



Flanders' Competitiveness and Investment Priorities in Key Strategic Technologies

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EXECUTIVE SUMMARY

As the global race for technological leadership accelerates, the central challenge for Flanders is to identify where to invest to maximize long-term competitiveness, resilience, and prosperity. This CEPS report aims to inform that choice by assessing Flanders' position across 38 Key Strategic Technologies using machine-learning and economic-complexity methods applied to large-scale data on publications, patents, and startup investments (2020–2025). The analysis highlights world-class strengths in life sciences and biotechnology, alongside persistent gaps in translating scientific excellence into technological leadership and high-growth startups. These weaknesses are most acute in foundational digital technologies. Based on these findings, the report identifies clear priorities: consolidate leadership where Flanders is strongest, pursue selective moonshot investments where leadership is within reach, remove barriers to deep-tech scaling, leverage industrial champions, and position Flanders more clearly within European technology networks.



1. INTRODUCTION

The global race for technological leadership is accelerating, driven by a new wave of transformative technologies - such as artificial intelligence and advanced biotechnology - and by rising geopolitical tensions. For Flanders, leadership in Key Strategic Technologies (KSTs) will be decisive for securing sustainable prosperity, economic resilience, and long-term competitiveness.

Achieving technological leadership will require bolder, more targeted investments focused on strengthening structural advantages and addressing critical gaps.

This CEPS report aims at supporting Flanders' competitiveness diagnostics and investment-priority setting by providing a comprehensive assessment of its position across 38 Key Strategic Technologies, such as artificial intelligence, semiconductors, or smart grids. The analysis combines machine-learning with economic complexity frameworks and draws on millions of scientific publications, patent documents, and startup investment records from 2020 to 2025.

The findings highlight exceptional strengths in health and biotechnology sectors, in particular mRNA technologies, advanced therapy medicinal products (ATMPs), and bioinformatics.

These capabilities are underpinned by a dense and internationally recognised scientific ecosystem - most notably KU Leuven and Ghent University - and reinforced by strong research institutes such as VIB (Vlaams Instituut voor Biotechnologie) and IMEC and multinationals in chemicals, materials, and life sciences.



At the same time, important structural gaps persist across the overall innovation ecosystem. While Flanders demonstrates strong scientific capabilities in several advanced domains, these strengths are too often not translated into technological leadership, or a dynamic pipeline of high-growth startups.

This gap between knowledge generation, technological development, and market deployment represents both a strategic vulnerability and a significant opportunity for targeted policy action.

There is also a notable and specific weakness in foundational digital technologies. Across most key digital domains - in particular artificial intelligence, IOT, HPC, quantum computing - Flanders lags behind other leading EU regions simultaneously in scientific output, technological development, and investment activity.

Unlike in the life sciences, where strengths are visible across the entire innovation chain, digital technologies show no comparable concentration of leadership, with limited startup formation, weaker patenting intensity, and lower capital attraction. While some areas display promising capabilities in scientific excellence (such as semiconductors or microelectronics), they remain fragmented and insufficient to offset the broader structural lag in digital technologies that risk in the future underpinning competitiveness across broader sectors of the economy.

Based on these insights, the report points to four main avenues for action: (1) consolidating and extending leadership in selected life-sciences and biotech domains; (2) pursuing targeted “moonshot” investments in niche areas where scientific excellence exist and leadership is in reach; (3) addressing structural



bottlenecks in deep-tech startup formation and scaling; and (4) position Flanders more aggressively as a central hub within European technology networks.

2. DATA & METHODS

To assess Flanders' competitiveness and investment priorities in Key Strategic Technologies (KSTs), this report combines large-scale data integration with methods from economic complexity, innovation studies, and smart specialisation frameworks.

The analysis draws on three complementary data sources that capture distinct but interrelated dimensions of innovation activity: technological invention, scientific research, and entrepreneurial investment.

Patent data are sourced from the OECD REGPAT database and cover the period 2020-2024; scientific publications are drawn from OpenAlex and span 2021-2025; and startup investment data are taken from Crunchbase Pro, covering venture funding and deal flows from 2021 to 2025. All records are harmonised and reclassified into a common set of 38 Key Strategic Technologies, which are identified as critical for Flanders' long-term prosperity, economic resilience, and security.



A central methodological challenge is the consistent classification of heterogeneous data - patents, publications, and investments - into the selected KSTs. To address this, the report employs a *three-step hybrid approach* that combines (1) semantic machine learning with (2) empirical validation and (3) human-in-the-loop review.

First, descriptive keywords for each KST, together with *CPC patent classes*, *OpenAlex scientific topics*, and *Crunchbase industry tags*, are embedded into high-dimensional semantic vectors using a large-scale text embedding model (*text-embedding-large* - the embedding model underlying GPT-5). Candidate matches between records and KSTs are generated using *cosine similarity*, allowing the classification to capture semantic similarity even when different terminologies are used (for instance, 3D printing and additive manufacturing). Second, these semantic matches are validated through empirical relatedness, measured by normalised co-occurrences: CPC codes co-appearing on the same patent, topics within the same publication, or industry tags within the same funded startup. This step filters out semantically plausible but empirically irrelevant links. Third, borderline and ambiguous cases are subject to systematic manual review, primarily to define robust thresholds and ensure conceptual coherence. The final classification is therefore not driven by rigid rules, and results are not sensitive to marginal threshold choices.

To quantify Flanders' performance in each KST, the analysis constructs several indicators: absolute counts measure the scale of activity in a given technology. Revealed Comparative Advantage (RCA), computed using the standard Balassa formulation (Hidalgo et al., 2007), measures relative specialisation by comparing the region's share of activity in a technology to the European regional average (EU27 + UK + EFTA NUTS2 regions). Finally, relatedness



density captures the extent to which the region already possesses capabilities closely connected to a given technology, reflecting the ease with which it could diversify into that domain based on its existing knowledge base.

The resulting indices are used in combination to contrast technological, scientific, and entrepreneurial strength.

A key indicator in this analysis is relatedness. In contrast to approaches that infer relatedness from co-export patterns such as Hjalgo et al. (2007), this report computes KST-KST proximity directly from normalised co-occurrences of domains within the same patents, publications, or investment deals, following the approach proposed by Boschma et al. (2015). Relatedness between categories is then measured using *cosine similarity* and is calculated over the full technology universe rather than being restricted to the 38 focal KSTs.

Figure 1 below shows for instance the degree of relatedness between the key strategic technologies analyzed in this report, using normalized co-occurrences on patent documents. We can see, as one would expect, health and biotech clustering together, and specific technological connections between smart grids and IOT. This measure is key to identify strong candidates in the effort of technological prioritization.



Figure 1. Technological relatedness between the key strategic technologies

For every target technology, *relatedness density* then measures the share of that technology's weighted links that connect to technologies in which Flanders' already exhibits RCA greater than one. For more details, see methodological discussion in Hidalgo et al., 2018; and Balland et al., 2022. As recommender systems use a form of relatedness to filter products, movies or news that matches users' interests, relatedness density plays a key input to opportunity mapping as related technologies are more feasible.



The analysis also incorporates a measure of *technological complexity* inspired by urban scaling research (Balland et al., 2020). Complexity is inferred from the global spatial concentration of technological activity in urban areas, under the assumption - well established in economic geography, urban economics and innovation studies - that highly sophisticated activities tend to cluster in large, dense innovation hubs, while simpler or more ubiquitous activities are distributed broadly.

Using a location–technology matrix based on patent counts, locations are ordered by total activity (number of patents) and progressively included in multiple runs (e.g. top 10 locations, top 15, top 20, and so on). For each run, the share of a technology’s global activity concentrated in the top locations is computed. Technologies that remain highly concentrated in major hubs as smaller locations are added are considered complex, reflecting their reliance on rare, specialized, and complementary capabilities that are only available in a limited number of places. By contrast, technologies whose concentration declines rapidly as additional locations are included are considered simple, as they draw on more ubiquitous knowledge, skills, and infrastructure that are widely distributed across space. Final complexity scores are obtained by averaging concentration shares across all runs. This output-based approach is robust to scale differences and captures revealed sophistication¹.

Combined together, technological relatedness and technological complexity are the building blocks of our strategic investment framework (see figure 2).

¹ It is important to note that, in a limited number of cases such as resource-dependent or security-sensitive domains, spatial dispersion may reflect constraints rather than low complexity.

The strategic framework positions technologies on a two-dimensional map defined by relatedness density on the horizontal axis - capturing feasibility, or how easily Flanders can develop new capabilities given its existing strengths - and technological complexity on the vertical axis, reflecting long-term economic impact and competitive sustainability. This framework follows the seminal approach described in Balland et al. (2019) developed in the context of operationalizing the EU smart specialization strategy.

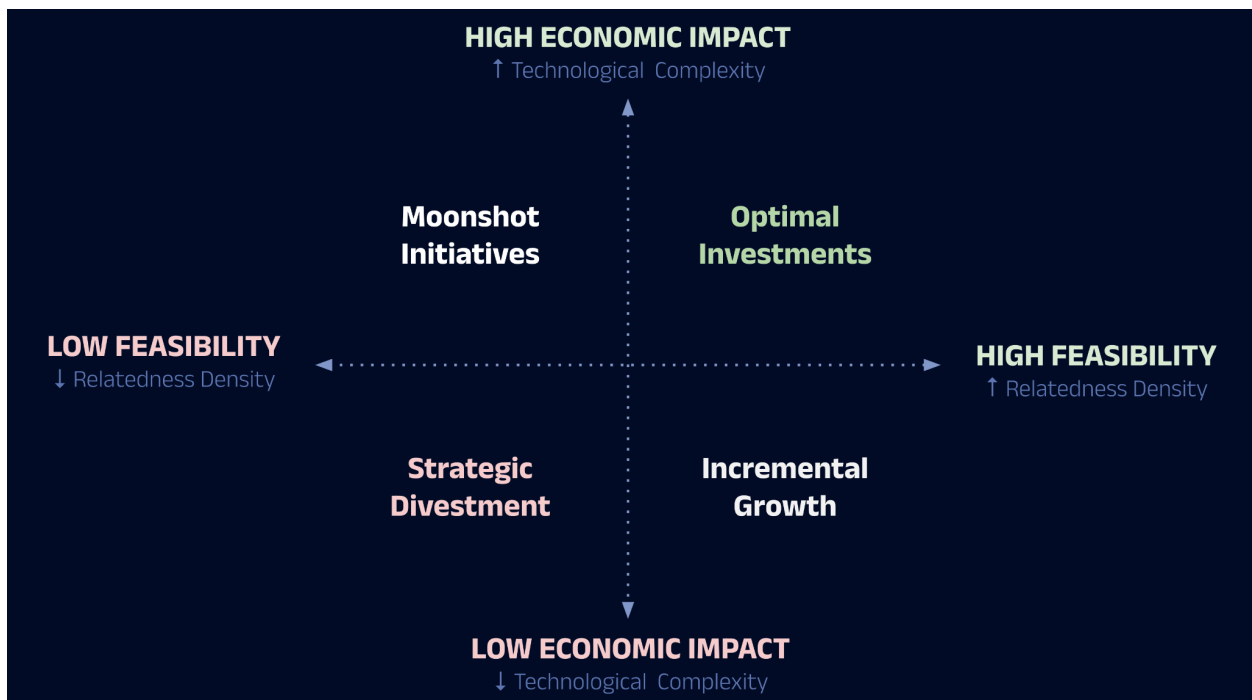


Figure 2. Strategic Investment Framework

This structure yields four investment-relevant quadrants. The top-right quadrant identifies *optimal investments*, where high feasibility and high complexity converge, representing the most compelling opportunities for global leadership.



The top-left quadrant captures *moonshot initiatives*: highly complex technologies with strong long-term potential but low current feasibility, requiring bold, selective, sustained, and risk-tolerant investment, particularly in foundational domains.

The bottom-right quadrant corresponds to *incremental growth* opportunities, which are relatively easy to develop but offer limited differentiation and are best suited for steady, lower-risk portfolio expansion.

Finally, the *bottom-left* quadrant highlights cautious strategic considerations, where low feasibility and low complexity suggest limited returns to large-scale investment. This does not mean that bottom-left-positioned technologies should automatically be disregarded, they might also be key for non-direct-economic reasons (some form of tech independence for instance).

This framework is a way to avoid blindspot and look beyond the region. But it is a tool that requires active engagement and conversations with local stakeholders that have deep knowledge about the ecosystem.

It is important to note that the methodology acknowledges several limitations. Patent data may underrepresent some forms of innovations, tacit knowledge, or secrecy-driven research. Scientific publications do not fully capture industrial research activity, and investment data primarily reflect venture-capital-intensive domains, omitting private R&D expenditures by large incumbents.

Despite these limitations, the combination of patents, publications, and investments provides a comprehensive and triangulated view of competitiveness. Future extensions could integrate labour-market data, such



as online job postings and skill supply (LinkedIn), as well as web-scraped firm-level information, trade data, and digital signals (web traffic), to further enrich the analysis and capture additional dimensions of technological capability and diffusion.

3. COMPETITIVE POSITION OF FLANDERS IN THE 38 KEY STRATEGIC TECHNOLOGIES

3.1 Technological Competitiveness Diagnostic

Flanders demonstrates a relatively diversified technological landscape distributed across 38 key strategic technologies, revealing both areas of competitive advantage and opportunities for development.

Figure 3 uses a treemap representation where the size of each rectangle indicates the proportion of patents in a given technology domain, while the color indicates competitive positioning: green shading denotes domains where Flanders has a revealed comparative advantage ($RCA > 1$), meaning the region specializes in these technologies relative to the European benchmarks, while red shading highlights domains with RCA values below 1, indicating relative underperformance compared to other European regions and what one would expect based on the scale of a given technology. Note that the RCAs are relative metrics, but are not impacted by the selection of KST as it is benchmarked to the full universe of technologies.

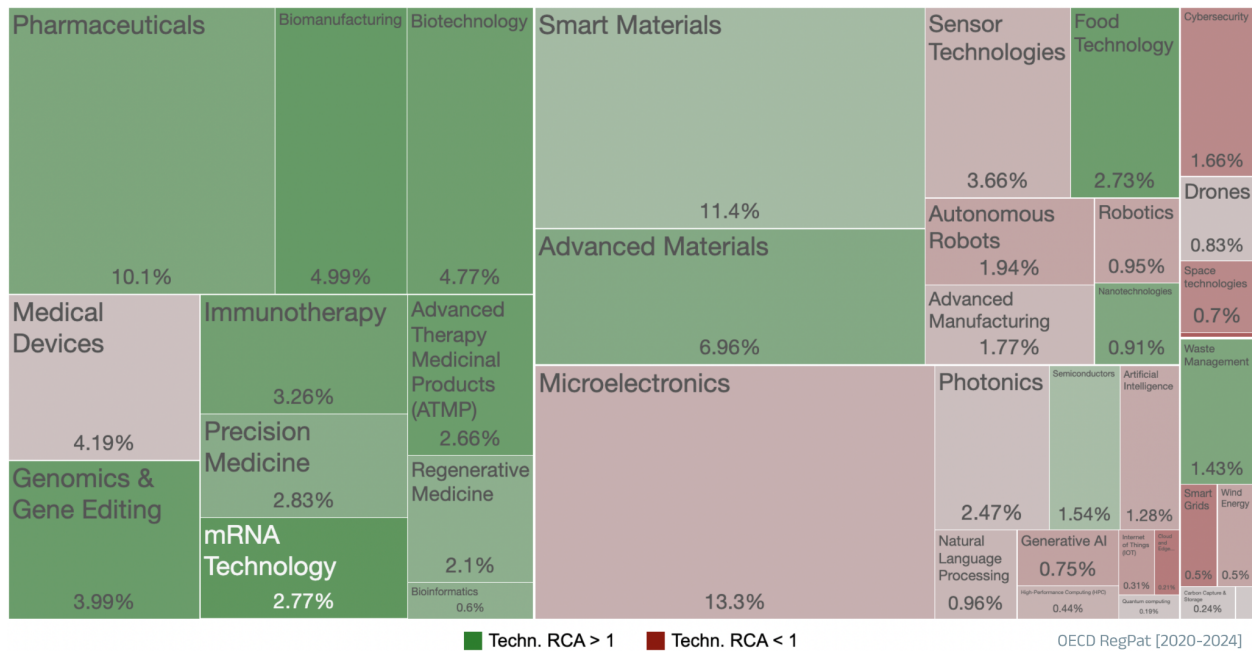


Figure 3. Technological composition of Flanders in KST (2020-2024)

The region's innovation portfolio shows particular concentration in materials science and life sciences, with almost half of the 38 KST patent activity clustered in just five domains: Microelectronics (13.3%), Pharmaceuticals (10.1%), Smart Materials (11.4%), Advanced Materials (7.0%), and Biomanufacturing (5.0%). Size of a technology domain is important when it comes to investment priority and potential impact.

The Revealed Comparative Advantage (RCA) analysis highlights Flanders' technology profile and its strengths and vulnerabilities in the 38 KST. The region exhibits exceptional specialization in life sciences and biotechnology, with mRNA Technology leading at an RCA of 2.01. This means that, in this field, we find in Flanders twice the amount of patents one would expect by



chance. Then follows Biomanufacturing (1.84), Genomics & Gene Editing (1.76), Advanced Therapy Medicinal Products (1.73), and Food Technology (1.72). These domains represent areas where Flanders punches significantly above its weight by European standards. In contrast, despite substantial patent volumes in Microelectronics (1,694 patents), the domain shows an RCA of only 0.69, indicating under-specialization relative to other EU hubs - a strategic concern given this sector's (and related technologies) foundational importance for digital transformation and impact across the broader regional economy.

Perhaps the most striking finding is the digital gap in transformative digital technologies such as Artificial Intelligence (RCA = 0.65) and Cloud Computing (0.34). This signals significant underperformance compared to other regions and suggests Flanders risks falling behind in technologies critical to future economic competitiveness, even as it maintains leadership in traditional strengths like pharmaceuticals and advanced materials.

Overall, the data points to a regional innovation system that excels in established industrial and biotech domains but may need strategic reinforcement in (selected) emerging digital technologies to remain competitive in an increasingly AI-driven global economy.

3.2 Scientific Competitiveness Diagnostic



The scientific RCA analysis confirms Flanders' life sciences and biotechnology leadership. The region maintains strong competitive advantages in both patents and publications for core biotech domains: Biomanufacturing (publication RCA 1.25 vs patent RCA 1.84), Biotechnology (1.14 vs 1.69), and Genomics & Gene Editing (1.12 vs 1.76) all demonstrating sustained excellence across the research-to-innovation pipeline.

The persistent weakness in emerging digital technologies remains evident across both metrics, though with concerning variations. Quantum Computing records an RCA of just 0.36 in publications - even lower than its patent RCA of 0.88 - while Cloud and Edge Computing (0.67), Internet of Things (0.75), and Artificial Intelligence (0.92) all remain below EU competitive parity in publications as well. Semiconductors shows a very strong RCA of 2.15 in publications (1.10 in patents), while Microelectronics demonstrates 1.65 versus 0.69 - suggesting here robust fundamental research that has not translated into proportional commercial innovation.

The dual underperformance in both academic research and patent activity in critical AI and computing domains suggests systemic gaps in Flanders' digital innovation ecosystem, raising fundamental questions about the region's capacity to compete in technologies that will define future industrial competitiveness.

3.3 Funding Competitiveness Diagnostic

Flanders' startup ecosystem has attracted substantial funding across the 38 strategic technology domains, revealing a funding landscape that slightly diverges from its research and patenting profiles.

Unlike publications and patents where volumes were distributed across many domains, startup funding concentrates heavily in just a few areas: Advanced Manufacturing (17.9%), Artificial Intelligence (14%), Food Technology (10.5%), and Cybersecurity (10.2%) clearly lead capital allocation to new ventures. This extreme concentration suggests a more selective venture capital environment compared to the broader academic and corporate innovation activities, with investors focusing on domains perceived as having clearer commercialization pathways.

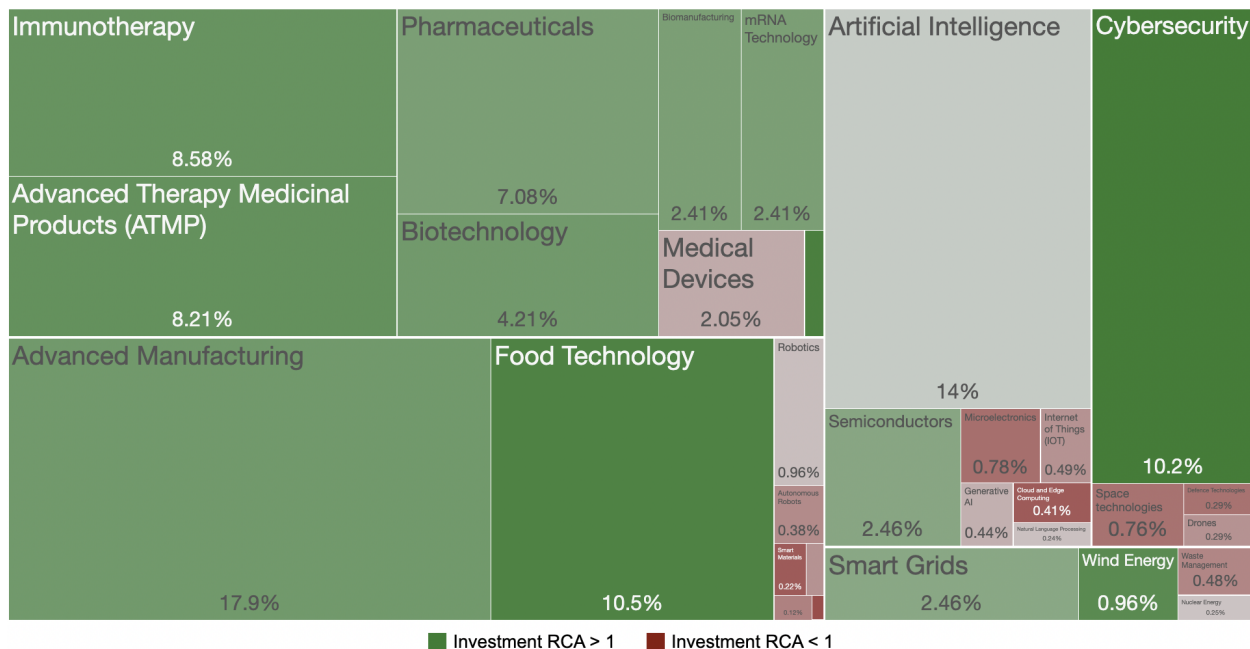


Figure 5. Funding composition of Flanders in KST (2021-2025)



The RCA analysis reveals Flanders' startup funding competitive advantages align only partially with its research and patent strengths, exposing critical gaps in the innovation-to-market pipeline.

Perhaps the most surprising is that the region's strongest biotech domains in patents and publications receive very little startup funding. Genomics & Gene Editing, Precision Medicine, Regenerative Medicine, and High-Performance Computing all register zero funding despite strong academic and patent portfolios. In life sciences related fields, funding flows to Bioinformatics (RCA = 3.51), but also ATMP (2.22) and Immunotherapy (2.12). Food Technology emerges as a funding star with strong volume and an RCA of 3.23, significantly outperforming its research and innovation foundations. Most remarkably, Semiconductors shows up again here as a strong technology in terms of funding. Cybersecurity, quite absent from the technology and scientific landscape shows exceptional volume and RCA in funding.

The digital technology funding gap persists but with nuanced variations from the research patterns. Microelectronics receives minimal startup investment (RCA 0.26) despite strong publication performance (RCA 1.68) and moderate patent activity (RCA 0.69), revealing a troubling failure to commercialize fundamental research advantages. Quantum Computing, Cloud and Edge Computing, and Smart Materials register very little funding, compounding their overall R&I weaknesses. However, Artificial Intelligence achieves near-parity with an RCA of 1.01 in funding - far better than its patent (0.65) and publication (0.91) positions - suggesting emerging entrepreneurial activity.

This fragmented picture indicates Flanders faces a second-order challenge in research strengths to attract capital.

4. SMART INVESTMENT GRAPHS

4.1 Technological Relatedness & Technological Complexity

Flanders' patent portfolio reveals a concentration of optimal investment opportunities in its established life sciences and biotechnology domains, where high technological complexity (high economic value) converges with strong relatedness density (high feasibility) to existing capabilities (figure 6).

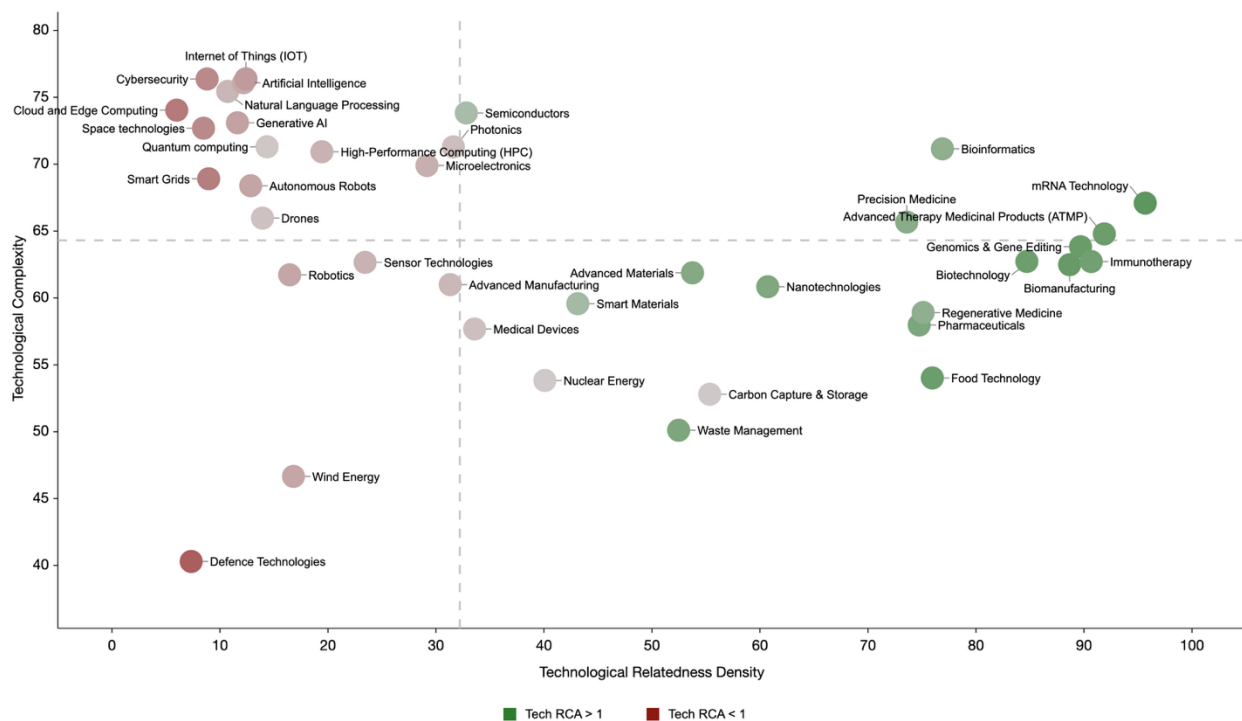


Figure 6. Smart investment graph & tech RCA



The top-right quadrant - representing technologies with both high feasibility (high relatedness density) and high economic impact (high complexity) is dominated by biotech specializations where Flanders already demonstrates competitive advantage: Bioinformatics (76.9 relatedness, 71.1 complexity, 1.3 RCA), mRNA Technology (95.7 relatedness, 67.1 complexity, 2.01 RCA), Immunotherapy, Advanced Therapy Medicinal Products, Genomics & Gene Editing, Biomanufacturing. These technologies occupy the strategic sweet spot where Flanders can leverage existing capabilities to capture high-value market opportunities. This clustering suggests Flanders has a deeply interconnected biotech/life sciences innovation system where capabilities in one domain naturally support advancement in adjacent fields.

The moonshot quadrant exposes Flanders' most critical strategic challenge: emerging digital technologies that offer high economic complexity but low feasibility given current capabilities.

Artificial Intelligence (12.2 relatedness, 76.1 complexity, RCA 0.65) is the most obvious candidate, alongside Cybersecurity (8.8, 76.4, RCA 0.43), Internet of Things (12.4, 76.4, RCA 0.54), and Natural Language Processing (10.7, 75.4, RCA 0.74). Despite their high technological complexity -indicating substantial long-term economic potential and competitive sustainability - these domains show minimal connection to Flanders' existing innovation base. Semiconductors is slightly more reachable, as its relatedness is in between the core digital cluster and the life science one, with also a positive RCA.



The region faces a fundamental choice: either make bold, sustained investments to build new capability clusters in AI and digital technologies, accepting the scale, risk and long time horizons required for moonshot initiatives, or risk deepening dependence on external providers for technologies that increasingly underpin all industrial sectors. The low relatedness scores indicate these technologies cannot be developed through incremental evolution of current strengths; they require deliberate capability-building initiatives, targeted talent acquisition, and potentially strategic partnerships or acquisitions to establish foundational competencies.

The incremental growth and strategic divestment quadrants reveal a more cautious landscape for expansion. Advanced Manufacturing (31.3 relatedness, 61.0 complexity, RCA 0.76), Microelectronics (29.2, 69.9, RCA 0.69), and Medical Devices (33.6, 57.7, RCA 0.83) occupy the incremental growth space - technologies relatively accessible given existing capabilities but offering moderate economic complexity and differentiation potential. However, Flanders demonstrates competitive strength (RCA >1) in several domains positioned in the bottom half of the complexity scale, indicating areas where the region excels but faces long-term commoditization risk: Food Technology (76.0 relatedness, 54.0 complexity, RCA 1.72) and Waste Management (52.5, 50.1, RCA 1.45) show high feasibility but limited complexity, suggesting these sectors may mature into lower-value-add activities without strategic upgrading.

Most concerning is the bottom-left concentration of domains like Wind Energy (16.8, 46.7, RCA 0.62) and Defence Technologies (7.3, 40.3, RCA 0.20), which combine low feasibility, low complexity, and weak competitive positioning.

While the framework suggests caution toward large-scale investment in these areas, it serves as a diagnostic tool rather than a divestment mandate - some technologies may warrant strategic investment for energy security, supply chain resilience, or as enablers for higher-value domains, underscoring the need for active stakeholder engagement to contextualize these findings within broader regional priorities.

4.2 Scientific publications RCA overlay

Overlaying scientific publication RCA values onto the previously presented strategic framework sharpens investment priorities by revealing where research excellence aligns with - or diverges from - technological feasibility and complexity (figure 7).

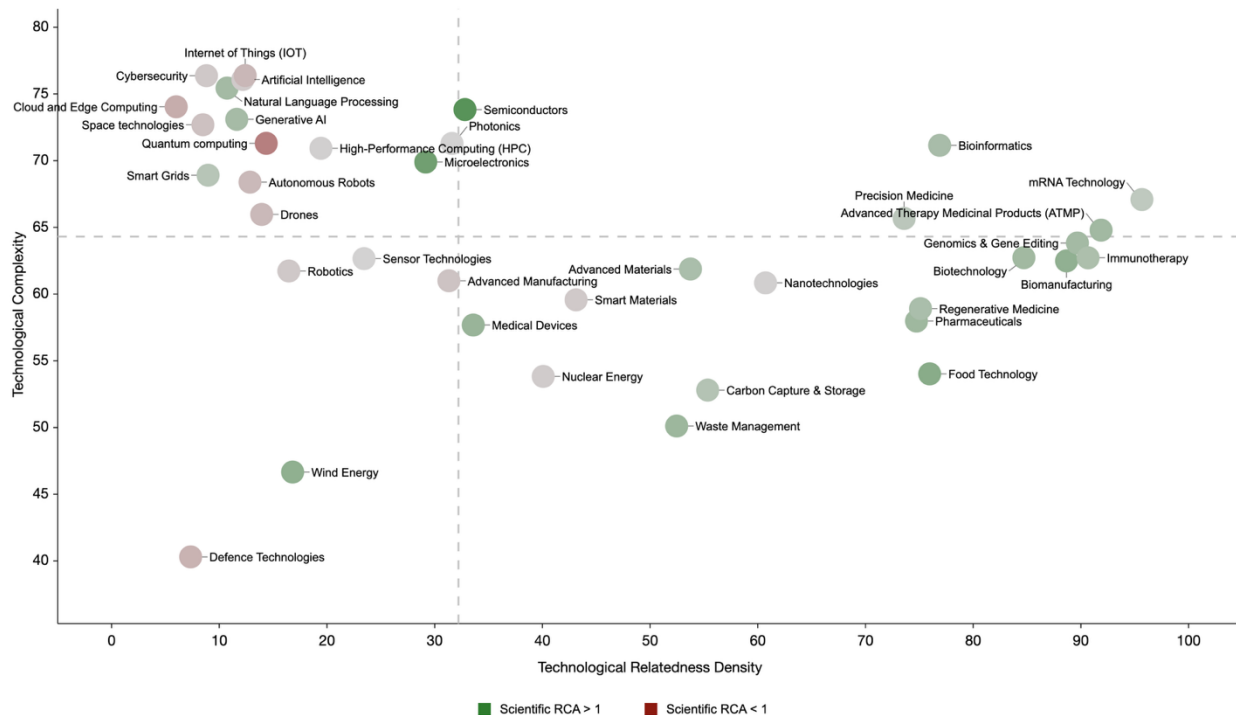


Figure 7. Smart investment graph & scientific RCA

In the optimal investment quadrant, Flanders' biotech domains maintain strong research foundations: Biomanufacturing (1.25 publication RCA), Biotechnology (1.14), and Genomics & Gene Editing (1.12) all demonstrate competitive research output matching their high tech relatedness and complexity positioning. mRNA Technology drops a bit in terms of publication RCA but still very strong overall. These domains are excellent candidates to double down as Flanders possesses both the research excellence and capability base to compete.

The moonshot quadrant presents a more nuanced picture when research strength is considered. Semiconductors emerges again as the most compelling moonshot candidate - despite moderate relatedness (32.8) and high complexity (73.8), its publication RCA of 2.15 represents Flanders' strongest research competitive advantage in the digital space. This exceptional research foundation in a high-complexity domain suggests strategic investment could build on existing academic excellence to develop commercial capabilities, making it a lower-risk moonshot than technologies lacking any foundational strength.

Microelectronics is also strong but we need to keep in mind that this is a much broader field. Conversely, Quantum Computing's publication RCA of 0.36 makes it way harder to reach. Natural Language Processing (1.12 publication RCA) and Generative AI (1.11) show modest research competitiveness that slightly exceeds their patent performance, suggesting emerging research clusters that could be nurtured selectively. The framework thus recommends

a focused moonshot strategy: prioritize Semiconductors where research excellence provides a foundation, and selectively support AI subdomains showing research momentum.

4.3 Startup Funding RCA overlay

In a third step, we now overlay startup funding RCA values alongside research and patent metrics (figure 8) to create an even more comprehensive view of where Flanders could concentrate resources versus where critical gaps demand attention.

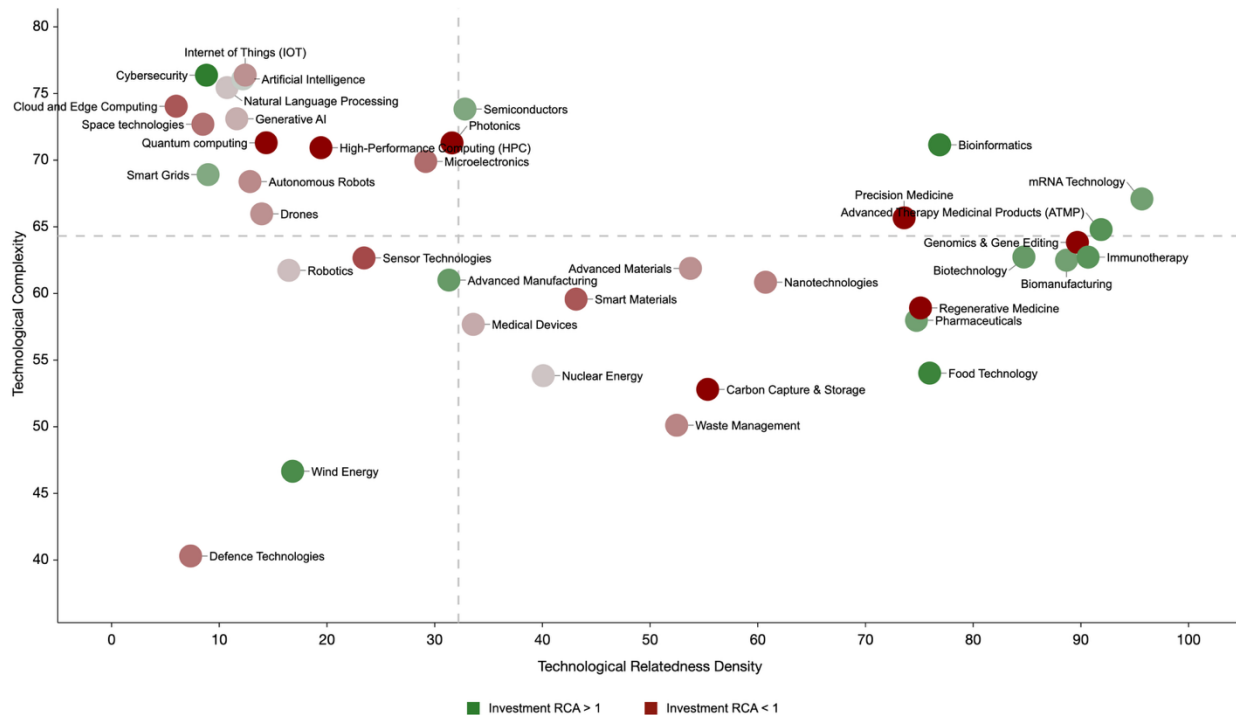


Figure 8. Smart investment graph & funding RCA



Perfect alignment - high relatedness, high complexity, strong patent RCA, strong publication RCA, and substantial funding RCA - naturally appears exceptionally rare.

ATMP comes closest to this ideal: exceptional funding RCA (2.22), strong patent RCA (1.73), solid publication RCA (1.15), optimal relatedness (91.9), and elevated complexity (64.8). Immunotherapy shows strong funding (2.12 RCA) and moderate-to-strong patent performance (1.63 RCA) but weaker but still high publication positioning (1.10 RCA). Most striking are the "funding orphans": Genomics & Gene Editing (1.76 patent RCA, 1.14 publication RCA, but zero funding), Precision Medicine (1.33 patent, 1.08 publication, zero funding), and Regenerative Medicine (1.28 patent, 1.12 publication, zero funding) all demonstrate research and innovation strength in highly feasible, moderately complex domains yet attract no entrepreneurial capital - exposing a potential commercialization failure where innovation stops at the lab.

Cybersecurity shows a surprisingly strong funding RCA (4.03) despite weak patent and publication performance, and low technological relatedness. Food Technology presents a contrasting "double down" opportunity with exceptional alignment at moderate complexity: strong funding, robust patenting activity, excellent publications, and high feasibility create a rare convergence, though its lower complexity demands strategic focus on premium applications.

Bioinformatics represents perhaps one of the most interesting case - stellar funding (3.51 RCA) with overall backing patent (1.27) and publication (1.05) strength in a high-feasibility (76.9), high-complexity (71.2) domain, suggesting investors recognize transformative potential and Flanders should



5. ACTIONABLE POLICY SUGGESTIONS

5.1. Doubling Down on Competitive Strongholds in Biotech

Flanders possesses world-class capabilities in health and biotechnology, representing a critical competitive advantage that demands strategic reinforcement. The region's technological leadership, scientific excellence, and startup investments are heavily concentrated in this sector, creating a natural foundation for global leadership. To maximize this advantage, Flanders could further prioritize some key domains. Three particularly interesting ones emerge from the analysis: mRNA technology, which uniquely translates scientific excellence into scalable commercial products; Advanced Therapy Medicinal Products (ATMPs), which require deep scientific capabilities that create high entry barriers against competitors; and bioinformatics, which provides essential large-scale biological data infrastructure for the entire life-science ecosystem.

While the region also demonstrates strength in biomanufacturing, genomics and gene editing, and broader biotech/pharma sectors, these areas face different strategic challenges. Biomanufacturing requires substantial domestic production capabilities, genomics is becoming increasingly commoditized, and pharma is a very broad domain that also represents a mature field where differentiation is difficult.



The primary objective is to lock in global leadership positions where Flanders already sits at the technological frontier, ensuring that existing strengths compound into sustained competitive advantages.

5.2. Targeting Moonshots Through Scientific Excellence in Digital Technologies

The digital and artificial intelligence technology landscape presents Flanders with a fundamentally different challenge: virtually all these domains currently sit in *moonshot territory* requiring careful selection and concentrated investment rather than broad coverage.

The region could leverage its existing scientific capabilities to focus on a small number of targeted bets that can compound into meaningful impact over time. Semiconductors emerge as a priority area, given that Flanders' research excellence provides a solid foundation for commercial development.

Selective support for AI subdomains showing research momentum also merits attention, particularly given AI's character as a general-purpose technology with cross-sectoral applications.

Cybersecurity represents another potential opportunity, offering lower capital intensity requirements despite current capability gaps. However, several digital domains present formidable barriers to entry: high-performance computing, autonomous robotics, and microelectronics are capital and scale-intensive with entrenched global incumbents; cloud and edge computing



markets are dominated by hyperscalers with overwhelming resources; IoT value has shifted decisively to platform ecosystems; drones have become commoditized and face geopolitical constraints; and space technologies require capabilities beyond the region's current reach.

The strategic imperative here is to move from fragmented project-based funding to mission-oriented investment envelopes in very few domains, prioritizing infrastructure-heavy investments where private actors cannot act alone.

5.3. Addressing the Startup Bottleneck in Deep Technology Commercialization

While Flanders demonstrates some startup activity in biotech and medtech, the region faces a pronounced bottleneck in venture funding and scale-up capacity within digital technologies and advanced industries and materials.

This asymmetry reveals both a critical weakness and a clear opportunity for policy intervention. The region should expand public-private deep-tech growth funds and establish co-investment mechanisms with Flemish industrial corporate venture capital arms, creating more robust pathways from early-stage innovation to commercial scale.

Beyond capital, scale-up success requires building structural bridges through access to pilot customers, industrial validation contracts, and comprehensive



export and internationalization support that helps young companies access global markets.

Equally important are addressing any systemic institutional bottlenecks that impede entrepreneurial dynamism: university appointment rules that discourage faculty entrepreneurship, equity practices of technology transfer offices that may not optimally incentivize commercialization, and setting-up a very focused flagship research center capable of attracting world-class talent to the region.

The strategic objective underlying these interventions is to explicitly de-risk innovation in domains where Flanders maintains comparative advantage, creating pathways that transform promising startups into globally competitive firms that can capture and retain value within the regional economy.

5.4 Scaling Through Inter-Regional Integration in Complex Technologies

Despite Flanders' solid knowledge foundations, the region cannot achieve leadership alone in the most complex and capital-intensive technologies. Even though this was not part of the empirical research in this report, success increasingly depends on strategic inter-regional network integration.

Policy must shift toward prioritizing targeted partnerships with complementary European and global regions based on existing linkages and technological



complementarities, positioning Flanders as a central hub within European value chains.

This networked approach to capability building recognizes that complex technologies require combinations of skills, infrastructure, and market access that exceed any single region's resources.

Simultaneously, Flanders must accelerate the diffusion of artificial intelligence capabilities into its traditional industrial strengths, particularly manufacturing, logistics, and chemicals, where AI applications can create significant competitive advantages. This requires expanding applied AI talent pipelines that are closely linked to concrete industry use cases rather than purely academic AI research, ensuring that advanced capabilities translate into practical industrial applications.

The combination of strategic inter-regional partnerships and AI diffusion into established sectors creates a pathway for Flanders to leverage its existing strengths while accessing capabilities and markets essential for competing in technology domains that demand scale, specialization, and integration across geographic boundaries.

6. CONCLUSION

Flanders possesses genuine competitive advantages - world-class biotech capabilities, strong scientific foundations, globally integrated industrial champions, and strategic European positioning. But it is also clear that further

developing leadership in Key Strategic Technologies (KSTs) will require bolder, more targeted investments focused on strengthening structural advantages and addressing critical gaps.

Strategic clarity on priorities is essential. This report is intended as an input to that decision-making process, to be combined with deep, place-based knowledge from local stakeholders. What is clear is that success will depend on willingness to make bold, concentrated bets - rather than spreading investments too thin - and to sustain those commitments over the long time horizons required by deep technologies.

A clear path forward is to double down on biotech leadership where Flanders already excels, make targeted moonshot bets in digital technologies leveraging scientific strengths, ease the deep-tech startup bottleneck through structural reforms, and integrate strategically into European technology networks.

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