

How ‘Advanced Equipment for the Country’ Break Through Core Technologies in Key Fields: The Duality of System Architecture

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Abstract: Breaking through key Core technologies in key fields for ‘Advanced equipment for the country’ is a core proposition for shattering international blockades, ensuring strategic security, and leading industrial upgrading. ‘Advanced equipment for the country’ are typical complex product systems. However, existing research rarely discusses the development of their internal different system levels as independent analytical units. To this end, this paper, based on a system architecture perspective and using the Chinese manned spaceflight program and Chinese shield tunneling machine engineering as case studies, reveals the common logic behind their breakthroughs in key core technologies. The research finds that manned spaceflight builds a safety bottom line with ‘overall system stability’ and drives technological iteration with ‘key system breakthrough’; shield tunneling machines, on the other hand, break monopolies with “overall system breakthrough” and ensure project implementation while promoting domestic substitution with ‘key system stability’. Based on this, this paper proposes the mechanism of ‘system architecture duality’, meaning that the intrinsic logic for ‘Advanced equipment for the country’ to break through key core technologies is the dialectical unity of ‘stability’ and ‘breakthrough’ oriented towards different system levels. It then attempts to define two categories of ‘Advanced equipment for the country’: safety – oriented ones serving national strategies and market – driven ones responding to technological blockades. Furthermore, it identifies the boundary conditions for the differentiated roles of system architecture duality in different categories of ‘Advanced equipment for the country’ from the perspectives of technological risk, market differentiation, and action logic. This finding not only contributes Chinese experience and wisdom to theories of technological progress and latecomer catch – up but also provides practical references for China to solve stranglehold technology and drive technological self – reliance and self – strengthening with ‘Advanced Equipment for the Country’.

Key words: Advanced equipment for the country; Core technologies in key fields; The duality of system architecture; China manned space program; Tunnel boring machine

Breakthrough Technological Innovation of Enterprises and Internal and External Interaction : A Dynamic Coupling Framework of Dual Repair and Dual Circulation

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Abstract:

Purpose: As the core engine of the leap of corporate competitive advantage, the generation mechanism of breakthrough technological innovation has long been trapped in the split between “endogenous capability determinism” and “exogenous opportunity capture theory”. Existing research mainly expounds on the “internal – external” relationship from a single theoretical perspective, ignoring the coupling and synergy mechanism of internal and external resources in time, space and network dimensions. Especially in terms of the dynamic coupling mechanism of internal and external resources, the existing theoretical framework cannot effectively reveal its internal logic. The single perspective and lack of connection between theories in these studies have led to the fragmentation and even stagnation of enterprise technology innovation management theory. In view of this, it is particularly urgent to build a new theoretical framework to deeply understand and analyze the internal and external relationship of technological innovation.

Design/methodology/approach: Based on the review of relevant literature on technological innovation and competitive advantage, this paper constructs a theoretical framework of “internal and external interaction” dual cultivation and dual circulation based on the dynamic system view and dialectics of contradictions, and systematically reveals the multi – dimensional dynamic coupling mechanism of enterprise breakthrough technological innovation and the “three – order transition – dual circulation” dynamic model.

Findings: The main research findings are as follows: Firstly, the internal and external synergistic evolution mechanism. The essence of breakthrough technological innovation is the two – way dynamic coupling of the internal cycle (strengthening internal strength) and the external cycle (borrowing external forces). The internal cycle forms endogenous power through the linkage of “entrepreneurial drive – resource orchestration – strategic regulation”, and realizes the original innovation capability leap through the construction of the technical base and the reconstruction of the boundary breaking of conventions; the external cycle forms exogenous power through the linkage of “market capture – institutional adaptation – ecological dominance”, and completes the dimensional upgrade from resource integration to rule definition through the expansion of ecological niches and the reconstruction of the technology value network. Secondly, the third – order transition path and dynamic coupling regulator. Breakthrough technological innovation follows the three – order path of “original innovation (0→1) – concept verification (1→10) – ecological diffusion

(10→N)”。Its successful realization depends on the internal cycle “technical base construction” to provide endogenous power, the external cycle “niche expansion” to provide exogenous power, and the dynamic coupling regulator of “knowledge flow – capability flow – competitive tension governance” to achieve system balance.

Originality/Value: This paper mainly makes the following theoretical contributions: Firstly, this paper breaks through the split paradigm of “endogenous capability determinism” and “exogenous opportunity capture theory” in traditional technological innovation research, innovatively integrates relevant internal and external theories such as resource – based view, dynamic capability and open innovation, deeply integrates China’s “yin – yang balance” thought and dialectics of contradiction, and proposes a “internal and external interaction” dual cultivation and dual circulation theoretical framework. Secondly, based on the theory of technological evolution and the view of complex systems, this study proposes a “three – order transition – dual circulation” dynamic model, reveals the inherent laws of breakpoint breakthrough and path dependence in the process of technological evolution, and systematically explains the theoretical path to achieve a balance between openness and control. Thirdly, based on the dynamic system view, this paper organically integrates Western management theory with Eastern traditional thought, proposes a “strong internal and external connection” dual circulation synergy paradigm, and constructs a Chinese contextual theoretical framework with dynamic, mutually coupled and spiral evolution characteristics, which is helpful to build a management theory system with Chinese characteristics and contribute Eastern wisdom to the global management knowledge system.

Implications/research limitations/suggestions for future research: At the practical level, the breakthrough technological innovation practice path of “internal strength and external connection, dynamic adaptation, and ecological co – governance” is proposed, emphasizing the dynamic balance of innovation from multi – dimensional interactions. However, this article still has some limitations: Firstly, the micro – deconstruction of the dynamic coupling mechanism is still insufficient, and there is a lack of quantitative analysis on nodes such as knowledge flow and capability transformation, especially in the governance of competitive tension, and the applicability in cross – cultural contexts has not been tested; Secondly, the research mainly focuses on large enterprises and key industries facing technological blockades, and the applicability and innovation path of small and medium – sized enterprises in breakthrough technological innovation have not been fully involved. In the future, it is necessary to further explore the complex mechanism of breakthrough technological innovation through interdisciplinary methods and multi – context empirical research, and construct a “internal and external interaction” technological innovation theory system that connects “microscopic mechanism – mesocosmic synergy – macroscopic system” .

Key Words: internal and external interaction; breakthrough technological innovation; dynamic coupling; dual cultivation and dual circulation; competitive advantage

Research on the Value Co – creation of Core Technology Breakthroughs in Enterprises in the Context of Digital Intelligenc

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Abstract: Under the wave of digital intelligence, the value creation logic of enterprise core technology breakthroughs is shifting from the linear innovation paradigm to the value symbiosis paradigm of multi – agent collaboration, and the existing research is not perfect in the analysis of the dynamic interaction and value creation mechanism from single subject to multi – agent in enterprise core technology breakthroughs. Based on a general project of the National Natural Science Foundation of China presided over by the author, this paper analyzes the value co – creation of enterprise core value breakthroughs in the context of digital intelligence and provides a theoretical paradigm and practical path based on the theoretical context of “value capture – value delivery – value realization” . Firstly, this paper systematically sorts out the conceptual characteristics of core technologies in the context of digital intelligence, pays attention to the importance of opportunity identification and capability building in the process of enterprise core technology breakthroughs, and excavates the value capture mechanism of core technology breakthroughs from the perspective of cross – border innovation. Secondly, the evolution characteristics, evolution trajectory and diffusion path of core technology breakthroughs are analyzed with value transmission as a clue, and the dynamic cooperation and competition behaviors of enterprises are explained. Finally, from the perspective of value realization, the business logic transformation mechanism of core technology breakthroughs within and outside the organization is revealed, and the research limitations and prospects of this paper are proposed.

Keywords: digital intelligence; core technology breakthroughs; Value co – creation

Theoretical Origins, Current Status, and Future Research Directions of Crucial Core Technologies from the Perspective of the Innovation Ecosystem

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Abstract: Chokepoints in crucial core technologies have become a major constraint on China's high-quality development and pose serious risks to national security. Theoretically, these chokepoints can be traced back to the study of technological bottlenecks within innovation ecosystems. In recent years, technological bottlenecks have emerged as a central issue in innovation ecosystem research, alongside closely related concepts such as ecosystem architecture, dynamic architecture capabilities, and innovation ecosystem strategies. These constructs are essential for understanding and addressing chokepoint challenges. However, a lack of systematic review of these key issues has hindered theoretical advancement in this domain. This paper adopts an innovation ecosystem perspective to systematically examine five interrelated themes central to the chokepoint problem: (1) the knowledge structure and typology of critical technologies, (2) technological bottlenecks, (3) ecosystem architecture and their dynamic architecture capabilities, (4) innovation ecosystem strategies, and (5) methodological approaches. Based on a comprehensive review of leading studies published in top-tier management journals, this article maps the theoretical origins and evolution of research on chokepoints, identifies current challenges, and outlines future research directions to advance theory development in this increasingly critical area.

Key Words: Innovation Ecosystem; Crucial Core Technology; Ecosystem Bottleneck; Ecosystem Architects; Dynamic Architecture capabilities

A Perspective of Phenomenology of Technology on the Expansion of Management Subject in Manager – AI Relations

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Abstract: Since artificial intelligence (AI) presents the behavior characterized with “autonomy” and “initiative”, it breaks the myth that only human being can be a manager, and constructs a variety of manager – AI relations from AI as a manager’s tool to AI as a substitute of managers, that in turn gives rise to a philosophical question: What kind of changes in management subjects will AI bring? By referring to a perspective derived from a phenomenology of technology and applying a phenomenological variation method to transform D. Ihde’s “Human – Technology – World” Relationship Model into a “Manager – AI – World (Working Contexts + Symbolic Contexts)” model, the present paper identifies four types of Human – Machine Relationships representing AI in management, including (1) Embodiment relations, in which managers install AI to augment or diminish the sense and/or capacity; (2) Hermeneutic relations in which AI plays a mediating role to make managers cope with texts, symbols, images and other information in the symbolic contexts; (3) Alterity relations, in which AI works as “Others” to cooperate with managers or even to replace the latter; and (4) Background relations, in which AI builds the infrastructures for managers to work. The present paper further argues, in addition to traditional human manager as a management subject, AI technology gives birth to two additional management subjects, i. e. AI agents and Inter – Manager – Generative AI hybrids, and discusses the corresponding relations between the three forms of management subjects versus four types of Manager – AI relations and their characteristics, as well as the value of human managers in an era of AI.

Key Words: Artificial Intelligence; Human – Machine Relations; Subjectivity of Management; Phenomenology of Technology; Ihde’s Human – Technology Relations Model.

Strategic Group Identity , Intra – group Strategic Difference and Analyst Decision – making Behavior : An Empirical Study based on the ' Two – stage Decision ' Model

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Abstract:

Purpose: Achieving a favorable position in stakeholders' minds through effective strategic positioning has become critical for firms to gain competitive advantages and achieve superior operational performance. Existing studies, using an internal comparison paradigm, have explored the degree of alignment between a firm's strategic positioning and internal prototypes, exemplar, or goals of evaluators. However, the results of such internal comparisons heavily rely on evaluators' personal experiences and knowledge, making it difficult for firms to establish a universal and standardized guideline to direct strategic positioning. Therefore, it is imperative to introduce effective external references to provide fresh insights into the relationship between a firm's positioning and external audience perceptions. Strategic groups, as external reference groups, can significantly influence decision – making among both internal and external organizational actors. However, existing research has not deeply explored the specific processes by which external audiences use strategic groups as references to perceive and evaluate firms.

Design/ methodology/ approach: To reveal the decision – making reference role of strategic groups in the evaluation and judgment processes of external audiences, this study first defines the group reference function of strategic groups at both inter – group and intra – group levels based on reference group theory. Inter – group identity differences reflect the sources of competitive advantages, business scopes, and overall characteristics of resources and technologies. Intra – group strategic differentiation determines the competitive dynamics and intensity faced by firms. Secondly, based on the "two – stage decision – making model," the influence of a firm's strategic group identity and intra – group strategic differentiation on external audience evaluations follows a sequential decision – making pattern of "legitimacy first, differentiation second." Finally, this study focuses on the decision – making behavior of analysts, considering strategic groups as the reference groups for securities analysts in their cognitive evaluations of firms. It explores the two – stage process by which strategic group identity and intra – group strategic differentiation influence analysts' decision – making and the moderating effects of corporate social responsibility (CSR) and negative events on analysts' evaluations of firms through strategic groups. Empirically, the study applies text topic analysis to annual report data of Chinese listed firms, followed by clustering based on topic analysis results to classify strategic groups within industries, identifying firms' strategic group identities and intra – group strategic differences. This approach creatively addresses empirical measurement challenges related to strategic groups.

Findings: By treating strategic groups as reference groups for securities analysts' cognitive evaluations of firms, this study explores the effects of strategic group identity and intra – group strategic differentiation on analysts' decision – making at different stages. The findings clarify the role mechanisms of reference group patterns in external audiences' cognitive decision – making processes. The study shows that, during the coverage decision – making stage, a firm's strategic group identity enhances analysts' perception of the firm's legitimacy, attracting more attention from analysts. In the subsequent valuation stage, intra – group strategic differentiation boosts the firm's competitive premium, prompting analysts to issue more favorable investment ratings. Overall, analysts' decision – making aligns with the sequential pattern of "legitimacy first, differentiation second." Furthermore, CSR and negative events significantly moderate analysts' evaluations of firms through strategic groups. CSR enhances analysts' attention and improves their investment ratings, playing a positive role in both decision – making stages. Conversely, negative events undermine analysts' perceptions of a firm's legitimacy and competitiveness, exerting negative moderating effects on both tracking and valuation decisions.

Originality/value: First, this study, from the perspective of reference group social comparison, examines the role of strategic groups as reference groups in analysts' decision – making at different stages. It shifts the evaluation standards of external actors like analysts from internal expectations to external reference groups, breaking away from the internal comparison paradigm and extending research on firm positioning and audience evaluation decisions from the reference group perspective. Second, by introducing CSR and negative events as contrasting states of sociopolitical legitimacy, this study explores their effects on analysts' two – stage decision – making, systematically distinguishing between cognitive legitimacy and sociopolitical legitimacy in external stakeholders' perception and evaluation processes. This expands the research boundaries of the "firm positioning – audience evaluation" framework. Lastly, by deconstructing analysts' decision – making processes into stages, this study elucidates the cognitive patterns of external actors like analysts in perceiving and evaluating firm behavior. This not only enriches theoretical research on analysts' decision – making but also provides practical guidance for firms to establish cognitive links between group competition dynamics and external audience evaluations.

Implications/research limitations/suggestions for future research: The study's findings suggest that firms should adopt a strategic positioning approach of "integrating into the group while standing out." This involves leveraging appropriate strategic group identities to convey an overall corporate image while emphasizing differentiation advantages within intense intra – group competition. These findings provide practical guidance for firms in external communication, such as drafting annual reports, investor briefings, and promotional materials. Furthermore, the conclusions clarify the decision – making patterns of securities analysts, offering valuable insights for talent development and improving the scientific rigor and accuracy of analysts' decision – making processes. In terms of limitations, this study focuses on the reference group effect of strategic groups on external audience evaluations, using securities analysts as representative external stakeholders. This approach may overlook the broader diversity and varying preferences of other external audiences. Future research should include a wider variety of stakeholder types to enhance the generalizability and scientific validity of the findings.

Keywords: strategic group; strategic differences; analyst decision; Corporate social responsibility; negative events; theme analysis

The Influence of the Co – governance Model of Core Family Members on the Dual Innovation of Family Business

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Abstract: Enterprises serve as the primary drivers of innovation activities , and family businesses as a crucial segment of the private economy , have increasingly attracted scholarly attention due to their distinctive innovation decision – making processes. However, extant research remains inconclusive regarding whether family business promote or hinder innovation. This theoretical paradox can be attributed not only the heterogeneity of innovation decisions but also to the different family kinship network co – governance models within family members. Prior studies have emphasized the uniqueness of family members' co – governance , as family executives with different kinship relationships have different agency costs due to significant differences in emotional closeness , altruism , and self – interest tendencies. Given that core family members constitute the fundamental unit of family structure , an in – depth examination of how their co – governance models shape innovation decision – making in family business is both timely and necessary. This exploration holds significant theoretical and practical value for advancing the understanding of governance structures and strategic decision – making processes within family business.

Design: Based on the agency theory , this article analyzed the impact of different core family members' co – governance models on dual innovation (i. e. , exploratory and exploitative innovation) . The analysis was conducted using a sample of A – share listed companies from 2013 to 2022. The data on kinship relationships among family members were verified using the firms' annual reports , prospectuses , and listing announcements. For senior management members with unknown kinship ties , their relationships were further verified by tracing the firms' actual controllers and complemented by searches from professional business databases , as well as publicly available sources.

Findings: (1) The husband – wife co – governance had a significant positive impact on dual innovation; The father – son co – governance model had a significant negative impact on exploratory innovation and a significant positive impact on exploitative innovation; Sibling co – governance and compound co – governance models had a significant negative impact on dual innovation. (2) Long term orientation played a mediating role in the relationship between the husband – wife co – governance model and dual innovation; Information transparency played a mediating role in the relationship between father – son co – governance and exploratory innovation. Meanwhile , it played a masking role in the relationship between father – son co – governance and exploitative innovation; Risk – taking capacity played a mediating role in the influence of sibling co – governance and compound co – governance models on dual innovation. (3) Clan culture acted as a positive moderator for the effects of both husband – wife and sibling co – governance models on exploratory innovation , whereas it negatively moderated their relationships with exploitative innovation; Clan culture served as a negative moderator for the linkages of both father – son and compound co – governance models to exploratory innovation , whereas it functioned as a positive moderator for their linkages to exploitative innovation. (4) The performance expectation gap

negatively moderated the relationship between the husband – wife co – governance model and exploratory innovation, and positively moderated the relationship between the husband – wife co – governance model and exploitative innovation; The performance expectation gap positively moderated the relationship between father – son co – governance model and dual innovation; The performance expectation gap acted as a positive moderator for the effects of both sibling co – governance and compound co – governance models on exploratory innovation, whereas it negatively moderated their relationships with exploitative innovation; (5) The relationship between the co – governance models of core family members and dual innovation exhibited regional heterogeneity and environmental uncertainty heterogeneity.

Value: Firstly, from the perspective of family member structure, this study focuses on the core family members, and divides the core family members' co – governance models into husband – wife co – governance, father – son co – governance, sibling co – governance and compound co – governance, which provides new ideas for further understanding family governance and co – governance mechanisms. Secondly, this study delves further into how the co – governance models of core family members affect the dual innovation of family businesses. This not only helps to better understand the heterogeneous innovation behavior of family businesses, but also provides new ideas for understanding the contradictions and divergences in existing research conclusions. Moreover, this study identifies and validates the influence mechanism between core family members' co – governance models and dual innovation, and enriches the research on family firms' dual innovation under the core family members' co – governance model.

Suggestions for future research: This study provides scientifically reasonable guidance suggestions for the governance and innovation of family businesses, facilitating the modernization and scientificization of corporate governance in family businesses. But there are still the following limitations: (1) This article only considered the impact of core family members' combination entering management on innovation decisions in family businesses, and did not examine the impact of ownership allocation on innovation decisions. Future research can explore the impact of core family members' co – governance models on innovation decisions in family businesses from the perspective of ownership involvement. (2) This article only selected family businesses listed on the Shanghai and Shenzhen A – shares in China, excluding non listed family businesses. Future research can include unlisted family businesses in sample selection to make the sample more representative and enrich related studies on family businesses.

Key words: co – governance model of core family members; dual innovation; mechanism of action; Clan culture; performance expectation gap