

Toward a Theory of Coopetitive Energy: A Systems Model of Strategic Interactions under Institutional Influence

Abstract

Coopetition, the simultaneous pursuit of cooperation and competition, is central to strategic interdependence among organizations. Yet existing theories often struggle to explain how systemic dynamics of coopetition unfold under varying institutional conditions. In this paper, we introduce the concept of *coopetitive energy* and present a formal model rooted in potential game theory to capture the cross-influences of cooperative and competitive interactions. We theorize that systemic performance depends not only on dyadic ties but also on the regulatory environment that modulates the effect of one mode of interaction on the other. We develop a set of propositions to explain the conditions under which coopetition enhances or degrades system-level outcomes, identify boundary conditions, and contribute to the literature on paradox theory, coopetition, and strategic ecosystems.

1. Introduction

The paradox of simultaneous cooperation and competition—coopetition—is widely acknowledged in strategic management (Bengtsson & Kock, 2000; Brandenburger & Nalebuff, 1996). However, the theoretical infrastructure explaining how coopetitive interactions evolve and influence collective outcomes remains underdeveloped. In particular, existing work lacks a

systemic perspective that captures how institutional contexts shape the interplay between cooperation and competition.

To address this gap, we propose a novel construct: *coopetitive energy*. We conceptualize energy as the system-level result of cooperative synergy and competitive friction among actors who exert strategic effort. Drawing on potential game theory and systems modeling, we develop a mathematical framework that captures how institutional factors (e.g., regulation, culture) modulate this energy through two cross-influence parameters: competition dampening cooperation, and cooperation mitigating competition. The model enables us to generate new propositions about the emergent behavior of coopetitive systems.

2. Theoretical Framing and Literature Foundations

2.1 Coopetition and Strategic Paradoxes

The literature acknowledges coopetition as a paradoxical logic requiring simultaneous attention to joint value creation and individual value appropriation (Gnyawali & Park, 2011; Smith & Lewis, 2011). However, paradox theory tends to emphasize managerial cognition over systemic conditions. We complement this view by offering a system-level analysis that highlights structural and environmental determinants of how the paradox plays out.

2.2 Systemic Interactions and Potential Games

In strategic networks, each actor’s payoff depends not only on its own decisions but on the actions of others. Potential game theory provides a natural foundation for modeling such interdependence. In a potential game, there exists a global energy (or potential) function that aligns with individual incentives (Monderer & Shapley, 1996). We use this logic to model how collective coopetitive behavior reaches equilibrium under varying institutional parameters.

2.3 Institutional Influence on Strategic Behavior

Institutions—regulatory frameworks, norms, and culture—shape the rules of engagement among firms (North, 1990). Prior work on coopetition has noted that institutional contexts affect the stability and outcomes of coopetitive relationships (Czakon et al., 2020), yet these effects remain under-theorized. We address this gap by formalizing a regulatory parameter that shifts the balance between cooperation and competition.

3. Core Concepts and Model Logic

We conceptualize a coopetitive system as consisting of:

- **Actors:** Firms or units that exert effort toward cooperative and/or competitive initiatives.
- **Effort:** A resource allocation variable representing strategic intensity.
- **Interaction Matrices:** Cooperation matrix C and competition matrix D , capturing synergistic and antagonistic ties.
- **Cross-Influence Parameters:** ϕ (competition dampens cooperation) and ψ (cooperation mitigates competition).
- **Regulatory Factor:** $\lambda \in [-1, 1]$, modeling institutional orientation.

We define coopetitive energy as:

$$E(\mathbf{e}) = (1 + \psi)\mathbf{e}^T C \mathbf{e} - (1 + \phi)\mathbf{e}^T D \mathbf{e} - \frac{b}{2}\|\mathbf{e}\|^2$$

Where $\mathbf{e}$ is the vector of effort levels, and b is the baseline cost of effort.

4. Propositions

Proposition 1 (Systemic Balance Condition): In a multi-actor strategic system, equilibrium effort is achieved when the marginal benefits of cooperation (adjusted by ψ) equal the marginal costs of competition and effort (adjusted by ϕ and b).

Proposition 2 (Institutional Modulation of Coopetitive Equilibria): A regulatory environment promoting cooperation (low ϕ , high ψ) increases equilibrium effort and system energy, while a competition-promoting regime (high ϕ , low ψ) depresses system-level performance.

Proposition 3 (Nonlinear Scaling of Systemic Effects): The difference in energy between cooperation-dominated and competition-dominated regimes grows approximately with the number of pairwise interactions ($\sim N^2$), making institutional influence disproportionately impactful in large networks.

Proposition 4 (Paradox Management through Regulatory Design): Institutional settings that moderate both ϕ and ψ enable dynamic equilibrium in coopetitive systems, helping actors sustain strategic paradoxes without performance degradation.

5. Boundary Conditions

- **Homogeneity of Actors:** Model assumes symmetric effort cost and interaction intensities; outcomes may differ in highly asymmetric settings.
- **Network Density:** Results hold most clearly in dense interaction networks; sparse or modular networks may behave differently.
- **Temporal Dynamics:** Model is static; paradox evolution over time is not captured.

6. Contributions to Theory

- To **paradox theory**, we add a systems-based model explaining how structural parameters modulate the stability and performance of paradoxical strategies.
- To **coopetition literature**, we offer a formal framework that goes beyond dyadic interaction to system-level equilibria, enabling generalization across network sizes and institutional regimes.
- To **strategic management**, we provide a method for quantifying how regulatory choices shape strategic outcomes in interdependent systems.

7. Conclusion and Future Research

This paper advances a theory of coopetitive energy to explain how cooperation and competition interact at a systemic level under institutional influence. By formalizing strategic interactions as a potential game, we link paradox theory with game-theoretic logic and offer testable propositions for future research. Empirical work could calibrate this model in platform ecosystems, innovation consortia, or multi-party alliances to examine how varying λ and network topologies shape coopetition outcomes.

We invite scholars to explore dynamic extensions, incorporate heterogeneity, and test our framework across institutional settings. In doing so, we hope to deepen understanding of how the interplay between strategic behavior and institutional design sustains—or destabilizes—the paradoxical logic of coopetition.