Japan's Science, Technology & Innovation Strategy: Strategic Prioritization, Open Science & Economic Security

By Kazuyuki Motohashi



Author
Kazuyuki Motohashi

Introduction

Japan's Seventh Science, Technology and Innovation Basic Plan, adopted in March 2026, represents a significant reorientation of the country's science, technology and innovation policy. Covering fiscal years 2026–2030, the Plan is based on a diagnosis that scientific knowledge is becoming increasingly important as a source of technological innovation, and the proximity between science and innovation is shortening. At the same time, intensifying geopolitical tension has made advanced science and technology an increasingly important element of national and economic security.

The Plan seeks to respond to these changes through six pillars: the "revitalization of science" as the foundation of knowledge; strategic prioritization of technology fields; organic linkage between science and technology policy and national security; upgrading the innovation ecosystem connecting industry, academia and government; strategic science and technology diplomacy; and reform of governance and implementation. The overall objective is to rebuild Japan's research capabilities and translate them more effectively into national strength. The Integrated Innovation Strategy 2026, adopted on July 14, 2026, serves as the first annual implementation strategy under the Seventh Basic Plan and translates these six pillars into measures to be pursued particularly during FY2026 and FY2027.

I agree with two basic propositions underlying this policy shift. First, Japan needs to rebuild its scientific capability because science is becoming increasingly important to technological innovation. Second, because science has become more closely connected to economic value and technological capability, science and technology policy can no longer be considered independently of economic security.

My concerns relate less to these diagnoses than to how they are translated into policy. I focus on two issues. The first is strategic prioritization. The Plan identifies 17 strategically important technological fields, but the innovation processes underlying these fields are highly heterogeneous. Prioritization should therefore move beyond identifying important technologies toward understanding how innovation actually occurs in each field. The second issue concerns economic security. Once this heterogeneity is recognized, the appropriate point of security intervention must also differ across technologies. The relevant distinction is not simply between academia and industry, but between open knowledge creation and activities sufficiently close to strategically sensitive technological capabilities from national security perspectives.

Science & Innovation Are Becoming Closer – But Not Uniformly

The Plan's emphasis on the growing proximity between science and innovation is supported by empirical evidence. In our study of the relationship between scientific publications and patents in Japan, we used text information from approximately 1.7 million research papers involving Japanese authors and 12.3 million patents filed at the Japan Patent Office. By placing papers and patents in a common semantic space and identifying neighboring documents on the basis of textual similarity, we constructed indicators of the degree to which patented technologies are linked to scientific research.

The results show a clear long-term increase in the science intensity of inventions. Patents have increasingly appeared in technological spaces in which related scientific publications already exist. This trend is particularly pronounced for patents involving universities and public research institutes and university–industry collaboration. At the same time, however, the relationship is asymmetric: technology increasingly draws on science, but scientific research itself has not become correspondingly oriented toward existing technologies.

This distinction matters. The growing importance of science for innovation does not mean that science and innovation have become identical activities. Indeed, 58.2% of patents in our dataset had no scientific paper among their 200 closest neighboring documents. Large areas of technological development therefore continue to have little direct overlap with academic science.

More importantly for policy, science–technology relationships differ substantially across technological fields. Some technologies are strongly stimulated by advances in scientific understanding. Others evolve through engineering, production experience, changing customer requirements, new product architectures, standards, and market competition. This heterogeneity has direct implications for the Seventh Basic Plan's strategic prioritization.

Strategic Prioritization: Different Technologies Follow Different Innovation Regimes

The Seventh Basic Plan identifies 17 important technology areas, including six designated as national strategic technology areas: AI

and advanced robotics; quantum technologies; semiconductors and communications; biotechnology and healthcare; fusion energy; and space. The rationale for concentrating resources on strategically important technologies is understandable. In addition, the Integrated Innovation Strategy 2026 accordingly places the 17 areas at the center of its strategic technology policy. The government has articulated broad criteria for strategic selection, including economic and social importance, technological promise, and Japan's existing or potential capabilities. The issue is therefore not simply the absence of criteria. Rather, the selection process of these technologies is not transparent. Furthermore, it does not seem that the government take into the account the differences in innovation process by technologies to come up with priority fields.

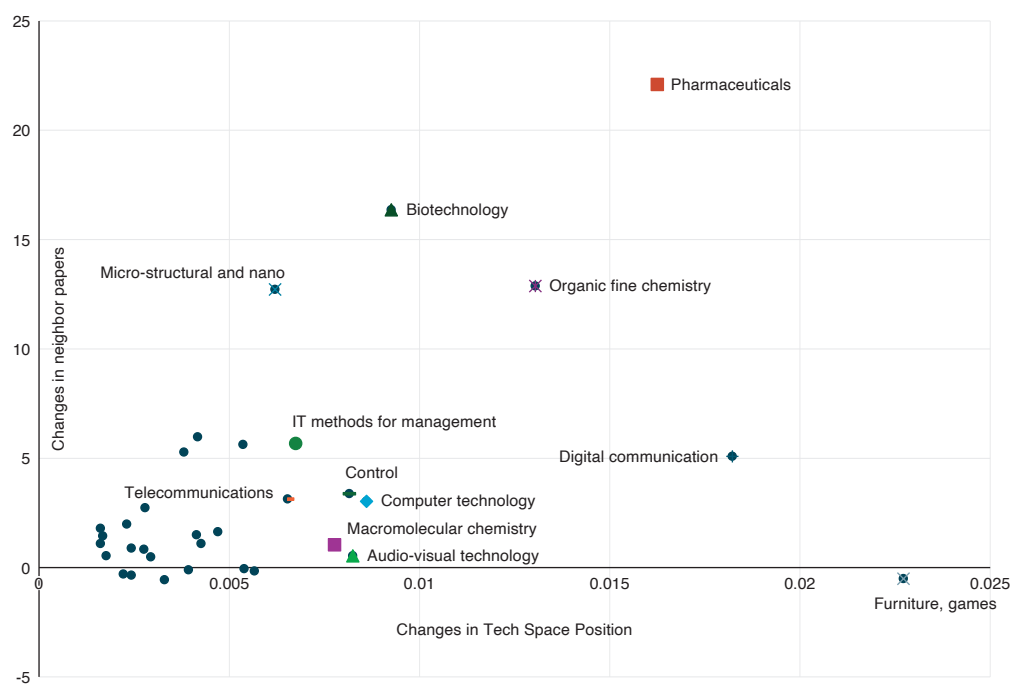
The *Chart*, extracted from our empirical analysis based on research paper and patent documents, compares 35 technology fields along two dimensions. The horizontal axis indicates the degree of technological change between the 1990s and the 2010s, measured by the movement of each technology field in patent-text space. The vertical axis represents the change in science intensity, measured by changes in the number of scientific papers located close to patents in the same technological space.

The pattern is revealing. Pharmaceuticals, biotechnology, organic fine chemicals, and nanotechnology combine substantial technological change with a significant increase in science intensity. These fields can broadly be interpreted as exhibiting a science-push innovation regime: changes at the scientific frontier generate new technological opportunities that can subsequently be translated into inventions and commercial applications.

In contrast, in other technologies such as digital communication and furniture and games, substantial movement in technology space is observed while the science intensity is very low and shows almost no change. Digital communication technology has changed substantially in this decade, by communication speed and quality (e.g. 3G to 5G in mobile telecommunication service). The changes in furniture and game is found in an advancement of mobile Internet gaming. In both cases, such technological progress is not driven by

CHART

Changes in science intensity & technological position across technology fields



Source: Motohashi, Koshiba, and Ikeuchi (2024), "Measuring science and innovation linkage using text mining of research papers and patent information", Scientometrics, 129: 2159-2179, Fig. 14. The horizontal axis measures changes in technology-space position between the 1990s and the 2010s, while the vertical axis measures changes in science intensity through the number of neighboring scientific papers around patents.

scientific progress, but suppliers' reactions to market demand.

This distinction should not be interpreted as one between "scientific" and "non-scientific" technologies. Scientific knowledge matters in virtually all advanced technological fields. Rather, it concerns the relative forces directing technological change. In some fields, new scientific knowledge itself creates technological opportunities. In others, customer demand, engineering improvements, production learning, standards, new product architectures, or market competition play relatively greater roles. The distinction can therefore be understood as a continuum between science-push and market- or engineering-driven innovation. Biotechnology provides a relatively clear example of the former. Digital communications lie closer to the latter.

Given such heterogeneity in the nature of technological progress, I will illustrate more detailed features of six strategic fields in the Plan, and recommend policy instruments for each *(Table)*.

The mechanism connecting science to innovation substantially varies by technology field, so that the policy instrument for technological competitiveness is different. Biotechnology is a typical case of science-driven technology. A similar characteristic is found both in quantum technology and fusion energy. In these fields, frontier scientific capabilities with specialized research infrastructure are required to make them technologically competitive. In contrast, the semiconductor and communication field requires more industrial technological development, so that a relevant policy is for facilitating a firm's activity of ecosystem formation and technological standardization. In the AI field, the pass-breaking technologies such as transformer models came from an industry, and hyper-scalers are implementing them into foundational AI models. Therefore, the issues in AI innovation are computing resources and engineering talents to make them into new products and services. Finally, space technology is a system's innovation based on complex models, so that public procurement is important to overcome coordination problems with a variety of technological components.

Again, it is important to re-evaluate the criteria for prioritization, described in the Plan, i.e., economic and social importance, technological promise, and Japan's existing or potential capabilities, seen from an innovation system's lens. It is also important for the government to identify where technological opportunities originate, where Japan's principal bottlenecks lie, which actors are responsible for moving knowledge toward commercialization, and how strongly the innovation process depends on international scientific, technological and production networks.

The annual nature of the Integrated Innovation Strategy provides an institutional opportunity to take into account the heterogeneity in the nature of technology operational. Rather than simply repeating a list of 17 important technologies each year, the Strategy could attach an "innovation profile" to each priority field. The profile would identify the field's dominant innovation regime, and specific policy instruments for each technology field should be identified as an implementation plan.

Such technologies themselves move along the science–market spectrum, so that the profiles should be periodically revised rather than treated as permanent classifications. AI, for example, has shifted rapidly from a field strongly associated with academic research toward one in which computing infrastructure, applications

TABLE

Technology regime & potential policy instruments for priority technology fields

National strategic technology area	Dominant innovation regime	Illustrative focus of policy
AI and advanced robotics	Mixed: science + market/engineering	human resource development, compute/ data infrastructure
Quantum technologies	Mainly science-push	basic research investment, science-to-technology transfer
Semiconductors and communications	Mixed, strongly engineering/market-driven	ecosystems, supply chains, standards
Biotechnology and healthcare	Mainly science-push, with downstream market regulation	science, commercialization, startup and regulatory ecosystems
Fusion energy	Science/mission-push	public R&D and large mission-oriented projects
Space	Engineering/mission-driven with growing market component	procurement, public infrastructure, commercial ecosystems

Source: Compiled by the author

and industrial deployment play increasingly important roles. Strategic prioritization therefore needs to be updated regularly.

Economic Security: Intervention Should Follow Technological Risk

The growing proximity of science and innovation inevitably raises economic-security concerns. The Seventh Basic Plan explicitly treats science and technology as important components of national security, while current government policy seeks to combine research security with the maintenance of an open and free research environment and international collaboration.

I agree that economic security must now be incorporated into science and technology policy. Traditionally, science policy such as funding to non-profit academic institutions was not within the scope of national security. However, as the proximity of science and innovation gets closer, the scientific progress becomes to influence technological competitiveness directly. In addition, the distinction between military and civil uses of technology is blurring, particularly in emerging technologies such as AI and quantum computing. Therefore, there is no question that the science and technology policy takes into account the economic security issues. The question is where and how intervention should occur.

An overly simple distinction between open academic science and proprietary corporate technology is no longer adequate. The more relevant boundary is the proximity of an activity to deployable technological capability.

In a strongly science-push field, a large domain of academic research may remain far upstream from identifiable commercial or security applications. Researchers explore many scientific trajectories, only a small fraction of which eventually generate economically valuable technologies. International conferences, researcher mobility, joint publications and informal exchange are important mechanisms through which this frontier advances. Restricting them too early may reduce precisely the pool of knowledge from which strategically important innovations subsequently emerge.

This consideration is especially important for Japan. Japan cannot reproduce the global scientific frontier within its national borders. Access to international research networks and leading researchers is therefore an input into domestic scientific capacity itself. Excessive restrictions on upstream science could weaken rather than strengthen Japan's long-term economic security.

However, in relatively market- or engineering-driven strategic fields, university research itself can be close to commercially or strategically relevant applications. University–industry projects in semiconductors, communications, robotics, cybersecurity or applied AI may involve prototypes, production processes, sensitive data or proprietary know-how. Institutional location within a university does not necessarily imply that the activity belongs to upstream basic research.

This institutional distinction has also become increasingly blurred by the rise of the entrepreneurial university. Beginning most visibly in the United States and subsequently spreading to other countries, universities have become active participants in the commercialization of research through patenting, licensing, industry-sponsored research, university spin-offs, and other forms of technology transfer. This trend has also reached Japan through policies promoting technology licensing organizations, university ownership and management of intellectual property, and university-based startups. Universities therefore remain nonprofit institutions with public missions, but they can no longer be treated simply as actors located outside commercial innovation. In many fields, they participate directly in the process through which scientific knowledge is converted into proprietary technologies and marketable assets. The appropriate principle for academic science is therefore not non-intervention, but a presumption of openness combined with risk-based safeguards.

International scientific collaboration should remain the default for open knowledge creation. Safeguards should become progressively stronger as research approaches identifiable intellectual property, sensitive data, prototypes, production know-how, commercially deployable technologies or capabilities with clear military or dual-use relevance. In market-driven strategic fields, this boundary may arise relatively early; in fundamental science-intensive fields, it may arise later.

This risk-based approach is broadly consistent with Japan's current policy direction. The government states that research security should be strengthened while maintaining an open and free research environment and promoting international joint research. What remains difficult is translating this general principle into operational distinctions at the level of particular fields and research activities. A further complication concerns government reach. There is an important difference between where government *should* intervene and where it *can* intervene effectively.

Universities and public research institutions are comparatively accessible to government policy because competitive grants, institutional funding and public research infrastructure provide channels through which disclosure requirements, due diligence, cybersecurity rules and research-security procedures can be imposed. Privately financed corporate R&D is more difficult to control directly. Governments have instruments such as export controls, investment screening, procurement, subsidy conditions and intellectual-property rules, but these offer only partial leverage

over internal corporate knowledge creation and international technological exchange.

This asymmetry creates a potential regulatory bias, that is, the activities that are easiest for government to regulate are not necessarily those that pose the greatest security risk. If research-security policy focuses disproportionately on universities simply because public funding makes them administratively easier to control, the government could restrict valuable international scientific exchange while leaving more commercially consequential knowledge flows comparatively difficult to address.

Recently, some cases of restricting research grants to international students have been spotted, which should be scrutinized by the security risk profile of each type of project, which I would propose as a second component to innovation profiles for prioritization in the previous section. The two profiles would answer different questions. The innovation profile would ask: How does innovation occur, and where is Japan's bottleneck? The security profile would ask: Where does strategic sensitivity arise, through what channels could capability be lost or controlled by foreign actors, and what intervention is proportionate and feasible?

For example, in biotechnology, the security profile should assess the dual-use potential of particular research outputs, datasets, biological materials, and platform technologies, as well as the consequences of their transfer to foreign actors. The key issue is whether such assets could contribute to military or public-security applications, or whether their loss could create strategic dependence in technologies that are difficult to replace.

In semiconductors, the relevant risks are different. A security profile should identify technological choke points in advanced processes, equipment, materials, design, and manufacturing capability; assess the risk of critical know-how moving abroad; and examine whether Japan could become dependent on foreign suppliers for technologies it cannot readily substitute domestically. Such dependence would become a serious economic-security vulnerability if geopolitical tensions or export controls were used to restrict exports of advanced semiconductor products or production equipment to Japan. Security assessment should therefore cover both outbound leakage of strategic technology and inbound vulnerability arising from the loss of domestic capability.

The Integrated Innovation Strategy, because it is updated annually, is well suited to this task. Each year, the government could review the 17 strategic areas on the basis of updated innovation and security profiles, rather than treating designation itself as the endpoint of strategic policy. This would also make it easier to explain why policy instruments and degrees of openness differ across fields.

Conclusion

The Seventh Science, Technology and Innovation Basic Plan represents an important step in Japan's effort to rebuild its scientific and technological capabilities. Its emphasis on revitalizing science is well founded, as is its recognition of the growing proximity between scientific research and innovation. The incorporation of economic security into science and technology policy is also unavoidable in an era of geopolitical and technological competition. The challenge lies in avoiding excessive uniformity.

The first issue is strategic prioritization. Six fields in the Plan provide useful signals of national importance, but a technology list alone is not a strategy. The *Chart* demonstrates empirically that technological fields differ substantially in the relationship between scientific knowledge and technological change. Pharmaceuticals, biotechnology and nanotechnology show patterns consistent with relatively science-push innovation, whereas digital communication illustrates technological dynamism in which market change and product development appear to play a more prominent role.

Priority-setting should therefore be accompanied by an innovation profile for each strategic field, specifying its innovation regime, Japan's bottlenecks, major actors, international dependencies and appropriate policy instruments.

The second issue follows directly from the first. Economic-security policy must also vary across innovation regimes. Some academic science remains far upstream and benefits greatly from openness and global exchange. Other university research, particularly in market- and engineering-driven fields, may already be close to deployable technology. A simple academia–industry distinction is therefore inappropriate.

Each innovation profile should consequently be paired with a security risk profile, identifying where strategically sensitive capabilities arise, the nature of the risks involved, and the most proportionate and feasible means of addressing them. Updating both profiles through the annual Integrated Innovation Strategy would allow Japan to move from static technology selection toward dynamic portfolio management of strategic technologies.

Ultimately, the Seventh Basic Plan should be judged not by how many technologies it identifies as strategic or how many restrictions it introduces, but by whether it can simultaneously maintain access to the global scientific frontier, build domestic technological and industrial capabilities, and protect genuinely strategic knowledge.

JS

Kazuyuki Motohashi is a professor at the Research Centre for Advanced Science and Technology, the University of Tokyo, and Faculty Fellow of the Research Institute of Economy, Trade and Industry. Until this year, he had held a variety of positions in METI as well as being an economist at the OECD.