yap, 2017), the goodness-of-fit measures are "quite robust when data are not normal" (p. 575). However, although SEM does not directly require normality of data, non-normal distributions can be prone to some limitations (Hair et al., 2019; Jannoo, Yap, Auchoybur, & Lazim, 2014).

Third, our study, and thus the results obtained, are constrained by the specific national and industrial contexts under investigation. While the relatively large sample size provides valuable insights and may contribute to broader conclusions, it does not suffice as a foundation for universal generalization. On the one hand, coopetition is acknowledged as a context-sensitive phenomenon (Dorn et al., 2016; Meena et al., 2023), which justifies these contextual limitations. On the other hand, to derive more generalizable conclusions regarding the significance of coopetition attributes for performance, research replication across diverse industries and national contexts is needed.

In conclusion, it is crucial to recognize these limitations, particularly regarding data distribution and the need for further refinement in measurement methods for specific attributes. Future research should address these limitations to deepen our understanding of the coopetition phenomenon.

6.4. Future research directions

To leverage reliability and generalizability of our findings, future research should validate our models across diverse empirical contexts. Given that coopetition is highly contextual (Czakon et al., 2014; Meena et al., 2023), replicating this study in different countries and industries would be valuable, as our study was geographically and sectorally limited. Broadening the scope could provide a deeper understanding of how coopetition attributes influence performance across varied environments.

During the analysis of relational attributes, we found that three key attributes - complexity, coopetition intensity, and mutual dependence - did not meet the requirements for discriminant validity. Since these attributes are recognized in the literature as critical for coopetition performance (complexity (Crick & Crick, 2021a; Geurts et al., 2022), coopetition intensity (Lechner et al., 2016; Mariani & Belitski, 2023; Telg et al., 2023), mutual dependence (Jakobsen, 2020; Randolph, Fang, Memili, Ramadani, & Nayir, 2023), future research should develop more robust measurement methods for these attributes to better capture their impact on performance.

Further research directions regarding the attributes of dynamics, tension, and conflict can be identified. The slightly negative effect of dynamism on coopetition performance observed in our study is reasonable, as high variability in strategies, actions, and tasks can lead to delays and hinder goal attainment (Bengtsson & Raza-Ullah, 2016; Bouncken et al., 2018; Raza-Ullah, 2020; Ritala & Hurmelinna-Laukkonen, 2009). However, since coopetition is often favored in dynamic, fast-growing industries, some degree of dynamism is necessary (Chai et al., 2020; Crick & Crick, 2019; Gernsheimer, Kanbach, et al., 2024), which explains why the negative effect is minimal. It would be interesting for future studies to explore how to balance dynamism and stability, potentially investigating what levels of dynamism are most conducive to maximizing performance in different contexts.

While excessive tension has been shown to reduce coopetition performance, moderate levels of tension may stimulate innovation and problem-solving (Gast et al., 2015; Kwon et al., 2020; Luo, 2004). Determining an optimal level of tension remains challenging, as it depends on various contextual factors such as industry characteristics and partnership dynamics. Future research could focus on developing methodologies to measure and better understand the ideal tension levels

that foster performance without becoming detrimental.

Our results regarding conflict indicate that low levels of conflict do not negatively affect coopetition performance, with the absence of conflict showing only a slightly positive effect (0.029). This aligns with previous studies (Chai et al., 2020; Kam & Lai, 2018; Kraus et al., 2017). While the data does not suggest that conflict significantly enhances performance, the findings imply that maintaining a low level of conflict is not harmful, and eliminating conflict entirely is unnecessary. Future studies could delve deeper into whether controlled conflict can, in fact, drive higher performance, as this relationship has not been widely quantified.

In conclusion, future research should address these gaps by refining measurement methods and exploring additional dimensions of coopetition, including optimal levels of dynamism, tension, and conflict. These efforts will further enrich the understanding of how coopetition attributes influence performance across different contexts.

CRediT authorship contribution statement

Patrycja Klimas: Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Arkadiusz Kawa:** Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Conceptualization. **Karina Sachpazidu:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sylwia Stańczyk:** Writing – original draft, Formal analysis, Data curation, Conceptualization. **Katharina Brenk:** Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Data curation, Conceptualization. **Dominik K. Kanbach:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of the exclusivity of submission

The manuscript has not been published previously, it is not under consideration for publication elsewhere, and if accepted, it will not be published elsewhere in the same form, in English or any other language.

Availability of data and material

The raw quantitative data set is available in open access in open repository Zenodo.

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Appendix

Table A

Measurement followed in the study.

Code	Questions	α	AVE	CR
Dependent variable				
Cooptition performance				
This relationship is successful in the following manner ...		0.876	0.878	
q0029_0001	... produces the expected results and meets its milestones	0.473		
q0029_0002	... generates revenues or customer references that meet or exceed expectations			
q0029_0003	... enables a high-quality solution based on an integration of both firms' technologies, resources, and/or expertise			
q0029_0004	... generates new customers, products, or projects			
q0029_0005	... adds to our core competence and/or competitive advantage			
q0029_0006	... reduces time to market for launching products, services, or solutions			
q0029_0007	... increases competitiveness			
q0029_0008	... generates unexpected, positive results (R)			
Independent variables				
Strategic attribute – dynamics				
q0017_0001	In general, this cooptition changes more infrequently than frequently. (R)	0.885	0.883	
q0017_0002	In general, this cooptition is characterized more by regular than irregular exchanges. (R)	0.522		
q0017_0003	Our cooptition with this business partner changes frequently. (R)			
q0017_0004	The meaning of cooperation with this cooptition partner changes over time. (R)			
q0017_0005	The scope of cooperation with this cooptition partner changes over time. (R)			
q0017_0006	The amount of cooperation with this competitor changes over time. (R)			
q0017_0007	The amount of competition with this competitor changes over time. (R)			
Strategic attribute – paradoxicality				
q0024_0001	The agreements between us and our cooptitor provide clear and easily applicable penalties for any incorrect behavior by a participating firm.	0.799	0.806	
q0024_0002	There is the right level of trust between us and the cooptitor.	0.412		
q0024_0003	There is a robust sharing of common values between us and the cooptitor.			
q0024_0004	Thanks to the cooptition, the partners share human resources and/or other essential resources.			
q0024_0005	The cooptition develops joint projects that our company could not undertake.			
q0024_0006	The cooptition develops a strategy through a cooptition-level plan.			
q0024_0007	<i>In this cooptition, we feel both positive and negative emotions simultaneously.</i>			
Relational attribute – asymmetry				
q0010_0001	There is an asymmetry in terms of possessed and controlled resources between us and our cooptitor.	0.835	0.801	
q0010_0002	There is an asymmetry in terms of exchange between us and our cooptitor.	0.408		
q0010_0003	There is an asymmetry in terms of power held by us and our cooptitor.			
q0010_0004	There is a difference between us and our cooptitor in terms of size.			
q0010_0005	There is an asymmetry in terms of mutual engagement and investments made by us and our cooptitor.			
q0010_0006	In our cooptition, the strength/intensity of cooperation and competition are not the same.			
Relational attribute – complexity				
q0014_0001	In this cooptition high number and variety of individual actors engaged.	0.860	0.813	
q0014_0002	It is high number and variety of issues covered by cooptition.	0.473		
q0014_0003	Heterogeneity and diversity of actions undertaken are intense in this cooptition.			
q0014_0004	Multidimensionality of actions undertaken (e.g. on such levels as individual, operational, strategic, inter-organizational) is intense.			
q0014_0005	Multidimensionality of links between us and our partner, e.g. cognitive, technological, social, organizational, institutional, geographical, etc. is intense.			
Relational attribute – competition intensity				
q0013_0001	We are in close competition with our partner.	0.863	0.817	
q0013_0002	<i>Active competition with our collaborator(s) is important to us.</i>	0.318		
q0013_0003	<i>There is a high level of competition (based on the solution element overlap).</i>			
q0013_0004	<i>Our firm competes directly with our partner for the customer firm's business.</i>			
q0013_0005	Our firm's target markets are similar to those of our partner.			
q0013_0006	Our firm considers our partner as a major competitor in various product markets.			
q0016_0001	We actively cooperate with our partner in R&D and exchange of know-how.			
q0016_0002	We frequently discuss common problems with our partner.			
q0016_0003	We share close ties and social relationships with people in our partner's firm.			
q0016_0004	We share our production facilities with our partner.			
q0016_0005	We cooperate with our partner in developing new products.			
q0016_0006	We share our complementary resources with our partner.			
Relational attribute - mutual dependence				

(continued on next page)

Table A (continued)

Code	Questions	α	AVE	CR
q0023_0001	We and the coopetitor have an equal say in all business dealings in the alliance.	0.773	0.718	
q0023_0002	We and the coopetitor have an equal influence on each other in all alliance-related decisions.		0.320	
q0023_0003	Our outcomes from coopetition depends on our coopetitor's behavior and actions.			
q0023_0004	We and our coopetitor are mutually dependent in a structural manner due to common challenges, financial interlinks and actions undertaken jointly			
q0023_0005	We and our coopetitor are mutually dependent in a psychological manner due to the existing trust, generosity and emotions between us.			
Relational attribute - strength				
q0026_0001	We are not looking for alternatives to replace our current coopetitor.	0.873	0.878	
q0026_0002	Even if we find a better coopetitor, we will definitely not leave the current one.		0.449	
q0026_0003	We do not want to change our coopetitor right away.			
q0026_0004	We have good informal relationships with this coopetitor.			
q0026_0005	We like the interaction with this coopetitor.			
q0026_0006	We defend this coopetitor when other firms criticize or attack them.			
q0026_0007	We care about our coopetitor's long-term success.			
q0026_0008	We have close relationship with our coopetitor.			
Relational attribute - tensions				
q0027_0001	In this coopetition, it is difficult to both cooperate in some areas and compete in others. (R)	0.878	0.837	
q0027_0002	In this coopetition, building a close relationship and keeping a certain distance is difficult. (R)		0.512	
q0027_0003	In this coopetition, it is difficult to both share knowledge and protect important knowledge. (R)			
q0027_0004	In this coopetition, learning from each other and winning the learning race is difficult. (R)			
q0027_0005	In this coopetition, there is a continuous willingness to both co-create and appropriate value. (R)			
Behavioral attribute - competition intensity				
q0013_0001	We are in close competition with our partner.	0.857	0.858	
q0013_0002	Active competition with our collaborator(s) is important to us.		0.503	
q0013_0003	There is a high level of competition (based on the solution element overlap).			
q0013_0004	Our firm competes directly with our partner for the customer firm's business.			
q0013_0005	Our firm's target markets are similar to those of our partner.			
q0013_0006	Our firm considers our partner as a major competitor in various product markets.			
Behavioral attribute - conflict				
q0015_0001	Generally, with this business partner, we have disagreements about the future of our relationship and its development path. (R)	0.900	0.903	
q0015_0002	It is usually difficult to reach agreements on contract terms. (R)		0.610	
q0015_0003	It is NOT easy to agree on handling various issues that arise in the relationship with this business partner. (R)			
q0015_0004	Misunderstandings between us and this business partner are quite common. (R)			
q0015_0005	The business partner's motives are generally not clear to us and we see them rather as conflicting. (R)			
q0015_0006	It is hard to understand each other as we take on different roles under coopetition. (R)			
Behavioral attribute - formality				
q0018_0001	Our collaboration is regulated through a comprehensive and clearly worded contract.	0.916	0.916	
q0018_0002	The contract with this partner describes in detail every aspect we think is of interest.		0.686	
q0018_0003	We and our partner fixed all the collaboration related details in a contract.			
q0018_0004	We always refer back to the contract or other assigned documents in a dispute.			
q0018_0005	We are committed to abide by our contract with this partner.			
Behavioral attribute - investments				
q0020_0001	Just for this relationship with this partner, we have made efforts and/or invested time and resources in equipment and specialized tools dedicated to the relationship.	0.857	0.857	
q0020_0002	Just for this relationship with this partner, we have made efforts and/or invested time and resources in learning their information system and tailoring our own.		0.546	
q0020_0003	Just for this relationship with this partner, we have made efforts and/or invested time and resources in learning their procedures and routines, and tailoring our own.			
q0020_0004	Just for this relationship with this partner, we have made efforts and/or invested time and resources in learning their production system/product line, and tailoring our own.			
q0020_0005	Just for this relationship with this partner, we have made efforts and/or invested time and resources in training our and/or their employees to deal with shared tasks.			
Behavioral attribute - trust				
q0028_0001	Our partner keeps the promises made to our firm.	0.880	0.880	
q0028_0002	Our partner has always been even-handed in their negotiations with us.		0.551	
q0028_0003	Our partner is always trustworthy.			
q0028_0004	Our partner is very honest.			
q0028_0005	Our partner helps us when we need it.			
q0028_0006	In this coopetition relationship, there is interfirm and interpersonal trust.			

Note: (R) Reverse coding. Grey font variables were excluded as they did not meet the discriminant validity criteria. Grey font in italics - items removed due to the too-low factor loadings (i.e. below 0.5).

Source: Measurements incorporate operationalizations already available in the literature:coopetition performance (Klimas, Gadomska-Lila, & Sachpazidu, 2024); strategic and relational attributes – (Klimas, Stańczyk, & Sachpazidu, 2024); behavioral attributes (Klimas et al., 2025).

Data availability

Data will be made available on request.

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