

Strategic Development of Korean Brands in the Life Science Research Tools Sector: Insights from Global Leading Brand Strategie

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Received: 07 January 2025

Revised: 15 May 2025

Accepted: 30 November 2025

Published: 27 February 2026

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Abstract: Background/Purpose: The Korean life science research tools market remains heavily import-dependent, with global leaders from the United States, Europe, and Canada dominating key technology domains—Next-Generation Sequencing (NGS), Flow Cytometry, Chromatography, Mass Spectrometry, and Real-Time PCR (qPCR). This study examines the strategic frameworks underlying the global dominance of five leading brands and derives actionable recommendations for Korean manufacturers seeking to build globally competitive brands. **Study Design/Methodology/Approach:** A qualitative, case-study methodology was employed, systematically analysing five global leaders—Illumina (NGS), BD BioSciences (Flow Cytometry), Agilent Technologies (Chromatography), Thermo Fisher Scientific (Mass Spectrometry), and Roche Diagnostics (qPCR)—across six strategic dimensions: corporate history, business strategy, branding and value proposition, customer relationship management, global market entry and localisation, and sustainability/CSR. Data were collected from annual reports, market research reports, corporate websites, and industry news through January 2025. **Findings:** Nine common success factors were identified across all five cases: (1) continuous technological innovation and R&D investment; (2) strategic mergers and acquisitions; (3) integrated solution provision; (4) robust global distribution and localised service networks; (5) brand value built on reliability and quality; (6) close collaboration with academia and industry; (7) national-level R&D funding support; (8) successful private capital raising; and (9) proactive education and marketing. The global market for life science research tools was estimated at USD 133.6–159.6 billion in 2023, with CAGR forecasts of 7–11% through 2032. **Originality/Value:** This study provides the first systematic cross-case comparison of global brand strategies across all five major life science technology domains from the perspective of Korean market development, offering six strategic recommendations—technology innovation, localisation, talent and collaboration, IP protection, branding, and government-industry cooperation—with direct implications for Korean manufacturers, policymakers, and investors.

Keywords: life science research tools; brand strategy; NGS; flow cytometry; chromatography; mass spectrometry; qPCR; Korean life science industry; global market entry; technology innovation

1. Introduction

1.1. Research Background

The life science research tools industry provides the technological foundation that underpins modern scientific research and industrial development across genomics, cellular analysis, compound analysis, and molecular diagnostics. Technologies including NGS, Flow Cytometry, Chromatography, Mass Spectrometry, and qPCR have become indispensable across biopharmaceuticals, personalised medicine, clinical diagnostics, food safety, and environmental analysis. The global market for life science research tools was estimated at USD 133.6–159.6 billion in 2023 and is projected to grow at a CAGR of approximately 7–11% through 2032 (Mordor Intelligence, 2024; Global Information, 2024).

Despite this global expansion, the Korean life science research tools sector remains largely import-dependent. Key instruments are overwhelmingly sourced from US and European manufacturers, imposing high costs on

research institutions and constraining Korean industrial competitiveness. R&D capabilities of Korean firms lag behind global leaders, who sustain dominance through massive investment and global networks. Exceptions such as Seegene's success with multiplex PCR technology during the COVID-19 pandemic demonstrate Korean firms' potential, but systematic, scalable strategies are lacking.

Global leaders—Illumina, BD BioSciences, Agilent Technologies, Thermo Fisher Scientific, and Roche Diagnostics—have established market positions through technological innovation, customer-centric solutions, strong brand values, and social responsibility. Benchmarking these strategies is essential for Korean companies aiming to establish globally recognised brands.

1.2. Research Objectives

This study pursues three specific objectives. First, to identify the success factors of global leading brands across the five major technology domains—NGS, Flow Cytometry, Chromatography, Mass Spectrometry, and qPCR—with particular attention to R&D investment, M&A activity, product portfolio expansion, customer-centric service, and regional specialisation strategies. Second, to analyse how these brands have built brand value and expanded market share to derive the key elements necessary for competitive advantage in global markets. Third, to propose strategic recommendations for developing Korean-branded life science research tools, including government policy support, drawing on the identified success factors.

1.3. Research Methodology

This study employs a qualitative, case-study approach centred on five global brand leaders. Data were collected from corporate annual reports and investor disclosures, market analysis reports from major research firms (Mordor Intelligence, Global Information, Fortune Business Insights, Markets and Markets), official corporate websites, and credible industry news and trade media through January 2025. Each case was analysed across six dimensions: corporate history and background; business strategy (technology innovation, M&A, integrated solutions, global distribution); branding and value proposition; customer relationship management and user experience; global market entry and localisation; and sustainability and CSR. Findings from the five cases were then synthesised to identify cross-cutting success factors and to derive strategic recommendations applicable to the Korean context.

2. Environmental Analysis

2.1. Global Market Trends

The life science research tools market is growing rapidly, driven by advances in biotechnology, genomics, and personalised medicine. The five key technology segments exhibit the following growth profiles (2023 estimates and projections):

- NGS: approximately USD 10 billion (2023), projected to reach USD 34.75 billion by 2031 (CAGR 16.8%), driven by rapid cost reductions in sequencing and expanding clinical applications (Fortune Business Insights, 2024).
- Flow Cytometry: approximately USD 5 billion (2023), projected to reach USD 8.2 billion by 2030 (CAGR 7.2%), driven by growth in immunology and oncology research (Mordor Intelligence, 2024).
- Chromatography: approximately USD 9.5 billion (2023), projected to reach USD 12.1 billion by 2028 (CAGR 6.5%), supported by continued biopharmaceutical industry expansion (Global Information, 2024).
- Mass Spectrometry: approximately USD 6.5 billion (2023), projected to reach USD 11.2 billion by 2032 (CAGR 6.0%), with growing clinical diagnostics applications (Global Information, 2024).
- Real-Time PCR (qPCR): approximately USD 3 billion (2023), projected to reach USD 4.3 billion by 2028 (CAGR 7.0%); COVID-19 pandemic accelerated adoption and ongoing expansion into new diagnostic domains (H&I Global Research, 2024).

2.2. Competitive Analysis: SWOT of the Life Science Research Tools Industry

Table 1 presents an industry-level SWOT analysis synthesising the competitive environment of the global life science research tools sector.

Table 1. SWOT analysis of the life science research tools industry.

Factor	Content
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Strengths	Highly advanced technology: NGS, Flow Cytometry, Chromatography, Mass Spectrometry, and qPCR maximise research accuracy and efficiency. Diverse application domains: widely used in biopharma, healthcare, food safety, and more. Essential research infrastructure for both academic and industrial settings.
Weaknesses	High cost structure: significant initial investment and maintenance costs limit adoption. Technology gap: disparity between global leaders and SMEs in emerging markets creates competitive imbalance. Limited global brand recognition of Korean manufacturers.
Opportunities	Emerging market growth: rapid economic expansion in Asia-Pacific (China, Korea) and government support create new market opportunities. Personalised medicine: rising demand for genomics-related technologies drives NGS growth. AI convergence: new application possibilities combining AI with life science instruments.
Threats	Regulatory tightening: stricter regulations in major markets raise entry barriers. Pace of technological change: companies failing to innovate continuously risk falling behind. Global uncertainty: trade regulations and economic downturns exert market pressure.

Source: Authors' synthesis based on Mordor Intelligence (2024), Global Information (2024), and Fortune Business Insights (2024).

Within each key technology area, competitive dynamics are distinct. In NGS, Illumina holds approximately 70% market share through sustained R&D investment, though high initial costs constrain access. In Flow Cytometry, BD BioSciences leads with a comprehensive product line, facing pressure from Beckman Coulter and Thermo Fisher. In Chromatography, Agilent Technologies competes with Waters Corporation, Thermo Fisher, and Shimadzu, with differentiation increasingly dependent on software integration. In Mass Spectrometry, Thermo Fisher Scientific leads against Waters, Agilent, and Bruker. In qPCR, Roche Diagnostics maintains clinical leadership against Thermo Fisher Scientific, Bio-Rad, and Qiagen.

2.3. Regulatory and Policy Environment

2.3.1. United States

The US FDA applies stringent In Vitro Diagnostic (IVD) regulations requiring clinical validation prior to market authorisation. The NIH's 2023 budget of approximately USD 49.1 billion (83% allocated to external institutions) provides major indirect support for instrument manufacturers. BARDA further supports diagnostic tool development through emergency and pandemic preparedness funding (e.g., USD 483 million to Moderna for COVID-19 vaccine development) (BioIN, 2024).

2.3.2. Europe

The EU's In Vitro Diagnostic Regulation (IVDR), effective from May 2022, substantially tightens conformity assessment requirements, imposing new challenges for both domestic and foreign manufacturers. The Horizon Europe programme (2021–2027, EUR 95.5 billion) supports life science R&D collaboration and competitiveness. GDPR establishes rigorous data governance requirements for research involving personal data (KEREC, 2024).

2.3.3. Asia-Pacific: Korea and China

Korea's Ministry of Food and Drug Safety (MFDS) has strengthened medical device regulations in alignment with global standards, most recently through the revised Medical Device Classification Regulation (March 2021) and enhanced safety management for high-risk raw materials. The government designates bio-health as a national growth industry, investing in infrastructure through institutions such as KBIOHealth (오송첨단의료산업진흥재단). China's NMPA implemented the Medical Device Supervision and Administration Regulations (effective June 2021) as part of a broader regulatory modernisation effort, complemented by 'Made in China 2025' industrial policy supporting domestic life science manufacturing (Medical News, 2024).

2.4. Technological Advances and Their Impact

Digitisation, automation, big data analytics, and artificial intelligence (AI) are transforming the life science research tools industry. In each key area: NGS platforms have advanced dramatically in speed, accuracy, and cost (Illumina's NovaSeq X); Flow Cytometry now supports simultaneous analysis of 50+ parameters (BD Symphony A5); Chromatography systems offer automated workflow optimisation (Agilent InfinityLab Assist); Mass Spectrometry provides ultra-high resolution for proteomics and metabolomics (Thermo Fisher Orbitrap Fusion Lumos); and qPCR systems offer rapid, multiplexed pathogen detection (Roche LightCycler PRO, launched

November 2023).

2.5. Regional Market Analysis

North America is the largest market (estimated USD 65 billion in 2023, CAGR 7.2% to 2028), anchored by US federal research funding and strong regulatory infrastructure. Illumina, Thermo Fisher, and BD BioSciences dominate. Europe represents the second-largest market (estimated USD 50 billion, CAGR 6.5% to 2028), led by Germany, the UK, and France; key players include Agilent, Roche, and Merck Group. Asia-Pacific is the fastest-growing region (estimated USD 40 billion, CAGR 8.0%+), driven by China and Korea. The Korean market was estimated at approximately USD 2.9 billion in 2023 (CAGR 7.5%), with growth supported by government bio-health investment and rising domestic companies including Seegene, SolGent, and Bioneer. However, Korean firms still face significant technology and brand recognition gaps relative to global leaders.

3. Case Analysis: Global Leading Brand Strategies

The following section analyses each global leader across the six dimensions described in the methodology. Table 2 provides a cross-case comparative summary.

Table 2. Comparative analysis of global leading brand strategies in life science research tools.

Brand	Growth Strategy	Key Strength	Differentiator
Illumina (NGS)	NGS platform innovation; cloud-based data analysis; strategic M&A (Solexa, BlueGnome, GRAIL)	Dominant technology leadership in genomics and clinical diagnostics (~70% market share)	Scalable platform range (MiSeq to NovaSeq); integrated BaseSpace Sequence Hub cloud analytics
BD BioSciences (Flow Cytometry)	High-precision multiparameter system development; expanded global sales network; M&A (Pharmingen)	Trusted reliability and accuracy in cellular analysis for research and clinical use	Simultaneous multi-parameter analysis; comprehensive reagent, software, and support ecosystem
Agilent Technologies (Chromatography)	High-performance HPLC/GC instrument development; integrated software + consumables solutions; M&A (Varian)	Strong positioning across pharma, environmental, and food safety sectors	Consistent quality and durability; InfinityLab Assist automation; diverse industry applicability
Thermo Fisher Scientific (Mass Spectrometry)	High-resolution mass spectrometry R&D; integrated MS + chromatography + software solutions; M&A (Life Technologies, Dionex)	Superior resolution and sensitivity; essential for proteomics, metabolomics, and drug discovery	Orbitrap and Tribrid Fusion platforms; Proteome Discoverer and TraceFinder software suite
Roche Diagnostics (Real-Time PCR)	qPCR commercialisation and standardisation; integrated clinical diagnostic solutions; M&A (GenMark, Ventana)	Highest trust in molecular diagnostics; stringent international regulatory compliance	LightCycler and COBAS platforms; multiplexing capability; proven clinical performance (HIV, HBV, HCV)

Source: Authors' compilation based on corporate annual reports, official websites, and industry data (2023–2025).

3.1. Illumina — NGS

3.1.1. Corporate History

Illumina was founded in 1998 and initially focused on microarray technology before pivoting to NGS with the acquisition of Solexa in 2007. This acquisition enabled Illumina to commercialise the sequencing-by-synthesis (SBS) technology that underlies its entire platform portfolio. Illumina currently holds approximately 70% of the global NGS market (Sandiegomics, 2023).

3.1.2. Business Strategy

Illumina's strategy centres on continuous R&D investment to develop differentiated NGS platforms (HiSeq, MiSeq, NextSeq, NovaSeq), strategic M&A to extend technology reach (Solexa 2007, Verinata Health, BlueGnome, GRAIL 2021), provision of end-to-end integrated solutions including cloud-based data analysis via BaseSpace Sequence Hub, and a global distribution network with localised subsidiaries across Asia, Europe, and North America. In Q4 2023, revenues reached approximately USD 1.15 billion (+3% year-on-year), with full-year 2023 revenues of approximately USD 4.5 billion. NovaSeq X shipments reached 390+ units in 2023.

3.1.3. Branding and Market Dominance

Illumina positions 'reliability' and 'innovation' as core brand values, offering scalable platforms from small-laboratory to population-scale projects and a unified software-to-instrument ecosystem. Its CRM approach includes technical support, education programmes, and cloud-based user experience optimisation. The brand functions as the de facto reference standard in genomics, directly competing with Thermo Fisher (Ion Torrent), Pacific Biosciences (long-read), and Oxford Nanopore (real-time/portable).

3.2. BD BioSciences — Flow Cytometry

3.2.1. Corporate History

BD BioSciences is the life science division of Becton, Dickinson and Company (BD), founded in 1897. BD commercialised FACS (Fluorescence Activated Cell Sorting) technology in the late 1970s, establishing its foundational leadership in Flow Cytometry. The 1997 acquisition of Pharmingen substantially expanded its immunology research capabilities.

3.2.2. Business Strategy

BD invests heavily in R&D to advance multiparameter analysis—the BD Symphony A5 supports simultaneous detection of 50+ parameters. Integrated solutions encompass instruments (FACSCanto, LSRFortessa, FACSsymphony), fluorescent antibodies and reagents, and FACSDiva/FlowJo software. Global distribution is reinforced by localised technical support centres. BD's sustainability and CSR activities focus on reducing its environmental footprint and improving global healthcare access.

3.2.3. Branding and Market Dominance

BD BioSciences brands on 'reliability' and 'quality,' targeting both research and clinical diagnostics settings. Competitors include Beckman Coulter, Thermo Fisher, and Merck Millipore. BD differentiates through instrument performance, product breadth, and its global service network. IP protection and continuous innovation sustain its leadership.

3.3. Agilent Technologies — Chromatography

3.3.1. Corporate History

Agilent Technologies was spun off from Hewlett-Packard in 1999, inheriting a strong HPLC and GC instrument portfolio. It has since become a global standard-setter in analytical instrumentation for pharmaceuticals, environmental analysis, and food safety.

3.3.2. Business Strategy

Agilent's strategy combines technology leadership (1290 Infinity II HPLC, 8860 GC, Intuvo 9000 GC), portfolio expansion through M&A (Varian Inc. 2010, BioTek Instruments 2019), and integrated solution provision including OpenLAB CDS and MassHunter software. Agilent University provides structured customer education. Six Sigma quality methodology and ISO 9001/ISO 17025 certification underpin quality management. Competitors include Waters Corporation, Thermo Fisher, and Shimadzu.

3.3.3. Branding and Market Dominance

Agilent's brand promise centres on analytical precision, reliability, and comprehensive solution integration. The company maintains strong positions in pharmaceutical QC, environmental monitoring, and food safety—markets requiring rigorous accuracy and audit-trail documentation. Its global localisation strategy includes regional subsidiaries and market-specific product configurations.

3.4. Thermo Fisher Scientific — Mass Spectrometry

3.4.1. Corporate History

Thermo Fisher Scientific was formed in 2006 through the merger of Thermo Electron Corporation and Fisher

Scientific International. It is today the world's largest life science company by revenue, holding leadership in Mass Spectrometry through platforms such as the Orbitrap Fusion Lumos Tribrid and TSQ Quantis triple-quadrupole systems.

3.4.2. Business Strategy

Thermo Fisher's strategy integrates Mass Spectrometry with chromatography, sample preparation, and software (Proteome Discoverer, TraceFinder) into a unified analytical workflow. Strategic M&A (Dionex 2011, Life Technologies 2014) has extended its portfolio into ion chromatography and NGS/PCR. The company's global service infrastructure includes regional distribution centres and localised customer support. PPD (its clinical research division) serves NIH Blueprint MedTech under a multi-year federal contract. Annual R&D reinvestment and continued M&A activity maintain technological leadership. Competitors include Waters, Agilent, and Bruker.

3.4.3. Branding and Market Dominance

Thermo Fisher's brand is built on high-resolution analytical accuracy, instrument durability, and comprehensive end-to-end support across research, clinical, and industrial applications. Its Harvard Medical School partnership (Thermo Fisher Scientific Center for Multiplexed Proteomics) illustrates its academic collaboration model.

3.5. Roche Diagnostics — Real-Time PCR

3.5.1. Corporate History

Roche was founded in 1896 and its diagnostics division has played a defining role in commercialising PCR-based molecular diagnostics, commencing with the 1991 acquisition of Cetus Corporation's PCR patent portfolio. Roche's qPCR platforms—LightCycler and COBAS—are widely used in clinical settings globally for infectious disease diagnosis (HIV, HBV, HCV) and oncology.

3.5.2. Business Strategy

Roche Diagnostics invests heavily in R&D to maintain qPCR sensitivity, specificity, and throughput. Major M&A include Ventana Medical Systems (2008, tissue diagnostics), CAPP Medical (2015, liquid biopsy), and GenMark Diagnostics (2021, syndromic panel testing, USD 1.8 billion). Integrated solutions pair instruments with Roche-branded reagents and Cobas IT data management software. Localised regulatory compliance ensures FDA, CE, and PMDA approvals across markets. The November 2023 launch of the LightCycler PRO System advanced clinical and research performance. A January 2023 MOU with the Korea Health Industry Development Institute (KHIDI) supports domestic SME collaboration.

3.5.3. Branding and Market Dominance

Roche Diagnostics is the de facto clinical qPCR standard, competing with Thermo Fisher, Bio-Rad, and Qiagen. Brand strength rests on clinical-grade reliability, regulatory compliance, and a global service network. Its CSR strategy ('Let's Go for Zero' in the broader Roche context) addresses environmental sustainability and global health equity.

3.6. Cross-Case: Common Success Factors

Across all five cases, nine common success factors were identified: (1) continuous technological innovation and R&D investment, sustaining differentiated competitive advantage; (2) strategic M&A to accelerate technology acquisition and market penetration; (3) integrated solution provision (instruments + reagents + software + support) maximising customer value; (4) global distribution and localised service networks ensuring rapid, consistent product access; (5) brand values anchored in reliability and quality, certified through international standards (ISO 13485, GMP, ISO 9001, FDA 510(k)/PMA, CE-IVDR); (6) close collaboration with academic and industrial partners to set technology standards and accelerate commercialisation; (7) national-level R&D funding support (US NIH, EU Horizon Europe, Swiss/Belgian national programmes); (8) successful private capital raising (IPO, bond issuance, sustained R&D reinvestment of 20%+ of revenues); and (9) proactive education and marketing through dedicated training academies, international conferences, and digital platforms.

4. Strategic Recommendations for Korean Life Science Instrument Manufacturers

Korean manufacturers—including Seegene, SolGent, Young In Chromass, and Bioneer—have demonstrated meaningful domestic and selective global success, but systemic barriers remain: technology gaps relative to global leaders, limited brand recognition, and import dependency. Drawing on the nine cross-case success factors identified above, six strategic recommendations are proposed. Table 3 provides a summary.

Table 3. Summary of strategic recommendations for Korean life science research tool manufacturers.

Strategic Recommendation	Key Actions	Expected Outcomes
Technology Innovation & Product Differentiation	Expand R&D investment; advance NGS, PCR, and AI-integrated data analysis platforms; develop cost-effective high-performance solutions for emerging markets	Technological leadership in global markets; competitive advantage through product differentiation
Global Market Entry & Localisation	Establish local subsidiaries; develop region-specific products/services meeting regulatory and cultural requirements; expand strategic global partnerships	Increased market share; reduced costs; enhanced trust with local customers
Talent Acquisition & Global Collaboration	Recruit international talent; collaborate with global research institutions; activate industry-academia partnership programmes; leverage digital collaboration platforms	Accelerated innovation ecosystem; rapid adoption of latest technology trends and commercialisation
IP Protection & Regulatory Compliance	Build international patent portfolio; obtain FDA, CE, and PMDA certification early; operate a regulatory compliance monitoring team	Technology protection; reduced market entry barriers; improved global credibility
Branding & Marketing Strategy	Utilise digital marketing; actively participate in global academic conferences and exhibitions; provide personalised customer solutions and after-sales support	Strengthened brand recognition and loyalty; differentiated brand image in target markets
Government–Industry Collaboration	Expand R&D funding and policy support; regulatory reform and sandbox environments; form industry consortia and innovation clusters	Sustainable growth foundation for life science industry; strengthened global competitiveness

Source: Authors' recommendations derived from cross-case analysis.

4.1. Technology Innovation and Differentiated Product Development

Continuous R&D investment is the foundational requirement. Korean companies should advance existing strengths—e.g., Seegene's multiplex PCR platform—by developing simultaneous detection capability for greater target multiplicity, integrating mutation-detection algorithms, and improving turnaround speed. Fusion of NGS and AI for large-scale genomic data analysis represents a high-priority opportunity for differentiated platform development. Cost-effective, high-performance instruments targeting emerging markets should be developed in parallel. Concrete milestones—e.g., annual R&D growth targets; five new international patents within five years—should be defined and monitored. Global R&D co-operation with overseas institutions should be pursued through joint patent applications and technology commercialisation agreements.

4.2. Global Market Entry and Localisation Strategy

Korean manufacturers must move beyond product export to implement genuine localisation: establishing local subsidiaries and service centres in target markets (US, EU, Southeast Asia); recruiting regional regulatory compliance specialists to accelerate FDA, CE, and PMDA approvals; developing localised marketing communications that address regional cultural and scientific priorities; building local distribution partnerships to accelerate market access; and developing cost-efficient products specifically designed for emerging market contexts where price sensitivity is high and infrastructure constraints limit adoption of high-complexity instruments.

4.3. Talent Acquisition and Global Collaboration

Technology leadership requires commensurate human capital. Korean firms should implement targeted global recruitment campaigns for senior R&D and clinical affairs talent, supported by competitive remuneration and quality-of-life infrastructure (international schooling, research campuses). Industry-academia partnerships with leading Korean and international universities (e.g., KAIST, Seoul National University, and international partners) should be formalised into joint R&D programmes with structured technology transfer mechanisms. Digital collaboration platforms—cloud-based data sharing, virtual laboratories, AI-assisted co-development

environments—should be deployed to overcome geographic constraints. Government cooperation to simplify researcher visa processes and establish tax incentives for international talent is recommended.

4.4. Intellectual Property Protection and Regulatory Compliance

Systematic patent portfolio construction is essential. Korean firms should map their technology innovations against international classification systems, file patents in all target markets concurrently, and establish cross-licensing agreements where appropriate. Dedicated regulatory compliance teams should monitor evolving requirements in the US (FDA IVD regulations), EU (IVDR, GDPR), Japan (PMDA), and Korea (MFDS) and ensure that product design decisions incorporate regulatory requirements from the outset. Quality management systems meeting ISO 13485 and GMP standards should be implemented and maintained.

4.5. Branding and Marketing Strategy

Korean manufacturers must develop internationally credible brand identities anchored in clear value propositions—technical innovation, quality, and customer partnership. Participation in high-visibility international scientific conferences (e.g., ASHG, EuroFlow, ASMS, Pittcon) provides essential brand exposure. Digital marketing—SEO, targeted social media, webinars, virtual exhibitions—expands reach beyond physical events. Customer-centric services including tailored instrument configuration, on-site installation support, and data analysis consulting reinforce long-term loyalty. Seegene's COVID-19 success provides a referenceable case for Korean brand credibility that should be actively leveraged in subsequent market communications.

4.6. Government–Industry Collaboration

Government partnership is a strategic multiplier. Key priorities include expanded R&D grant programmes targeting life science instrumentation (extending existing bio-health policy to include research tools); regulatory sandbox environments enabling accelerated proof-of-concept testing; facilitation of industry consortia to share pre-competitive technology investments; formation of innovation clusters integrating manufacturers, research institutions, and start-ups; and international research network development to attract foreign collaboration and enable Korean participation in global programmes such as Horizon Europe. Social responsibility and environmental sustainability should be incorporated into industry strategy, both as a genuine commitment and as an enabler of access to international markets with ESG procurement criteria.

5. Discussion

The cross-case analysis confirms that no single success factor explains global market dominance; rather, it is the coherent integration of technological leadership, strategic portfolio management, customer-centric service, brand credibility, and ecosystem collaboration that sustains competitive advantage. For Korean manufacturers, the most immediate leverage points are likely to be (1) technology differentiation in specific niches where existing capabilities can be extended—multiplex PCR, AI-integrated genomic platforms, cost-optimised diagnostic instruments for emerging markets—rather than broad-front competition with established leaders; and (2) targeted regulatory compliance investment, since FDA and CE certification fundamentally unlocks market access in North America and Europe.

The COVID-19 pandemic demonstrated that exogenous shocks can rapidly reshape competitive landscapes, providing windows for challengers to establish market presence. Korean firms—particularly Seegene—demonstrated the capacity to exploit such windows. The strategic challenge is to convert that episodic success into durable brand equity. This requires the sustained, systemic investment across all six strategic dimensions identified in this study, rather than product-specific tactical responses.

Government policy has been decisive for all five global leaders analysed—US NIH funding, EU Horizon Europe, and Swiss research support all played enabling roles. Korean government bio-health policy is well-intentioned but has historically under-indexed on life science research tools relative to pharmaceutical and medical device sectors. Rebalancing toward instrumentation R&D support, regulatory harmonisation, and international collaboration infrastructure is a policy priority with high potential multiplier effects.

6. Conclusions

This study analysed the strategic frameworks of five global life science research tool leaders—Illumina, BD BioSciences, Agilent Technologies, Thermo Fisher Scientific, and Roche Diagnostics—and derived six actionable strategic recommendations for Korean manufacturers. The principal conclusions are:

- Nine common success factors explain global market leadership: continuous R&D innovation, strategic M&A, integrated solution provision, global distribution with localised service, quality-based brand trust,

academic/industry collaboration, national R&D funding, private capital raising, and proactive education and marketing.

- Technology differentiation in specific niches—building on existing Korean strengths in multiplex PCR, genomic diagnostics, and chromatographic analysis—offers the most viable near-term pathway to global competitiveness.
- Localisation, regulatory compliance capability, and brand-building require sustained, coordinated investment across government, industry, and academia; no single actor can drive the transformation alone.
- Korean government policy should be expanded to explicitly encompass research tool instrumentation within bio-health strategy, providing R&D grants, regulatory facilitation, and international collaboration infrastructure comparable to pharmaceutical and medical device support.

Korean life science research tool manufacturers that implement these recommendations coherently—sustaining technological leadership, building internationally credible brands, securing regulatory approvals, acquiring global talent, and forging durable industry-academia-government partnerships—are well-positioned to establish themselves as globally recognised brands and contribute to both national scientific capability and economic competitiveness.

6.1. Research Limitations and Future Directions

This study relied on secondary data from public disclosures; direct primary data from company executives or proprietary databases were not available. The qualitative case-study design provides depth but limits quantitative generalisation. Future research should apply quantitative financial analysis comparing R&D investment ratios, market share growth trajectories, and brand valuation metrics. Longitudinal case studies tracking the impact of specific strategic interventions over 5–10 year horizons would strengthen causal inference. Comparative analysis of successful challengers from other technology-advanced nations (Israel, Taiwan, Germany's Mittelstand) would provide additional benchmarks.

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