THE ROLE OF ECONOMIC INCENTIVES IN SHAPING HIGH-TECH SECTOR GROWTH

Yuri ZAKHARYAN
PhD Researcher, Public Administration Academy of the RA

Keywords: economic incentives; high-tech sector; innovation policy; R&D tax incentives; knowledge spillovers; small open economy; Armenia; structural transformation

Introduction

Rapid technological progress and the expansion of knowledge-intensive activities have reshaped modern economies in recent decades. High-tech industries now play a central role in productivity growth, innovation, export diversification, and high-skilled employment. Many countries, therefore, view technology-intensive sectors as strategic drivers of long-term competitiveness [Aghion et al., 2015, 94–99; OECD, 2015, 1–5]. Endogenous and neo-Schumpeterian growth theories stress that technological change stems from deliberate investment in research and development (R&D) and human capital, while long-run growth is driven by continuous “creative destruction” as new technologies displace old ones [Aghion et al., 2015, 94–99; Henrekson, 2024, 104–106].

Yet high-tech sector development faces structural obstacles. Innovative projects are risky, require large sunk R&D costs, and generate knowledge spillovers that firms cannot fully appropriate, leading to systematic underinvestment in innovation. Young technology firms also encounter financing constraints and challenges in scaling. These factors justify public intervention: governments deploy economic incentives to correct market failures, share risks, and induce investments that would not occur under market forces alone [Dimos & Pugh, 2016, 797–799; OECD, 2020, 3–5].

Modern innovation policy treats such incentives as part of a broader policy mix integrated with industrial strategy and human capital development. Rather than relying on traditional protectionist tools, contemporary approaches emphasize horizontal, time-bound measures such as R&D tax credits, innovation grants, and incubator or accelerator programs that support private-sector innovation while preserving competition [OECD, 2015, 7–12]. Their effectiveness depends on sound governance and alignment with complementary policies in education, finance, intellectual property, and regulation. In successful cases, the state assumes a more “entrepreneurial” role, actively supporting high-risk technologies and new industries where private actors hesitate to invest [Henrekson, 2024, 126–130].

Armenia offers a relevant case. As a small, open economy, it has prioritized high-tech and IT as engines of future growth. Since 2015, the government has introduced generous incentives for tech firms, including tax exemptions for new IT startups and reduced income taxation for sector employees. A 2024 policy package further lowered turnover and income tax burdens for high-tech and R&D-related activities. These reforms signal a strategic commitment to a knowledge-based economy, yet systematic analysis of how such incentives shape high-tech sector development in Armenia remains limited.

This article examines how economic incentives influence high-tech sector growth by combining theoretical insights with policy-oriented analysis. It synthesizes concepts from innovation economics and industrial policy to classify the main incentive types—tax measures, direct financial support, investment facilitation, and human capital tools—and discusses their expected impact on firm behavior and sectoral dynamics. The scientific novelty lies in an integrated conceptual framework that links micro-level firm responses to incentives with macro-level structural transformation, explicitly incorporating the mediating role of institutions and policy design quality. Using Armenia as an illustrative case, the article provides a conceptual foundation for future empirical research and practical guidance for policymakers in Armenia and other small economies seeking to foster sustainable high-tech development.

Methodology

This study use a *conceptual and qualitative methodology* based on three main elements:

1. *Focused literature review (2015–2025):* The article draws on recent theoretical and empirical work on innovation-driven growth, knowledge spillovers, and innovation policy instruments, with particular emphasis on high-tech sectors and small open economies [Aghion et al., 2015, 94–99; OECD, 2015, 1–10; Audretsch & Belitski, 2022, 1329–1331]. Only sources published in roughly the last decade are used to ensure up-to-date policy relevance.
2. *Analytical synthesis of policy instruments:* Evidence on R&D tax incentives, direct R&D subsidies, and related instruments (e.g., support for incubators, accelerators, and human capital) is synthesized from comparative OECD studies and meta-analyses [Dimos & Pugh, 2016, 797; OECD, 2020, 3-7; OECD, 2023, 5-9]. This synthesis identifies common mechanisms through which incentives affect firm behavior and sectoral outcomes.
3. *Conceptual framework and case-based reasoning:* Building on this literature, the article develops an integrated multi-level conceptual framework (micro, meso, macro) that links economic incentives to high-tech sector growth under varying institutional conditions. The Armenian case is then used illustratively to derive policy implications, based on recent incentive reforms and structural characteristics as a small open economy. Because reliable time-series microdata for Armenian high-tech firms are still limited, the article does not perform econometric estimation. Instead, it provides a *theory-driven, policy-oriented framework* designed to guide future empirical work and inform the design and evaluation of incentive schemes.

Literature Review

High-tech industries and growth: Recent literature confirms that high-tech industries are key engines of long-run growth because they generate both productivity gains and knowledge spillovers. Neo-Schumpeterian growth models describe economic development as a process of innovation-driven creative destruction, where new technologies and firms displace outdated ones [Aghion et al., 2015, 94-96; Henrekson, 2024, 104-110]. ICT, biotechnology, and advanced manufacturing play a central role in this process due to their high R&D intensity and capacity to generate general-purpose technologies.

Spillovers from high-tech activity extend beyond individual firms. Evidence shows that innovation outcomes are shaped by both firms' own R&D investments and external knowledge flows within and across industries [Audretsch & Belitski, 2022, 1330–1335]. Localized knowledge spillovers can enhance regional innovation capacity, while global linkages through trade and investment support technology diffusion and upgrading. For small open economies, positioning in high-tech niches is therefore a crucial channel for integration into global value chains and upgrading toward higher value-added activities [OECD, 2015, 31–37].

Rationale for economic incentives: Despite their importance, high-tech industries are subject to several market failures that lead to *underinvestment in innovation*. R&D is characterized by uncertainty, indivisibilities, and knowledge spillovers that innovators cannot fully appropriate, which reduces private incentives to invest relative to the socially optimal level. Empirical and meta-analytic work on R&D support confirms that public intervention can influence private R&D decisions but also highlights the risk of limited additionality and possible inefficiencies [Dimos & Pugh, 2016, 797–802].

Knowledge spillover research indicates that unexploited knowledge in incumbent firms and universities can serve as a source for entrepreneurial activity if appropriate channels exist [Audretsch & Belitski, 2022, 1331–1336; Lattacher et al., 2021, 120660]. However, information asymmetries and financing constraints hinder entrepreneurial entry, especially in new technological domains. For these reasons, governments deploy economic incentives to reduce the cost and risk of innovation, address coordination failures, and accelerate the commercialization of knowledge in high-tech sectors [OECD, 2015, 85–92; OECD, 2020, 11–16].

Tax incentives versus direct financial support: Recent comparative evidence from OECD countries shows that *R&D tax incentives and direct public funding* are the two dominant instruments used to support business R&D and innovation [OECD, 2020, 3–7; OECD, 2023, 5–9].

- *Tax incentives* (e.g. R&D tax credits, enhanced deductions, or preferential regimes for income from intellectual property) provide broad-based support by reducing the user cost of R&D. Studies based on microdata find that tax incentives generally increase business R&D expenditure, although the magnitude of additionality varies across schemes and firm types [OECD, 2020, 41–56; OECD, 2023, 27–35]. A key advantage is that firms retain autonomy in project selection. However, tax incentives may generate deadweight losses when they subsidize R&D that would have occurred anyway and can favor larger, profitable firms with sufficient tax liabilities.

- *Direct financial support (grants, subsidies, or seed funds) is typically more targeted*, allowing policymakers to support specific technologies, firm categories (e.g., startups), or collaborative projects. Meta-regression evidence suggests that, on average, public R&D subsidies do not crowd out private R&D, but also that evidence of strong additionality is mixed and context-dependent [Dimos & Pugh, 2016, 804–811]. For small and young high-tech firms facing severe financing constraints, well-designed grants and seed funding can be particularly catalytic, enabling risky projects that private investors might consider too uncertain.

Most countries, therefore, combine both instruments: tax incentives serve as a broad horizontal tool to foster innovation, while direct support focuses resources on strategic priorities, early-stage ventures, or collaborative initiatives [OECD, 2015, 93–101].

Incentives, firms, and the entrepreneurial ecosystem: Recent work on knowledge spillovers and entrepreneurial ecosystems emphasizes that the effect of incentives depends on firm characteristics and institutional context. Firms differ in their ability to absorb external knowledge and respond to policy stimuli [Audretsch & Belitski, 2022, 1337–1344]. Startups and small firms rely more heavily on external finance and networks, so grants, accelerators, and incubator programs play a key role in translating knowledge into new ventures [Lattacher et al., 2021, 120660].

At the same time, large established firms are often better positioned to exploit tax-based incentives for large-scale R&D projects. Neo-Schumpeterian literature highlights that competition, entry, and the presence of dynamic entrepreneurs are crucial to ensure that incentives lead to genuine innovation rather than protected rents [Henrekson, 2024, 120–132]. This reinforces the view that incentives must be embedded in a broader ecosystem that promotes openness, competition, and high-quality institutions.

Gaps in the literature: While the evidence on specific instruments in advanced economies has expanded, there are still important gaps regarding:

- How *policy mixes* tax incentives, direct support, and ecosystem-building jointly shaped long-term sectoral transformation in small open economies.
- The interaction between economic incentives and the **quality of institutions**, including administrative capacity, transparency, and policy stability,
- The role of incentives in fostering structural change toward high-tech activities in contexts with narrow domestic markets and significant outward migration of skilled labor.

There is particularly limited systematic work on countries such as Armenia. Existing analyses tend to be descriptive or focused on individual programs rather than on the integrated role of incentives in shaping a high-tech development trajectory. The present article addresses this gap by proposing a multi-level conceptual framework tailored to such contexts.

Scientific novelty

The scientific novelty of this study lies in:

1. *An integrated multi-level framework* that links micro-level firm responses to economic incentives, meso-level sectoral dynamics (entry, growth, and competition in the high-tech sector), and macro-level structural transformation of the economy, under explicit conditions of institutional quality and policy design.
2. *A focus on small open economies,* using Armenia as an illustrative case, to show how incentive-based strategies can support high-tech development despite limited market size and resource constraints.
3. *A policy-oriented synthesis* that connects recent international evidence on R&D tax incentives and subsidies with the specific challenges of building a high-tech ecosystem in a transition economy.

This combination of levels and context-specific insights is intended to guide both empirical work and the design of more coherent high-tech incentive packages.

Results and analysis

Conceptual framework: Economic incentives and high-tech sector growth: High-tech sector growth is a multidimensional process involving both quantitative expansion (more firms, more output) and qualitative upgrading (more complex technologies, higher productivity, and stronger innovation capabilities). The proposed framework links economic incentives to this process at three levels.

Micro level – firm behavior and innovation decisions. Economic incentives alter the cost–benefit calculus of innovation. R&D tax credits, enhanced deductions, and preferential income regimes reduce the user cost of R&D, while grants, seed funding, and soft loans share risk and ease financing constraints. Human capital incentives—such as subsidized training, lower payroll taxes for R&D personnel, or talent-attraction schemes—improve access to skills. By lowering costs and risks, these instruments encourage firms to:

- initiate new R&D and innovation projects
- increase expenditure on research and experimentation
- hire or retain highly skilled workers
- adopt new technologies and upgrade organizational processes

As more firms respond, aggregate innovation inputs rise, increasing the probability of breakthroughs, new products, and productivity-enhancing processes.

Meso level – firm life cycle and sectoral dynamics. The impact of incentives varies across firm types and life-cycle stages.

- For *startups* and early-stage ventures, targeted grants, accelerators, incubators, and seed funds can be decisive in overcoming initial financing and validation barriers. They help transform latent knowledge and ideas into new firms [Lattacher et al., 2021, 120660; Audretsch & Belitski, 2022, 1335–1338].
- For *scale-ups and established high-tech firms,* instruments such as R&D tax credits, investment allowances, and support for large collaborative projects enable capacity expansion and continuous innovation, including entry into export markets.

A balanced incentive mix that supports both entry and growth can create a vibrant ecosystem, with a pipeline from startups to mature firms and intense competitive pressure that drives continuous upgrading, consistent with Schumpeterian creative destruction [Aghion et al., 2015, 96–98; Henrekson, 2024, 120–126]. Cluster policies, support for networks, and innovation infrastructure (science parks, digital platforms) further reinforce sectoral dynamics by facilitating knowledge exchange.

Macro level – structural transformation and long-term development. When micro- and meso-level mechanisms function effectively, high-tech incentives contribute to broader structural transformation:

- The share of high-tech activities in GDP, exports, and employment rises
- Productivity and real wages grow
- The economy diversifies away from low-value-added and resource-based sectors toward more knowledge-intensive activities

Knowledge-intensive sectors also generate spillovers to traditional industries through digitalization, as well as advanced manufacturing technologies, and data-driven services [OECD, 2015, 31–37]. A successful high-tech trajectory thus feeds back into higher fiscal capacity and stronger demand for skills, reinforcing the conditions for further innovation.

Cross-cutting role of institutions and policy design. At each level, outcomes depend on governance quality, policy coherence, and stability. Transparent eligibility criteria, predictable rules, efficient administration, and regular evaluation are necessary to ensure that incentives support productive innovation rather than rent-seeking [OECD, 2020, 71–79; OECD, 2023, 41–47]. In weak institutional environments, incentives risk being captured by well-connected actors or used to sustain low-productivity firms. The framework, therefore, stresses that economic incentives must be embedded in:

- An innovative-friendly business environment (competition, property rights, contract enforcement)
- Complementary policies in education, research, and infrastructure
- A credible long-term commitment to innovation-led development.

Policy implications for Armenia: Applying this framework to Armenia highlights several policy directions to enhance the effectiveness of high-tech incentives.

Strategic focus and targeting. Given limited fiscal and administrative resources, Armenia should concentrate incentives on high-potential domains where it can build dynamic comparative advantage, such as software development, AI-related services, embedded systems, and possibly selected hardware or semiconductor-related design activities. Broad tax reliefs for "all IT" may be less effective than targeted schemes that reward R&D, export performance, and innovation collaboration [OECD, 2015, 93–101].

Strengthening institutions and governance. To improve trust and effectiveness, Armenia's incentive system should:

- further clarify the legal definition of "high-tech" and "R&D" for tax, grant purposes,
- simplify application and reporting procedures through digital one-stop platforms,
- ensure timely implementation (e.g., prompt tax refunds or grant disbursements),
- establish clear monitoring and audit mechanisms to document R&D expenditure and innovation outcomes.

Regular public reporting on the uptake and results of incentive schemes would enhance transparency and help identify design flaws. Coordination among the Ministry of High-Tech Industry, the Ministry of Economy, the Ministry of Finance, and education and research institutions is essential to avoid fragmentation and overlapping programs.

Human capital and ecosystem development. Economic incentives focusing narrowly on taxes or grants will not suffice if Armenia faces persistent skill shortages and a fragmented ecosystem. Complementary measures should include:

- scaling up STEM education, vocational training, and management programs relevant to tech entrepreneurship.
- encouraging university–industry contacts, joint laboratories, applied research centers
- supporting incubators, accelerators, and technology parks that connect startups to mentors, investors, and global markets
- designing targeted schemes to attract and retain Armenian and foreign specialists, including diaspora talent.

These measures help ensure that firms benefiting from incentives have access to the skills and networks to turn support into innovation and growth [Audretsch et al., 2022, 1340].

Fiscal sustainability and evidence-based adjustment. Because incentives entail fiscal costs, Armenia should adopt *time-bound, evaluable* schemes with sunset clauses and periodic reviews. Systematic evaluation—using firm-level data and rigorous methods such as difference-in-differences or propensity-score matching—can quantify the additionality of support in terms of R&D spending, patenting, product launches, employment, and exports [OECD, 2020, 41–56; OECD, 2023, 27–35]. Measures with low additionality or high deadweight loss should be redesigned, while effective instruments can be scaled up.

Performance-based designs, where part of the support is contingent on achieving pre-defined milestones (for example, reaching a certain export threshold, employment level, or R&D intensity), can align firm and public objectives. Combined with transparent communication, such an approach can preserve fiscal sustainability while maintaining political and social support for an incentive-based high-tech strategy. Armenia's high-tech incentives can make a meaningful contribution to long-term growth if strategically focused, institutionally well-governed, and complemented by investments in skills and ecosystems.

Conclusions

This article has examined how economic incentives shape high-tech sector growth, combining recent theoretical and empirical insights with a policy-oriented analysis. The results suggest that well-designed instruments – tax credits, R&D subsidies, invest-ment support, and human capital measures can act as powerful catalysts for innovation, entrepreneurship, and structural change. By lowering the cost and sharing the risk of innovation, they encourage firms to invest in R&D, adopt new technologies, and employ skilled workers, thereby fostering the emergence and expansion of high-tech activities in economies like Armenia. At the same time, the analysis underscores that incentives are *not a stand-alone solution.* Their effectiveness depends critically on institutional quality, policy coherence, and alignment with long-term development objectives. Efficient administration, capable educational and research institutions, and a stable macroeconomic and legal environment are necessary conditions for incentives to generate additional, not re-labeled, private investment [OECD, 2015, 7-12; OECD, 2020, 71-79]. When incentives are embedded in a broader strategy combining fiscal support with talent development, ecosystem-building, and strong institutions, they can significantly enhance the contribution of the high-tech sector to growth. If the complements are weak, the impact is also reduced. From a theoretical standpoint, the main contribution is an integrated conceptual framework that links micro-level firm responses to economic incentives with meso-level sectoral dynamics and macro-level structural transformation, under the mediating influence of institutional factors. This framework helps fill a gap in the literature on small open economies by providing a unified lens through which to understand both short- and long-run mechanisms of incentive-based high-tech development. The Armenian case illustrates how general principles can be adapted to a specific national context. Future research should build on this conceptual foundation by using firm- and sector-level data from Armenia and comparable economies to assess the causal impact of specific incentive schemes on R&D investment, innovation output, and firm performance. Comparative studies with other small or transition economies (Baltic states, Israel) would help identify best practices and clarify how institutional conditions shape the effectiveness of incentive mixes. Under conditions of prudent design, credible governance, and sustained investment in human capital, today's incentive-supported startups and R&D projects in Armenia may evolve into tomorrow's self-sustaining engines of growth and competitiveness.

References

1. Aghion, P., Akcigit, U., & Howitt, P. (2015). *Lessons from Schumpeterian growth theory*. *American Economic Review, 105*(5), 94–99. https://doi.org/10.1257/aer.p20151067
2. Aghion, P., Akcigit, U., & Howitt, P. (2015). *The Schumpeterian growth paradigm*. *Annual Review of Economics, 7*(1), 557–575. https://doi.org/10.1146/annurev-economics-080614-115412
3. Audretsch, D. B., & Belitski, M. (2022). *The knowledge spillover of innovation*. *Industrial and Corporate Change, 31*(6), 1329–1357. https://doi.org/10.1093/icc/dtac035
4. Dimos, C., & Pugh, G. (2016). *The effectiveness of R&D subsidies: A meta-regression analysis of the evaluation literature*. *Research Policy, 45*, 797. https://doi.org/10.1016/j.respol.2016.01.002
5. Henrekson, M. (2024). *The entrepreneur in neo-Schumpeterian growth theory*. *Entrepreneurship Theory and Practice, 48*(1), 104. https://doi.org/10.1177/10422587221141679
6. Lattacher, W., Gregori, P., Holzmann, P., & Schwarz, E. J. (2021). *Knowledge spillover in entrepreneurial emergence: A learning perspective*. *Technological Forecasting and Social Change, 166*, 120660. https://doi.org/10.1016/j.techfore.2021.120660
7. OECD. (2015). *The Innovation Imperative: Contributing to Productivity, Growth and Well-Being*. Paris: OECD Publishing. https://doi.org/10.1787/9789264239814-en
8. OECD. (2020). *The Effects of R&D Tax Incentives and their Role in the Innovation Policy Mix: Findings from the OECD microBeRD Project, 2016–19* (OECD Science, Technology and Industry Policy Papers, No. 92). Paris: OECD Publishing. https://doi.org/10.1787/65234003-en
9. OECD. (2023). *The Impact of R&D Tax Incentives* (OECD Science, Technology and Industry Policy Papers). Paris: OECD Publishing. https://doi.org/10.1787/1937ac6b-en
10. Wanzenböck, I., Wesseling, J. H., Frenken, K., Hekkert, M. P., & Weber, K. M. (2019). *A framework for mission-oriented innovation policy: Alternative pathways through the problem–solution space*. *Science and Public Policy, 47*(4), 474–489. https://doi.org/10.1093/scipol/scaa027

Yuri ZAKHARYAN

The role of economic incentives in shaping high-tech sector growth

Key words: Economic incentives; high-tech sector; innovation policy; R&D tax incentives; knowledge spillovers; small open economy; Republic of Armenia; structural transformation

The high-tech sector is a key driver of innovation, productivity growth, and long-term competitiveness, yet technology-intensive industries face high uncertainty, large upfront costs, long payback periods, and underinvestment in research and development (R&D) due to knowledge spillovers. Governments therefore deploy economic incentives, such as tax relief, direct funding, investment support, and human capital measures, to stimulate private investment, spur innovation, and guide structural transformation toward knowledge-based growth. This article examines the role of such incentives in shaping high-tech sector development from theoretical and policy perspectives. Drawing on a focused review of recent literature, it analyzes how different instruments affect firm behavior, innovation dynamics, competitiveness, and long-term sectoral outcomes. The study shows that effectiveness depends not only on instrument design but also on institutional quality, policy coherence, and alignment with national strategies. Using the Republic of Armenia as an illustrative case, it develops an integrated conceptual framework linking micro-level innovation responses to macro-level structural transformation, providing a foundation for future empirical research and design of incentive projects fostering sustainable high-tech growth.