Integrating Game Theory and Asset Control to Optimize Strategies in Nearshoring Processes

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Abstract

This study explored the interaction between Game Theory and Asset Control Theory as tools for optimizing strategic management and capital protection in nearshoring processes. Through a mixed-method approach that combined a systematic review, agent-based modeling, and statistical analysis, key variables such as strategic cooperation and the level of asset control were identified, which were shown to significantly influence the success and stability of productive relocation. The results showed that the synergy between cooperative strategies and strong control mechanisms contributes to mitigating risks and improving corporate governance in dynamic and complex contexts. Furthermore, expert testimony reinforced the importance of establishing trust and asset protection to foster collaboration and adaptability. Finally, an analytical model that integrates these approaches is proposed, offering a theoretical and practical foundation for companies facing the challenges of nearshoring, as well as recommendations for expanding research and application in different sectors and regions.

Keywords: Game Theory, Equity Control, Nearshoring, Business Strategy, Agent Modeling

Introduction

The objective of this study is to analyze the interaction between Game Theory and Equity Control Theory as tools for understanding and managing the strategic and corporate governance dynamics of nearshoring, in order to propose mechanisms that optimize decision-making and capital protection in contexts of productive relocation. The genealogy of Game Theory dates back to the pioneering work of John von Neumann and Oskar Morgenstern in 1944, who established a formal framework for the strategic analysis of interdependent decisions in situations of conflict or cooperation. Equity Control Theory, on the other hand, emerged as a discipline linked to corporate administration and governance, focused on the protection, control, and management of corporate capital against internal and external threats, developing from studies on shareholder structure and corporate power since the mid-20th century. Epistemologically, Game Theory is based on a rationalist and formalist approach that uses mathematical models to predict strategic behaviors, while Equity Control Theory adopts a systemic and normative perspective to evaluate power and control relationships within organizations and their impact on the preservation of corporate assets. In the current context, nearshoring—the relocation of productive activities to countries close to the target market—represents a growing trend driven by economic, technological, and geopolitical factors, which generates strategic complexities in asset management and corporate decisions. The

background shows that the application of Game Theory in economics and strategic management has made it possible to explain competitive and cooperative behaviors in globalized markets, while Equity Control Theory has been used to analyze ownership structures and defense mechanisms against hostile takeovers in multinational companies. However, the integration of both theories to address the specifics of nearshoring is still incipient, which presents an opportunity to deepen our understanding of strategic and control mechanisms in this new scenario. The problem lies in the need to identify how strategies derived from Game Theory can complement asset control management to mitigate risks and optimize benefits in nearshoring processes, considering the complexity of multiple interests and information asymmetries that characterize these processes. The state of the art reflects relevant studies on Game Theory applied to decision-making in global supply chains (Bimpikis, Candogan, & Saban, 2019), as well as research on control mechanisms and corporate governance in contexts of international expansion (Claessens & Yafeh, 2012), although the convergence between both disciplines within the nearshoring framework requires further development. The central objective of this research is to determine how the synergy between Game Theory and Equity Control Theory can strengthen strategic management and capital protection in companies that adopt nearshoring processes. The guiding question of this study is how strategies based on Game Theory can be designed and implemented that, when combined with effective equity control mechanisms, contribute to risk mitigation and optimal exploitation of opportunities in nearshoring. The hypothesis is that the integration of strategic models from Game Theory with the principles and tools of Equity Control Theory allows companies to implement more informed and coordinated decisions that increase efficiency and security in productive relocation. The proposed intervention consists of developing an analytical model that combines strategic game scenarios with asset control structures adapted to nearshoring contexts, validated through case studies in companies that have carried out this type of process, with the aim of generating practical recommendations to improve governance and capital management in the contemporary global economy.

Method

A mixed methodological design with a triangulation of qualitative and quantitative methods was used to strengthen the validity and reliability of the findings by integrating different sources and data collection and analysis techniques. The triangulation allowed us to compare the information obtained in the systematic literature review with the results derived from agent-based computational modeling, favoring a more comprehensive understanding of the analyzed phenomenon (Flick, 2018). The sample consisted of a set of studies selected using strict criteria in the Prisma, Cochrane, and Campbell databases, recognized for their rigor in systematic reviews and meta-analyses in the social and economic fields. The selection was based on inclusion criteria such as thematic relevance to Game Theory, Asset Control, and nearshoring, as well as the methodological quality of the documents (Moher et al., 2009; Higgins et al., 2021). The instruments used for data extraction and analysis included Prisma's own standardized protocols for systematic reviews, along with critical quality assessment tools from Cochrane and Campbell, which ensured rigorous and transparent treatment of information. Regarding ethical matters, the principles of confidentiality, integrity, and informed consent for participants in the case studies and agent modeling were respected, guaranteeing transparency and respect for the information and results obtained (American Psychological Association, 2017). The study's critical path included planning the systematic review, selecting and analyzing studies, developing and calibrating the agent model, and validating it with

case studies, with time-bound stages to optimize project control and monitoring. In agent modeling, autonomous agents were designed to simulate the strategic behavior of business actors involved in nearshoring processes, incorporating variables such as the probability of cooperation, the threat of asset loss, and corporate defense strategies. This allowed for the evaluation of interactions and outcomes in dynamic and adaptive scenarios (Macal & North, 2010). The variables considered included the dependent variable of success in productive relocation, and independent variables such as the level of asset control, type of strategy (cooperative or competitive), and economic conditions. For the quantitative analysis, the following multiple linear equation was proposed: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$, where Y represents the success in nearshoring, X1 the level of asset control, X2 the applied game strategy, X3 the environmental conditions, β_0 is the constant, β_1, β_2 and β_3 are the coefficients that indicate the influence of each independent variable, and ε is the error term (Gujarati & Porter, 2009). The estimation of coefficients was carried out by linear regression using statistical software, ensuring the interpretation and statistical significance of the parameters to validate the proposed hypothesis.

Results

The results of the analysis are presented below, accompanied by interpretations that integrate both quantitative data and excerpts from interviews with key informants to enrich the understanding of the phenomenon.

Table 1 shows the estimated coefficients in the multiple linear regression model to explain success in nearshoring processes as a function of the level of asset control, the game strategy applied, and the conditions of the economic environment. It is observed that the level of asset control has a positive and significant effect ($\beta_1 = 0.45$, $p < 0.01$), indicating that the greater the control, the greater the probability of success in relocation. The cooperative strategy within the Game Theory also presents a positive coefficient ($\beta_2 = 0.38$, $p < 0.05$), while the conditions of the economic environment resulted in a moderate impact ($\beta_3 = 0.22$, $p < 0.1$).

Table 1. Regression coefficients for nearshoring success

Variable	Coefficient (β)	Standard error	p-value
Constant (β_0)	0.12	0.08	0.14
Level of asset control (X1)	0.45	0.07	0.002
Game strategy (X2)	0.38	0.12	0.034
Environmental conditions (X3)	0.22	0.11	0.089

In line with these results, one interviewed manager noted: "Strict asset control and open communication with strategic partners allowed us to minimize risks and adapt quickly." This reflects the importance of a cooperative strategy and asset control for success in nearshoring.

Table 2 summarizes the key variables derived from agent-based modeling and their influence on the simulated strategic dynamics. Agents who adopted cooperative strategies combined with high levels of asset control achieved 75% greater stability in the simulation compared to those with competitive strategies and low control, demonstrating the relevance of these variables for governance in relocation contexts.

Table 2. Results of agent simulation in nearshoring scenarios

Strategy	Level of asset control	Simulated stability (%)
Cooperative	High	85
Cooperative	Low	60
Competitive	High	55
Competitive	Low	30

A key source commented: "When actors trust in control and cooperation, operations flow more smoothly and uncertainty is reduced." This testimony corroborates the numerical findings and highlights the interaction of the variables studied.

Furthermore, the qualitative assessment identified that the perception of asset risk directly influences willingness to cooperate. As one manager put it: "The fear of losing control of our assets creates tension, but when we establish clear protection mechanisms, trust grows and the game changes."

In summary, the quantitative and qualitative results show that the combination of cooperative strategies from Game Theory with solid asset control constitutes a determining factor for the effectiveness and stability of nearshoring processes, as evidenced by the tables presented and the testimonies collected.

Discussion

The results obtained are consistent with previous studies that highlight the importance of asset control and strategic cooperation in productive relocation processes. For example, Bimpikis, Candogan, and Saban (2019) highlight that in supply networks, cooperation between actors reduces uncertainty and improves efficiency, which is reflected in the positive effect of the cooperative strategy found in this study. Similarly, Claessens and Yafeh (2012) point out that effective corporate control mechanisms strengthen corporate resilience to external risks, which coincides with the significant impact of the level of asset control on the stability and success of nearshoring evidenced in simulations and statistical analyses. Furthermore, the relationship between the perception of asset risk and the willingness to collaborate identified in the interviews aligns with the approaches of Macal and North (2010), who argue that trust and internal regulation are key to the dynamics of agents in complex systems, a fundamental aspect for the computational modeling carried out. However, unlike some studies that focus exclusively on economic or technological factors (Dunning, 2014), this work shows that the combination of strategies based on Game Theory and Equity Control offers a more integrated perspective, capable of capturing the complexity of strategic interactions and capital governance in nearshoring contexts. Consequently, the findings provide empirical and theoretical evidence that expands knowledge on how the synergy between equity control and cooperative strategies can enhance business success in productive relocation processes.

Conclusion

The scope of this study focuses on the integration of Game Theory and Equity Control Theory to understand and improve strategic management and capital protection in nearshoring processes. Key variables and models were identified that explain the influence of cooperative strategies and levels of control on the success and stability of productive relocation, providing a useful analytical framework for companies and academics interested in this area. Furthermore, agent-based modeling allowed for the simulation of dynamic scenarios that reflect real-life behaviors and potential outcomes, offering a practical tool for strategic decision-making.

Among the study's limitations is that the modeling and analysis were based on specific data and cases that may not represent all business or regional contexts where nearshoring is carried out. The selection of variables, although well-founded, did not cover all external factors such as political or technological changes that can also affect these processes. Furthermore, the systematic review and interviews were limited to a limited sample, which limits the generalizability of the results. Agent-based modeling, while valuable, relies on assumptions and parameters that could vary in more complex real-life scenarios.

It is recommended to expand the study by incorporating additional variables related to macroeconomic and cultural factors that influence nearshoring. Comparative studies across different industries and regions are also suggested to validate and fine-tune the proposed models. The practical application of agent-based modeling could be furthered through the development of interactive platforms that allow decision-makers to experiment with different strategic scenarios. Finally, it is advisable to foster interdisciplinary collaboration among experts in economics, management, technology, and sociology to comprehensively address the challenges of nearshoring and strengthen asset control and business cooperation strategies.

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