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Economic Innovativeness of Austria and Germany as a Determinant of National and International Security

Abstract

The article examines the role of economic innovativeness in strengthening national and international security, with a particular focus on Austria and Germany as highly integrated European economies. The *subject* of the study is the relationship between the innovative capacity of national economies and their ability to maintain economic resilience, competitiveness, technological capabilities, and strategic autonomy under conditions of global transformation. The relevance of the study is determined by the increasing importance of technological development, research and development, digitalization, and innovation capacity amid geopolitical uncertainty, disruptions in global value chains, and growing competition for technological leadership. The *purpose* of the study is to identify the key dimensions of economic innovativeness in Austria and Germany and to assess their significance for national economic security and the broader international security environment. The research is based on a comparative *methodological approach* that combines comparative analysis, systematization, statistical analysis, and synthesis. The empirical basis of the study includes international and European innovation indicators, particularly data from the European Innovation Scoreboard, as well as selected indicators reflecting research and development activity, business innovation, technological capabilities, and the integration of national innovation systems into the European economy. The study also applies a conceptual approach to interpreting economic innovativeness as a multidimensional strategic capability rather than merely a source of economic growth. The *results* of the study demonstrate that both Austria and Germany possess strong innovation systems, although their structural characteristics and individual strengths differ. Germany benefits from a powerful industrial and technological base, substantial business research and development activity, and strong integration into international value chains. Austria demonstrates a high level of innovation performance supported by effective cooperation between business, research institutions, and public-sector actors. At the same time, both economies face challenges related to technological competition, changing global value chains, and the need to strengthen their strategic technological capabilities. The analysis indicates that economic innovativeness contributes to security by strengthening competitiveness, supporting technological capabilities, reducing certain forms of critical external dependence, and increasing national economies' capacity to adapt to external shocks. The *conclusion* is that economic innovativeness should be regarded not only as a driver of economic growth but also as a strategic component of national and international security. The comparative analysis of Austria and Germany demonstrates that sustained investment in research, technology, human capital, and innovation ecosystems can strengthen economic resilience and strategic capacity while contributing to the stability of the wider European economic environment.

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Keywords

economic innovativeness, innovation capacity, national security, economic security, strategic autonomy, technological competitiveness, Austria, Germany, European economy

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1 Introduction

The acceleration of technological change, the transformation of global value chains, increasing geopolitical tensions, and the growing interdependence of national economies are fundamentally changing the conditions for economic development and security. Digitalization, the diffusion of advanced technologies,

the transition towards a low-carbon economy, and the increasing importance of knowledge-intensive production create new opportunities for economic growth while simultaneously generating new sources of vulnerability. Disruptions in supply chains, dependence on critical technologies and resources, technological competition, and geopolitical fragmentation have demonstrated that a national

economy's ability to innovate is increasingly tied not only to its competitiveness but also to its capacity to withstand external shocks and protect strategic economic interests. Contemporary approaches to economic security, therefore, increasingly encompass supply chain resilience, access to critical technologies and resources, the protection of strategic industries, and the ability to maintain stable economic development amid uncertainty (OECD, 2025).

In this context, economic innovativeness acquires broader strategic significance. Countries with strong research and development systems, technological capabilities, skilled human capital, innovative enterprises, and effective mechanisms for transferring knowledge into economic activity are better positioned to adapt to structural changes and reduce certain forms of critical external dependence. At the same time, growing geopolitical competition in emerging technologies has contributed to the convergence of innovation, economic, and security policies. Governments increasingly seek to strengthen national capabilities in critical technology fields while maintaining the international cooperation essential to scientific and technological progress (OECD, 2025). Thus, economic resilience cannot be reduced to either self-sufficiency or unrestricted openness but increasingly depends on the ability to combine international integration with sufficient domestic technological and innovative capabilities.

Austria and Germany provide a particularly relevant basis for examining this relationship. Both countries possess developed innovation systems, strong industrial and research capabilities, and a high degree of integration into the European and global economy, while differing in economic scale, institutional characteristics, and technological specialization. Germany represents one of Europe's largest industrial economies, with a strong manufacturing base, export orientation, and substantial innovation activity among large companies and the *Mittelstand*. At the same time, it faces challenges related to digitalization, the transformation of traditional industrial competencies, and the resilience of critical inputs and supply chains (OECD, 2022). Austria, despite its smaller economic scale, has a strong innovation ecosystem and high R&D intensity, but its openness and dependence on imported energy and specialized intermediate goods create additional vulnerabilities. Therefore, strengthening productivity, digitalization, business dynamism, and the commercialization of innovation remains important for its economic resilience. The comparison of the two countries enables examination of how innovation capacity can contribute to economic resilience and security in highly interconnected economies, and whether strong innovation performance is sufficient to mitigate structural external dependencies.

The *novelty of this study* lies in considering economic innovativeness through the combined

perspective of economic competitiveness, resilience, and security. Instead of treating innovation exclusively as a driver of economic growth, the study approaches it as a strategic capability that can strengthen national economic security and, through the international interconnectedness of advanced economies, contribute to the stability of the broader international economic environment. The comparative analysis of Austria and Germany enables the identification of both common patterns and structural differences in the relationship between innovation capacity and economic security.

The *relevance of scientific research* is determined by the growing need to clarify how the innovative capacity of advanced European economies contributes to their ability to respond to external economic and technological challenges and to what extent innovation can be considered a component of national and international security.

The *research tasks* are to clarify the relationship between economic innovativeness, competitiveness, resilience, and economic security; identify and compare the key characteristics and performance of the innovation systems of Austria and Germany; assess the strengths and vulnerabilities of their innovation-driven economic models; and determine the implications of economic innovativeness for national economic security and the broader international economic environment.

The *study's logic* is guided by the transition from the theoretical interpretation of economic innovativeness and its relationship to security to the empirical comparison between Austria and Germany. First, the conceptual foundations of the relationship between innovation and economic security are examined. Second, the innovation performance and structural characteristics of the two national economies are comparatively assessed. Third, the implications of identified innovation strengths and vulnerabilities for national economic resilience and security are analyzed. Finally, the study formulates conclusions regarding the strategic role of economic innovativeness in conditions of global transformation and identifies prospects for further research.

2 Economic Innovativeness and Security

Economic innovativeness is traditionally associated with the capacity of national economies to generate, adopt, and commercialize new knowledge, technologies, products, and production processes. It represents a multidimensional characteristic determined by the interaction of research and development activities, human capital, technological infrastructure, institutional conditions, entrepreneurial activity, and the capacity of firms and national innovation systems to transform knowledge into economic value. Consequently, economic innovativeness should be understood not merely as the availability of individual

technological achievements but as the systemic ability of an economy to continuously generate and absorb innovation.

In contemporary economic conditions, innovation capacity is increasingly linked to the resilience and security of national economies. Global economic interdependence has expanded access to technologies, knowledge, capital, and international markets; however, it has simultaneously increased exposure to external risks. Disruptions in global value chains, technological competition, restrictions on access to critical technologies, and growing geopolitical uncertainty have demonstrated the strategic importance of domestic innovation capabilities (Rodrik, 2018). The capacity to develop and adapt technologies, therefore, influences not only the competitiveness of national economies but also their ability to respond to external shocks and maintain the functioning of strategically important sectors.

The relationship between economic innovativeness and security can be examined through several interconnected dimensions. First, innovation contributes to economic security by increasing productivity, competitiveness, and the capacity of national firms to generate high-value-added products. Economies with advanced technological capabilities are generally better positioned to maintain their competitive advantages and adapt to structural changes in international markets.

Second, innovation capacity may reduce certain forms of strategic vulnerability. Although economic openness remains an important driver of development, excessive dependence on external technologies, critical components, and specialized knowledge can pose economic risks. The development of domestic technological and innovation capabilities can therefore increase the strategic autonomy of national economies. Such autonomy should not be interpreted as economic self-sufficiency but rather as the capacity to maintain access to critical capabilities and respond effectively to external disruptions.

Third, economic innovativeness contributes to resilience by increasing the adaptability of national economies. Innovation enables the development of new production processes, the substitution of disrupted inputs, the introduction of alternative technologies, and the creation of new forms of economic activity. In this sense, an economy's innovative capacity may determine not only its ability to achieve long-term growth but also its capacity to recover from crises and structural shocks.

Finally, the security implications of economic innovativeness extend beyond the national level. In highly interconnected economies, technological and innovation capabilities influence participation in international value chains, the distribution of economic power, and the stability of regional economic systems. Advanced economies with strong innovation systems can contribute to international economic stability by

supporting technological cooperation, strengthening resilient production networks, and participating in developing common responses to global challenges (Lundvall, 2022).

Thus, economic innovativeness may be conceptualized as a strategic economic capability that simultaneously affects competitiveness, resilience, strategic autonomy, and security. This perspective provides the theoretical basis for analyzing Austria and Germany, whose highly developed yet structurally distinct innovation systems offer an opportunity to examine how national innovation capacity can contribute to economic resilience and security amid global transformation.

3 Innovation Performance of Austria and Germany

Austria and Germany represent two highly developed European economies with strong innovation systems and substantial technological capabilities. Both countries are among the Strong Innovators in the European innovation landscape, although their innovation models differ in economic scale, industrial structure, and the organization of innovation activity. The comparative analysis of their innovation performance is therefore relevant not only for identifying differences in innovation capacity but also for assessing the economic foundations of resilience and strategic capability.

The main indicators characterizing the innovation performance and structural features of Austria and Germany are presented in Table 1.

Austria demonstrates a consistently high level of innovation performance relative to the European Union average. According to the European Innovation Scoreboard 2026, Austria ranked eighth among EU Member States, with an innovation performance equivalent to 113% of the EU average. The country has maintained its position among the Strong Innovators, despite a slight decline in its overall innovation score compared with the previous year.

Germany also remains one of Europe's most technologically and industrially advanced economies. Its innovation system is characterized by substantial research and development activity, a strong manufacturing base, the significant role of business enterprises in innovation, and the integration of research institutions with industrial production. Germany's innovation model is particularly associated with technological specialization in manufacturing, engineering, automotive production, advanced industrial technologies, and other knowledge-intensive sectors.

The quantitative comparison demonstrates that both countries possess a strong foundation for innovation-based development. In 2024, Austria's gross domestic expenditure on research and

TABLE 1 Comparative innovation profile of Austria and Germany

Indicator	Austria	Germany	Comparative significance
Innovation group, EIS 2026	Strong Innovator	Strong Innovator	Both countries perform above the EU average
Innovation performance relative to the EU average	113%	Above the EU average	Both economies demonstrate strong innovation capacity
Position in EU innovation ranking	8th	Strong Innovator group	Austria occupies a higher relative position in the current EIS ranking
Gross domestic expenditure on R&D, % of GDP (2024)	3.3%	3.1%	Both countries demonstrate high R&D intensity
EU-27 gross domestic expenditure on R&D, % of GDP (2024)	–	2.2%	Both countries significantly exceed the EU average
Innovation system characteristics	Strong research base; close interaction between research institutions, public actors, and enterprises	Large-scale industrial and technological base; strong business R&D and manufacturing innovation	Different structural models of innovation capacity
Key economic basis of innovation	Knowledge-intensive industries, SMEs, applied research, European integration	Manufacturing, engineering, industrial technologies, export-oriented production	Innovation is strongly embedded in the productive structure of both economies

Source: compiled by the author based on the European Innovation Scoreboard, 2026, and DESTATIS, 2026

development reached 3.3% of GDP, while Germany's amounted to 3.1%, substantially exceeding the EU-27 average of 2.2%. These indicators reflect the importance of knowledge creation and technological development within both national economic models.

At the same time, similar levels of R&D intensity do not imply identical innovation structures. Austria's innovation model is shaped by the interaction of a relatively strong research base, applied research institutions, small and medium-sized enterprises, and integration into European innovation and production networks. The Austrian model benefits from close cooperation between public institutions, universities, research organizations, and the private sector. Its relatively high innovation performance, despite the smaller scale of the national economy, demonstrates the importance of institutional coordination and the effective integration of knowledge-generation and innovation processes (OECD, 2026).

Germany's innovation model, in contrast, is distinguished by its larger economic scale and substantial industrial capacity. Innovation is deeply integrated into the country's manufacturing structure and supported by significant investment from business enterprises. The combination of research and development, engineering capabilities, specialized industrial production, and export-oriented manufacturing provides Germany with a strong technological foundation. However, the transformation of global production systems, growing technological competition, and the transition toward digital and green technologies create the need for continuous adaptation of established industrial strengths.

The innovation capacity of both economies, therefore, represents an important strategic asset, but it also exists within conditions of considerable

international interdependence. Austria and Germany benefit substantially from access to international markets, European research cooperation, and participation in cross-border value chains. At the same time, this integration creates potential vulnerabilities related to critical technologies, specialized components, energy resources, and disruptions in international supply networks. The relationship between innovation capacity and economic security should consequently be assessed not only through the level of innovation performance but also through the structural strengths and potential vulnerabilities of national innovation systems.

The main innovation strengths and strategic vulnerabilities of Austria and Germany are summarised in Table 2.

The comparative assessment demonstrates that Austria and Germany have developed different but complementary models of economic innovativeness. Austria illustrates how a relatively small economy can achieve high innovation performance through effective institutional coordination, substantial investment in research and development, and deep integration into European knowledge and production networks. Germany demonstrates the importance of combining innovation capacity with large-scale industrial production and technological specialization. In both cases, innovation contributes to economic strength not only by creating new products and technologies but also by developing adaptive capabilities.

At the same time, the comparison confirms that a strong innovation system does not automatically guarantee the absence of strategic vulnerabilities. Both economies remain dependent on international economic relations and exposed to global technological, energy, and supply-chain disruptions. Therefore, the

TABLE 2 Innovation strengths and strategic vulnerabilities of Austria and Germany

Dimension	Austria	Germany	Security implications
Research and development	High R&D intensity and developed research infrastructure	High R&D expenditure and substantial private-sector research activity	Strengthens the capacity to generate and adapt strategically important knowledge and technologies
Industrial and technological capacity	Strong, specialized manufacturing and knowledge-intensive sectors	Extensive industrial base and global technological specialization	Supports economic resilience but requires continuous technological modernization
Innovation ecosystem	Strong interaction between public institutions, research organizations, and enterprises	Large research and industrial ecosystem involving corporations, SMEs, and research institutions	Facilitates knowledge transfer and the commercialization of innovation
Economic structure	Smaller and highly open economy integrated into European value chains	Large export-oriented industrial economy strongly integrated into global markets	International integration creates both opportunities and exposure to external shocks
Human and knowledge resources	Highly developed education and research environment	An extensive scientific and technological workforce	Provides the basis for long-term technological adaptability
Potential strategic vulnerabilities	Dependence on external markets, technologies, energy, and specialized imports	Exposure to global supply-chain disruptions and structural challenges in traditional industries	Innovation capacity can mitigate, but cannot completely eliminate, external dependence
Strategic innovation challenge	Maintaining high innovation performance and improving commercialization and digital transformation	Transforming established industrial strengths while maintaining technological competitiveness	The adaptability of innovation systems becomes an important component of economic resilience

Source: compiled by the author

strategic significance of economic innovativeness lies not in achieving economic self-sufficiency but in strengthening national economies' capacity to adapt, diversify, and maintain critical technological and productive capabilities. This creates the basis for the next stage of the analysis, which examines more specifically the implications of economic innovativeness for national economic resilience and security.

4 Economic Innovativeness and Security Implications

The growing strategic importance of innovation reflects broader transformations in the global economy. Technological competition, disruptions to global value chains, geopolitical tensions, and the growing importance of critical technologies have broadened the understanding of economic security. In this context, the capacity of national economies to generate, adopt, and apply new technologies has become important not only for maintaining international competitiveness but also for ensuring resilience to external shocks. For Austria and Germany, economic innovativeness is therefore an essential component of national economic strength and of the capacity to contribute to broader European stability.

One of the key security implications of economic innovativeness is its contribution to economic resilience and strategic autonomy. Economies with developed innovation systems are better positioned to adapt to technological, economic, and geopolitical changes, diversify production, and respond to disruptions in global supply chains. For Austria and

Germany, this issue is particularly relevant given their deep integration into European and global economic networks. Germany's industrial model depends substantially on international supply chains, while Austria, as a relatively small and open economy, is strongly integrated into European production and innovation networks. Such integration creates significant economic benefits but also exposure to external disruptions. Strengthening domestic technological capabilities and diversifying innovation ecosystems can therefore reduce excessive dependence on individual suppliers, markets, or technological sources.

Strategic autonomy, however, should not be understood as complete economic independence. Rather, it refers to the ability to maintain access to critical resources, technologies, and production capabilities while preserving strategic flexibility. The experiences of Austria and Germany demonstrate different ways of developing such capabilities. Germany's extensive industrial and technological base provides important strengths in advanced manufacturing, engineering, and knowledge-intensive industries, although the country faces the challenge of maintaining technological competitiveness as it transitions to digital and green technologies. Austria, despite its smaller economic scale, has developed strong innovation capabilities through specialized industries, research institutions, and cooperation between the scientific and business sectors (Bundeskanzleramt, 2026). In both cases, innovation capacity can reduce strategic vulnerabilities while remaining compatible with international economic integration.

Economic innovativeness also increasingly influences economic sovereignty, understood as the capacity to maintain critical productive and technological capabilities. Dependence on foreign technologies, digital systems, specialized components, or critical infrastructure may constrain national economies' ability to respond effectively to external shocks. Consequently, strengthening domestic innovation capacity represents an important instrument for preserving strategic flexibility. At the same time, neither Austria nor Germany can achieve economic security through technological isolation. Their competitiveness depends substantially on international trade, investment, research cooperation, and participation in cross-border innovation networks. The objective is therefore not to eliminate external dependencies completely, but to prevent excessive dependence in strategically important areas.

The security implications of innovation also extend beyond the national level. Within the European Union, the innovation capacities of individual Member States contribute to collective economic resilience. Germany represents one of Europe's major industrial and technological centers, while Austria contributes through specialized industries, research capabilities, and its integration into Central European production and innovation networks. At the same time, technological competition in areas such as artificial intelligence, advanced manufacturing, digital infrastructure, and energy technologies increasingly influences the international distribution of economic power (Dicken, 2015). Strengthening innovation capabilities at both national and European levels is therefore becoming an important element of economic security.

Overall, the experiences of Austria and Germany confirm that economic innovativeness should not be considered in isolation from economic security. Innovation strengthens resilience by increasing the adaptability of national economies, contributes to strategic autonomy by reducing critical technological dependencies, and supports economic sovereignty by expanding domestic productive and technological capabilities. At the same time, the effectiveness of innovation-based security depends on the ability to combine national capabilities with European cooperation and international economic integration.

Thus, economic innovativeness represents not only a source of competitiveness and long-term economic growth but also a strategic resource for national and international security. The cases of Austria and Germany demonstrate that the most sustainable approach is neither economic isolation nor unrestricted dependence on external capabilities, but a combination of technological capacity, strategic diversification, and openness to international cooperation.

5 Conclusions

The study demonstrates that economic innovativeness has become an increasingly important determinant of national economic resilience, strategic autonomy, and security under conditions of global economic transformation. The analysis of Austria and Germany confirms that innovation capacity should be considered not only as a source of productivity growth and international competitiveness but also as a strategic economic capability that shapes national economies' ability to adapt to external shocks, technological change, and geopolitical uncertainty.

The comparative analysis shows that Austria and Germany have strong but structurally different innovation systems. Austria combines high innovation performance with a relatively small and highly open economic structure, relying on specialized industries, research institutions, and close cooperation between scientific and business sectors. Germany, in turn, possesses a large-scale industrial and technological base in which innovation is strongly embedded in manufacturing, engineering, and export-oriented production. Despite these differences, both countries demonstrate the importance of sustained investment in research and development, human capital, technological capabilities, and cooperation between public research institutions and the private sector.

The findings also indicate that high innovation performance does not eliminate external economic vulnerabilities. Both Austria and Germany are deeply integrated into European and global value chains and therefore benefit from international trade, investment, technological cooperation, and access to foreign markets. At the same time, such integration may create exposure to disruptions in supply chains, technological dependencies, energy risks, and changes in global economic conditions. Consequently, economic security cannot be achieved through either complete openness or economic self-sufficiency.

In this context, strategic autonomy should be understood as the capacity to preserve critical technological, productive, and innovation capabilities while remaining actively integrated into international economic networks. Economic innovativeness is particularly important for achieving this balance because domestic technological capabilities allow countries to reduce excessive dependence on external sources without abandoning the benefits of international cooperation. The experience of Austria and Germany suggests that the objective of economic policy should therefore be not the elimination of interdependence, but the management of strategically significant dependencies.

The research further demonstrates that the security effects of innovation extend beyond the national level. In the European Union, national innovation capacities contribute to collective technological and economic resilience. Germany's industrial and

technological capabilities and Austria's specialized innovation potential are part of a broader European economic system in which cooperation, technological complementarity, and diversified value chains can strengthen the region's resilience. This makes the development of national innovation systems relevant not only to domestic economic policy but also to European economic security.

Therefore, the central conclusion of the study is that economic innovativeness should be regarded as a strategic component of national and international security. Its significance lies in its ability to strengthen economic resilience, support technological autonomy, maintain competitiveness, and expand economies' capacity to respond to external challenges. The cases of Austria and Germany demonstrate that the most sustainable model is based on the combination of

strong domestic innovation capabilities, strategic diversification, and continued participation in international economic cooperation.

For countries facing profound structural and geopolitical challenges, including Ukraine, this experience has important implications. The development of national innovation capabilities, support for knowledge-intensive industries, investment in human capital and research, and integration into European innovation networks should become complementary rather than competing objectives. Further research should focus on developing comparative indicators to measure the contribution of economic innovativeness to strategic autonomy and economic security, and on identifying policy mechanisms to strengthen these links across national contexts.

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