

Tensions in Coopetition between Gypsy and Non-gypsy Breweries in the Light of Actor-network Theory

Elisa Priori de Deus¹ , Alexandre Borba da Silveira² , Luciana Maines da Silva³ , Patrícia Kinast de Camillis⁴ 

¹ Universidade Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brazil

² Universidade Federal do Paraná, Curitiba, PR, Brazil

³ Universidade do Vale do Rio dos Sinos, Porto Alegre, RS, Brazil

⁴ Centro Universitário Alves Faria - Unialfa, Goiânia, GO, Brazil

How to cite: Deus, E. P., Silveira, A. B., Silva, L. M., & Camillis, P. K. (2024). Tensions in coopetition between gypsy and non-gypsy breweries in the light of actor-network theory. *BAR-Brazilian Administration Review*, 21(1), e230101.

DOI: <https://doi.org/10.1590/1807-7692bar2024230101>

Keywords:

coopetition; relationships; tensions; actor-network theory; craft brewery

JEL Code:

O39

Received:

August 30, 2023.

This paper was with the authors for two revisions

Accepted:

March 12, 2024.

Publication date:

April 15, 2024.

Corresponding author:

Alexandre Borba da Silveira
Universidade Federal do Paraná
Av. Prefeito Lothário Meissner, 632, Jardim Botânico,
CEP 80060-000, Curitiba, PR, Brazil

Editor-in-Chief:

Ivan Lapuente Garrido 
(Universidade do Vale do Rio dos Sinos, Brazil).

Guest Editors:

Jefferson Marlon Monticelli 
(Universidade do Vale do Rio dos Sinos, Brazil);

Emilene Leite 

(Örebro University School of Business, Sweden);

Adriana Fumi Chim Miki 

(Universidade Federal de Campina Grande, Brazil).

Reviewers:

Arnaldo Rizzardo Filho 
(Universidade do Vale do Rio dos Sinos, Brazil);
and two anonymous reviewers.

Editorial assistants:

Eduarda Anastacio and Simone Rafael
(ANPAD, Brazil).

ABSTRACT

Objective: The search for market expansion challenges Brazilian craft breweries. Based on coopetition strategies, many join in seeking to overcome these challenges. The challenge for gypsy breweries is even more significant, as they must produce beer in a non-gypsy brewery. Some tensions emerge from this relationship, such as space availability and costs. **Methods:** From the actor-network theory, we analyze the relationship between gypsy and non-gypsy breweries, deepening the analysis of their tensions. Based on a case study with craft breweries in Rio de Janeiro State. **Results:** As the results highlighted, the tension between them starts at a level not mentioned in the literature on coopetition. **Conclusions:** This extension expands the existing literature on coopetition by highlighting the influence of nonhuman elements (e.g., factory, resources, equipment, and operations) in shaping inter-organizational relationships, with the factory being the main generator of this tension. The study offers insights into how actors (human and nonhuman) navigate, interact, and negotiate tensions to achieve mutual goals. By applying ANT to analyze coopetition dynamics, the study contributes to the theoretical framework by demonstrating how this approach can enhance understanding of complex mechanisms, processes, and relationships through which coopetition dynamics unfold in practice.



Data Availability: Priori de Deus, Elisa; Silveira, Alexandre; Camillis, Patrícia; Silva, Luciana (2024), "TENSIONS IN COOPETITION BETWEEN GYPSY AND NON-GYPSY BREWERIES IN THE LIGHT OF ACTOR-NETWORK THEORY", Mendeley Data, V1, doi: <https://doi.org/10.17632/kbdys7472d.1>
BAR – Brazilian Administration Review encourages data sharing but, in compliance with ethical principles, it does not demand the disclosure of any means of identifying research subjects.

Plagiarism Check: BAR maintains the practice of submitting all documents received to the plagiarism check, using specific tools, e.g.: iThenticate.

Peer review: is responsible for acknowledging an article's potential contribution to the frontiers of scholarly knowledge on business or public administration. The authors are the ultimate responsible for the consistency of the theoretical references, the accurate report of empirical data, the personal perspectives, and the use of copyrighted material. This content was evaluated using the double-blind peer review process. The disclosure of the reviewers' information on the first page is made only after concluding the evaluation process, and with the voluntary consent of the respective reviewers.

Copyright: The authors retain the copyright relating to their article and grant the journal BAR – Brazilian Administration Review, the right of first publication, with the work simultaneously licensed under the Creative Commons Attribution 4.0 International license (CC BY 4.0) The authors also retain their moral rights to the article, including the right to be identified as the authors whenever the article is used in any form.

INTRODUCTION

Coopetition is based on simultaneous cooperation and competition between companies in the same segment (Silva et al., 2023). This dynamic relationship alters and outlines the balance and strength of cooperative and competitive interactions (Dahl, 2014; Padula & Dagnino, 2007). Despite being a beneficial strategy for the business ecosystem, balancing these dynamic relationships is challenging (Tidström, 2014), especially when considering the tensions between partners and competitors (Tidström, 2014; Wegner & Mozzato, 2019).

The coopetition process reflects the coexistence of cooperation between competitors, generation tension and conflict between them (Nguyen et al., 2022). This dual process refers to a hybrid relationship of competition and cooperation 'to jointly create value' while competing 'to capture a part of that value' (Bouncken et al., 2015, p. 591). Coopetition actors can be individuals, technologies, organizations, or other entities cooperating and competing in different activities, interactions, relationships, or processes for different reasons (Bengtsson & Kock, 2014; Gryawali & Charleton, 2018).

The definition of market-oriented coopetition guides this study as "a paradoxical relationship between two or more actors in a network" (Robert et al., 2018, p. 575). Despite being a topic that is currently widely studied, as well as the tension between companies that, according to Tidström (2014), is "natural in cooperative business relationships that simultaneously involve cooperation and competition," (p. 261) some gaps have not yet been deepened, such as tensions between competition and cooperation among small companies (e.g., Lundgren-Henriksson & Tidström, 2021). Despite this, research opportunities exist to focus on how companies can deal with the tensions and paradoxes that arise in coopetition (Silva et al., 2023).

Tensions represent a negative side of commercial and market relations, as well as conflicts, competition, burdens, discussions, crises, and problems (Tidström, 2014). The number of members, relationships, and resources they hold are critical to the network's survival (Wegner & Mozzato, 2019). Thus, cooperative tensions can be marked as paradoxical, sometimes as negative consequences of paradoxes, or as an opposing relationship between two or more elements (Lundgren-Henriksson & Tidström, 2021). Tensions are characterized by decision-making (centralized or decentralized in the network), network unity and diversity, network flexibility and stability, and internal and external legitimacy of the network of cooperating and competing actors (Bengtsson & Kock, 2000; Lundgren-Henriksson

& Tidström, 2021; Tidström, 2014). In addition, it highlights positive, negative, or mixed results by being positive and negative between companies that use a coopetition strategy (Schmidt et al., 2019).

The craft microbreweries sector exemplifies the coopetition strategy (Kraus et al., 2019). The collaboration, co-sharing, interdependence and complementarity of individuals, technologies, processes, and organizations that operate in craft beer production provides an ideal context to study this phenomenon (Silva et al., 2023) since this is a common strategy among them (Monticelli et al., 2018) – more analysis of the balance between stresses and performance (Raza-Ullah et al., 2014). Previous studies have connected dynamic capabilities, processes, routines, and governance to coopetition (Silva et al., 2023). On the other hand, much of the potential for gaining coopetition advantages lies in the recognized types of knowledge, culture, processes, apprehension, interactions, and tensions between multiple actors (Bouncken et al., 2015; Lundgren-Henriksson & Tidström, 2021; Tidström, 2014). An analysis at the tensions between craft breweries has yet to be done, especially when considering gypsy breweries (those that do not have their own factory and need to produce in the factories of other breweries) and non-gypsy breweries (those who own their factory).

Given this research gap, this study explores the establishment of coopetition, answering the question: 'How do coopetition relationships manage the tensions between gypsy and non-gypsy breweries?' This study aims to analyze how tensions occur in the coopetition relationships between these types of craft breweries. This research carried out a qualitative case study applying the actor-network theory (ANT) approach in the Brazilian market. Brazil is the third largest producer of all types of beer in the world (Beverage Industry, 2018) and Rio de Janeiro State (RJ) is one of the pioneers in the production of craft beers.

The authors consider a sociotechnical perspective based on the actor-network theory (ANT) (Latour, 2005, 2011; Law, 1992) to analyze and translate these tensions between craft breweries considering different actors, routines, processes, and relationships. ANT is empirically realistic and allows an interpretive understanding of how an event or phenomenon develops through the practices and relationships of different actors (Callon, 1986; Latour, 2005; Law, 1992). Therefore, the theoretical-methodological approach of ANT offers insights and paths based on exploratory and analytical procedures. The tools given to the researcher can reveal the production of knowledge and

interpret phenomena in a descriptive, relational, and interactive way (Silveira et al., 2022).

The literature on coopetition states that tensions occur at the individual, intraorganizational, and interorganizational levels (Raza-Ullah et al., 2014; Schweizer et al., 2023). As the main finding of the research, the analysis pointed out that tension arises from the factory, a nonhuman actor-network that, by becoming an obligatory crossing point (OPP), establishes a fourth level of tension in coopetition relations: between humans and nonhumans.

The next section provides a broad overview of actors (stakeholder) relationships to explain the co-competitive tension in microbrewery research and its need for understanding this process. This section also discusses why this research focuses on coopetition among gypsy and non-gypsy breweries considering all actors involved. In the sequel, the conceptual approach of ANT theory is then discussed as a comprehensive framework for understanding networked coopetition, tracing network interactions, and examining the dynamics of actors (stakeholder) relationships. Therefore, the translation processes (elements from ANT) (Callon, 1986) are the main methodological and theoretical support for understanding the phenomenon, suggesting alternative ways to advance studies on tensions in coopetition between gypsy and non-gypsy breweries. Afterward, the gypsy and non-gypsy breweries in Rio de Janeiro State are presented, and the translation process analyses ends with the discussion and conclusions.

LITERATURE REVIEW

Coopetition

Research on coopetition involves understanding antecedents and motives, dynamics, tensions, value creation and value appropriation, and outcomes and evaluation (Peng et al., 2018). Coopetition, combining elements of competition and cooperation, presents a paradoxical nature (Chen, 2008), where companies capable of integrating their resources effectively and managing uncertainties gain an advantage in their markets (Klein et al., 2020; Monticelli et al., 2018; Padula & Dagnino, 2007).

Coopetition involves a spectrum of strategies that combine cooperation and competition, varying in degrees at different levels and areas of interaction (Bengtsson & Kock, 1999; 2000). Ranging from complete coopetition to complete cooperation, the level of cooperation inversely affects the level of coopetition and vice versa (Bengtsson & Kock, 2000). Recent perspectives consider coopetition as a dynamic and paradoxical relationship between competing entities,

where cooperation and competition coexist, leading to strategic changes and opportunities (Bengtsson & Kock, 2014). This approach promotes innovation, reduces resistance among competitors, and promotes sustainable strategies by encouraging companies to navigate both competitive and cooperative realms for mutual benefit. Furthermore, coopetition evolves over time, influenced by industry or institutional changes, promoting strategic adaptations and redefining competitive rules through continuous interactions (Bengtsson & Kock, 2000; Dahl, 2014).

The tensions inherent in coopetition also play a significant role in the strategic landscape. When dealing with the duality between competing and cooperating, companies face complex challenges that require delicate balance and astute management skills (Gnyawali & Ryan Charleton, 2018). Managing these tensions effectively is essential to maximizing the benefits of coopetition, as they can serve as drivers of innovation and strategic progress when approached constructively (Bengtsson & Kock, 2014).

Tensions in coopetition

Coopetition can lead to ambiguity in the relationship between organizations (Bengtsson & Raza-Ullah, 2016). Expectations may not be clearly defined, which can result in tensions related to how to cooperate and compete in a balanced way (Bengtsson & Johansson, 2014; Tidström, 2014). Tensions can be emotional. Ambivalent emotional tensions can vary in intensity and persistence in different contexts (Raza-Ullah et al., 2014). Tensions can be influenced by contextual factors, such as the type of industry, the nature of coopetition, and the characteristics of the organizations involved (Bengtsson et al., 2016; Raza-Ullah et al., 2014). It is important to highlight that tension is a human phenomenon. Nonhuman factors can be tension generators; however, they cannot perceive it (Raza-Ullah et al., 2014; Sheep et al., 2017). Furthermore, tensions can be individual, organizational, or interorganizational (Raza-Ullah et al., 2014):

- (1) Individual tensions: individuals involved in coopetition may experience contradictory or ambivalent emotions, such as positive feelings of collaboration and negative feelings of competition. These individual tensions can arise due to the duality of coopetition, where participants need to balance the pursuit of collaborative and competitive goals.
- (2) Organizational tensions: organizations involved in coopetition may face internal tensions, as different parts of the organization may have diverging

interests regarding cooperation and competition. It can result in conflicts of interest between different business units or departments, creating organizational tensions.

(3) Interorganizational tensions: tensions can also occur between organizations involved in coopetition. While there is a desire to collaborate in certain respects, organizations also compete with each other. This tension between cooperation and competition can create distrust and rivalry between the involved parties.

Individual and organizational tensions are considered internal tensions, tension experienced by lower levels of the organization, such as employees, non-professional management, and owners doing everything from producing to selling and deliver (Raza-Ullah et al., 2014). While coopetition occurs between units or departments within the company, different opinions and interests arise regarding the value of cooperating with a competitor (Bengtsson & Kock, 2000). This divergence of opinion can lead to frustration and tension within the organization, especially when operational levels need to understand strategic decisions made by top management (Raza-Ullah et al., 2014). This internal tension can involve positive and negative feelings for employees, as they may not fully understand or support strategic decisions (Nguyen et al., 2022; Raza-Ullah et al., 2014). Beyond this, tensions occur between individuals, units, departments, organizations, and market segments through several human and nonhuman actions (e.g., individual and organizational processes) (Nguyen et al., 2022). In short, internal tension refers to tensions within the organization arising from differing opinions and a lack of understanding of strategic decisions.

On the other hand, external tension refers to the difficulties top-level managers face in dealing with the duality of cooperation and competition with other companies in the same market segment (Bengtsson et al., 2016; Raza-Ullah et al., 2014). This tension arises from balancing value creation against competition for maximum value sharing. The difficulty of balancing knowledge sharing, and knowledge protection can also arise, especially in R&D alliances between competitors (Estrada et al., 2016). Furthermore, the differences in cultural and economic interests of the two companies may further increase the difficulty of working together, resulting in external tension. Thus, external tension originates from the variable contributions of different vertical

and horizontal coopetitors over time (Raza-Ullah et al., 2014). Coopetitors try to resolve or balance this tension constantly via the orchestration of individual coopetitors in pursuit of similar goals (Geurts et al., 2022). Therefore, coopetition occurs between organizations within the same market segment, when different opinions and interests arise regarding the value of cooperating with a competitor (Silveira et al., 2019; Monticelli et al., 2022).

Basically, external tension refers to the difficulties top-level managers play out in multilateral coopetition through a combination of cooperation-inducing and competition-inducing mechanisms (Geurts et al., 2022). In contrast, internal tension refers to tensions between generalists (actors who contribute a range of resources, bits of knowledge, and experiences through dispersed efforts over time) and specialists (actors who contribute few resources, bits of knowledge, and experiences in a concentrated effort, often at one point in time) with divergent views and opinions inside the same organization (Bengtsson et al., 2016; Geurts et al., 2022; Raza-Ullah et al., 2014; Silva et al., 2023). Therefore, coopetition enables companies (or individuals) to pursue difficult yet highly rewarding opportunities that cannot be attained of singular format. However, these simultaneous choices can result in direct or contradictory goals, determining coopetitive tensions.

Tension between competitors can be managed (Tidström, 2014). However, to manage tensions in coopetition, it is important to consider the particularities of the relationship, the characteristics of the companies involved, and the specific circumstances. Many approaches are suitable for all cases. Therefore, it is necessary to adapt strategies according to the needs and challenges of the situation (Tidström, 2014). Table 1 presents some strategies to manage tensions.

More recent studies show the use of emerging technologies such as artificial intelligence and blockchain to support multi-competitor coopetition by enhancing governance (e.g., Narayan & Tidström, 2020; Woolley, 2023). These technologies address concerns related to proprietary data protection, knowledge leakage, and information asymmetries, reducing tension between collective value creation and individual value appropriation (Woolley, 2023). The formal role of institutional agents is highlighted by Monticelli et al. (2022), who highlight that these agents promote cooperation among competitors and improve export performance. These agents help minimize tension and foster cooperative performance.

Table 1. Strategies to manage coopetition tensions.

Strategy	Aspects	References
Address the underlying issues	Trust and commitment are key factors influencing the management of tensions in coopetition. It is important to work on these aspects to strengthen the relationship between the parties. It can be done through open communication, transparency, and meeting deadlines. Mutual trust reduces conflict and promotes cooperative behavior.	Celuch et al. (2010); Ndubisi (2011)
Use different styles of management	Different styles of managing tensions can be applied, such as compromise and collaboration. Compromise involves finding mutually agreeable solutions where both parties compromise. Collaboration, in turn, seeks to achieve optimal results that satisfy all parties involved. These styles can be chosen based on the situation and the specific needs of the coopetition.	Fang et al. (2011); Osarenkhoe (2010)
Consider the similarities and differences between companies	The similarity between companies generally favors closer cooperation and more efficient interactions. However, it is important to recognize that similarity can also lead to tensions, especially if companies compete for the same customers. Understanding cultural and procedural differences and seeking convergence points can help manage similarity-related tensions.	Bengtsson et al. (2003); Morris et al. (2007)
Valuing personal relationships	The existence of personal relationships between the actors involved in coopetition can reduce the risk of opportunistic behavior and strengthen mutual trust. Investing in developing personal relationships can be beneficial for managing tensions in coopetition.	Uzzi (1997); Kemp and Ghauri (1999); Zaheer et al. (1998)
Build mutual trust	Trust is an essential element for successful cooperation. It can be developed through sharing resources, communicating effectively, and fulfilling commitments. Mutual trust reduces conflict and promotes cooperative behavior.	Parkhe (1991); Zaheer et al. (1998)
Cultivate commitment	Commitment is essential for strengthening coopetition. The parties must realize that they are responsible for the goals and activities that contribute to the results of the relationship. A high level of commitment from both parties contributes to the viability of the cooperation over time.	Morris et al. (2007); Ndubisi (2011)
Consider institutional factors	Institutional factors, such as social norms and the regulatory context, can also influence tensions in coopetition. Understanding and respecting these factors can facilitate interaction between competing companies in a cooperative relationship.	Mele (2011); Oliver (1991)

Note. Developed by the authors.

Coopetitive interorganizational relationships between microbreweries

Coopetition relationships happen between competitors, suppliers, complementary businesses, government agencies, local people, and customers (Chim-Miki & Batista-Canino, 2017). However, the most challenging relationship, without a doubt, is between competitors. The craft beer industry is no different. Unlike the industrial beer market, which has few (and large) breweries, the craft beer market comprises several small producers (Associação Brasileira das Cervejarias Artesanais [ABRACERVA], 2017).

In some cases, such as in Porto Alegre City, several brewers got together and, with the support of private social service entities, such as Brazilian Support Service for Micro and Small Businesses (SEBRAE), took the first steps in organizing and seeking greater professionalization in the sector. From then on, the creation of the Associação Gaúcha de Microcervejeiros (AGM) and Associação dos Cervejeiros Artesanais (ACERVA) contributed even more to the consolidation of the sector (Monticelli et al., 2018).

Many breweries joined individually, understanding they could gain scale, reduce costs, and expand knowledge. The union of a group of five breweries strategically located in a region undergoing revitalization in Porto Alegre demonstrated that coopetition generates a competitive advantage based on dynamic capabilities (Teece et al., 1997). Such dynamic capabilities were developed from processes and routines such as collective purchases, shared distribution expenses, shared production, education of consumers and other beer producers, group interaction, and a business roundta-

ble with entrepreneurs from the food and drink sector in the hospitality industry (Silva et al., 2023).

Despite the individual and collective gains from coopetition, the process has tensions (Silva et al., 2023). These tensions will be analyzed from the perspective of the relationship between two types of breweries: gypsy breweries — those that develop recipes but need to use the production structure of another brewery, and non-gypsy breweries — that have their factory to produce their recipes. The next section details the methodology used for this analysis.

METHOD

This study was guided by qualitative research procedures, considering the case study method and ANT adequate to investigate tensions among brewers (gypsy and non-gypsy), equipment, routines, processes, and relationships — all of them can be considered as actors. Thus, the exercise carried out in this research was to observe and question the associations and relationships developed between human beings (brewers) and nonhumans (equipment, routines, processes, and relationships), accompanying the actors, and preserving the actions carried out by the social, natural, and material in these translations, processes, and descriptions.

Actor-network theory (ANT) explores the relationships and interactions between human and nonhuman actors within a network. It emphasizes the idea that both human and nonhuman entities (such as technologies, objects, and institutions) play active roles in shaping social phenomena. ANT considers these entities as 'actors' and focuses on how they form connections, influence each other, and contribute to the construction of social realities. ANT seeks to understand

the dynamic and symmetrical nature of these relationships, challenging traditional distinctions between the social and the material (Latour, 2005; Law & Hassard, 1999); its ontology is relational, whereby actors are treated symmetrically, and humans and nonhuman are placed on an equal analytical footing (Law & Singleton, 2013, 2014).

Therefore, the study is characterized by qualitative longitudinal research and used the interpretative case study methodology (e.g., Stake, 2006; Walsham, 1995) to guide data collection and analysis. Moreover, the study was carried out through several practical processes of observation, annotation, interview, and image capture, added to the operational process of transcriptions, encodings, descriptions, and translation and analysis. The researchers followed the actors through their construction, assembly, association, and deconstruction in society, relations, and the market (Latour, 2005; Silveira et al., 2022). The data was collected mainly through semi-structured interviews and monitoring the social networks of the microbreweries and the different actors (members) participating in each context analyzed. The immersion in the research field occurred

at different times, between September 2018 and March 2019. Data collection interviews with eight non-gypsy and seven gypsy breweries totaled 15 microbreweries. The interview searched what is happening or how and why the relation occurs. The interviewer seeks to understand what interviewers know, believe, expect, desire, comprehend, searching the relation and their role in the development of the Fluminense Rio de Janeiro craft beer market. Each interview lasted around 60 minutes and it was held in breweries. The paths chosen are described in the next section, followed by the collection, coding, and analysis of the data. The researchers chose a case study of gypsy and non-gypsy breweries in the Rio de Janeiro State market due to the pioneering spirit that took place in the region.

Although interpretative case studies do not follow positivist premises (Tonelli, 2016), they also have criteria to ensure their quality and methodological rigor. Pozzebon (2004) identified four criteria for evaluating interpretive research, considering its ontological and epistemological assumptions: (1) authenticity, (2) plausibility, (3) criticality, and (4) reflectivity, as illustrated in Table 2.

Table 2. Critical-interpretive research quality indicators.

Criterion	Description	Technique adopted
Authenticity	The researcher must have contact with the field to interact with participants and access documents.	Several sources of evidence collected were used during the field research, namely: (a) interviews with relevant actors; (b) participant observations with field notes; (c) access to documents such as audio messages, news, social media, and website content.
Plausibility	Refers to the capacity of the text to make sense for the readers, that is, to have good development and structure for their understanding, in addition to being relevant to them.	Diagrams and summary tables were used to facilitate the understanding of the actor-network formation process and explain the translation processes associated with the relationships and tensions between gypsy and non-gypsy microbrewery entrepreneurs.
Criticality	The text should encourage readers to question a study's prevailing and conventional views.	The research sought to highlight the tensions in the analyzed case, such as the view of different actors (users, entrepreneurs, and stakeholders) about the information from interviews versus those from the news, documents, and observations made.
Reflectivity	The author must contribute to the study by describing his activities and views on this research, revealing his role, as well as his idiosyncrasies and personal assumptions.	The researchers presented their position on the analyzed case, describing their routines, activities, processes, and relations.

Note. Developed by the authors.

Some gypsy breweries were listed for their relevance in the market and for being open to receiving researchers to conduct interviews with those responsible. Thus, a non-probabilistic sample was used using the criteria of accessibility and typicality defined by Vergara (1998, p. 49), resulting in in-depth interviews with eight gypsy brewers from the Rio de Janeiro State.

To complete this research, those responsible for breweries that rent their idle space (non-gypsies) or built breweries that serve as incubators for gypsies were interviewed. Twenty-eight were found in Rio de Janeiro State, and seven were selected for interviews. Again, using the criteria established by Vergara (1998, p. 49), accessibility

and typicality, prominence in the market and receptivity to research¹.

The interviews with gypsy and non-gypsy brewers (actors) are considered relevant to the description of coopetition tensions. They were developed between September 2018 and March 2019, and divided into two phases. In the first phase, pilot interviews were carried out (September 2018 to October 2018), and in the second phase, between February 2019 and March 2019, the subjects, the daily number of interviews and the means of contact carried out in person were evaluated. In person, telephone call or video call depending on the availability of each participant during the research collection. Thus, 15 interviews with codes were created to preserve

the identity of the interviewees. Appendices A and B detail this interview script with their categories.

The interviews were recorded, later transcribed, and organized into categories for analysis by the authors. In addition, the researchers observed some gypsy breweries in sales places, such as bars, food fairs, beer events, and other spaces such as supermarkets, convenience shops, and social media where the researchers found gypsy brewers offering their products to the consumer. This process made it possible to reach individuals at different times and locations. Thus, the snowball technique was applied (for example, [Walsham, 1995](#)) with different actors involved. Therefore, a registration system was established in a field notebook, resulting in 80 pages after 10 hours of observing the events, monitoring the virtual communities, and interviewing brewery entrepreneurs.

To analyze this data, we used the actor-network theory translation process as an analytical lens to understand the phenomenon of coopetition between gypsy and non-gypsy brewers. The starting point of the description is considering the coopetition as a black box. From there, we identify human and nonhuman actors and their relationships. Based on the relations, we organized the four phases of translation according to [Callon \(1986\)](#) and identified the obligatory passing point (OPP). An OPP refers to a crucial juncture or a specific location within a network where various elements converge and are required to pass through for an action or process to continue ([Callon, 1986](#)).

Some notions are important for the analysis that will follow actors, human and nonhuman, network, black box, and translation. Actors are not fixed entities, they have flow and movement throughout the network, although they can have stability and continuity. It includes humans and nonhumans and leaves traces that can be followed. Actors are also networks ([Latour, 1997, 2005, 2011](#)). For [Latour \(1999\)](#), nonhumans can include a wide range of things such as technologies, objects, animals, institutions, and even ideas. The key insight of ANT is to treat humans and nonhumans symmetrically, meaning that these entities are both seen as active participants in the construction of social reality. The network is formed by the association, even if transient, of heterogeneous elements and depends on different relationships to exist ([Latour, 2005, 2011](#)).

A black box refers to a concept used to describe the process by which certain elements within a network become stabilized and taken for granted, thereby hiding the complexity of their inner workings; it means that its internal mechanisms, associations, and dependencies are no longer questioned or visible ([Latour, 1999](#)). That's why we use the translation processes. Translation means understanding how actors mobilize, bring together, and keep

together the various elements of the network ([Callon, 1986](#)).

[Callon \(1986\)](#) suggests four moments (or movements) to explain the translation process: problematization, inter-essement, enrolment, and mobilization. The distinctions between these four movements are not given a priori immediately and do not imply an implicit temporal differentiation ([Bergström & Diedrich, 2011](#)). Throughout this process, the identity of actors, the possibilities of interaction, and the margins of maneuvers are negotiated ([Bruce & Nyland, 2011](#)). There are struggles over identities and interests that can be studied empirically ([Bergström & Diedrich, 2011](#)). [Callon \(1986\)](#) describes the first phase of how actors become essential in a network at the problematization. A topic or issue that disturbs (or starts to disturb) the network needs to be stabilized, even temporarily.

Problematization aims to identify the network's actors and define each one's identities by a shared understanding or obligatory passage point (OPP). This moment describes an actor's efforts to persuade others to accept their vision ([Alcouffe et al., 2008](#)). The inter-essement ([Callon, 1986](#)) aims to stabilize the actors' roles. There is still flexibility for previously recognized entities to integrate into the problematized plan or to reject participation (completely or in part), defining their identities, orientations, motives, and interests in new ways ([Dambrin & Robson, 2011](#)). The inter-essement involves an actor ('actant') attempting to convince others that the benefits he/she/it has defined for them align with his/her/its benefits ([Bergström & Diedrich, 2011](#)).

At the enrolment movement, the enroller actor seeks to define and coordinate the roles of the other actors ([Callon, 1986](#)). According to [Bergström and Diedrich \(2011\)](#), enrolment is a movement that defines a group of interconnected roles and assigns them to the players who accept them. The fourth movement refers to the mobilization of allies in the relational arrangement. The selection of a spokesperson is the result of a chain of intermediaries and equivalences ([Bergström & Diedrich, 2011](#)). The representative actor reinforces the roles, identities, and purposes previously negotiated by speaking on behalf of the different actors, resulting in indifference. After the agreement is established, each entity's room for maneuver will be clearly defined.

At this point, "the network can act as a single unit, which can be distinguished from its environment as an object (actor-network) with its own consistent identity" ([Callon & Law, 1997](#), p. 170). However, each entity comprises a network in and of itself. Therefore, every change in an actor network's entities results in changes to the network's organizational structure ([Sayes, 2014](#)). As a result, the stability of the network is not only dependent on the connections between its pieces.

Finally, it should be noted that rather than four separate, linearly sequenced movements, the translation approach considers the arrangement of any network a complex process with multiple, cumulative, and conjunctive progressions of convergent, parallel, and divergent activities (Alcouffe et al., 2008). Therefore, to realize this process, we describe the gypsy and non-gypsy micro-brewery study case.

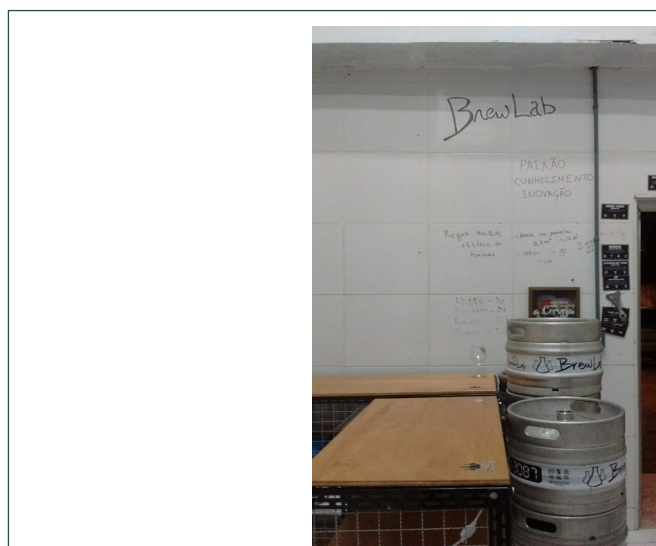
GYPSY AND NON-GYPSY BREWERIES IN RIO DE JANEIRO STATE

Brazil is the third largest beer producer in the world, with about 16 billion liters per year, behind only the United States and China, the world's largest consumer markets (Ministério da Agricultura e Pecuária [MAPA], 2023). The beer market encompasses beers produced on a large scale and sold in different parts of the world. The craft beers are made in micro and small breweries in a smaller volume than the production of large breweries. In addition, craft beer favors manufacturing through manual processes and without preservatives, mixing water, yeast, hops, and malted barley. Moreover, the master brewers can use their creativity in choosing original ingredients to give a different flavor to their production. The quality and the authentic taste are the great attractions of craft beer to face the dominance of the beer market by the big breweries, which sold the beer produced on a large scale (SEBRAE, 2016).

In Brazil, craft beer production has more than 1,700 registered breweries. The highest concentration of breweries is in the Southeast (46.2%) and South (39.7%) regions. Data collected from the Ministério da Agricultura e Pecuária (MAPA, 2023) for 2022 presented the number of craft breweries by state: São Paulo (387), Rio Grande do Sul (310), Minas Gerais (222), Santa Catarina (215), Paraná (161), and Rio de Janeiro (120). The Midwest has an expanding market, and the Northeast concentrates the smallest number of craft breweries. Still, it is a place that is establishing development, even at a slower pace (MAPA, 2023).

The Beer Yearbook prepared by MAPA (2023) highlights that the number of breweries in the country (1,729) is different from the number of existing labels (42,831); that is, there are a greater number of brands than breweries. This phenomenon is due to the gypsy breweries that produce their labels in the idle spaces of other breweries with their factories (ABRACERVA, 2023).

The gypsy brewery, also known as a collaborative or associated brewery, where brewers do not have their own factory, rent the idle space of a third brewery to produce their beer in a larger volume than that brewed at home (Roncolato, 2016). The initial investment of a gypsy brewery is around ten times lower than investing in a factory of its own. This brewery model promotes the expansion of production, transforming homemade production into a volume production for sale and professionalized (Silva, 2017).



Source: Authors' collection.

Figure 1. Gypsy brewery.



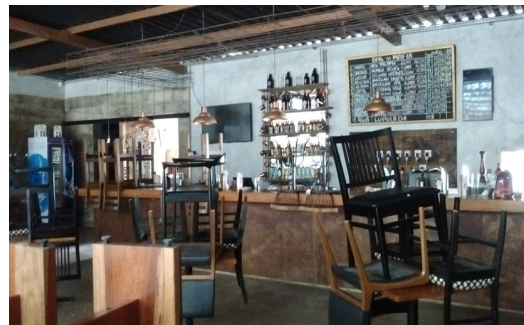
For commercialization, the gypsy brewer needs to legalize the recipe in the MAPA and it is also necessary to register the company to sell the beer (Torrente, 2016). After creating the company, the search process for the factory that will produce the recipe begins. Such

partnerships take two forms. The first is a commercial agreement in which the gypsy, in addition to producing the beer, must purchase a batch of beer produced by the factory that is receiving him. The payment is at the end of production, and the gypsy will distribute its own

beer. In the second form, the factory owner will carry out the entire process using the gypsy's recipe: purchase of inputs, production, stock, and distribution, and the gypsy will pay per liter of beer produced. However, this does not mean that the gypsy will not accompany the beer production; in this model, he transfers the burden of searching for resources to the factory receiving him and monitors the production process.

The relationship established between the two beer brands should provide benefits for both. The micro-brewery that receives the gypsy recipe in its tanks can exchange knowledge and innovation with the gypsy brewers who develop more daring recipes and

carry out a collaborative work of trading experience between all those involved. Ultimately, it is earned by renting the idle tank to continue producing when the revenue is not in production (Roncolato, 2016). Figures 1 and 2 show differences between gypsies' and non-gypsies' spaces. One side of the relation is the gypsy brewery (see Figure 1). It does not need a massive structure for the commercialization of its beer. On the other side, there is a non-gypsy brewery (see Figure 2) with a significant structure to produce and commercialize its beer. The differences exemplify an unbalance in the relationship between gypsies and non-gypsies.



Source: Authors' collection.

Figure 2. Brewery factory.

Gypsy breweries, for not having to manage a factory and its operating costs, focus their efforts on brand development and product innovation, turning their attention to developing new markets through participation in brewing events and the search for partners to produce and distribute their beer (Chaves, 2016).

Since 2014, Rio de Janeiro has had a beer route that promotes tourism in craft breweries in the countryside, such as Petrópolis, Teresópolis, Nova Friburgo, Cachoeiras de Macacu, Guapimirim, and Santa Maria Madalena. The craft market is characterized by the predominance of gypsy breweries and the need to establish relationships between factories and gypsies to sustain it.

The growth in craft beer consumption across the country has been reflected in the development of gypsy microbreweries producing their beers in Rio de Janeiro. According to the Association of Microbreweries of Rio de Janeiro (AMACERVA-RJ), there is an estimate that there are more than 175 craft beer producers in the state, including factories and gypsy breweries. These numbers extrapolate data from the MAPA. However, this number needs to be more accurate. Therefore, the association sought to regularize the numbers and work

toward developing the sector with legal entities and among the producers themselves (Zobaran, 2017).

The authors applied a survey on the social networks Facebook and Instagram, finding the existence of 180 microbreweries in the state of Rio de Janeiro, divided into the following classifications:

- 126 gypsy microbreweries;
- 28 microbreweries that are factories that receive gypsies;
- 26 microbreweries that are factories that do not receive gypsies.

This research employs ANT translation as a methodological process to trace collective actions and relationships between microbreweries. This methodology guides the entire process of examining actors' relationships for coopetition in the two types of microbreweries (gypsy and non-gypsy). In this way, this research reveals how cooperation emerges between competing (or conflicting) actors (stakeholders) and how tensions occur between them. These relationships are obtained through joint activities and interacting/debating/tensing/opposing actions (Nguyen et al., 2022; Ralandison

et al., 2021). The following section discusses the ANT translation process used to fulfill the research objectives.

ANT TRANSLATION PROCESS

It is well known that actors' (stakeholders) relationships constantly change throughout the production and commerce development process (Lundgren-Henriksson & Tidström, 2021; Silva et al., 2023). By tracking collective actions for specific goals related to coopetition tensions in the ANT translation processes, this research revealed actors' (stakeholders) assemblages, combinations, and interactions in networking processes, influencing their relationships and tensions in these routines.

The main actor determines possible problems, controversies, routines, decisions, tensions, and relationships (Callon, 1986). In this case study, the decision to

be resolved is related to the following question from gypsy and non-gypsy breweries: 'How do coopetition relationships occur between gypsy and non-gypsy breweries?'

The dynamic actors' (stakeholder and entrepreneurs) relationships manifested in three ways, revealing different tensions and types of coopetition occurring at a network level in the two brewery types. Coopetition emerged between activities, routines, produce processes, interfirm relationships, and the brewery community. Thus, the translation process contributed to identifying three central actors-networks in the coopetition process in the craft brewery market in the state of Rio de Janeiro: the gypsy brewers, the non-gypsy brewers, and the factory. Table 3 details the four translation phases performed at the gypsy and non-gypsy breweries relationships that highlight our findings.

Table 3. Translation phases.

Translation phases	Gypsy and non-gypsy breweries
Problematisation	The problematisation is brought into play in coopetition when, on the one hand, a brewer (gypsy) needs a place to produce without the high costs of a factory and, on the other hand, a brewer (non-gypsy) has idle space in his factory. The choice of a place to produce gypsy beer goes through a process of building trust. In efforts to demonstrate trust, non-gypsies define roles in the coopetition relationship to become the obligatory passage point (OPP). However, a relationship of trust will be established with the factory (equipment and people). What matters to non-gypsy is the factory technology, the factory staff, and the factory certificates and credentials. The OPP is the factory.
Interessement	The factory stabilizes the identity of the other actor-networks, gypsy and non-gypsy. The gypsy, as the actor-network, has the advantage of not having the factory, and the non-gypsy is responsible for the factory's costs. The factory establishes itself as an essential actor, first to produce gypsy beer and, secondly, as an advantage of the gypsy not to worry about the production costs related to the factory since the non-gypsy brewer takes care of the costs. Thus, the factory establishes itself as an OPP, and more than that, the factory defines the roles of the other actors.
Enrollment	The gypsy brewer promotes alliances to coordinate roles. The gypsy brewer assigns himself the role of creating new recipes and thus moves the craft beer market. As they are not committed to maintaining the factory, gypsies can experiment with more recipes and launch new products alone or in conjunction with other breweries or factories. However, gypsies are linked to the factory's production time and a market requirement of always presenting an innovation. Thus, although gypsies become an OPP when the craft beer market refers to innovation and new recipes, the factory remains.
Mobilization	The human actors-networks reinforce their roles and close the black box of coopetition between gypsies and non-gypsies. All utter the same speech: it is only with the existence of the coopetition relationship that the craft beer market innovates and remains active. With this unified discourse, the human actors agree to have roles that disguise the existing tensions involving the nonhuman actor (factory).

Note. Developed by the authors.

The actor-network concept represents a heterogeneous network of interests and aligned actions, including people, artifacts, organizations, paths, facts, and other elements. Therefore, the human and nonhuman actors are a collective group that acts and interacts as a coordinated network in motion (Latour, 2005; Silveira et al., 2022). The analysis of translations provides guidelines for understanding the routines, activities, and interactions of the relationships between breweries' production process, equipment, individuals, and factories.

The physical structure represents the factory and equipment, the first characteristic differentiating gypsy from non-gypsy breweries. In the factories are the resources, processes, routines, equipment, machines, supplies, and raw materials that support the responsible brew master hired and other work teams that depend on this structure. Individuals have as their main characteristic the management of these resources because they know the production processes, administrative

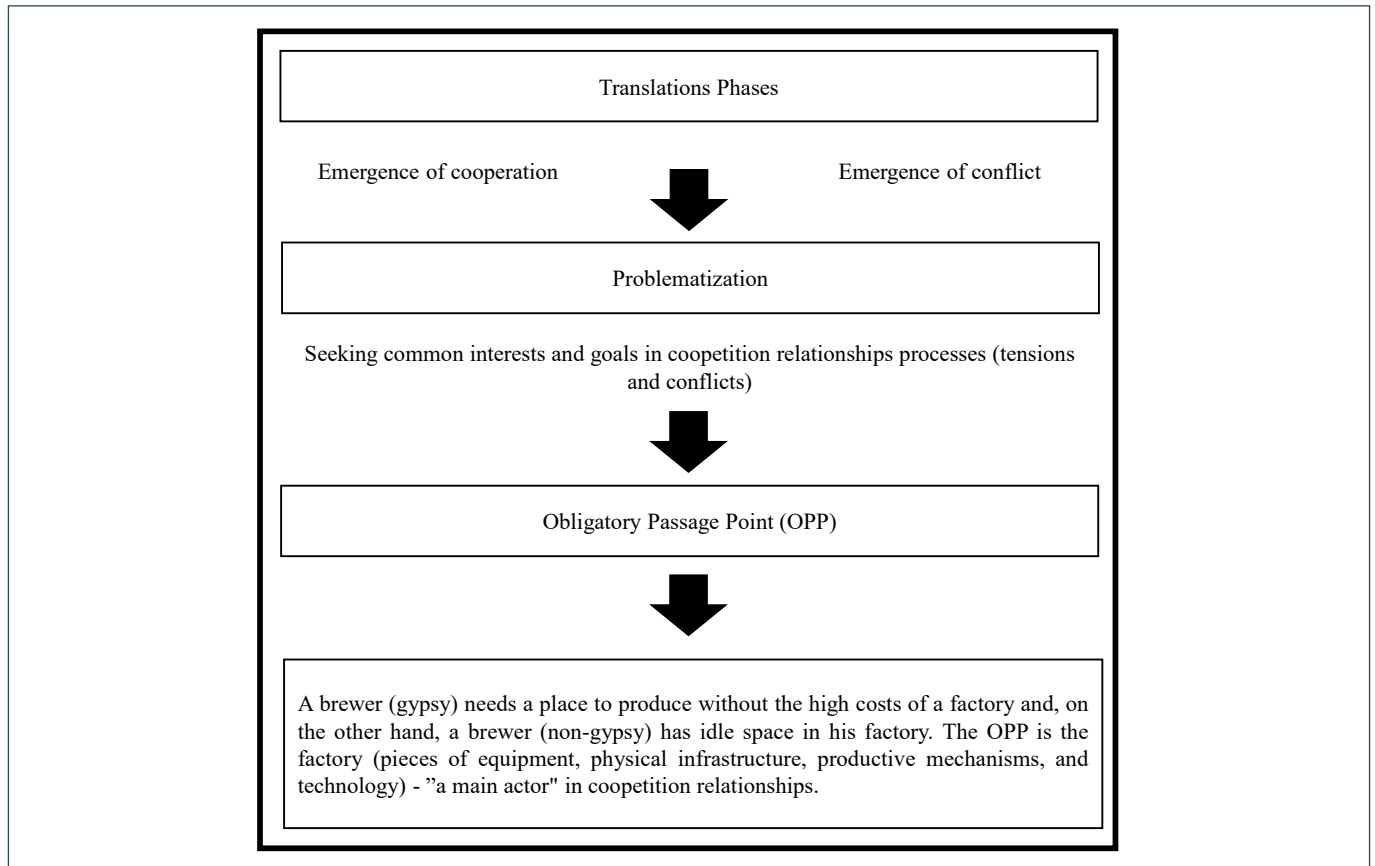
routines, and operational activities of production, distribution, and commercial craft beer. At the same time, individuals are represented by brewers, master brewers, administrative employees, commercial partners, technical supporters, partners/investors, and consumers. Therefore, the translated evidence highlights the broad relevance of the factory agency for establishing relationships, routines, activities, and processes in the microbrewery market.

It brings market recognition to these craft breweries and much knowledge about the craft beer market and how production works between gypsy and non-gypsy brewers (Silva, 2017; Silva et al., 2023). Thus, these models are consolidated in the craft beer market. Non-gypsies have labels known to the public. To do so, they invested time and money. As a result, they know the working dynamics of the craft beer market: consumers and suppliers (Monticelli et al., 2018). In addition, because they own the factories and have beer labels

known to the consuming public, they have autonomy for production and distribution processes (Monticelli et al., 2018; Silva et al., 2023). They can welcome gypsy brewers and produce their beer simultaneously.

In this way, the factory and brewers (entrepreneurs) are the actors: nonhuman and human entities that

perform or mediate some action or make a difference in the heterogeneous network, leaving a trail in routines, processes, activities, and relationships (Callon, 1986; Latour, 2005, 2011; Law, 1992, 2004). Thus, Figure 3 presents the OPP the actors use to reach their proposed objectives in this relationship process.



Source: Developed by the authors.

Figure 3. Coopetition relationship process in gypsy and non-gypsy craft breweries.

Usually of those seven, four are with the gypsies, and three with my beer" (non-gypsy factory representative 5).

There are factories with a focus on work aimed at gypsies, with a larger simultaneous production space, as one of the respondents reported: "... simultaneously we serve up to nine [gypsies] because that is the number of fermenters we have; a large part of our production, about 85% of our production, is gypsy" (non-gypsy factory representative 3).

However, after all, what is the factory? It is the equipment for beer production: fermentation tanks (fermenters) and others, the spaces destined for the administrative part of the brewery, and the spaces to store the beer production. Some non-gypsy breweries have a factory connected to a bar. But not just that. The brew master and the register at MAPA are linked to the factory. The factory is also a place of learning. Representative 2 from the non-gypsy brewery reinforce that:

There was a lot of exchange of experience in all the factories where we worked. There are always exchanges and learning, very experienced and attentive brewers. When I started working, even though I had a brewer's vision, I was not used to day-to-day life, and this relationship with structured factories added to the process of learning and experience (non-gypsy factory representative 2).

The relationship between gypsy and non-gypsy breweries is a model of non-ownership, in which gypsy brewers use the benefits of the factory, that is, fermenters, spaces, government certificates, and others, without having to build the factory, as well as not incur maintenance costs (Silva et al., 2023). They also benefit from the social capital and reputation that non-gypsy possess (Silva, 2017). As for the non-gypsies, in addition to not having idle space in the factory, which implies sharing costs, they benefit from the constant launch of

new labels and closer contact with the public that the gypsies have. Non-gypsy brewers also build their reputations on gypsy and the innovations they produce. These innovations favor the craft beer market.

Gypsies have a preference because they bring new ideas, suggestions, and creations. Gypsy brewers are creative and very collaborative, helping in the production process. They [the gypsies] monitor the tank control at most, which is online, where they check the temperature, pH, extract, supporting and implementing new processes and forms of production (non-gypsy factory representatives 1 and 4).

Although the word 'gypsy' designates someone with no fixed residence, many gypsy breweries do not frequently change the place of production. They do not change the factory. Half of the interviewees (four gypsies) work with only two factories. On the other hand, three gypsies produce with a single brewery. Only one gypsy brewery calls itself a nomadic gypsy, one that produces its beer with as many factories as possible: "Currently four, but we are going to five, six and seven soon. Concept of the nomadic gypsy is the gypsy who is really the one who runs. We do not stop, and if we have the opportunity to go somewhere, we go" (gypsy brewery representative 8).

The person in charge of the gypsy brewery 4 stated that the gypsy production model allows him not to be trapped in the structure of a single factory, letting him to experiment with other production sites: "... not being tied to a physical structure, it gives freedom to migrate to other factories" (gypsy brewery representative 11).

However, this is not so simple, as the choice of the place to produce depends on establishing relationships of trust, especially between the gypsy and the factory. The problematization is at stake, but the roles are still being defined. In efforts to demonstrate trust, non-gypsies begin to define roles in the coopetition relationship to become the OPP (obligatory passing point). However, a relationship of trust will be established with the factory (equipment, machines, and people). Problematization is when an 'actant' (or more) "establishes itself as an obligatory crossing point in the network of relationships that he or they have been building" (Callon, 1986, p. 6).

All these processes went through relationships developed in a non-spontaneous and spontaneous way. The evidence demonstrates that routines, activities, processes, interactions, and coopetitive human relationships are mediated by the factory's equipment, mechanisms, and physical infrastructure (nonhuman actors).

Those responsible for the factories consider the advantage of being a gypsy to be that they do not have to pay for the construction of the factory, maintenance of equipment, staff, and a series of expenses that non-gypsies need to be concerned about. That is, the gypsy brewers do not need to pay attention to the factory, as reinforced by a representative from a non-gypsy factory:

The biggest advantage [of not having a factory] is the investment cost. Setting up a factory today requires an investment of at least one million (reais) ... Then you have maintenance costs, employees, electricity, water, inputs, transportation, etc. (non-gypsy factory representative 4).

This aspect denotes one of the tensions [Raza-Ullah et al. \(2014\)](#) pointed out regarding inter-organizational tensions. Some aspects stand out despite non-gypsies' interest in occupying their idle space and time in the factory.

The factory is the nonhuman actor that the gypsy needs in order to produce. Despite the lack of concern for factory costs, which allows the gypsies the freedom to create a recipe, they must wait for the factory to produce, generating individual tension ([Sheep et al., 2017](#)). In some moments, to maintain the factory, non-gypsy produces more line beers without much freedom to create different recipes. In other words, the gypsies are who they are only because of the existence of factories.

We didn't know what the business model was like for producing beer using the gypsy model; Everything we discovered along the way, that is, there was a six-month queue to start the process of producing gypsy beers. It was very difficult for you to become a gypsy (non-gypsy factory representative 1).

The gypsies are concerned about the cost savings they get when they come together to buy inputs, participate in events, and exchange experiences with factories. Gypsy brewery representative 9 explains that "various partnerships arise and sometimes there are factories that bring together several gypsies, which reduces the cost ... this partnership issue is also very important." This reduction cost for both sides (gypsy and non-gypsy) based on the factory's sharing is one of the benefits highlighted by the coopetition model ([Monticelli et al., 2018](#); [Silva et al., 2023](#)).

The factory establishes itself as an essential actor, first by producing gypsy beer and, secondly, as an advantage for the gypsy not to worry about the production costs related to the factory since the non-gypsy

brewer takes care of the costs. Thus, the factory establishes itself as an OPP and, more than that, the enrollment happens: this is when an 'actant' (or more) promotes alliances and negotiations in order "to define and coordinate the roles" (Callon, 1986, p. 10). Therefore, the factory (nonhuman actor-network) defines the other actors' roles in this coopetitive craft beer production process.

Gypsies have disadvantages over factories, such as higher production costs, dependence on factory availability, and difficulties in logistics to distribute production, among others. All respondents claim that one of the advantages of gypsy brewers over factories is the freedom to create different recipes, as their production is smaller. Incidentally, this is one of the hallmarks of the gypsy actor. This freedom is explored by non-gypsy brewery factory representative 2, who said, "The gypsy already has a little more freedom to create because he can brew a small amount of a newly created beer to try it out." Gypsy brewery representative 10 reinforces it, affirming, "Freedom is the greatest advantage of the gypsy, so we have the beer recipe and produce it in any factory."

Exploring new ways of production, raw materials, and recipes contributes to the gypsies to expand the craft beer market, partnerships, and commercial relationships, in addition to bringing new pricing strategies, management, performance measures, and marketing tools to the market (Mayo, 2003; Monticelli et al., 2018).

It fosters culture in a way because the fact that there are many different labels on the shelf encourages people to stop, or at least makes them curious. In the past, there was a very big limitation when I started to be very interested in craft beer. There was not even a craft beer shelf in the markets ... Today, you have shelves with 200, 300, 400 labels. So, this brings curiosity to consumption and encourages the market (gypsy brewery representative 8).

Moreover, the gypsy brewer becomes a temporary OPP when the craft beer market refers to innovation. The factory is still present since the "lack of commitment to the costs that the factory represents" (non-gypsy factory representatives 1, 2, 4, and 6), allows for coopetition through enrollment. This enrollment happens in one movement between groups (human and nonhuman actors) with interconnected roles that assign them to the players who accept them and participate in this cooperative process.

Consequently, the black box of coopetition between gypsy and non-gypsy brewers is closed when they all utter the same speech: it is only with the existence of this relationship that the craft beer market innovates and

remains active, dependent on a solid physical infrastructure, and on active, engaged, and innovative processes and techniques. This representative actor reinforces the previously agreed-upon roles, identities, and goals by speaking on behalf of the numerous 'actants'. Thus, mobilization occurs when an 'actant' (or more) becomes a representative spokesman, which means "to render mobile entities which were not so beforehand" (Callon, 1986, p. 12). In this phase, a series of intermediaries and equivalences leads to the designation of a spokesman, so "the network can act as a single unit, which can be distinguished from its environment as an object (actor-network) with its own consistent identity" (Callon & Law, 1997, p. 170). Some evidence describes this process:

Big brands that exist today are gypsy, one or another that is not, but if in Rio de Janeiro there was not this gypsy movement, I do not know how the beer market would be here (gypsy brewery representative 13).

Representatives of non-gypsy breweries agree with gypsy breweries about the results that gypsy breweries produce in the craft beer market in Rio de Janeiro.

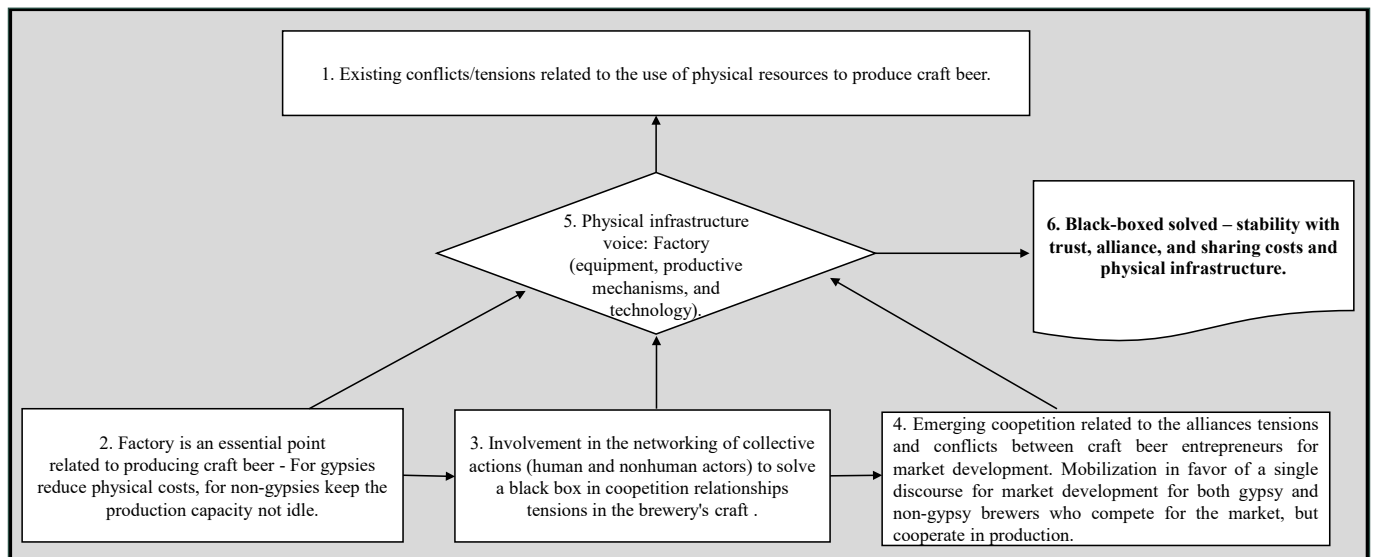
This movement ends up generating more brands. If each gypsy had its factory, perhaps it would not have the variety of brands it has today (non-gypsy factory representative 7).

The more gypsy breweries you have, the greater this disclosure, the greater the variety of styles, the greater the public interest, the greater the scope of this product in the general market ... (non-gypsy factory representative 4).

The main contribution of gypsy breweries to the craft beer market perceived by the two human network actors in this relationship is to develop the craft beer culture with new recipes, packaging, labels, and promotions. With this unified discourse, the human actors assume roles that disguise the existing tensions that encompass the nonhuman actor (factory), that is, having or not having power, ownership, and control of production processes, equipment, mechanisms, techniques, and routines of manufacture. Gypsy brewery representative 9 explained that,

I believe that they [gypsy breweries] contribute mainly to one thing: creativity.

In the end, the authors identified that besides being an OPP at various times, the factory is also an actor who is a mediator. Figure 4 demonstrates this path.



Source: Developed by the authors.

Figure 4. Obligatory passage points in gypsy and non-gypsy craft breweries' coopetition.

Mediators transform, translate, distort, and modify the meaning or elements that are supposed to carry a fact, process, or relationship (Lamine, 2017). Mediators, even in silence, are considered and recognized in many analyses as intermediaries in action; "What goes into them never defines exactly what comes out" (Latour, 2005, p. 65). Craft beer, reputation, experience, knowledge, and new flavors come from the factory. The factory is a mediator being disputed and participates in the dispute being an OPP in this coopetitive relationship process.

CONCLUSIONS

The study's main objective is to analyze how tensions occur in the coopetition relationships between gypsy and non-gypsy craft breweries. The empirical findings in this research assist in deepening understanding of this relationship tensions by revealing the influence of factory (nonhuman actor) on the emergence of coopetition. Factory, equipment, mechanisms, and physical infrastructure become factors affecting/creating goal/interest, compatibility/incompatibility, conflicts/tensions, and a platform for developing relationships and coopetition between gypsy and non-gypsy breweries. In addition, using ANT to examine networking processes, this research applies the translation processes (this practice theory) to understanding coopetition in given production routines in the craft beer market.

According to the ANT perspective, actors act, produce and interact on behalf of their networks, and networks become actors that have a single agency to act collectively (Nguyen et al., 2022; Silveira et al., 2022). Thus, the translation process can produce 'facts' and stabilize fully to become a 'black box.' According to Latour (1997, p. 131), a 'black box' can be considered a

taken-for-granted system where many elements and actors act as one. Therefore, this perception enabled this research to explore the emergence of coopetition at a network level, as a network was positioned as an actor that could cooperate or conflict with other actors or networks of humans or nonhumans (e.g., entrepreneurs, brewery masters, factories, recipes, processes, and physical equipment).

While coopetition has primarily been explored within business networks, supply chain networks, marketing relationships, sharing knowledge, and dynamic capabilities (Bengtsson & Kock, 2014; Monticelli et al., 2018; Robert et al., 2018; Silva et al., 2023; Silveira et al., 2019), this research expands the understanding of coopetition in a heterogeneous network of multiple actors (brewers, physical infrastructure, equipment, mechanisms, and processes) collectively working for a business relationship. However, there needs to be more tension in these productive, marketing, and commercial relationships. In these relationships, we have another level of tension between humans and nonhumans participating in these cooperative and competitive activities. Thus, we identified the tension between having a physical structure or not, that is, a factory, its equipment, and mechanisms to carry out the productive processes of craft beer. Therefore, this research provides insight into the role of dual relationships (human and nonhuman actors) in achieving goals and empowering gypsy and non-gypsy breweries.

This research is an initial effort to contribute specific empirical case studies highlighting an intervention of conflict or tensions in existing collaboration to secure individual interests. This research found that coopetition happens between human and nonhuman actors in collective relationships. Raza-Ullah et al. (2014) pro-

posed three levels of tension: individual, organizational, and interorganizational. However, this study highlights a fourth level: the nonhuman, in this case, the factory. The factory, as a nonhuman actor, generates tensions between individuals (brewery owners), organizations (non-gypsy breweries dealing with the internal tension of own production versus gypsy production), interorganizations (between gypsy and non-gypsy breweries), and, in the end, the nonhuman – the factory.

For Nguyen et al. (2022) and Ralandison et al. (2021), there is a dynamic between actors that are brought together through networks to have established cooperation between competitors/conflicting actors (stakeholders) or have generated conflicts between different actors. Networking becomes a factor that affects/creates the objectives/interests for the emergence of coopetition. Thus, using ANT translation process to examine networking processes, this research contributes with an application of practice, theory, and method to understanding coopetition in given situations like relationships and tensions.

Considering the strategies to manage the tensions, the results of this research corroborate the studies by Bengtsson et al. (2003) and Morris et al. (2007), which consider the similarities and differences between companies. Gypsy and non-gypsy breweries benefit from cooperation and efficiently exploit these interactions. Despite the tensions generated in the relationship, mainly between the breweries and the factory (nonhuman actor), they have a win-win relationship. Therefore, these insights can provide valuable managerial implications for brewery owners in optimizing their resources, physical equipment, operations, and relationships to manage collaborative and competitive interactions.

Some limitations are inherent to this research, mainly concerning the number of interviews and the regional selection. Based on that and the study's findings, expanding the analysis to other states in Brazil with greater representation, such as São Paulo and Rio Grande do Sul, and even different sectors, such as olive oil production, can bring new insights. By the end, it is suggested to analyze the intra-organizational tensions in craft breweries, considering that even non-gypsy ones are small organizations with few employees and are managed by the owners.

ENDNOTE

1. The full list of interviewees, script, interviews stages, and analyzed categories is available on https://www.researchgate.net/publication/373446602_List_interwied at Research Gate.

REFERENCES

- Associação Brasileira das Cervejarias Artesanais. (2017). Com 91 novos registros no 1º semestre, mercado das artesanais avança no Brasil e já tem 610 cervejarias. <https://abracerva.com.br/2017/09/21/com-91-novos-registros-no-1o-semester-mercado-das-artesanais-avanca-no-brasil-e-ja-tem-610-cervejarias/>
- Alcouffe, S., Berland, N., & Levant, Y. (2008). Actor-networks and the diffusion of management accounting innovations: A comparative study. *Management Accounting Research*, 19(1), 1-17. <https://doi.org/10.1016/j.mar.2007.04.001>
- Bengtsson, M., & Johansson, M. (2014). Managing coopetition to create opportunities for small firms. *International Small Business Journal*, 32(4), 401-427. <https://doi.org/10.1177/0266242612461288>
- Bengtsson, M., & Kock, S. (1999). Cooperation and competition in relationships between competitors in business networks. *Journal of business & industrial marketing*, 14(3), 178-194. <https://doi.org/10.1108/08858629910272184>
- Bengtsson, M., & Kock, S. (2000). "Coopetition" in business Networks—to cooperate and compete simultaneously. *Industrial Marketing Management*, 29(5), 411-426. [https://doi.org/10.1016/S0019-8501\(99\)00067-X](https://doi.org/10.1016/S0019-8501(99)00067-X)
- Bengtsson, M., & Kock, S. (2014). Coopetition—Quo vadis? Past accomplishments and future challenges. *Industrial Marketing Management*, 43(2), 180-188. <https://doi.org/10.1016/j.indmarman.2014.02.015>
- Bengtsson, M., & Raza-Ullah, T. (2016). A systematic review of research on coopetition: Toward a multilevel understanding. *Industrial Marketing Management*, 57, 23-39. <https://doi.org/10.1016/j.indmarman.2016.05.003>
- Bengtsson, M., Hinttu, S., & Kock, S. (2003). Relationships of cooperation and competition between competitors. *Proceedings of the Annual IMP Conference*, Lugano, Switzerland.
- Bengtsson, M., Raza-Ullah, T., & Varyushyn, V. (2016). The coopetition paradox and tension: The moderating role of coopetition capability. *Industrial Marketing Management*, 53, 19-30. <https://doi.org/10.1016/j.indmarman.2015.11.008>
- Bergström, O., & Diedrich, A. (2011). Exercising social responsibility in downsizing: Enrolling and mobilizing actors at a Swedish high-tech company. *Organization studies*, 32(7), 897-919. <https://doi.org/10.1177/0170840611407019>
- Beverage Industry. (2018). 2018 beer market report. <https://www.bevindustry.com/2018-beer-market-report>
- Bouncken, R. B., Gast, J., Kraus, S., & Bogers, M. (2015). Coopetition: A systematic review, synthesis, and future research directions. *Review of Managerial Science*, 9, 577-601. <https://doi.org/10.1007/s11846-015-0168-6>
- Bruce, K., & Nyland, C. (2011). Elton Mayo and the deification of human relations. *Organization studies*, 32(3), 383-405. <https://doi.org/10.1177/0170840610397478>
- Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay. *The sociological review*, 32(Suppl 1), 196-233. <https://doi.org/10.1111/j.1467-954X.1984.tb00113.x>
- Callon, M., & Law, J. (1997). After the individual in society: Lessons on collectivity from science, technology, and society. *Canadian Journal of Sociology*, 22(2), 165-182. <https://doi.org/10.2307/3341747>
- Celuch, K., Bantham, J., & Kasouf, C. (2010). The role of trust in buyer-seller conflict management. *Journal of Business Research*, 64(10), 1082-1088. <https://doi.org/10.1016/j.jbusres.2010.11.011>
- Chaves, R. L. P. (2016). *Reinventing a business model: How contract breweries became a permanent form of organizing* [Doctoral dissertation]. Fundação Getúlio Vargas, Rio de Janeiro, RJ, Brazil.
- Chen, M. J. (2008). Reconceptualizing the competition-cooperation relationship: A transparadox perspective. *Journal of Management Inquiry*, 17(4), 288-304. <https://doi.org/10.1177/1056492607312577>
- Chim-Miki, A. F., & Batista-Canino, R. M. (2017). The coopetition perspective applied to tourism destinations: A literature review. *Anatolia*, 28(3), 381-393. <https://doi.org/10.1080/1303291720171322524>
- Dahl, J. (2014). Conceptualizing coopetition as a process: An outline of change in cooperative and competitive interactions. *Industrial Marketing Management*, 43(2), 272-279. <https://doi.org/10.1016/j.indmarman.2013.12.002>
- Dambrin, C., & Robson, K. (2011). Tracing performance in the pharmaceutical industry: Ambivalence, opacity and the performativity of flawed measures. *Accounting, Organizations and Society*, 36(7), 428-455. <https://doi.org/10.1016/j.aos.2011.07.006>
- Estrada, I., Faems, D., & Faria, P. (2016). Coopetition and product innovation performance: The role of internal knowledge sharing mechanisms and formal knowledge protection mechanisms. *Industrial Marketing Management*, 53, 56-65. <https://doi.org/10.1016/j.indmarman.2015.11.013>
- Fang, S.-R., Chang, Y.-S., & Peng, Y.-C. (2011). The dark side of relationships: A tension-based view. *Industrial Marketing Management*, 40(5), 774-784. <https://doi.org/10.1016/j.indmarman.2011.02.003>

- Geurts, A., Broekhuizen, T., Dolfsma, W., & Cepa, K. (2022). Tensions in multilateral coopetition: Findings from the disrupted music industry. *Industrial Marketing Management*, 105, 532-547. <https://doi.org/10.1016/j.indmarman.2022.06.020>
- Gnyawali, D. R., & Charleton, T. R. (2018). Nuances in the interplay of competition and cooperation: Towards a theory of coopetition. *Journal of Management*, 44(7), 2511-2534. <https://doi.org/10.1177/0149206318788945>
- Kemp, R., & Ghauri, P. (1999). Cooperation and conflict in international joint venture relationship. *Proceedings of the 15th Annual IMP Conference*, Dublin, Ireland.
- Klein, K., Semrau, T., Albers, S., & Zajac, E. J. (2020). Multimarket coopetition: How the interplay of competition and cooperation affects entry into shared markets. *Long Range Planning*, 53(1), 101868. <https://doi.org/10.1016/j.lrp.2019.02.001>
- Kraus, S., Gast, J., Klimas, P., & Stephan, T. (2019). Sleeping with competitors: Forms, antecedents and outcomes of coopetition of small and medium-sized craft beer breweries. *International Journal of Entrepreneurial Behaviour & Research*, 25(1), 50-66. <https://doi.org/10.1108/IJEBR-09-2017-0356>
- Lamine, W. (2017). The social network and entrepreneurial process: A sociotechnical approach. *Thunderbird International Business Review*, 59(5), 623-633. <https://doi.org/10.1002/tie.21907>
- Latour, B. (1997). The trouble with actor-network theory. Keele University.
- Latour, B. (1999). *Pandora's hope: Essays on the reality of science studies*. Harvard University Press.
- Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford University Press.
- Latour, B. (2011). Network theory| networks, societies, spheres: Reflections of an actor-network theorist. *International Journal of Communication*, 5, 796-810. <https://ijoc.org/index.php/ijoc/article/view/1094/558>
- Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systems practice*, 5, 379-393. <https://doi.org/10.1007/BF01059830>
- Law, J. (2004). *After method: Mess in social science research*. Psychology Press.
- Law, J., & Hassard, J. (1999). *Actor network theory and after*. Wiley-Blackwell.
- Law, J., & Singleton V. (2013). ANT and politics: Working in and on the world. *Qualitative Sociology*, 36(4), 485-502. <https://doi.org/10.1007/s11133-013-9263-7>
- Law, J., & Singleton V. (2014). ANT, multiplicity and policy. *Critical Policy Studies*, 8(4), 379-396. <https://doi.org/10.1080/19460171.2014.957056>
- Lundgren-Henriksson, E. L., & Tidström, A. (2021). Temporal distancing and integrating: Exploring coopetition tensions through managerial sensemaking dynamics. *Scandinavian Journal of Management*, 37(3), 101168. <https://doi.org/10.1016/j.scaman.2021.101168>
- Mayo, A. (2003). Inovação e aprendizagem. In A. Mayo (Ed.), *O valor humano da empresa* (pp. 150-171). Prentice Hall.
- Mele, C. (2011). Conflicts and value co-creation in project networks. *Industrial Marketing Management*, 40(8), 1377-1385. <https://doi.org/10.1016/j.indmarman.2011.06.033>
- Ministério da Agricultura e Pecuária. (2023). Anuário da Cerveja 2022. MAPA/SDA. <https://www.gov.br/agricultura/pt-br/assuntos/inspecao/produtos-vegetal/publicacoes/anuario-da-cerveja-2022/>
- Monticelli, J. M., Garrido, I. L., Vieira, L. M., Chim-Miki, A. F., & Carneiro, J. (2022). Can competitors cooperate? The impact of formal institution agents in promoting coopetition among emerging market exporters. *Journal of Business & Industrial Marketing*, 37(9), 1915-1932. <https://doi.org/10.1108/JBIM-10-2020-0482>
- Monticelli, J. M., Silveira, A. B., & Silva, L. M. (2018). The process of cooperative strategy: A case study of microbreweries in Porto Alegre. *Revista de Administração Mackenzie*, 19(4), eRAMR180012. <https://doi.org/10.1590/1678-6971/eRAMR180012>
- Morris, M., Kocak, A., & Özer, A. (2007). Coopetition as a small business strategy: Implications for performance. *Journal of Small Business Strategy*, 18(1), 35-55. <https://libjournals.mtsu.edu/index.php/jsbs/article/view/77>
- Narayan, R., & Tidström, A. (2020). Tokenizing coopetition in a blockchain for a transition to circular economy. *Journal of Cleaner Production*, 263, 121437. <https://doi.org/10.1016/j.jclepro.2020.121437>
- Ndubisi, N. (2011). Conflict handling, trust and commitment in outsourcing relationship: A Chinese and Indian study. *Industrial Marketing Management*, 40(1), 109-117. <https://doi.org/10.1016/j.indmarman.2010.09.015>
- Nguyen, T. Q. T., Johnson, P., & Young, T. (2022). Networking, coopetition and sustainability of tourism destinations. *Journal of Hospitality and Tourism Management*, 50, 400-411. <https://doi.org/10.1016/j.jhtm.2022.01.003>
- Oliver, C. (1991). Strategic responses to institutional processes. *Academy of Management Review*, 16(1), 145-179. <https://doi.org/10.2307/258610>
- Osarenkhoe, A. (2010). A coopetition strategy — A study of inter-firm dynamics between competition and cooperation. *Business Strategy Series*, 11(6), 343-362. <https://doi.org/10.1108/17515631011093052>
- Padula, G., & Dagnino, G. B. (2007). Untangling the rise of coopetition: The intrusion of competition in a cooperative game structure. *International Studies of Management & Organization*, 37(2), 32-52. <https://www.jstor.org/stable/40397696>
- Parkhe, A. (1991). Interfirm diversity, organizational learning, and longevity in global strategic alliances. *Journal of International Business Studies*, 22, 579-601. <https://doi.org/10.1057/palgrave.jibs.8490315>
- Peng, T. J. A., Yen, M. H., & Bourne, M. (2018). How rival partners compete based on cooperation? *Long Range Planning*, 51(2), 351-383. <https://doi.org/10.1016/j.lrp.2017.10.003>
- Pozzebon, M. (2004). The influence of a structurationist view on strategic management research. *Journal of Management Studies*, 41(2), 247-272. <https://doi.org/10.1111/j.1467-6486.2004.00431.x>
- Ralandison, G., Milliot, E., & Harison, V. (2021). The paradoxes of cooperative integration in madagascar: an approach based on the actor-network theory. In S. M. Apitsa, E. Milliot (Eds.), *Doing Business in Africa: From Economic Growth to Societal Development* (pp. 35-57). Palgrave Macmillan.
- Raza-Ullah, T., Bengtsson, M., & Kock, S. (2014). The coopetition paradox and tension in coopetition at multiple levels. *Industrial Marketing Management*, 43(2), 189-198. <https://doi.org/10.1016/j.indmarman.2013.11.001>
- Robert, M., Chiambaretto, P., Mira, B., & Le Roy, F. (2018). Better, faster, stronger, the impact of market-oriented coopetition on product commercial performance. *Management*, 21(1), 574-610. <https://doi.org/10.3917/mana.211.0574>
- Roncolato, M. (2016, December 16). Cerveja artesanal avança no Brasil com pequenos e 'ciganos'. *Jornal Nexo*. <https://www.nexojornal.com.br/reportagem/2016/12/16/cerveja-artesanal-avanca-no-brasil>
- Sayes, E. (2014). Actor-Network Theory and methodology: What does it mean to say that nonhumans have agency? *Social Studies of Science*, 44(1), 134-149. <https://www.jstor.org/stable/43284223>
- Schmidt, J. R. R., Wegner, D., & Fortes, M. V. B. (2019). A governança de redes interorganizacionais: uma análise da tensão entre eficiência e inclusão no processo decisório. *Revista de Empreendedorismo e Gestão de Pequenas Empresas*, 8(2), 319-340. <https://doi.org/10.14211/regepe.v8i2.1137>
- Serviço Brasileiro de Apoio às Micro e Pequenas Empresas. (2016). Microcervejarias. [http://www.bibliotecas.sebrae.com.br/chronus/ARQUIVOS_CHRONUS/bds/bds.nsf/8818d2954be64fcd48628defef1f70f8/\\$File/7503.pdf](http://www.bibliotecas.sebrae.com.br/chronus/ARQUIVOS_CHRONUS/bds/bds.nsf/8818d2954be64fcd48628defef1f70f8/$File/7503.pdf)
- Silva, E. (2017). Mercado de cerveja artesanal acompanha a evolução do shopper para inovar e crescer. *Clube do Trade*. <https://clubedotrader.com.br/blog/mercado-de-cerveja-artesanal>
- Silva, L. M., Silveira, A. B., Monticelli, J. M., & Kretschmer, C. (2023). Microfoundations of dynamic coopetition capabilities in firms from a microbrewery cluster. *Revista de Gestão*, 30(2), 190-206. <https://doi.org/10.1108/REG-04-2021-0064>
- Silveira, A. B., Hoppen, N., & Camillis, P. K. (2022). Flattening relations in the sharing economy: A framework to analyze users, digital platforms, and providers. In A. B. Silveira, N. Hoppen, & P. K. Camillis, *Handbook of research on the platform economy and the evolution of e-commerce* (pp. 26-51). IGI Global.
- Silveira, A. B., Monticelli, J., Fortes, M., & Wegner, D. (2019). The role of interorganizational coopetition to reach the competitive advantage. *Journal of International Business and Management*, 2(2), 1-15.
- Sheep, M. L., Kreiner, G. E., & Fairhurst, G. T. (2017). I am... I said. In W. K. Smith, P. Jarzabkowski, M. W. Lewis, & A. Langley, *The Oxford handbook of organizational paradox* (pp. 453-472). Oxford University Press.
- Schweizer, R., Lagerström, K., Leite, E., & Pahlberg, C. (2023). The role of headquarters in managing coopetition within MNCs: A tale of two paradoxes. *Multinational Business Review*. <https://doi.org/10.1108/MBR-11-2022-0175>
- Stake, R. E. (2006). *Multiple case studies analysis*. The Guilford Press.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533. <https://www.jstor.org/stable/3088148>
- Tidström, A. (2014). Managing tensions in coopetition. *Industrial Marketing Management*, 43(2), 261-271. <https://doi.org/10.1016/j.indmarman.2013.12.001>
- Tonelli, D. F. (2016). Origens e afiliações epistemológicas da Teoria Ator-Rede: Implicações para a análise organizacional. *Cadernos EBAPE.BR*, 14(2), 377-390. <https://doi.org/10.1590/1679-395141596>
- Torrente, A. (2016). O que são e como funcionam as cervejarias ciganas. *Portal do Jornal Gazeta do Povo de Curitiba*. <http://www.gazetadopovo.com.br/bomgourmet/o-que-sao-e-como-funcionam-cervejarias-ciganas>
- Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly*, 42(1), 35-67. <https://doi.org/10.2307/2393808>
- Vergara, S. C. (1998). *Projetos e relatórios de pesquisa em Administração* (2nd ed). Editora Atlas.
- Walsham, G. (1995). Interpretive case studies in IS research: Nature and method. *European Journal of information systems*, 4(2), 74-81. <https://doi.org/10.1057/ejis.1995.9>

Wegner, D., & Mozzato, A. R. (2019). Shall we cooperate, or shall we compete? How network learning episodes influence strategic decisions in strategic networks. *International Journal of Management and Enterprise Development*, 18(3), 171-188. <https://doi.org/10.1504/IJMED.2019.100662>

Woolley, J. L. (2023). Getting along with frenemies: Enhancing multi-competitor coopetition governance through artificial intelligence and blockchain. *Industry and Innovation*, 30(9), 1-34. <https://doi.org/10.1080/13662716.2023.2168519>

Zaheer, A., McEvily, B., & Perrone, V. (1998). Does trust matter? Exploring the effects of interorganizational and interpersonal trust on performance. *Organization Science*, 9(2), 141-159. <https://doi.org/10.1287/orsc.9.2.141>

Zobaran, E. (2017, September 5). *Rio ganha associação de microcervejarias com promessa de grande evento e diálogo com o poder público* [Web log post]. <http://blogs.oglobo.globo.com/aqui-se-bebe/post/rio-ganha-associacao-de-microcervejarias-com-promessa-de-grande-evento-e-dialogo-com-o-poder-publico.html>

Authors

Elisa Priori de Deus 

Universidade Federal do Rio de Janeiro
Rua Pascoal Lemme, 355, Cidade Universitária, CEP 21941-901, Rio de Janeiro, RJ, Brazil
elisa.priori@coppead.ufrj.br

Alexandre Borba da Silveira 

Universidade Federal do Paraná
Av. Prefeito Lothário Meissner, 632, Jardim Botânico, CEP 80060-000, Curitiba, PR, Brazil
alexandre.silveirars@gmail.com

Luciana Maines da Silva 

Universidade do Vale do Rio dos Sinos
Av. Dr. Nilo Peçanha, 1600, Boa Vista, CEP 91330-002, Porto Alegre, RS, Brazil
lucianamaines@unisinos.br

Patrícia Kinast de Camillis 

Centro Universitário Alves Faria - Unialfa
Av. Mutirão, 2600, St. Bueno, CEP 74215-240, Goiânia, GO, Brazil
patriciadecamillis@gmail.com

Authors' contributions

1st author: data curation (lead), funding acquisition (equal), investigation (lead), project administration (equal), resources (lead), validation (equal), writing – original draft (equal), writing – review & editing (equal).

2nd author: conceptualization (lead), data curation (equal), formal analysis (lead), investigation (lead), methodology (lead), project administration (equal), resources (equal), software (equal), supervision (equal), validation (equal), visualization (equal), writing – original draft (equal), writing – review & editing (equal).

3rd author: conceptualization (equal), data curation (equal), formal analysis (lead), funding acquisition (equal), investigation (equal), methodology (equal), project administration (equal), resources (equal), software (equal), supervision (lead), validation (equal), visualization (equal), writing – original draft (lead), writing – review & editing (equal).

4th author: conceptualization (equal), data curation (equal), formal analysis (lead), funding acquisition (equal), investigation (equal), methodology (lead), project administration (equal), resources (equal), software (equal), supervision (equal), validation (lead), visualization (equal), writing – original draft (equal), writing – review & editing (equal).