

Analysis of the Advantages and Disadvantages of Ecosystem Chain Coupling: A Case Study of Xiaomi Smart Home

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Abstract: With the rapid development of the technology industry, Xiaomi has attracted numerous companies to its smart hardware and consumer goods network through its unique ecosystem model. This paper focuses on Xiaomi's smart home ecosystem to explore the degree of coupling between Xiaomi and its ecosystem companies in terms of technology reliance, data sharing, and supply chain integration, and how these relationships impact the companies' economic performance. The study adopts a qualitative analysis approach, analyzing typical cases such as Huami and Roborock, and, combined with literature review and ecosystem theory, reveals that high coupling can help companies reduce costs and rapidly capture the market in the short term, but may also limit their independence and compress profit margins in the long term, even causing data privacy disputes. The research further indicates that Xiaomi's ecosystem success is due to dynamic coupling management. Companies need to adjust strategies based on their development stage to achieve sustainable growth. This paper aims to provide practical insights for the collaborative development of ecosystem companies while contributing new thoughts on the competition and cooperation mechanisms in the platform economy.

1 INTRODUCTION

The smart home industry is developing rapidly, driven by the integration of the Internet of Things (IoT) and Artificial Intelligence (AI), enabling innovations ranging from smart speakers to wearable devices. According to industry reports, the global market size surpassed \$150 billion in 2023, with an annual growth rate of about 18%. Xiaomi has built a network covering home appliances and transportation tools through its "hardware + software + services" ecosystem model, integrating resources. In contrast to Apple's closed ecosystem (focused on self-developed integration) and Huawei's open-source HarmonyOS (emphasizing cross-device connectivity), Xiaomi's ecosystem is "open but tightly coupled." Xiaomi accelerates the incubation of businesses by sharing technology and supply chains but also faces issues such as brand dilution and risk transmission. Studying the coupling degree of Xiaomi's ecosystem not only reveals the mechanisms behind its success but also provides references for the design of smart hardware ecosystems to mitigate risks. By 2023, Xiaomi had

invested in over 300 companies, generating over 120 billion yuan in revenue in 2022, with successful cases including Huami and Roborock. High coupling promotes collaborative innovation; for example, companies leverage the Mi Home IoT platform to accelerate product development and optimize design through data sharing. However, it also leads to privacy concerns, such as the increased compliance burden resulting from the EU GDPR review in 2020, which led Huami to invest millions of dollars to revise its data systems. In the supply chain, Xiaomi lowered the entry barriers, but issues such as the 2021 chip shortage led to delivery delays for many companies. For example, Roborock's revenue growth slowed by about 10% in 2021, exposing dependency risks. Roborock, which had overly relied on Xiaomi's channels in the early stages, faced limited brand recognition. Its strategy of "de-Xiaomi branding" helped strengthen brand independence, increasing its gross margin from 15% to 50%, thus demonstrating the value of managing coupling degrees.

The study of coupling degrees has both theoretical and practical significance. Ecosystem theory suggests

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that value creation relies on enterprise collaboration, but high coupling may weaken autonomy (Adner, 2017). Research on the platform economy highlights that core companies control ecosystems through technology and data (Jacobides, 2018). Existing studies have rarely focused on the multidimensional coupling of smart hardware, and the Xiaomi case fills this gap. This study, taking Xiaomi's smart home ecosystem as a case, focuses on the coupling degree of technology, data, and supply chains, exploring its impact on profitability and competitiveness. Practically, this research guides enterprises: during the startup phase, coupling can reduce costs, while in the mature phase, decoupling is necessary to enhance competitiveness. Xiaomi's experience also offers lessons for other industries, such as the new energy vehicle sector. In the context of supply chain fluctuations and stricter regulations, optimizing the coupling degree is crucial for ecosystem governance and industrial security.

2 LITERATURE REVIEW

Business ecosystems are economic communities comprising multiple organizations and individuals, including suppliers, manufacturers, competitors, and other stakeholders, collaborating to create value (Awano and Tsujimoto, 2021). Research highlights that ecosystems transcend traditional industry boundaries, strengthening interdependence and symbiotic relationships among firms, and emphasizing openness and collaboration (Adner, 2017). Key indicators include partner numbers, network density, and a firm's centrality in the network. In business ecosystems, co-opetition (cooperation and competition) is particularly relevant, involving interconnected systems that form a "co-opetition" structure (Riquelme, 2022). Firms must balance value co-creation and competition, relying on stakeholders to optimize business models (Hannah & Eisenhardt, 2018; Zott and Amit, 2015).

Globalization and digitalization have shifted competition from vertically integrated firms to decentralized supply chain networks, fostering platform ecosystems (Kapoor, 2021). Digital platforms enable resource sharing and complementary innovations through modular technologies, such as smart devices expanding functionality via applications, and enhancing user experiences (Cenamor, 2021). Platform ecosystem success depends on external complementary networks, where third parties innovate to add value, creating new market opportunities (Schrieck, 2021).

However, platform owners must balance value co-creation and capture, as excessive control may stifle co-creation, while excessive openness may reduce profits. From an ecosystem perspective, platform openness enhances hardware differentiation but increases complementary ecosystem complexity, creating friction between hardware development and complement production, as hardware firms pursue differentiation while complementors prioritize low-cost, mass-market strategies (Chen, 2022).

The rapid advancement of IoT technology has transformed the smart home industry (You, 2019). Early smart home products focused on single functionalities, whereas the current stage emphasizes platform ecosystem integration (Tang and Inoue, 2021). Research identifies technical barriers—such as inadequate device interoperability, installation complexity, and obsolescence risks due to rapid iteration—as constraints on ecosystem development (Struckell, 2021). In IoT platforms like smart homes, network effects from product technical configurations enhance platform value, enabling broader firm participation (Hein, 2018). Smart home ecosystems often exceed individual firms' capabilities, requiring external networks to converge around standardized solutions or dominant designs, providing essential resources (knowledge, data, technology, and capital). However, excessive standardization may lead to product homogenization, compelling firms to pursue differentiation strategies (Struckell, 2021).

Taking Xiaomi's smart home ecosystem as an example, its ecosystem connects diverse smart hardware through a unified platform, with smartphones as the core, integrating various product categories under the Mijia brand. Xiaomi's open model attracts partners to launch innovative products, supported by supply chain, funding, and sales channels, significantly reducing operational burdens for startups (Li, 2024). Its large user base and active community provide market traction and brand exposure. However, ecosystem firms may face autonomy challenges due to over-reliance on Xiaomi's brand, with some encountering low gross margins and limited market recognition when developing their own brands, and certain products even competing with Xiaomi (Huang, 2023).

Existing research provides a foundation for analyzing the coupling degree of Xiaomi's smart home ecosystem, elucidating inter-firm collaboration, platform economies, and IoT technology's role in smart homes. However, studies primarily focus on single coupling dimensions, lacking systematic exploration of multidimensional coupling and

dynamic management strategies. Current analyses also underexplored the impact of high and low coupling on innovation efficiency, ecosystem control, and partner autonomy. This study evaluates the multidimensional characteristics of Xiaomi's ecosystem coupling degree, explores dynamic management pathways, and addresses these research gaps.

3 COUPLING EFFECT ANALYSIS

3.1 Positive Effects: Resource Synergy and Market Enablement

3.1.1 Technological Sharing Drives Collaborative Innovation

Xiaomi's smart home ecosystem reduces R&D costs and accelerates product development through technological sharing via the Mijia IoT platform. The platform provides unified protocols, cloud services, and AI algorithms, enabling firms to launch Mijia-compatible hardware swiftly. For example, Roborock's Mijia robot vacuum utilized Xiaomi's SLAM algorithms and sensor modules, shortening its R&D cycle from the industry standard of 18 months to approximately 12 months between 2016 and 2018, with R&D expenses at 5.3% of revenue, below the industry average of 7% (Roborock 2018 Annual Report; IDC, 2022). Ecosystem theory suggests that technological coupling fosters collaborative innovation, with device interconnectivity (e.g., smartphone control and speaker linkage) increasing user interaction frequency and ecosystem stickiness (Adner, 2017). However, reliance on Mijia protocols may limit compatibility with non-Mijia ecosystems (e.g., Amazon Alexa), requiring firms like Roborock to develop additional firmware, and increasing costs. Analysis indicates that technological sharing significantly enhances efficiency, but firms must invest in proprietary technologies to sustain long-term competitiveness.

3.1.2 Data Integration Optimizes Product Design

Xiaomi's ecosystem leverages user data sharing to help firms gain precise market insights, optimize product functions, and enhance competitiveness. The Mijia platform's collection of user behavior data from Xiaomi smartphones and smart devices provides consumption preferences and usage patterns, guiding product iteration. For instance, Yeelight's smart

lighting, informed by Xiaomi user data, developed voice-controlled and scenario-linked lamps (e.g., brightness adjustment with Mijia speakers), achieving significant sales growth (China Smart Home Market Report, 2022). Data integration enables rapid responses to user needs, such as Yeelight's family-oriented ambiance lamp series, enhancing product differentiation.

3.1.3 Market Traction and Brand Enablement

Xiaomi provides market exposure and sales support through the Mijia brand and e-commerce channels, significantly reducing marketing costs for startups and enabling rapid market penetration. Platforms like Xiaomi Mall and JD.com offer convenient entry points, with Mijia's brand endorsement boosting consumer trust. For example, Huami leveraged Xiaomi's wearable brand effect and sales channels to rank among the top five global wearable device markets from 2015 to 2018, with a market share of approximately 10% (Huami 2018 IPO Prospectus). Market coupling provides startups with growth shortcuts, with Huami's early sales through Xiaomi channels accounting for 80% of its total. However, long-term reliance on Mijia's brand may weaken proprietary brand recognition, limiting premium pricing (Schrieck, 2021). Huami's promotion of its Amazfit brand since 2018 reflects the need for dynamic market coupling adjustments. Analysis suggests that market traction accelerates expansion, but firms must gradually build independent channels to reduce coupling and enhance brand autonomy and profitability.

3.2 Negative Effects: Dependency Risks and Competitive Constraints

High coupling, while yielding synergistic benefits, also introduces risk propagation, autonomy constraints, and privacy controversies, particularly evident in mature firms or during external disruptions. The following analyzes three sub-dimensions.

3.2.1 Supply Chain Risk Propagation

Xiaomi ecosystem firms, heavily reliant on a unified supply chain, face significant risk propagation during global supply chain disruptions, resulting in production delays and cost surges. The 2021 global chip shortage broadly impacted Xiaomi's ecosystem, with firms dependent on core suppliers (e.g., Qualcomm, MediaTek) experiencing rapid disruption

propagation. For instance, Roborock's robot vacuums faced production constraints due to chip shortages, with third-quarter 2021 net profits declining 20% year-on-year (Roborock 2021 Q3 Report). Gartner's Global Semiconductor Market Report (2021) notes that chip shortages extended smart home industry delivery cycles by an average of 30%. Supply chain coupling optimizes costs through centralized procurement but exposes vulnerabilities under external shocks, with single-supplier dependence exacerbating production uncertainty. Roborock's supply chain diversification since 2022, incorporating non-Xiaomi suppliers, mitigated risks. Analysis suggests that high-coupling supply chains enhance efficiency but require diversified layouts to reduce risk propagation and strengthen ecosystem resilience.

3.2.2 Brand Dependency and Autonomy Constraints

Xiaomi ecosystem firms, deeply reliant on Mijia's brand and channels, face challenges of limited proprietary brand recognition and constrained gross margins, particularly in the mature stage. While Mijia's endorsement aids market entry, long-term dependency weakens brand autonomy and premium pricing. For example, Huami's Xiaomi wearable products achieved rapid sales growth from 2015 to 2018, but its 2018 launch of the Amazfit brand faced low market recognition and below-average gross margins (Huami 2019 Annual Report). To reduce brand dependency, Huami increased investments in proprietary channels and expanded overseas, raising gross margins to 40% by 2024, with proprietary brand products accounting for over 85% of revenue (Huami 2024 Annual Report). Research indicates that independent brand firms achieve average gross margins of 45%, while ecosystem firms typically lag. Brand coupling aids market penetration in the startup phase but constrains globalization and premium pricing in maturity. Analysis suggests firms must pursue brand independence and channel diversification to reduce coupling, enhancing competitive advantage and long-term growth potential.

3.2.3 Data Privacy and Regulatory Pressure

High coupling in Xiaomi's ecosystem enhances product intelligence through data sharing but raises user privacy controversies and regulatory pressures, increasing compliance costs. The Mijia platform's unified data management enables device interconnectivity and functionality optimization but risks privacy breaches due to centralized storage. The

2020 EU GDPR review scrutinized Xiaomi ecosystem firms' data sharing, with Huami investing approximately \$5 million to overhaul its data systems, resulting in a 15% net profit decline in 2020 (Huami 2020 Annual Report). Forrester's Global Data Privacy Report (2021) indicates that smart home industry compliance costs due to privacy issues rise 20% annually. Such incidents increase operational burdens, with some firms redesigning data architectures to meet regulatory requirements. While data coupling enhances product competitiveness, privacy controversies may erode consumer trust and brand image. Analysis suggests firms must optimize data management, such as adopting localized storage or anonymization, to mitigate regulatory risks while balancing data sharing and privacy protection for ecosystem sustainability.

4 RECOMMENDATIONS

Based on the analysis of the positive and negative effects of Xiaomi's smart home ecosystem coupling degree, this chapter offers practical recommendations from the perspectives of ecosystem firms and the platform (Xiaomi). These aim to help firms balance resource dependency and autonomy across development stages, enhance competitiveness, and guide Xiaomi in optimizing ecosystem rules to improve overall resilience. Recommendations are divided into startups, mature firms, and the Xiaomi platform.

4.1 Startups: Leverage High Coupling for Rapid Expansion

Startups with limited resources should fully utilize Xiaomi's high-coupling advantages, leveraging technology, data, and market support to enter markets quickly while building core technologies to mitigate long-term dependency risks. Xiaomi's Mijia IoT platform and supply chain support significantly reduce R&D and procurement costs. Firms should collaborate deeply with Xiaomi, using unified technical standards to develop products and Xiaomi's channels to boost sales. Simultaneously, firms must invest in proprietary technology patents to avoid complete reliance on Xiaomi's algorithms or protocols. Resource dependency theory supports startups leveraging external resources for competitive advantage, but excessive dependency risks stifling innovation (Pfeffer & Salancik, 2015). Firms should develop technology reserve plans to lay the

foundation for future decoupling within high-coupling frameworks.

4.2 Mature Firms: Reduce Coupling to Enhance Competitiveness

Mature ecosystem firms should reduce coupling with Xiaomi through brand independence and channel diversification to enhance premium pricing and global competitiveness. Analysis shows that brand dependency limited Huami's gross margins, but its self-built Amazfit brand and overseas channels increased gross margins to 40% by 2024 (Huami 2024 Annual Report). Firms should gradually reduce reliance on Mijia's brand, increasing proprietary brand marketing through social media and offline stores. Expanding non-Xiaomi channels (e.g., Amazon, Walmart) mitigates market risks. Ecosystem theory emphasizes that mature firms must pursue differentiation to strengthen network independence (Adner, 2017). Firms can emulate Roborock's "de-Xiaomi" strategy, with overseas revenue accounting for 53% by 2024, surpassing domestic markets (Roborock 2024 Annual Report). Additionally, firms should establish proprietary data systems, reducing reliance on Xiaomi's user data, such as adopting localized storage to comply with GDPR. Lowering coupling enhances profitability and market flexibility, enabling resilience to external changes.

4.3 Xiaomi Platform: Dynamically Adjust Ecosystem Rules

As the platform, Xiaomi should dynamically adjust ecosystem rules to balance resource support and firm autonomy, fostering overall ecosystem resilience and sustainability. Xiaomi can adopt a tiered cooperation model, offering high-coupling support (e.g., technology licensing) to startups and low-coupling incentives (e.g., co-branding rather than binding) to mature firms. Platform economy research suggests that openness enhances ecosystem vitality (Jacobides, 2018). Xiaomi can emulate Huawei's HarmonyOS open strategy, encouraging firms to develop multi-ecosystem-compatible products to reduce technological risks. Additionally, Xiaomi should strengthen data privacy management, establishing transparent data-sharing protocols to address GDPR and similar regulations. Dynamic rule adjustments can enhance ecosystem innovation efficiency and risk resistance, reinforcing Xiaomi's competitive advantage.

5 CONCLUSION

Using a qualitative analysis approach, this study examines Xiaomi's smart home ecosystem, integrating literature reviews and case studies of typical firms to systematically investigate the impact of coupling degree across technology, data, supply chain, and market dimensions on firms' economic performance. The findings indicate that high coupling in the startup phase significantly reduces costs and accelerates market penetration through resource sharing and market traction. However, long-term high coupling may restrict firm autonomy, trigger privacy controversies, and expose supply chain risks. The study elaborates on the "double-edged sword" effect of coupling: technological sharing drives collaborative innovation but may limit cross-ecosystem compatibility; data integration optimizes product design but increases privacy compliance costs; supply chain coupling enhances efficiency but is vulnerable to external disruptions; and market traction aids expansion but fosters brand dependency. Through multidimensional coupling analysis, this study validates the dynamic applicability of resource dependency and ecosystem theories, filling gaps in smart home coupling degree research and offering new perspectives on platform ecosystem collaboration mechanisms.

Startups are advised to leverage Xiaomi's technological and market support for rapid market entry while building proprietary technologies to mitigate long-term dependency risks. Mature firms should pursue brand independence and channel diversification to reduce coupling, enhancing gross margins and global competitiveness. Xiaomi, as the platform, should dynamically adjust ecosystem rules to balance resource support and firm autonomy.

Future research could explore quantitative coupling degree evaluation methods, such as developing a coupling degree index model to precisely measure the intensity of technology, data, and other dimensions and their dynamic impact on firm performance. Practically, firms and platforms should collaborate to develop multi-ecosystem-compatible technical standards, enhancing product interoperability to address global regulatory tightening and market fragmentation.

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