

# Coopetition with frenemies: Towards modeling of simultaneous cooperation and competition

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**Abstract.** Actor and goal modeling frameworks are concerned with the analysis of social phenomena and a number of notations and techniques have been proposed for depicting social behaviors. However, coopetition, which is a specific type of social interaction, has not been explored in the actor and goal modeling literatures. Coopetition, which refers to simultaneous cooperation and competition, has been studied extensively in the social sciences where conceptual theorizing and empirical fieldwork have established it as a prominent field of research. It is regularly observed in dealings between many kinds of organizations and institutions, such as businesses and governments, where it has been analyzed at both inter- as well as intra-organizational levels. Coopetition modeling ought to refer to actor and goal modeling because goal alignment/convergence can yield cooperation among actors while goal conflict/divergence can lead to competition among actors. In this paper we (a) present an overview of academic research into coopetition, (b) discuss the requirements for representing strategic coopetition, and (c) propose future work that will be relevant for the modeling of cooperation, competition, and coopetition.

**Keywords:** Coopetition. Strategy. Design. Modeling. Review.

## 1 Introduction

A number of researchers have proposed modeling notations and techniques for expressing and evaluating organizational strategy [1][2]. As such, a variety of modeling approaches have been developed to describe different aspects of enterprises (e.g., goal, actor, value, process, etc.) [3]. Additionally, requirements engineering (RE) researchers have applied many goal- and actor-oriented approaches to model and analyze business strategy [4][5]. However, none of these approaches have focused directly on the phenomenon of coopetition even though it impacts many of the enterprise-level entities that are of concern to them (such as goals, tasks, resources, boundaries, etc.). This can be partially explained by [3]’s claim that “business models are still a new kind of model, and there remains a number of open issues to be addressed”.

Coopetition, which refers to simultaneous cooperation and competition, has become “increasingly popular in recent years” [6] and is “an integral part of many companies’ daily agenda” [7]. While some research papers in the RE literature have discussed competition and cooperation between enterprises [8][9] — there are many characteristics of these strategic behaviors that are unexplored in the goal- and actor-modeling literature. It can be argued that these gaps “make it difficult for requirements engineers to validate low-level requirements against the more abstract high-level requirements representing the business strategy” [10]. Therefore, the ability to model and analyze cooperation, competition, and coopetition represents advancement in the state-of-the-art in conceptual modeling.

## **2 Enterprise Cooperation, Competition, and Coopetition**

Organizational Theory (OT) is an academic discipline that is concerned with the structure, behavior, and performance of organizations [11]. It emerged in the 1950s as an explanation of the strategic dynamics between firms in competitive industries [12]. It was closely related to Bain’s SCP (structure, conduct, performance) paradigm according to which the performance of a firm was determined by its conduct, which, in turn, was impacted by various industry factors [13]. Starting in the late 1970s, Porter popularized this view through his advancement of economic theories of “competitive advantage” [14][15]. As such, for the first thirty years, this competitive view of organizational strategy became the dominant paradigm in OT research.

This “militaristic” view in OT was challenged throughout the 1980s and 1990s by researchers who argued in favor of “cooperative advantage” and “collaborative advantage” [16][17]. This stream of research posited that firms could improve their performance and increase their profits by partnering with other firms. Dyer and Singh promoted the notion of “relational rents” as profits that were generated through relationship-specific idiosyncratic assets and resources [18]. Many rationales and justifications were offered for inter-firm relationships such as strategic alliances. These included the ability for partner firms to acquire knowledge, share risks, access markets, spread costs, pool resources, and achieve strategic objectives.

By the mid-1990s, the field of OT was divided into two camps that offered incompatible and divergent explanations of inter-firm behaviors. This is why [32] argue that “mainstream economics and managerial research has been largely based on the dichotomy between competition and cooperation”. The competitive camp argued that cooperation amongst rivals led to collusion or cartelization, which resulted in market failure through the creation of deadweight loss, reduction of consumer surplus, and obviation of incentives for innovation. Conversely, the cooperative/collaborative camp rejected these assertions and instead argued that competition between partners led to mutually destructive outcomes through the promotion of distrust/mistrust, reduction of goodwill, and persistence of disequilibrium in the market. It seemed that only an esemplastic theory could resolve the creative tension between these camps.

Coopetition theory was proposed as a syncretistic means for reconciling the competitive and cooperative perspectives [19]. It was introduced in 1995 by two economists who adopted a game-theoretic lens for interpreting inter-firm behaviors [20][21]. In the two decades since its introduction, coopetition theory has become a prominent field of scholarly inquiry. A number of literature reviews have noted the increase in research interest in this field [22][23] and eminent scholarly publications have devoted special issues to this topic [24][25]. Empirical fieldwork has also been used to explore “coopetition along the antecedents-process-outcomes trail” [17][23]. Additionally, coopetition has been studied within political science, diplomacy, and civics.

### 3 Emerging Requirements for Coopetition Modeling

OT researchers have identified various characteristics that define coopetitive relationships [6][26]. These include, but are not limited to, complementarity, interdependence, trustworthiness, and reciprocity. Tables 1 and 2 provide an overview of the key characteristics of coopetition that are essential for representing it. Table 1 presents a partial list of requirements that are relevant for modeling coopetition phenomenon. Table 2 presents a preliminary assessment of various techniques in terms of requirements for representing and reasoning about coopetition. The ‘Key’ column from Table 1 should be used to identify the coded column headings in Table 2.

The list in Table 1 and the assessment in table 2 are presented as aids to stimulate discussion and debate as they are neither comprehensive nor conclusive. Moreover, this assessment does not consider extensions, derivatives, or combinations of the reviewed techniques. These tables are intended so as to introduce our approach and orientation towards this research endeavor.

Characteristics	Features	Key	Description for Modeling Support
Actor	2 Actors or Dyad	A1	Two actors with links between them.
	>2 Actors or Network	A2	More than two actors with links between them.
	Actor Intention	A3	Internal intentional structure of actor(s).
Complementarity	Resource/Asset/Object	C1	Entity associated with some value, benefit, or utility.
	Value Added	C2	Incremental addition of some value, benefit, or utility.
	Added Value	C3	Worth of an actor in terms of value, benefit, or utility.
Interdependence	Positive Dependency	I1	Existence of dependency(ies) between actors.
	Negative Dependency	I2	Non-existence of any dependency between actors.
	Strength of Dependency	I3	Magnitude of dependency (however measured).
Trustworthiness	Goal Convergence	T1	Agreements between goals within and across actors.
	Goal Divergence	T2	Conflict between goals within and across actors.
	Compliance	T3	Evaluation of abidance with terms and conditions.
Reciprocity	Activity or Task	R1	Individual (step) or collection (process) of actions.
	Sequence	R2	Transition from predecessor to successor action.
	Condition	R3	Constraints or restrictions on actions.

**Tab. 1.** Partial list of requirements for modeling enterprise coopetition.

Technique	A1	A2	A3	C1	C2	C3	I1	I2	I3	T1	T2	T3	R1	R2	R3
NFR Framework	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	✓	✗	✗
i* Strategic Rationale	✓	✓	✓	✓	✗	✗	✓	✗	✗	✓	✓	✗	✓	✗	✗
KAOS	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓
e3Value	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗
Business Model Canvas	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗
Value Network Analysis	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Game Tree	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗
Payoff Table	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗
Change Matrix	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗

Tab. 2. Preliminary assessment of modeling support for requirements from Table 1.

Table 2 shows that prominent goal- and/or actor-modeling approaches such as NFR framework, KAOS, and i\* are able to support the representation of some, but not all, of the requirements from Table 1. Similarly, practitioner tools such as Business Model Canvas and Value Network Analysis are also deficient with respect to some of these requirements. Nonetheless, these approaches can be extended and combined in creative ways to overcome their respective limitations for modeling cooperation. This is not unusual because according to [27], “depending on the needs, several languages can also be used together in a complementary way”.

## 4 Conclusions and Future Work

This paper provided an overview of the phenomenon of cooperation as well as some of its key facets and characteristics that are relevant for conceptual modeling. In addition to being an eminent research area, cooperation is also widely observed in practice. [28] claim that “cooperation is common in several industries” and [29] note that roughly 50% of strategic alliances are between competitors. Nonetheless, in spite of its prominence, cooperation has not been explored in the actor- and goal-modeling literature. We intend to address this shortcoming by developing a modeling framework that is suitable for analyzing cooperation, competition, and cooperation.

We posit that an RE framework for cooperation ought to support the depiction of cooperation and competition because cooperation represents their coaction. This is challenging because competition and cooperation are diametric social behaviors that are undergirded by opposite logics and assumptions [30]. Their co-occurrence in any relationship represents a paradox that creates tensions between the cooperating actors [31] due to their “partially convergent interest (and goal) structure” [32].

The next logical step in our research is to identify and catalog the requirements for modeling and analyzing these phenomena. Table 1 presents a partial list of these requirements however it needs further elaboration and refinement. After identifying the requirements for modeling coopetition, our next step will be to assess the adequacy of extant modeling languages for satisfying those requirements. Tables 2 and 3 present preliminary findings however they merit improvement through more rigorous assay.

After evaluating individual modeling languages for satisfying the requirements from our catalog, our next step will be to address their shortcomings. We will do this by developing a conceptual modeling framework that extends and combines extant notations and techniques. To verify this framework, our goal will be to share it with management practitioners. Additionally, our intention is to validate this framework in the field by collaborating with industry partners. It is our expectation that this framework will allow the exploration of opportunities for coopetition as well as the evaluation of strategic alternatives in a structured and systematic manner. As such, this will represent our contribution towards advancing the state-of-the-art in conceptual modeling.

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