Original Research Article

Reforming enterprise R&D systems under open innovation: A comparative case study of Huawei, Haier, IBM, and P&G

Songzhou Han
411322200112093810

Abstract: In this article, it is investigated and explored how open innovation affects the enterprise R&D system reform and mechanism of performance improvement through a comparative analysis of Huawei, Haier, IBM, and Procter & Gamble (P&G). Based on the data from the 2024 annual report and established innovation theories such as absorptive capacity and the private-collective model, the article explores how firms merge internal and external types of innovation. The findings indicate that tailored open innovation models, from decentralized architecture to platform-based ecosystems, positively relate to enhanced financial and operational performance. The study concludes with strategic implications for innovation system design that are consistent with firm-specific capabilities and industry environments.

Keywords: open innovation; R&D system reform; absorptive capacity; enterprise performance; innovation management

1. Introduction

In today's hyper-competitive and knowledge-intensive global economy, innovation has emerged as a force capable of propelling long-term enterprise growth. Traditional closed R&D models centered on the innovation potential within companies are inadequate in coping with rapid technological advancements and market complexities. The idea of open innovation, which requires companies to strategically leverage both internal and external knowledge sources, has emerged as a dominant paradigm (West and Bogers, 2013).

Enterprise R&D systems in large multinationals are transforming to address open innovation challenges. The transformation is largely concerned with decentralized research teams, establishing outside partnerships with universities and start-ups, and adopting digital platforms that enable knowledge integration across boundaries. While that is happening, firms are restructuring performance improvement mechanisms in the form of new products or improved cycles of development as well as in measurable output terms such as cost savings, patent volumes, and top-line growth (Laursen and Salter, 2005).

The article examines how open innovation has affected reforms in enterprise-level R&D systems and how these have influenced firm performance. Using a case study research strategy and quantitative analysis of four multinational firms, Huawei, Haier, IBM, and Procter & Gamble (P&G), this research studies both internal and external open innovation strategies. Firms selected cover a variety of industries (telecommunications, consumer electronics, information technology services, and fast-moving consumer goods) to enable cross-industry comparative study of open innovation activities in various organizational and sectoral settings.

2. Theoretical framework

The analytical framework for the current study is built on several interrelated streams of theory of innovation underpinning explanations and mechanisms of open innovation in R&D system reforms.

Internal ability is required in order to exploit open innovation, as companies require sufficient technical and managerial capacities to be able to transform externally obtained knowledge into value-producing activities. Zahra and George (2002) developed this by drawing a line between potential absorptive capacity (obtaining and learning from knowledge) and realized absorptive capacity (converting and leveraging). When it comes to enterprise R&D reform, this difference can explain why some firms are likely to benefit more from open

collaborations or cross-boundary innovation systems.

Laursen and Salter (2005) empirically demonstrated that firms engaged in external search that is deep and wide, which involves multiple partners and sources of knowledge, attain higher innovation performance. However, such an association is nonlinear in nature; excessive openness can lead to inefficiencies or strategic control loss, and therefore, governance structures and organizational routines serve as a moderator.

West and Bogers (2013) further categorized open innovation practices into inbound, outbound, and coupled processes, providing a typology that can be applied to analyze the different approaches taken by the case study firms. For example, Huawei's reliance on platform ecosystems and Haier's internal entrepreneurship both represent distinct modes of coupling internal and external innovation efforts.

Von Hippel and von Krogh (2006) introduced the private-collective model of innovation incentives, pointing out the fact that firms can benefit from openly sharing their innovation while still earning private returns. This concept is extremely relevant for companies like IBM and Huawei, which donate to open-source software communities yet hold proprietary strengths in service platforms and hardware integration. Spender et al. (2016) also mentioned further that corporations and start-ups may collaborate to co-develop value through open innovation networks, provided internal R&D processes are made adequately flexible in order to incorporate external experimentation.

3. Methodology

This paper adopts a comparative case study approach grounded on secondary quantitative data from the 2024 annual reports of Huawei, Haier Smart Home, IBM, and P&G. The firms were selected based on their industry leadership, publicly disclosed revelations of innovation, and their open dedication to open innovation policies.

Four measures are under investigation:

- R&D intensity (R&D expenditure as a percentage of total revenue)
- Patent activity (patents filed/granted or intellectual property-based measures)
- Performance in operations (defect rate reduction, innovation using AI, new product launches)
- Financial performance (top line growth, net profit, operating margin)
- Data from the following reports form the empirical foundation:
- Huawei Technologies Co., Ltd. (2024)
- Haier Smart Home Co., Ltd. (2024)
- IBM (2024)
- Procter & Gamble (2024)

4. Case study analysis

Huawei is a classic example of internal investment-intensive innovation buttressed by strategically developed openness. In 2024, the firm allocated CNY 164.7 billion on R&D, the equivalent of approximately 23.4.% of its annual revenue (Huawei Technologies Co., Ltd., 2024). Not only was it the highest R&D intensity among the four firms examined, but it was also among the world's highest. Huawei's workforce betrays this emphasis, with over 114,000 employees, over 55% of its overall headcount, involved in R&D efforts. Such a grand investment has allowed Huawei to continue to lead in 5G technologies, AI integration, and software development, such as HarmonyOS and EulerOS platforms. The latter become not only products but open-source ecosystems with huge third-party involvement. Of specific interest, EulerOS engaged over 13,000 external developers and researchers across 2024, reflecting a mature inbound open innovation strategy (Huawei, 2024). Theoretically, Huawei reflects a robust deployment of Cohen and Levinthal's (1990) definition of absorptive capacity. Its sizeable internal knowledge base enables the firm to recognize, absorb, and apply external knowledge. This capacity underpins Huawei's ability to both contribute to and benefit from open communities without losing strategic control. Financially, this model paid off: Huawei saw a 9.6% increase in revenue and a dramatic 144% increase in net profit in 2024, affirming the operational impact of its R&D system. Huawei's strategy also aligns with West and Bogers' (2013) coupled model of open innovation, where firms engage in active two-way interaction with external actors while retaining a strong internal innovation base.

Haier Smart Home provides a compelling case of structural reform-enabled decentralized innovation. Its R&D process is grounded on the RenDanHeYi model, which dispenses with traditional hierarchies and provides autonomous micro-units within the firm with the freedom to think and execute innovation projects. All such autonomous units are closely connected with market needs so that they enhance product development cycles and customer responsiveness. In 2024, Haier achieved a 4.3% revenue increase and a 12.9% net profit rise along with an astonishing 11% reduction in product defect rates (Haier Smart Home Co., Ltd., 2024). These achievements show the productivity and quality gains facilitated by decentralizing R&D power to frontline workers. Haier's practice's theoretical contributions are best appreciated using Zahra and George's (2002) reconceptualization of absorptive capacity. Haier demonstrates excellent realized absorptive capacity, its ability to transform and utilize knowledge gained by embedding innovation responsibility at the grassroots level of the organization. Further, von Hippel and von Krogh's (2006) private-collective model illustrates how Haier workers and partners co-create publicly useful but privately valuable solutions. Although Haier spends less on total R&D than does Huawei, its structural openness enables it to incorporate a broad range of external inputs with little overinvestment in centralized attempts at premeditation, thus maximizing return on innovation.

IBM introduces still another form of open innovation, this focusing on intellectual property, co-developmental platforms, and strategic partnerships. In 2024, IBM invested USD 6.7 billion in R&D (10.8% of revenue), solidly grounded in frontier fields such as quantum computing, hybrid cloud, and artificial intelligence (IBM, 2024). IBM continued to dominate the U.S. patent list with over 1,400 artificial intelligence patents in that year. IBM's partnerships with organizations like MIT and its stewardship of open-source technologies (e.g., Red Hat, Linux Foundation contributions) establish it as a hub in various innovation systems. Nevertheless, IBM's 2024 expansion was less headline-grabbing: revenue expanded by 2.5%, and net profit increased by 3.2.%. IBM's innovation model is a living embodiment of Laursen and Salter's (2005) breadth and depth of external knowledge sourcing theory. The company engages in broad but selective search behaviors, collaborating with high-impact partners to acquire considerable knowledge while safeguarding core IPs. In contrast to Huawei or Haier, who emphasize greater vertical integration or structural empowerment, IBM adopts a platform-based approach. IBM has enough leverage in setting standards and ecosystems without taking full R&D costs on its own. It also illustrates West and Bogers' (2013) external innovation, as IBM often licenses and sells its technology assets outside.

P&G's open innovation strategy, known as "Connect + Develop," has been instrumental in maintaining its competitive edge in innovation in fast-moving consumer goods. In 2024, the company recorded USD 84 billion in net sales (a 2% rise), as well as recording USD 1.5 billion in cost savings through AI-fueled optimization in manufacturing and advertising operations (Procter & Gamble, 2024). R&D spending was estimated at some USD 2 billion, emphasizing spending lean but efficient. P&G partners with more than 2,000 external organizations, such as university research labs, small technology firms, and solo inventors. Its internal organizations are redesigned to function across functions, integrating product design, marketing, and analytics. The company's success in boosting media ROI by 40% in five years also illustrates how open innovation enhances not just product performance, but organizational effectiveness in general. P&G's approach aligns with Spender et al. (2016), which demonstrates that structural alignment with external partners, combined with process redesign and information systems, can create quantifiable results. Their innovation model operates between inbound and outbound innovation, leveraging external ideas internally and licensing internal technology externally when strategically sound.

5. Cross-case comparative insights

A cross-firm comparison highlights three key patterns. First, R&D intensity strongly correlates with innovation output and financial performance. Huawei's aggressive R&D spending corresponds with high revenue and profit growth, while IBM's moderate spending delivers stable but slower gains. Haier and P&G, with more moderate R&D investments, derive performance through structural efficiency and external integration.

Second, every firm follows a unique openness governance model. Huawei combines internal scale with chosen openness; Haier decentralizes power entirely; IBM uses proprietary platforms with external sources; P&G combines openness in a tightly integrated partner network. Such differences are not only industry-driven but also

reflect differences in absorptive capacities and strategic risk appetite.

Third, the role of the ecosystems varies. Huawei and IBM are platform leaders at the center, setting global standards and influencing supplier behavior. Haier innovates from the edge with enabled internal groups. P&G is a middle integrator, integrating innovations from a broad base of innovators. In all cases, however, open innovation is as much a practice as it is a very institutionalized practice embedded in organizational routines, measures, and culture.

6. Discussion

The case study findings demonstrate that open innovation can significantly improve enterprise performance, but the mechanisms and outcomes vary depending on organizational structure, industry context, and absorptive capacity. Huawei's high R&D intensity, combined with its extensive internal workforce and strategic platform openness, led to exceptional financial results, particularly in profit growth. This supports the idea that strong internal absorptive capacity enables firms to fully exploit external contributions (Cohen and Levinthal, 1990; Zahra and George, 2002). On the other hand, Haier's decentralized structure offers micro-enterprises the power to facilitate market-led innovation. This openness in structure generates rapid iteration and improved product quality, as with von Hippel and von Krogh's (2006) private-collective model of innovation. Haier shows us that open innovation is not necessarily going to be high-central investment-driven; it can also work through internal entrepreneurial architecture, accessing external inputs locally. IBM emphasizes platform integration and IP ownership. Though its growth was slower, leadership in AI and hybrid cloud-based ecosystems replicates long-term positioning through controlled openness (Laursen and Salter, 2005). P&G's leaner model illustrates that openness can be leveraged to enhance innovation efficiency when placed inside a coordinated, digitally enabled partner and supply network. In all instances, the role of open innovation is not only strategic but intrinsically intertwined with strategy, governance, and culture. The success of R&D reform under the umbrella of open innovation depends on the alignment of internal capabilities with appropriate external relations and creating innovation systems to be able to facilitate both.

7. Conclusion and recommendations

This study finds that reform of enterprise R&D systems within the open innovation regime leads to measurable performance improvement, only if openness is accompanied by absorptive capacity and operating models. High R&D spending without organizational readiness to extend to the outside environment is insufficient. Firms need to assess their maturity in innovation, invest in facilitation infrastructure, and use agile structures conducive to internal capability as well as external alliances. Subsequent research may explore sector-specific dynamics, cross-border open innovation challenges, and long-term value creation of open R&D ecosystems.

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