

French Polytech network form for PhD Research Grants from the China Scholarship Council

This document describes one of the PhD subjects proposed by the French Polytech network. The network is composed of engineering schools/universities. The document also provides information about the supervisor.

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Polytech name	PAC
University name	USMB
Country	France

PhD information	
Title	Interorganizational Interactions in Franchise Networks: A Molecular Dynamics-Inspired Modeling Approach
Main topics regards to CSC list (3 topics at maximum)	VII-5. Economie des réseaux (Network economics) VII-24. Gestion technologique et scientifique (Technological and scientific management) VII-31. Stratégie du développement durable (Sustainable development strategy)

Required skills in science and engineering	Strong knowledge of economics – particularly institutional, network, and development economics – along with skills in statistical analysis, computational modeling, interdisciplinary system modeling, materials science, and scientific programming
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Subject description (two pages maximum including biblio)

Franchise networks play a structuring role in the transformation of emerging economies, enabling the progressive formalization of trade, the dissemination of proven entrepreneurial models, and the diffusion of brand standards [1]. However, in contexts marked by institutional instability, information asymmetries, and weak legal protections, network organization must adapt to specific constraints [2,3].

At the same time, entrepreneurial ecosystems reveal complex social dynamics, where gender inequalities hinder access to entrepreneurial success, despite the emergence of new opportunities. Social and family support proves more decisive than funding in overcoming these barriers [4].

These social dimensions cannot be separated from the strategic choices involved in structuring franchise networks. For a long time, the franchise literature focused mainly on contractual or institutional aspects, overlooking a crucial dimension: the geographical deployment of networks and its impact on performance. In emerging economies, such choices are particularly strategic. Franchisees operating in close proximity may benefit from positive externalities such as shared brand image, pooled resources, and proximity to supply channels. Conversely, expansion into more distant areas can present increased challenges in coordination, operational support, and protection of intangible assets. Recent studies based on data from emerging countries show that regional concentration of outlets tends to correlate with better performance, largely due to economic agglomeration effects and enhanced local visibility [5,6]. These findings highlight the importance of territorial embeddedness in franchise network success and suggest that spatial decisions should be considered integral to development strategy, especially in uncertain institutional environments. Thus, franchising emerges as both a tool for economic structuring, a vector of commercial standardization, and a mirror of social and territorial tensions in emerging economies. It sits at the intersection of contractual logic, governance issues, and localized entrepreneurial dynamics. Understanding how it functions and adapts in such contexts requires a shift in analytical perspective.

It is in this perspective that the present thesis proposes an interdisciplinary and innovative approach: to mobilize modeling tools from the physics of complex systems, specifically molecular dynamics, to simulate and analyze interactions within franchise networks.

In this context, it becomes necessary to explore new ways of modeling franchise networks, no longer only as legal or transactional systems, but as dynamic and interconnected systems, subject to structural, relational, and social constraints. This thesis draws on an interdisciplinary analogy with molecular dynamics [7]. Inspired by behaviors observed in civil engineering materials, particularly the complex structure of calcium silicate hydrate (C-S-H) gel [8], a gel whose mechanical properties result from nanoscale interactions and which is subject to thermodynamic, mechanical, and chemical constraints, we propose a formal analogy between mechanical stresses in this material and the organizational tensions found in franchise networks.

The C-S-H gel matrix, a fundamental material in civil engineering, is characterized by a complex structure that can be modified and reinforced through the addition of nanoparticles, enabling it to adapt to various external constraints and behaviors [9–11]. In this model, the material matrix represents the national context—such as a given country, while the inserted particles symbolize network actors. The franchisor is modeled as a central particle, around which simpler particles – representing franchisees – are organized.

This parallel between C-S-H gel and franchise networks allows for the construction of an innovative model in which physical and chemical nanoscale interactions are mirrored in organizational and contractual relationships. Just as the structure and resistance of a composite material depend on the properties and interactions of its smallest components,

the performance and resilience of a franchise network are shaped by the quality of its links, the specialization of its actors, and its adaptability to external constraints – whether economic, institutional, or social.

The main objective of this thesis is therefore to formalize these analogies by developing a modeling framework based on molecular dynamics, applied to complex organizational systems such as franchise networks. By mobilizing numerical simulation codes widely used in molecular dynamics—known for their ability to replicate the dynamic behavior of complex materials – we aim to simulate and analyze contractual dynamics, internal tensions, and mechanisms of resilience or fragility within networks across different institutional environments, particularly in emerging markets.

This research aims not only to enhance theoretical understanding of franchise networks through an unprecedented interdisciplinary lens, but also to provide innovative methodological tools for scholars in strategy and entrepreneurship and practical insights for industry stakeholders seeking to optimize the structuring and sustainable development of their networks in uncertain and complex environments.

References :

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