

Analysis of China's new materials industry landscape and corporate strategic planning

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Abstract. The new materials industry is a strategic pillar industry underpinning China's pursuit of technological self-reliance and self-strengthening. It plays a vital role in the development of advanced manufacturing, the achievement of the "dual carbon" goals, and the security of industrial and supply chains. The deep integration of Artificial Intelligence (AI) with materials Research and Development (R&D) is continuously reshaping the innovation and production models of the industry. Existing literature has extensively examined new materials technologies and AI-driven innovation, but relatively little research has systematically analyzed the competitive landscape of the industry from the perspective of industrial economics. Clarifying the characteristics of industry competition can provide practical insights for domestic industrial policymaking and overseas industrial deployment under the framework of the Belt and Road Initiative. Using Porter's Five Forces model as the analytical framework, this study examines the competitive characteristics of China's new materials industry by drawing on publicly available industry reports, existing literature, and online interviews with industry practitioners, given the constraints on obtaining first-hand corporate research samples. The findings indicate that the industry as a whole has high entry barriers, while supplier bargaining power varies significantly across different segments. Buyers and substitutes exert moderate competitive pressure, and the intensity of intra-industry competition differs substantially between low-end and high-end segments. Based on these findings, corresponding industrial policy recommendations are proposed, followed by a discussion of the limitations of this study and directions for future research.

Keywords: new materials industry, Porter's Five Forces model, industrial competitive landscape, artificial intelligence

1. Introduction

1.1. Practical background

New materials constitute a fundamental pillar of advanced manufacturing and high-tech industries and are widely regarded as the "industrial grain". They serve as a core indicator of a country's overall strength in science and technology, national defense, and manufacturing. The new materials industry generates multiple forms of value, including, but not limited to, economic, technological, security, and ecological value. Domestically, it provides an important foundation for the transformation and upgrading of the real economy,

the achievement of the "dual carbon" goals, and the protection of people's livelihoods. Internationally, it represents a strategic core in competition among major powers and in efforts to achieve independent control over industrial and supply chains. It is also a key pillar for advancing new industrialization and building China into a leading country in science and technology.

Traditional R&D of new materials relies heavily on empirical trial and error, extensive manual experimentation, and conventional theoretical calculations. As a result, the industry generally faces such challenges as long R&D cycles, high investment costs, low rates of technology commercialization, difficulties in clarifying underlying mechanisms, and poor integration between laboratory results and industrial applications. With the deepening integration of intelligent technologies and the real economy, entirely new R&D models are reshaping the underlying development logic of the new materials industry. These models effectively address various shortcomings of traditional R&D approaches and have become an optimal means of overcoming the industry's development bottlenecks [1]. By optimizing R&D pathways through technological innovation, facilitating the commercialization of research outcomes, and enabling green and intelligent production, these new models can improve the quality and efficiency of the new materials industry, support the high-end manufacturing sector and the stable development of secure industrial and supply chains, and strengthen China's voice in global innovation in the field of new materials.

1.2. Theoretical background

The academic community generally recognizes that the deep integration of artificial intelligence and the new materials industry represents a core pathway for stimulating original innovation, achieving breakthrough technological advances, and promoting high-quality industrial upgrading. It is also regarded as a key measure for fostering new quality productive forces and consolidating the foundation for the development of the manufacturing sector¹.

The literature most closely related to this study has primarily focused on trends in the development of the new materials industry, pathways for industrial transformation, and the optimization of industrial chain management and control. Jinsong Xiao examined the directions of domestic substitution and technological breakthroughs in China's chemical new materials sector and proposed an overall development strategy for the sector during the "15th Five-Year Plan" period, emphasizing its transition toward high-end and pioneering development and providing a reference for high-quality industrial development [2]. Xiaojun Shi analyzed the practical challenges faced by new materials enterprises in R&D management and supply chain operations amid the upgrading of the manufacturing sector and explored pathways for improving internal controls [3]. The Central Committee of the China National Democratic Construction Association proposed promoting the deep integration of technology and the new materials industry to facilitate the generation of more original and breakthrough innovations in the field [4]. Yong Yu et al. reviewed the evolution of new materials technologies and industrial support policies adopted by different countries, proposed establishing a new materials innovation and development system suited to China's national conditions, and identified key tasks for R&D and application over the medium and long term [5]. Zifang Guo systematically summarized application scenarios for frontier technologies in materials R&D, covering key processes such as high-throughput materials screening, synthesis process optimization, and production parameter control [6]. Based on an empirical study using patent big data, Guo Wu and Hong Zhou demonstrated that the incorporation of

¹ Central Committee of the China Association for Promoting Democracy. (2025). Driving the innovative development of the new materials industry through scientific and technological innovation. *Qianjin Forum*, (4), 38.

intelligent technologies continues to reshape technological collaboration networks in the new materials field and promote iterative improvements in industrial innovation efficiency, thereby providing empirical support for the transformation of industrial models¹. Wen Li et al., drawing on reforms in materials science education, established case and teaching resource databases related to materials R&D and further improved the talent development system [7].

Meanwhile, foundational studies on the new materials industry and broader industrial transformation also provide theoretical support for this research. As the global manufacturing landscape undergoes profound restructuring and a new wave of technological and scientific revolution continues to advance, the materials industry has entered a critical stage of transformation and upgrading [8]. Xiaoyong Chen and Pei Chen pointed out that, as a strategic emerging industry, new materials provide substantial support for high-end manufacturing, information technology, and other sectors, while traditional operational and management models are increasingly unable to adapt to rapidly changing market conditions [9]. Cong Song and Li Fu argued that technological innovation is reshaping models of scientific and technological innovation, optimizing industrial production processes, improving the operational efficiency of innovation and industrial chains, and contributing to the development of new industrialization.

2. Research project content

Porter's Five Forces model is an analytical framework for industry competition developed by Michael E. Porter. It evaluates the competitive landscape of an industry from five dimensions: rivalry among existing competitors, the threat of new entrants, the threat of substitutes, the bargaining power of suppliers, and the bargaining power of buyers. In general, the stronger these five competitive forces are, the smaller the overall profit potential of the industry tends to be.

2.1. Threat of new entrants

The overall threat posed by new entrants is relatively low. The new materials industry is characterized by substantial R&D investment, lengthy qualification and certification processes, and heavy fixed-asset investment, resulting in relatively high barriers to entry. From an asset perspective, the industry's core production equipment is highly specialized and cannot be easily standardized or used interchangeably. Key equipment such as high-end sintering furnaces and specialized reaction vessels is expensive and often requires customized production, while delivery cycles are relatively long. Consequently, new entrants face considerable upfront capital requirements, and ongoing equipment depreciation further constrains their profit margins. From a certification perspective, when new materials products are introduced into high-end sectors such as semiconductors, aerospace, and healthcare, product validation typically takes two to five years. The industry therefore represents a high-barrier, long-cycle market with substantial barriers to entry and a pronounced competitive moat.

2.2. Bargaining power of suppliers

Supplier bargaining power varies considerably across different segments. Rare mineral resources such as lithium, rare earth elements, gallium, and germanium are unevenly distributed globally, while the qualification requirements for mining and smelting are stringent. Combined with international trade controls, these factors limit the elasticity of raw material supply. Downstream enterprises also face relatively high costs when switching raw material suppliers, giving upstream mineral suppliers relatively strong bargaining power. By contrast, the market for basic chemical raw materials has numerous participants, products are highly

standardized, and competition is relatively intense. New materials enterprises can therefore procure raw materials through multiple channels, making it difficult for suppliers to establish a price monopoly and resulting in relatively weak bargaining power.

2.3. Bargaining power of buyers

Buyer bargaining power is at a moderate level. Standardized new materials products tend to be highly homogeneous, and large downstream purchasers can exert considerable downward pressure on prices by leveraging their purchasing volumes. By contrast, high-end customized high-performance materials involve substantial technological barriers and strong product specificity. Downstream customers must generally undergo product revalidation when switching suppliers, resulting in relatively high switching costs and limited room for price negotiation. Considering these two types of market characteristics together, the overall bargaining power of buyers can be characterized as moderate.

2.4. Threat of substitutes

The threat of substitutes is moderate. In general-purpose applications, traditional materials can substitute for certain new materials due to their cost advantages. However, in high-end precision manufacturing, stringent requirements are imposed on material performance indicators, and traditional materials are often unable to meet the relevant technical standards, leaving virtually no room for substitution. Accordingly, the overall threat posed by substitutes remains within the moderate range.

2.5. Rivalry among existing firms

Competition among existing firms in the industry is moderately intense. In the low-end market for general-purpose new materials, barriers to entry are relatively low, the number of market participants is large, and excess production capacity is prevalent, resulting in pronounced price competition and a race to the bottom. In high-end new materials segments, technological barriers and customer certification requirements limit market entry, resulting in fewer market participants and relatively less intense competition. Overall, the competitive landscape of the new materials industry exhibits clear stratification across different market segments.

3. Conclusion

This study applies Porter's Five Forces model to analyze the competitive landscape of the new materials industry. The findings indicate that the threat of new entrants is relatively low; supplier bargaining power varies significantly across different segments; buyer bargaining power is moderate; the threat of substitutes is moderate; and rivalry among existing firms is moderately intense.

Based on these findings, five implications for industry development can be identified. First, given the relatively high barriers to entry, public pilot-scale testing and commercialization platforms should be established, material product certification procedures should be streamlined, and barriers to innovation-oriented market entry should be moderately lowered to foster a more diverse range of market participants. Second, in response to the differentiated bargaining power associated with upstream raw material supply, a strategic reserve mechanism for rare mineral resources should be established, while supply channels for basic chemical raw materials should be diversified to stabilize raw material procurement costs across the industrial chain. Third, in response to pricing pressure from downstream customers, enterprises should be encouraged to increase investment in the R&D of high-end customized new materials and mitigate the risk of downstream price pressure through differentiated products. Fourth, to address the risk of substitution, enterprises should

continuously improve the stability of material performance and promote the application of high-end new materials in advanced and precision manufacturing scenarios, thereby strengthening the irreplaceability of their products in terms of performance. Fifth, in response to the stratified competitive landscape of the industry, excess low-end production capacity should be phased out in an orderly manner, while enterprises should be guided toward healthy competition based on technological innovation, thereby fostering a sound and sustainable industrial competitive ecosystem.

This study has several limitations. First, future research could expand the sample of enterprises involved in field investigations and obtain more first-hand operational data to improve the precision of the analysis. Second, cross-border deployment strategies for the new materials industry could be further refined by taking into account differences in resource endowments, policies, and regulations among countries along the Belt and Road. Third, as the global supply chain landscape continues to evolve, further research could examine the opportunities and challenges that changes in geopolitical and trade relations present for the globalization of China's new materials industry and further develop pathways for cross-border industrial collaboration and coordinated development.

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