

Saudi Arabia: Building a national ecosystem for frontier innovation and deep-science commercialization



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Designing national architecture for frontier innovation

Vision 2030 as a foundation for innovation-led transformation

Vision 2030 has reoriented Saudi Arabia's development model, positioning research, development and innovation (RDI) as a primary instrument for reducing oil dependence and building long-term economic resilience. This transformation is anchored in deliberate investment across advanced technological domains, including artificial intelligence, quantum technologies, biotechnology and advanced materials, where innovation intensity and economic returns are highest (Research, Development and Innovation Authority (RDIA), 2025a).

Recent indicators point to a rapid expansion in national RDI capacity. By 2024, Saudi Arabia recorded more than 41,000 active researchers, reflecting a year-on-year increase of 12.8 percent, while the broader research and development (R&D) workforce surpassed 56,000 individuals, growing at 14.7 percent annually (General Authority for Statistics (GASTAT), 2025). Higher education institutions continue to anchor the majority of this activity, although early diversification into private-sector research capacity is also becoming evident.

At the same time, financial commitment to RDI has accelerated. National expenditure reached 29.5 billion Saudi riyals (SAR) in 2024, marking a 30 percent increase compared to preceding years. Although public funding remains the principal source of R&D financing, private-sector participation has become significant in terms of actual expenditure, indicating a gradual evolution toward a more balanced innovation system (GASTAT, 2025).

Institutional coordination and priority setting

Saudi Arabia's RDI landscape is supported by a more interconnected ecosystem linking public institutions, academia, industry and entrepreneurs. RDIA plays a coordinating role in fostering alignment across stakeholders, contributing to national priority-setting processes and monitoring system-level performance (RDIA, 2025b).

Efforts to formalize a comprehensive national framework for RDI reflect a structured approach aimed at strengthening institutional effectiveness and accelerating innovation outcomes. Priority-setting mechanisms are informed by the National Aspirations and Priorities framework, which provides long-term direction across four strategic domains and guides investment decisions in research and innovation (Saudi Press Agency, 2022).

Human capital development remains a critical enabling factor. Continued investment in science, technology, engineering and mathematics (STEM) education and advanced training programs is expanding the pool of scientific and technical talent required to sustain innovation-led growth (GASTAT, 2025).

Whole-of-government coordination

A defining governance requirement in innovation-intensive economies is cross-institutional coordination, where research, commercialization, regulation and investment involve actors with different mandates and planning horizons. Within this model, RDIA operates as the national coordinating body, ensuring that the efforts of universities, sectoral ministries, funding bodies and private-sector actors remain strategically aligned rather than fragmented or duplicative (RDIA, 2025b).

This coordinated approach is reinforced by differentiated institutional roles across the national innovation ecosystem. RDIA contributes to ecosystem coordination and strategic alignment, while King Abdulaziz City for Science and Technology (KACST) advances applied research and technology localization. The Saudi Authority for Intellectual Property (SAIP) strengthens the legal and operational framework for intellectual property, and the National Technology Development Program (NTDP) supports the development of the Kingdom's technology ecosystem. Sectoral ministries further integrate RDI priorities into domain-specific strategies, ensuring that innovation objectives are embedded across key areas such as health, energy, and industry (KACST, 2024; SAIP, 2025; NTDP, 2026).

Monitoring progress and international benchmarking

The increasing use of benchmarking and international comparison mechanisms has also become an important feature of Saudi Arabia's evolving innovation governance model. Beyond measuring performance, benchmarking frameworks are used to identify structural gaps, guide policy adjustments and support institutional learning across the RDI ecosystem. This reflects a broader shift toward evidence-based innovation governance, where performance indicators are integrated into long-term planning and ecosystem development efforts.

The Kingdom's progress in building an innovation-driven economy is reflected in both domestic indicators and international benchmarks. Ongoing reforms, coupled with sustained investment and institutional coordination, have contributed to measurable improvements in research capacity, technological capability and market dynamism.

These developments are captured in global benchmarking frameworks, such as the Global Innovation Index (GII), published by the World Intellectual Property Organization (WIPO). Saudi Arabia's overall GII rank advanced 22 places between 2019 and 2025, moving from 68th to 46th place among the 139 economies included in last year's index (WIPO, 2025). This improvement has been driven more strongly by innovation input gains, where the Kingdom reached 31st place globally, than by output performance, where scores are still maturing as foundational reforms translate into measurable results.

Regulatory reforms and intellectual property development

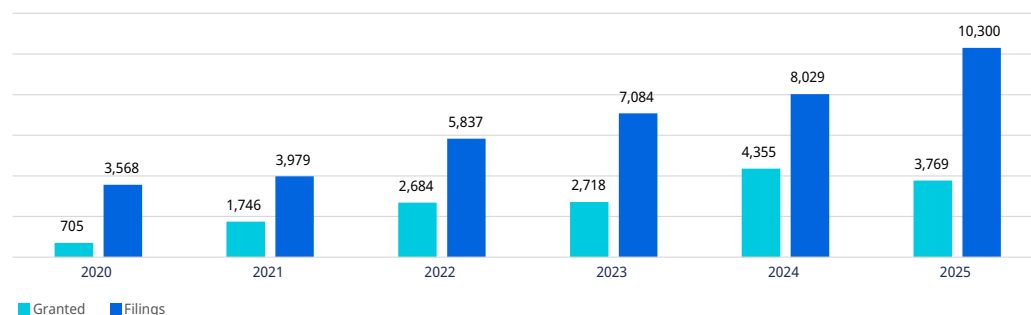
Enhancing the regulatory environment has been a key component of Saudi Arabia's innovation agenda. Recent reforms have focused on strengthening the intellectual property system to better support commercialization and attract investment (SAIP, 2025).

A substantial overhaul of Saudi Arabia's intellectual property framework was introduced in 2023, when amendments to the Patent and Industrial Design Laws brought the Kingdom's industrial design system into conformity with international standards under the Hague Agreement, extended protection duration to 15 years and streamlined procedural requirements to reduce cost and processing barriers for both domestic and international applicants (SAIP, 2025). These measures have contributed to a more transparent, predictable and internationally compatible intellectual property regime.

Subsequent regulatory developments in 2024 further clarified legal definitions and streamlined application processes, including those related to international filings.

These reforms have been accompanied by notable growth in intellectual property activity. As shown in Figure 1, patent applications increased from 3,800 in 2020 to 10,300 in 2025, while granted patents rose from 705 to approximately 3,800 over the same period. This trend reflects both increased demand and improvements in the quality of submissions (SAIP, 2025).

Figure 1 Patent filings and grants, 2020–2025



Source: SAIP (2025).

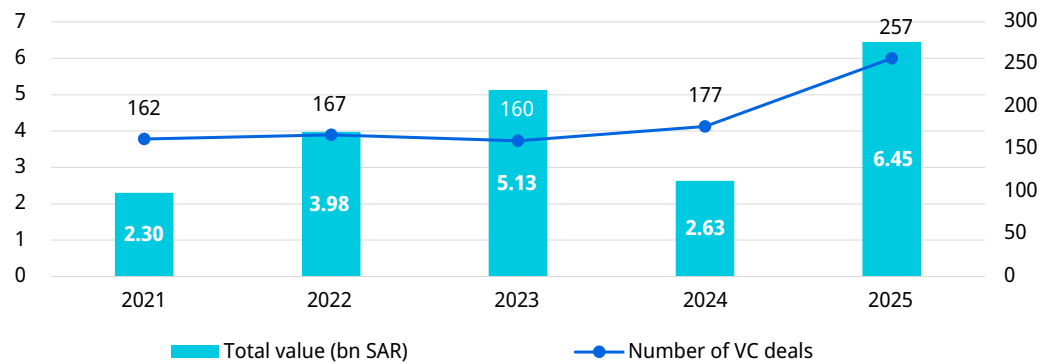
Supporting these developments, SAIP has expanded its advisory services and digital platforms to enhance application quality and facilitate engagement across academia, industry and government.

Financing mechanisms and deep-tech investment

Saudi Arabia's approach to financing innovation has evolved toward a more diversified and integrated model. A combination of direct funding instruments, such as grants and salary support, and indirect mechanisms, including co-investment platforms and financial guarantees, is helping to reduce risk and mobilize private capital (RDIA, 2025c).

This evolution is reflected in national investment trends. Gross domestic expenditure on R&D (GERD) reached SAR 29.5 billion in 2024 compared to SAR 14.5 billion in 2021, representing a near doubling within three years (GASTAT, 2025). Measured as a share of gross domestic product (GDP), national R&D expenditure has grown steadily across this period, underscoring the increasing strategic weight of RDI within the national economic model.

The financing landscape is further supported by a range of complementary instruments, including commercialization support, incentives specifically targeting small and medium-sized enterprises (SMEs) and mechanisms to facilitate international expansion. Together, these elements create a continuum of support from early-stage research to market deployment (RDIA, 2025c).

Figure 2 Venture capital funding and transactions in Saudi Arabia, 2021–2025

Source: MAGNiTT (2026).

Venture capital has emerged as a key component of this ecosystem. Saudi Arabia's venture capital market has expanded considerably in recent years, with transaction volumes rising from 162 deals in 2021 to 257 in 2025, while total funding grew from SAR 2.30 billion to SAR 6.45 billion over the same period (MAGNiTT, 2026). This trajectory reflects a broadening investor base and an increasingly active pipeline of technology-driven ventures across multiple sectors.

At the same time, targeted support for deep-tech sectors is expanding. Initiatives outlined in the *Innovation Services and Enablers Guide 2025*, including programs such as NEXTERA, provide tailored financial and technical support to address the longer development cycles and higher capital requirements associated with advanced technologies (RDIA, 2025c).

While national policy frameworks, financing mechanisms and regulatory reforms provide the structural foundation for innovation, universities are playing a central role in converting research capacity into technological and economic value. As Saudi Arabia's innovation ecosystem continues to evolve, higher education institutions are becoming important engines of commercialization, talent development and industry collaboration.

Universities as engines of deep-tech translation

Universities play a strategic role within contemporary innovation systems, serving not only as centers of scientific research and education, but also as platforms for technology commercialization, entrepreneurship and industrial collaboration. In Saudi Arabia, this transformation has accelerated under Vision 2030, with universities expanding their contribution to the national RDI ecosystem through technology transfer, startup support and research activities aligned with industry needs.

Within this evolving landscape, research universities across the Kingdom are strengthening their capabilities in frontier domains, such as artificial intelligence, biotechnology, advanced materials, renewable energy and digital technologies, all of which are central to the emergence of frontier technology innovation globally (World Economic Forum, 2023).

Alignment of research with national priorities

A defining feature of Saudi Arabia's evolving university system is the increasing alignment of academic research with national development priorities. Universities are aligning research agendas with broader national objectives across strategic domains, including health and wellness, sustainable environment and essential needs, energy and industrial leadership, and economies of the future (RDIA, 2025b; Saudi Press Agency, 2022).

Universities play a central role in advancing research within these frontier domains while simultaneously strengthening the Kingdom's human capital base. In 2024, Saudi Arabia recorded more than 41,000 researchers engaged in R&D activities, with the majority based

within universities and higher education institutions, highlighting the sector's critical contribution to national scientific capacity (GASTAT, 2025).

Beyond research production, universities are expected to contribute to economic and technological value creation through commercialization and industry engagement.

Technology transfer and commercialization pathways

Technology transfer systems have become more prominent in supporting the translation of university research into market-oriented applications. Saudi universities have expanded the role of Technology Transfer Offices (TTOs) in areas such as patent management, licensing, startup support and industry engagement, contributing to stronger pathways for research-intensive technologies.

This growing focus on intellectual property generation is reflected in the rising representation of Saudi universities within global patent rankings. The National Academy of Inventors' *Top 100 Worldwide Universities Granted U.S. Utility Patents* ranking indicates a steady increase in both the number of Saudi universities represented and the volume of patents granted over recent years (National Academy of Inventors, 2025).

At the institutional level, recent reforms have strengthened incentives for research translation and entrepreneurial activity. For example, revised intellectual property policies at King Fahd University of Petroleum and Minerals (KFUPM) provide researchers and students with greater participation in commercialization revenues and facilitate startup formation through licensing and equity-based mechanisms (KFUPM, 2025).

Similarly, internal research funding at King Saud University (KSU) has incorporated stronger market-oriented considerations, encouraging research teams to address industrial challenges while emphasizing proof-of-concept validation and early-stage prototyping.

These institutional developments have also been reinforced through national coordination mechanisms. The Technology Transfer Association, established by RDIA, connects technology transfer professionals across universities and research institutions to exchange best practices in intellectual property management, licensing and research translation (RDIA, 2025c).

As these capabilities continue to evolve, universities are also expanding their role in venture creation and entrepreneurial development.

University spin-offs and entrepreneurial pipelines

Universities are playing a more active role in supporting the creation of technology-based startups as a pathway for translating frontier research into scalable ventures. TTOs work closely with entrepreneurship centers and innovation programs to support venture creation through mentorship, technology validation and access to investors and industrial partners.

This institutional expansion has been reinforced by national initiatives designed to strengthen the connection between academic research and entrepreneurship. Programs such as the Breakthrough Program and the Saudi Innovation Grants Program (SIGP) support researchers and startups through commercialization training, proof-of-concept development and non-dilutive funding mechanisms (RDIA, 2025c).

Within this broader ecosystem, King Abdullah University of Science and Technology (KAUST) has developed one of the Kingdom's most advanced university commercialization models through integrated programs focused on technology transfer, venture development and startup acceleration. Initiatives such as TAQADAM provide funding, mentorship and market access for science-based startups emerging from university research (KAUST, 2025).

In parallel, KSU has strengthened its commercialization ecosystem through Riyadh Valley Company (RVC), which recently launched a university venture fund in partnership with SparkLabs to support early-stage technology startups emerging from university research and the broader innovation ecosystem (RVC, 2025).

Alongside domestic ecosystem development, international collaboration is becoming more important for strengthening scientific quality, technology transfer and global competitiveness.

Internationalization and global research networks

Saudi universities are becoming more integrated into global research and innovation networks. Strategic partnerships with leading international universities, multinational corporations and global research centers are strengthening knowledge exchange, joint scientific output and advanced talent development. These collaborations provide researchers with access to specialized infrastructure, frontier research programs and international commercialization pathways.

International collaboration is particularly important in frontier fields where scientific progress increasingly depends on multidisciplinary and cross-border cooperation. Joint laboratories, academic exchange programs and co-funded research initiatives are helping to accelerate the translation of scientific discoveries into commercially relevant technologies.

This growing international engagement is also enhancing the global visibility and competitiveness of Saudi universities. Greater participation in international rankings, patent systems and collaborative research initiatives reflects the expanding integration of Saudi academic institutions into the global innovation ecosystem. At the same time, these developments are contributing to stronger linkages between academic research and industrial innovation activities.

University-industry collaboration and joint research platforms

The integration of universities and industry has become a defining feature of Saudi Arabia's innovation ecosystem. Universities are adopting research models that align more closely with market needs, with industrial challenges and sectoral priorities playing a growing role in shaping research agendas.

To support this transition, several universities have established commercialization and investment entities that serve as interfaces between academic research and industry. These include Riyadh Valley Company at KSU, Dhahran Techno Valley at KFUPM and Makkah Valley Company at Umm Al-Qura University.

At the same time, major national companies maintain strategic partnerships with universities across priority sectors. Saudi Basic Industries Corporation (SABIC) collaborates with universities on advanced materials research, while Saudi Aramco has developed long-standing partnerships focused on energy technologies and industrial innovation.

Another important mechanism is the research chair model, through which corporations fund specialized research programs embedded within universities. These platforms facilitate collaboration among faculty members, graduate students and industry experts on applied technological challenges, strengthening the connection between academic research and industrial application (King Saud University Research Chairs Program, 2025).

As universities strengthen research commercialization and entrepreneurial capacity, the ability to scale frontier technologies increasingly depends on investment readiness, industrial partnerships and access to global markets. This highlights the growing importance of investment frameworks and ecosystem integration mechanisms that connect innovation outputs with commercialization and industrial deployment opportunities.

Investment, global integration and industrial scaling

Saudi Arabia's investment landscape has undergone substantial transformation under the National Investment Strategy (NIS), reflecting a broader shift from capital attraction toward capability development. Increasing emphasis is being placed on investments that support technology transfer, industrial localization and participation in high-value global sectors, including advanced manufacturing, digital infrastructure and frontier technologies (Ministry of Investment (MISA), 2025a).

This transition aligns investment policy more closely with the objectives of a knowledge-based economy, where capital functions not only as a source of economic growth, but also as a mechanism for building technological and industrial capabilities.

The first phase of the strategy has already contributed to measurable changes in the structure of the economy. The contribution of non-oil sectors to GDP has increased, while foreign direct investment flows and private-sector participation have expanded significantly (MISA, 2025b).

Regulatory reforms and entrepreneurship support

Regulatory reforms have contributed significantly to improving the entrepreneurial environment. Measures such as the Entrepreneurial License and Premium Residency pathways have facilitated market entry for foreign founders and innovation-driven companies, while reducing regulatory and operational barriers associated with business establishment and long-term relocation (MISA, 2025b).

To improve ecosystem coordination, the Ministry of Investment established Startup Saudi as a national platform designed to consolidate entrepreneurship support mechanisms and strengthen alignment across public-sector initiatives. The platform supports ecosystem navigation, partnership development and access to investment and commercialization opportunities (MISA, 2026).

In parallel, ecosystem platforms supporting entrepreneurship and venture development are also expanding. The Garage has emerged as a major innovation and entrepreneurship hub, providing incubation, mentorship, and collaborative environments for technology startups. Over a two-year period, startups associated with The Garage and its hosted programs reached a combined valuation exceeding SAR 3.7 billion, while more than 600 technology startups graduated from its programs, reflecting the growing scale and maturity of Saudi Arabia's startup ecosystem (The Garage, 2026).

Beyond regulatory reforms, partnership-driven models are also helping to connect investment activity with commercialization and industrial capability development.

Partnerships and commercialization pathways

Several sector-specific initiatives illustrate the Kingdom's integrated approach to innovation attraction and commercialization. Programs focused on deep-tech, sustainability, academic commercialization and frontier industries combine investment facilitation with research alignment, regulatory support and startup acceleration mechanisms (MISA, 2026).

Building on these efforts, partnership-driven initiatives involving entities such as RDIA, KAUST and sectoral ministries are helping to connect frontier research with commercialization opportunities, patient capital and industrial deployment pathways (MISA, 2024; MISA, 2026).

At the same time, stronger coordination across public institutions, universities, investors and industry is supporting company establishment, ecosystem navigation and access to research infrastructure, funding mechanisms and commercialization opportunities. Collectively, these coordination mechanisms help reduce operational barriers for both domestic and international innovators seeking to establish or scale technology ventures within the Kingdom.

In parallel with these institutional efforts, financing mechanisms are also evolving to better support frontier innovation and technology commercialization.

Venture capital expansion and deep-tech financing

The rapid expansion of venture capital activity has become one of the clearest indicators of the Kingdom's evolving innovation ecosystem. Over recent years, Saudi Arabia has emerged as one of the region's leading venture capital markets, supported by regulatory reforms, stronger institutional participation and rising investor confidence in technology-driven sectors.

Capital growth alone does not fully capture the transformation that is under way. Saudi Arabia has simultaneously built out the institutional scaffolding of a maturing venture ecosystem, spanning early-stage accelerators and incubators through to angel investor networks, corporate venture arms and government co-investment vehicles. What distinguishes this phase is the emergence of stage-appropriate financing instruments capable of supporting ventures from proof of concept through to commercial scaling.

Within this evolving landscape, greater emphasis is being placed on deep-tech ventures, which typically require longer development timelines, specialized infrastructure and patient capital. As a result, collaboration among investors, research institutions and industry partners has strengthened to support commercialization in areas such as semiconductors, biotechnology, advanced manufacturing and artificial intelligence. As the financing ecosystem continues to mature, attention is also shifting toward the development of sector-specific industrial capabilities and long-term technological competitiveness.

Industrial scaling and specialized investment vehicles

Saudi Arabia is also expanding sector-specific investment mechanisms aimed at supporting industrial scaling in frontier technology sectors. The National Semiconductor Hub (NSH) represents one example of this approach, combining specialized training, ecosystem development and targeted investment to strengthen local semiconductor design capabilities (MISA and RDIA, 2026).

More broadly, this model reflects a strategic direction in which investment vehicles are being aligned more closely with national capability-building priorities and long-term industrial development objectives across high-technology sectors.

Conclusion

Saudi Arabia's innovation ecosystem reflects a national system that has undergone measurable transformation. Governance frameworks have been strengthened, research capacity has expanded substantially, intellectual property systems have been modernized and financing instruments have been diversified to support ventures across multiple stages of development. The growing evidence of tangible outputs across patent volumes, university commercialization activity, venture capital growth and international research collaboration, demonstrates that the strategic investments of recent years are translating into concrete results.

The momentum established across policy design, university transformation and investment facilitation provides a strong foundation for the next phase of development. Continued deepening of the linkages between research institutions, industry and investment platforms will further accelerate the translation of scientific output into commercial and industrial value. Saudi Arabia's national target of raising R&D investment to 2.5% of GDP by 2040 sets a clear and ambitious direction for sustaining this trajectory.

Viewed within the global innovation landscape, Saudi Arabia's approach offers an example of coordinated ecosystem development, in which regulatory reform, institutional investment and strategic prioritization have advanced together across a compressed timeframe. With this foundation firmly in place, the Kingdom is positioned to further strengthen its role in frontier innovation and deep-tech commercialization.

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