Forging ahead. Aim:
TOP 5 KNOWLEDGE REGIONS

VARIO-memorandum 2019-2024

VARIO
Flemish Advisory Council
for Innovation & Enterprise

Flanders
State of the Art

The Flemish Advisory Council for Innovation and Enterprise (Vlaamse Adviesraad voor Innoveren en Ondernemen, VARIO) advises the Flemish Government and the Flemish Parliament on its science, technology, innovation, industry and entrepreneurship policy. The council does this on its own initiative as well as on request. The council was established by the Flemish Government by decree on October 14th, 2016. VARIO works independently from the Flemish Government and the Flemish stakeholders. The chairman and nine members of VARIO take part in a personal capacity.

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CONTENT

FORGING AHEAD

Flanders is a prosperous region, but our prosperity and well-being are not set in stone. We are faced with profound economic changes in an increasingly globalised world. We also face a range of social challenges, inter alia in the areas of demography, mobility, energy and the environment. The combination of these economic and social objectives represent excellent opportunities for Flanders. Sustainable growth is the key in this respect, with research and innovation playing a crucial role.

Flanders must be ambitious and aim to be in the Top 5 of innovative European knowledge regions.

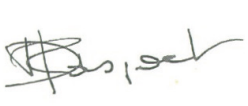
Where does Flanders currently stand? Since 2017, Flanders has been among the so-called 'innovation leaders' in the Regional Innovation Scoreboard (RIS) of the European Union, the only region of Belgium to have achieved this. Within the group of innovation leaders, Flanders is in 46th place, out of 53. The Top 10 is primarily made up of Swiss and Scandinavian regions[1]. As such, the objective of being in the Top 5 is still far from being achieved.

Is Flanders ready for the future? For the fourth Industrial Revolution? This year, the World Economic Forum published the first edition of the 'Readiness for the Future of Production Assessment'. This report analyses how well countries are currently positioned to shape the changing nature of future production, and benefit from it. Although this relates to Belgium as a whole, and no regional data are available, they do give an indication. Belgium is among the '25 leading countries', but with 19th place for 'technology and innovation', and 15th place for 'human capital' as important drivers, there is still a lot of room for improvement. Once again Switzerland, Germany, the Scandinavian countries, but also the Netherlands (4th place for 'technology and innovation') score much better.

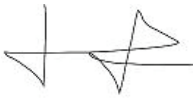
The efforts towards an efficient and targeted research and innovation policy must therefore be sustained, and even enhanced. Knowledge and talent are the drivers of progress and innovation. In order to strengthen and safeguard these for the future, it is vital to keep investing in them and anticipate new needs and developments, in an ever rapidly changing global framework. However, knowledge and talent by themselves are insufficient. The long-term competitiveness and prosperity of a region depends on the extent to which as much knowledge as possible is converted into domestic added value, by developing strong innovation ecosystems. The role of the government must be to create the right conditions, by organising tailored education, by creating a fertile environment for cooperation between different actors, and by providing effective and incentivising legislation and instruments.

As the Advisory Council for Innovation and Enterprise, VARIO wants this Memorandum to help achieve the Flemish ambition of being in the Top 5 of European knowledge regions.

VARIO would like to thank everyone who was consulted during the preparation of this Memorandum; for the time and energy invested, and for their expertise, insights and opinions.



DANIELLE RASPOET



LIEVEN DANNEELS

[1] From 1 to 10: Zurich (CH), Nordwestschweiz (CH), Stockholm (SE), Hovedstaden (DK), Zentralschweiz (CH), Ticino (CH), Ostschweiz (CH), South East (UK), Région Lémanique (CH), Östra Mellansverige (SE)

FIVE BUILDING BLOCKS WITH 25 CORE MESSAGES

FIVE BUILDING BLOCKS WITH 25 CORE MESSAGES

Flanders needs to be ambitious and aim for the Top 5 of innovative European knowledge regions. As the Advisory Council for Innovation and Enterprise, VARIO wants to help achieve this.

VARIO is requesting the next Flemish Government to focus on five building blocks: (I) Governance, (II) Talent, (III) Foundations, (IV) Innovation ecosystem and (V) Environment. VARIO has formulated 25 core messages in this regard.

I. DEVELOP AN EFFICIENT AND TARGETED GOVERNANCE FRAMEWORK

1. Speed up the development of an **overarching long-term vision** on **innovation** and translate this into a **strategy** with specific objectives. Vision and strategy must be future-proof, and therefore go beyond consecutive legislatures.

2. **Innovation** is pre-eminently **transversal** and must be embedded in the DNA of the entire Flemish Government and its administration. This requires an integrated approach. As such, strengthen systems thinking, transversality, coordination and structural cooperation within the Flemish government. The intentions in this regard already exist in Vision 2050, but now need to be consistently put into practice.

3. Continue to focus on research and innovation as a priority. The goal must be to achieve the **1% objective** for publicly funded R&D intensity by the end of the next legislature. The considerable efforts of the outgoing legislature have brought this within reach. Now it is a question of continuing this impetus. In light of the current economic climate, this would equate to another structural effort of at least € 500 million.

Just as important is that these **resources** are **deployed smartly and in the most efficient way** in order to achieve the objectives. The long-term strategy must form the basis for a long-term budget. For research and innovation, which often entail longer-term time frames, it is essential to provide continuity and financial security. A 'stop and go' approach would be detrimental to Flanders' innovative strength, and should be avoided. A gradual increase in resources makes it possible to respond better to the absorptive capacity, and the more meaningful use of these resources.

Public R&D spending needs to act as leverage and mobilise private R&D spending. The positive trend in R&D expenditure by companies, which brings the achievement of the 2% target in sight, needs to continue.

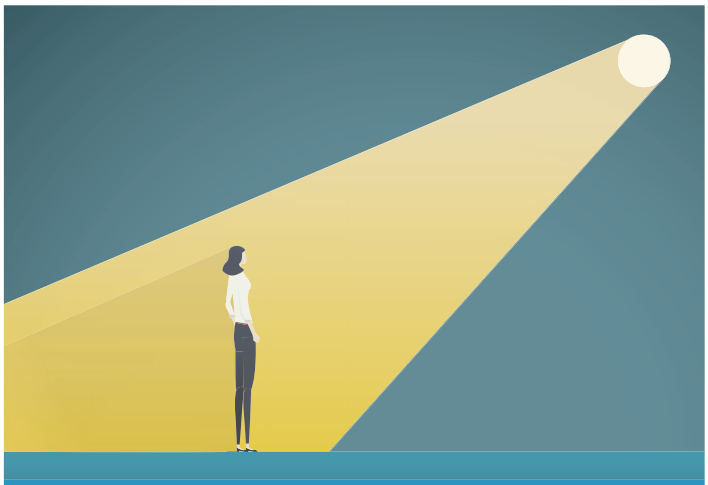
4. Monitor and evaluate the **effectiveness of the support instruments**, individually and as part of a system. Well-functioning instruments need to be retained, less effective instruments need to be improved or phased out.

Funding is a powerful instrument to achieve the stated goals: as such, use output parameters and KPIs intelligently, according to these goals. In addition, continually refine them and keep them up-to-date. Continously benchmark against the best performers in the world.

5. Make decision-making more **evidence-based**. Use the available data as well as indicators more, and more effectively, in decision-making, incorporate periodic evaluations, follow up, enhance, adjust or - if necessary - stop, bearing in mind that some initiatives take time to achieve results.

Substantive knowledge and capacity within the Flemish government are crucial in this respect. Expand this further.

Make optimal use of VARIO through more structural consultation; not only with the Minister in charge, but given the strong policy domain-crossing nature of innovation, also with other ministers, depending on the agenda.



II. DEVELOP TALENT: OUR MOST IMPORTANT 'RESOURCE'

6. In an ever rapidly changing society and labour market, it is high time for a recalibration of Flemish education. Give generic skills, the so-called **'21st century skills'**, an equal footing alongside the necessary technical and specialist knowledge.

Achieve the ambitious target of one in three higher education graduates having completed part of their training or internship abroad, within or outside Europe.

Finally, **practical experience** needs to be given greater importance in the curricula. From the next academic year on, the reformed system of dual learning in secondary education will be definitively rolled out. This is a promising approach for eliminating the shortage of technical profiles. But it needs to go further. As such, also develop a legislative framework for workplace learning in higher education.

7. Increase the efforts to address the shortage of **STEM** graduates and inspire young people to consider STEM training and professions. Set the ambition to achieve one in every three higher education graduates in STEM by 2024. As such, offer **STEM from an integrated vision**, whereby, firstly, STEM is incorporated in all study programmes, and secondly, the humanities and social sciences are incorporated into STEM study programmes. This integrated STEM vision should be the starting point for the preparation of the new STEM action plan.

8. Develop a policy - from primary to higher education - to challenge and encourage cognitively strong young people to **excel** and reach their full potential. Providing programmes of diversification and of excellence may be part of such a policy. A policy of excellence does not need to be at the detriment of a policy of inclusion.

9. Keep talent up-to-date by encouraging **lifelong learning** more effectively. Be ambitious in this regard, and bring forward the target date for tripling the number of lifelong learners from 2030 to 2024. The important role that university colleges and universities can play in this respect is not yet sufficiently enumerated. Stimulate this by financing the 'Master's-after-Master's' courses which are compatible with the Flemish long-term vision on R&D&I. Universities and university colleges also need to develop their own vision on lifelong learning and provide more flexible and shorter pathways, in combination with distance learning using new technologies. Encourage enterprises to enable lifelong learning for their employees.

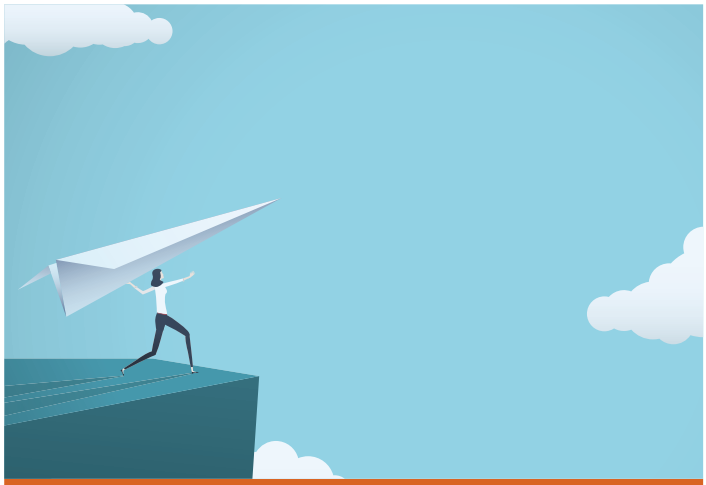
10. Encourage the implementation of **innovative forms of education** and in particular, embrace the most recent digital techniques, with a continuous focus on the quality of education. The government needs to be a stronger partner in this inexorable process of digitisation. Invest in teachers as well as in techniques, since teachers are still the key to excellent education. Do this at all levels of education - from basic to higher - and in all forms of lifelong learning.

11. Give priority to the integrated strategy for attracting and retaining **international talent**, as recommended by VARIO in its Advisory Report 'Attracting and retaining top international talent' (December 2017). The start of a new Flemish Government is the ideal moment in this respect. The strategy focuses on admissions policy, strong branding, target group policy, language policy, monitoring and retention policy via smart KPIs.

12. Encourage intersectoral **mobility** between knowledge institutions, enterprises, the service sector, the non-profit sector and government. As such, eliminate the current bottlenecks, including the different employee statutes, the fact that a temporary break in an academic career is not (or negatively) rewarded, but also the perception of conflicts of interest. Also stimulate mobility between Flemish knowledge institutions.

In education, focus on cross-over programmes with industry, government, and the cultural and social sectors. At all levels of education, there also need to be sufficient opportunities for people from the business world to teach, both on an occasional and more structural basis.

13. Closely monitor the effectiveness of existing initiatives to stimulate **ambitious entrepreneurship** and focus on the ones which really work. Policy domain-crossing coordination and alignment of the various initiatives should ensure that they are mutually reinforcing.



III. STRENGTHEN THE FOUNDATIONS: KNOWLEDGE INSTITUTIONS AND ENTERPRISES

14. The question arises as to whether the **Flemish universities and university colleges** are (financially) sufficiently **prepared** to meet the needs and requirements in the field of education, research, infrastructure, etc., and for the international competition. However, all funding mechanisms are relatively opaque and too complex to provide an unambiguous answer in this regard. Therefore, look at the funding system of higher education in its entirety - first and second budgetary flow, and their complementarity and/or mutual reinforcement - on the basis of recent evaluations. This needs to be complemented by data on the third and fourth budgetary flow from the universities and university colleges themselves. Only through such transparency we can determine whether any adjustment is necessary in function of their international competitiveness.

In any funding model, excellence, cooperation, interdisciplinarity and internationalisation must be paramount.

15. The Flemish economy has a robust, highly export-oriented industrial base, with a large number of SMEs ranging from sole traders to large companies, and which are very diverse in terms of their level of innovation. Continue to **support** these **companies** in their necessary and continuous transformation.

Particularly, innovative high-growth companies, young companies, but also more mature companies in a new growth phase, are crucial for job creation, and for a vibrant and dynamic economy. In its Advisory Report 'Innovative high-growth firms with impact' (November 2018), VARIO proposes an integrated strategy to increase the number of these companies. Roll out this strategy and focus on increasing the number of ambitious entrepreneurs, on developing effective entrepreneurial ecosystems, on creating a generally stimulating environment, and on strengthening monitoring instruments.

IV. MAKE THE INNOVATION ECOSYSTEM A FERTILE SOIL FOR VALUE CREATION

16. **State-of-the-art research infrastructures** are vital for both the science and innovation base. Research infrastructures are also crucial for maintaining local top talent, and attracting foreign top talent. Given the expected increase of demand within the channel for international research infrastructures (IRI) of the Fund for Scientific Research (FWO), there is an urgent need for a Flemish roadmap for research infrastructure with an investment plan, drawn up with a strategic long-term perspective. Work on this together with the relevant actors.

17. The Flemish innovation ecosystem must be organised as efficiently as possible. **Sharpen the objectives and the thematic focus of the various actors in the system** to a sufficient extent, so that undesirable overlap and competition are avoided. Accordingly, look at the innovation ecosystem as a whole in addition to the justified evaluations and monitoring of the individual actors and the standard KPIs.

Also make sure that SOCs and clusters remain at the service of the economic and innovative web in Flanders and that they do not evolve into 'companies' that compete with their own ecosystem.

Five years after the integration of the two-cycle higher education programmes, VARIO believes that the time is ripe for a first evaluation of the impact of the academisation process. One point for attention in this respect is retaining the individuality of the training profiles. In addition, there must remain sufficient complementarity and distinction in the role of the 'new' university colleges and 'new' universities.

18. **Cooperation between the Flemish R&D&I actors** (universities, university colleges, SOCs, clusters and enterprises, etc.) is **crucial to achieving value creation**. VLAIO has an important role to play in bringing innovative companies that do not yet cooperate, and non-innovative companies, into the innovation pool - via the 'Team Bedrijfstrajecten' (Business Pathways Team) and the VLAIO Network. The cluster pacts also focus on this area. However, VARIO still sees a lot of opportunity, not only for the clusters, but also for the SOCs, to identify companies from these two groups and initiate cooperation.

Combining forces and creating added value through working together also requires developing a common long-term vision regarding research, in interaction between companies and knowledge institutions, while respecting the individuality and role of each of these. Go back to the original concept of the regular Strategic Basic Research (SBO) channel, in which the business world is more actively involved in project creation and valorisation. This would also avoid duplication via cSBOs. Also examine whether ICON can be opened up more broadly to other actors.

Continue work on effective mechanisms for cooperation between SOCs and the clusters themselves. The new policy initiative 'Moonshots' appears to be a good start in this respect. Smart KPIs for SOCs and clusters are an excellent way of enhancing cooperation incentives.

Also remove barriers and generate incentives for collaboration between individual researchers. At the FWO, this could be done by making larger fundamental research projects possible with multiple PIs and a larger budget, as is currently the case with SBO projects.

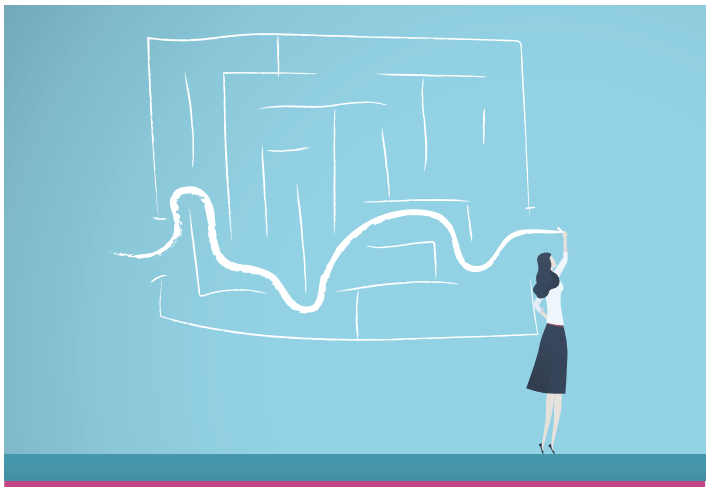
19. Take steps, together with the institutions involved, to remove the remaining barriers to interdisciplinary research and **encourage interdisciplinarity**, for example through smart KPIs/output parameters or through appropriate selection procedures. Indeed, most progress is made when disciplines intersect.

20. Throughout the support instruments, there are indications of a generally risk-averse and conservative selection and evaluation process. Ask the FWO to give more scope to bold breakthrough projects at the initiative of the researcher. **High risk-high gain applications** should be granted more often. **Give more trust** to companies and consequently build in more flexibility in the VLAIO tools. Although the numerical valorisation requirements have been phased out, the new approach has not yet sufficiently filtered down to the day-to-day operation of VLAIO, nor been given too much consideration when evaluating projects.

21. For Flemish companies and knowledge institutions, engaging in international networks is a must in order to succeed and grow in a global economy. Go along with this **international dimension** and adapt the terms of the policy instruments accordingly, at all levels. Stimulate internationalisation also through output parameters and KPIs.

During the next legislature, the Horizon Europe programme will be rolled out. If Flanders wants to take advantage of this and other programmes to the fullest, it will need to prepare itself as much as possible and act more proactively before the implementation phases. The threshold to European funding is often still too high for knowledge institutions, but especially for companies and above all SMEs. As such, strengthen the National Contact Points (NCPs) for (proactively) informing and supporting (potential) applicants. Flanders also needs to focus more on the ESA and the European space programme, as well as on the European Defence Fund.

International developments require a broader perspective than Europe alone. Give more attention to partners from outside Europe.



V. CREATE A FAVOURABLE ENVIRONMENT FOR INNOVATION

22. A good **policy mix**, with a balance between tax measures and subsidies, is advisable. In this respect, it is crucial that the federal government maintains the three current, effective tax measures for R&D.

23. This policy mix also needs to include non-financial instruments. Make **regulation** stable, transparent, straightforward and easy to enforce and flexible, so that it does not hinder **innovation**, but **stimulates** it. Experiment with limited-regulation or innovation-enhancing environments (e.g. testing sites for autonomous vehicles) to accelerate innovation pathways, ensuring that ethical aspects are respected.

24. **Minimise the administrative burden** and work towards more and better interaction with enterprises and citizens through e-government. Make access to the instruments sufficiently easy for companies. The recent expansion of the VLAIO front office with the 'Team Bedrijfstrajecten' (Business Pathways Team) appears to be a step in the right direction, as is the recently launched digital counter for entrepreneurs 'VlaanderenOnderneemt.be'. However, it is still too early to see the fruits of these initiatives.

25. Also **play a more active role in innovation**. This can be achieved by a good policy of innovative procurement. The Innovative Programme for Innovative Procurement, which is internationally recognised as best practice, is a good start in this regard. Act as first buyer even more often. With the government as an important reference customer, this offers Flemish entrepreneurs credibility in gaining the trust of other large potential customers. Also act as a responsible payer. This is crucial for the financial capacity of companies.

I.
DEVELOP AN EFFICIENT AND TARGETED GOVERNANCE FRAMEWORK

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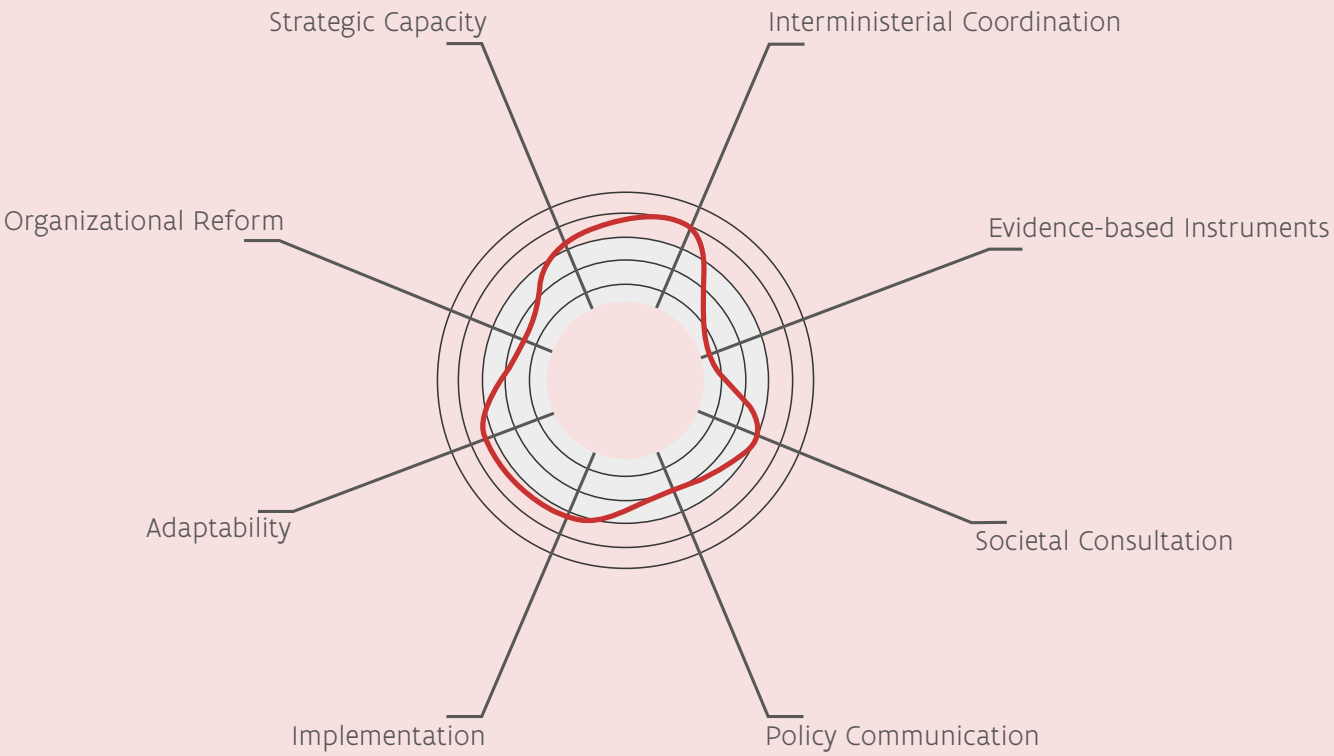
The Sustainable Governance Indicators project aims to support the governments of OECD and EU countries in their efforts to achieve efficient and targeted governance. According to the most recent report, Belgium ranks 30th out of 41 OECD countries[2]. Areas that were highlighted include the fact that the organisation of the Belgian government makes long-term planning very difficult. Belgium has a particularly weak score for evidence-based policy (Figure 1). As such, it is the worst student in the class. The Belgian government is described in the report as sailing a blind course, at best adjusting when things go wrong. Although there are no separate scores for Flanders, the areas for improvement largely apply here too.

Figure 1: Scores of the Belgian government (red line) for various aspects of executive capacity compared to the EU average (in grey)



Source: Bertelmanns Stiftung 2018.

[2] Bertelsmann Stiftung 2018, http://www.sgi-network.org/2018/Governance/Executive_Capacity

1. BASED ON AN OVERARCHING LONG-TERM STRATEGIC VISION

In the VRWI Foresight 2025, a long-term vision and stable policy on the part of the government clearly stood out as the most critical factors for achieving an innovative knowledge-based society.

The fact that Flemish knowledge centres are currently among the best in the world is largely due to the foresight and the courage of the very first autonomous Flemish Government in 1981 to make choices (Third Industrial Revolution Flanders (DIRV)), and of the subsequent governments that continued this policy and investments. A sustained policy in which the results and effects are also monitored is therefore worthwhile.

With its long-term strategy 'Vision 2050', the current Flemish Government is aiming for a strong, social, open, resilient and international Flanders that creates prosperity and well-being in a smart, innovative and sustainable way, where everyone plays a role. However, 'Vision 2050' and the earlier future project 'ViA' (Flanders in Action) have not (yet) generated the same impact and the same dynamics as the earlier DIRV action.

> Consequently, speed up the development of an overarching long-term vision on innovation and translate this into a strategy with specific objectives. Vision and strategy must be future-proof, and therefore go beyond consecutive legislatures. This long-term strategy must form the basis for a long-term budget for science and innovation. An overarching long-term vision also anticipates the social impact of innovations, such as a changing labour market.

More than other European countries and regions, Flanders has a detrimental risk-averse attitude, in comparison with the United States, China and emerging economies. Flanders is also too self centred.

> If we want to fulfil our ambition of being among the global leaders, we cannot rest on our laurels, and we must not let up in our drive for excellence. We need to be bolder, more ambitious and seize opportunities on all fronts. Especially since we are a small region, the perspective needs to be about engaging globally. Achieving long-term goals requires an innovative concept of innovation and the government apparatus itself, and will require changes in mentality, (also) within the Flemish government.

2. WHICH STIMULATES TRANSVERSAL THINKING AND ACTIONS

The structure and processes of the current administrative apparatus, and the Flemish administration, are still very much compartmentalised. The various entities of the Flemish government still work far too much within the boundaries of their own policy domain. Cooperation with other policy domains is not sufficiently encouraged. There is also a lack of coordination capacity and structures, both at the horizontal level, at the level of policy domains and at the vertical level (coordination with the local, provincial, federal, European and other international levels).

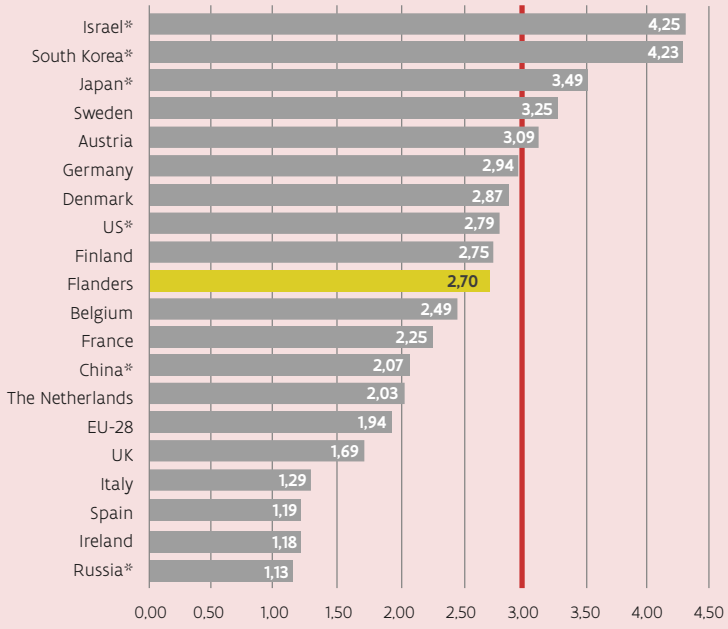
Research and innovation are increasingly taking on a policy domain-crossing character. In the current legislature, a step in the right direction has already been taken by bringing the Economy, Science and Innovation (EWI) - policy areas with significant alignment content-wise - under one minister, as recommended at the time in the VRWI Memorandum 2014-2019. VARIO wants to go one step further.

> Innovation is pre-eminently transversal and must be embedded in the DNA of the entire Flemish Government and its administration. As such, VARIO will call on the new Flemish Government to consistently implement the concept of the integrated approach of Vision 2050, and explicitly include it in the coalition agreement. We refer to the example of the Finnish government programme that works on a number of long-term projects that are domain-crossing and for which two or more ministers are responsible[3].
>
> This means more focus on systems thinking, transversality, coordination, integration and structural cooperation. Systems thinking needs to be put into practice by encouraging transversal action at the level of government and administration. It does not mean that there is no longer any need for a division of tasks and responsibilities within the policy, but that a new policy domain-crossing focus is needed. The various policy services work together in this respect, each based on their own expertise. VARIO suggests:
>
> - A strengthened role for the Minister-President as the person responsible for initiating and following up transversal projects and themes;
> - The appointment of intendants for major transversal projects that have a horizontal, connecting function within the Flemish (and, where applicable, local, federal, European and international) administration[4]. The current transition managers are a good initial step in this regard, but they have too little clout;

[3] 'Finland, a land of solutions. Mid-term review. Government Action Plan 2017–2019'. Government Publications 7/2017
[4] See also VARIO Advisory Report 'Internationaal toptalent aantrekken en verankeren' (Attracting and retaining top international talent) (December 2017)

- Formulating objectives for leading officials that not only are specific to their discipline but also more explicitly policy domain-crossing;
- Ensuring effective coordination between and within the different policy domains. The functioning of existing consultation structures needs to be evaluated and - where necessary - adapted;
- The pooling of resources (allocating budgets and deploying staff) for the roll-out of joint pathways.

Figure 2 International positioning of Flanders for R&D intensity (R&D expenditure as a % of GDP), based on figures for 2016, in the case of countries with * for 2015



Source: 3% light nota 2018

3. WITH SUFFICIENT AND OPTIMALLY-ALLOCATED FINANCIAL RESOURCES

An important requirement in the strategic vision is to decisively focus on research, development and innovation (R&D&I). In order to make Flanders a leading region in a worldwide innovative knowledge-based society, the Flemish government, the Flemish business world and the knowledge institutions committed themselves in the Innovation Pact in 2003 to endorse the Lisbon Strategy's objective of spending 3% of GDP (gross domestic product) on research and development (R&D) by 2010. The Flemish government needed to account for 1% of this, with enterprises generating the remaining 2%. Subsequent governments renewed this commitment - although the target was moved to 2020 in line with the EU2020 Strategy - and have deployed resources to the best of their ability.

During the outgoing legislature, R&D&I became the top priority, alongside healthcare. This has been reflected in an ambitious growth path for 'O&O en maatregelen bedrijfsleven' (R&D and business measures), with a total of € 500 million of recurrent additional resources at the end of the legislature. The final boost of € 280 million will be implemented in 2019. Less well-known are also one-off 'investeringskredieten voor O&O en het bedrijfsleven' (investment credits for R&D and business), which have totalled € 425 million (Table 1). By way of comparison, the total budget for EWI (Economy, Science and Innovation) is currently € 2.05 billion. The amount stated here only includes the R&D resources (25% of the block grants of higher education institutions) from the Education budget, in contrast to the 2018 EWI Speurgids (Budget browser), which also includes the resources for E&T (Education and Training, 75% of the block grants).

The most recent 3% 'light' note[5] shows that the result of these sustained efforts is that the R&D-intensity in Flanders – 2.70% in 2016 – has risen to well above the EU average of 1.94% (Figure 2). Within Europe, the frontrunners Sweden, Austria, Germany, Denmark, and Finland are ahead of Flanders.

As always, enterprises account for the lion's share of total R&D expenditure, as can be seen in the above-mentioned note; 69% of total R&D expenditure was accounted for by enterprises in 2016.

We can conclude from the 2018 EWI Speurgids (Budget browser) that, based on the initial budget figures of 2018 and estimates of federal and European contributions, the public R&D efforts in Flanders can be estimated at 0.81% of GDP (Figure 3).

[5] Debackere, K., Delanote, K., Hoskens, M., Verheyden, L., Viaene, P. (2018). Totale O&O-intensiteit in Vlaanderen 2006-2016 "3% light nota" (Total R&D intensity in Flanders 2006-2016 "3% light note"). ECOOM & EWI.

The estimated R&D intensity will evolve towards 0.88% if the announced boost of € 280 million materialises in 2019 and goes entirely to R&D (light blue line in Figure 3). Although this brings us closer, this significant boost is still insufficient to reach the 1% target by 2020 (green line in Figure 3).

Continue to focus on research and innovation as a priority. The goal must be to achieve the 1% objective for public R&D expenditure by the end of the next legislature. The major efforts of the outgoing legislature have brought this within reach. Now it is a question of continuing this impetus. In light of the current economic climate, this would equate to another structural effort of at least € 500 million.

Public R&D spending needs to act as leverage and mobilise private R&D spending. The positive trend in R&D expenditure by companies, which brings the achievement of the 2% target in sight (1.89% in 2015), needs to continue.

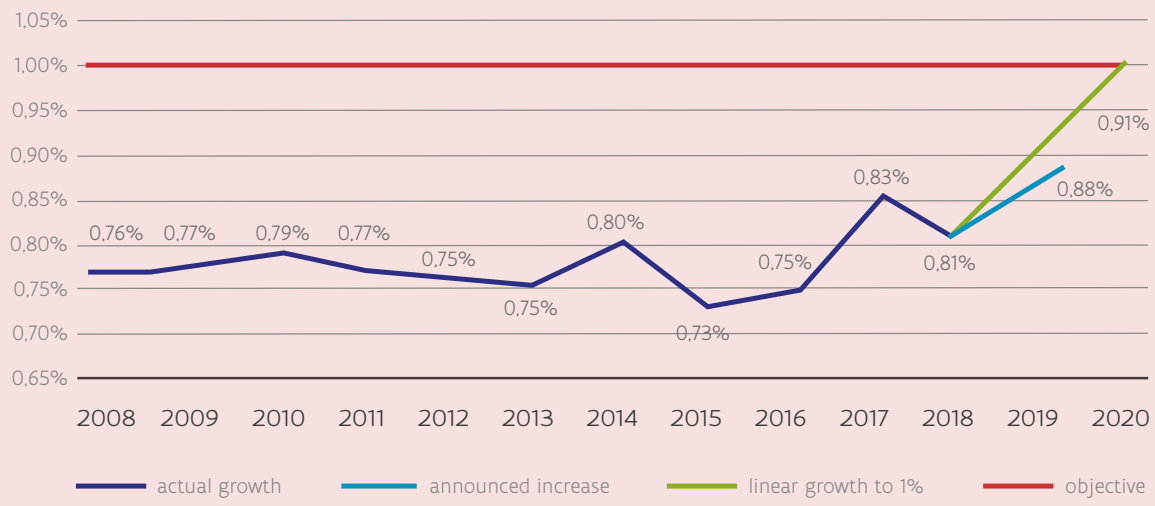
Achieving the 1% objective is crucial if we want to shape the knowledge economy. However, we should not forget that this objective is a pure input measure that only indicates how much we need to invest in research and development, but it says nothing about the return we can expect from these funds.

Achieving the objective should not be a goal in itself or a numerical obsession, but should always be seen in the broader context of a robust innovation policy. Research and innovation are instruments. Consequently, just as important is that financial resources are deployed smartly and in the most efficient way in order to achieve the objectives. The question is how the resources from the growth path can be optimised, in order to have positive effects in the field. This in turn requires a clear vision of what specific effects are targeted. Therefore, the long-term strategy must form the basis for a long-term budget. Ad hoc funding programmes and ad hoc financial injections into R&D&I are sub-optimal.

Table 1 shows that the recurrent growth path has been highly volatile: a boost of € 20 million in 2015, followed by a boost of € 5 million in 2016. An additional € 195 million was deployed in 2017, alternated with no additional resources in 2018, before ending with a major boost of € 280 million in 2019.

A more gradual distribution of the additional resources over the years is preferable to the current erratic approach, in which significant boosts are alternated with a status quo. Especially for science and innovation, which often entail longer-term time frames, it is essential to provide continuity and financial security. A 'stop and go' approach would be detrimental to Flanders' innovative strength, and should be avoided. In addition, a gradual increase could allow to better respond to the absorptive capacity and to make more meaningful use of resources.

Figure 3 Evolution of government budget outlays for R&D in Flanders as a % of GDP and growth path to the 1% objective



Source: EWI Speurgids (Budget browser) 2018.

Table 1 Overview of the growth path and investment credits for R&D&I of the legislature (2015-2019)

	2015	2016	2017	2018	2019
Recurring policy credits 2015-2019 (in millions of euros)					
Total	20	25	220	220	500
Annual boosts	+20	+5	+195	+0	+280
Investment credits 2015-2019 (in millions of euros)					
		90	100	115	120

A lot of additional resources (€ 500 million) were recurrently allocated to various channels in a short space of time. By way of comparison, the total EWI resources at present amount to € 2.05 billion (see above). It is a considerable challenge to deploy such significant additional resources effectively in such a short space of time.

VARIO has made a brief analysis of the growth path. It shows that, on the one hand, the choice was made to strengthen and expand the regular channels: in total around € 300 million (or 60%) of the € 500 million of additional recurrent resources.

Almost one quarter (€ 123.30 million) will go to bolstering fundamental research, the FWO (Fund for Scientific Research - Flanders) and BOF (Special Research Fund) combined, equating to an increase of around 25% compared to the 2016 budget. The lion's share of this, € 78.30 million, is for the FWO, a recurrent increase of around 25% compared to 2016. The BOF will receive an additional € 45 million, a recurrent increase of 28% compared to the 2016 budget.

A considerable share of the additional recurrent resources, totalling € 62.70 million (13%) will go to the SOCs (Strategic Research Centres) Imec, VIB and Flanders Make. Imec and VIB will see their recurrent subsidy grow by almost 40%. For Flanders Make, the total growth in recurrent resources is 109%.

The IOF (Industrial Research Fund) will see its recurrent resources (€ 27.14 million in 2016) almost double with the boost of € 25 million. This means that the growth that has long been demanded will materialise. The additional resources for the IOF represent 5% of the growth path.

A recurrent € 10 million (2%) will go to the Department of Education and Training to strengthen the resources for PWO (Practice-oriented Scientific Research). This represents an increase of almost 60% compared to 2016.

The 'O&O-bedrijfsprojecten' (R&D business projects) will receive an additional and recurrent € 50 million. This is partly related to the amendment of the R&D decree, which now also provides support for the later stages in the innovation trajectory, since this is now permitted by Europe. In addition, another € 15 million and € 10 million respectively will go to the projects COOCKs (Collective Research & Development and Collective Knowledge Dissemination/-transfer, former VIS, Flemish Innovation Partnership) and to the innovation fellowships.

On the other hand, around € 150 million (about 30%) will go to new initiatives and policy accents of the current minister. € 80 million will go to cluster policy and the so-called 'Moonshots', € 30 million to the new AI programme (Artificial Intelligence[6]), € 15 million to cyber security and € 15 million to personalised medicine. In addition, smaller amounts have been earmarked for the two test projects ('City of Things' and Industry 4.0), each with € 4 million, and € 5 million for the PIO (Programme for Innovative Procurement).

Finally, a smaller tranche, around € 33 million or around 7% of the resources from the growth path, will go to economic support, such as promoting entrepreneurship. There remains a small residual tranche for various channels, which is not covered in more detail here.

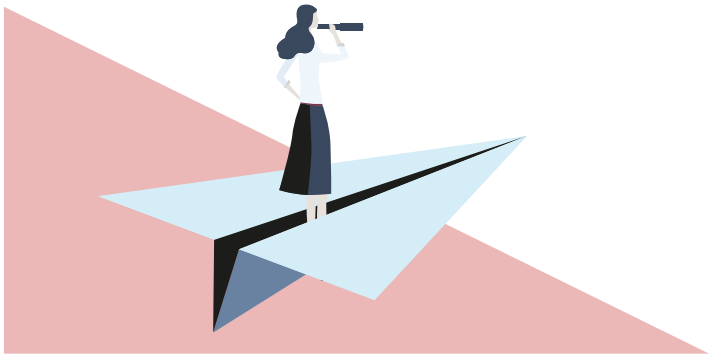
[6] VARIO Advisory Report 'Vlaamse beleidsagenda artificiële intelligentie' (Flemish Policy Agenda Artificial Intelligence) (in preparation)

Many of the above-mentioned actors/channels will therefore see significant increases to their budgets. It is important that the (annual) additional amounts are not only deployed strategically, but also realistically, and can be taken up. As such, VARIO reiterates its call for a long-term, legislature-transcending strategy on innovation as a guideline for the allocation of financial support.

It will be important to closely monitor the new resources and how they are used, and to adapt where necessary. The Flemish Government will need to have the courage, to reallocate the resources, if required or in order to be more effective.

The 'investment credits for R&D and business', totalling € 425 million over the course of the legislature, can only be spent once - in contrast to the resources from the recurrent growth path. Of this, € 30 million was invested in the supercomputer, € 12 million in four major infrastructures for research and development, € 5 million in the Inter-University Centre for proton therapy, and € 4 million in the context of ESFRI. It is striking that the lion's share of the funds were used to strengthen regular support channels, such as the SME portfolio and the Strategic Transformation Support (STS). As such, this strengthening is not structurally guaranteed for the future.

Also deploying one-off investment resources should preferably be done in accordance with a long-term strategy. This is the only way these resources can have a sustainable effect in the long term.



4. WITH A TARGETED AND EFFECTIVE SUPPORT FRAMEWORK

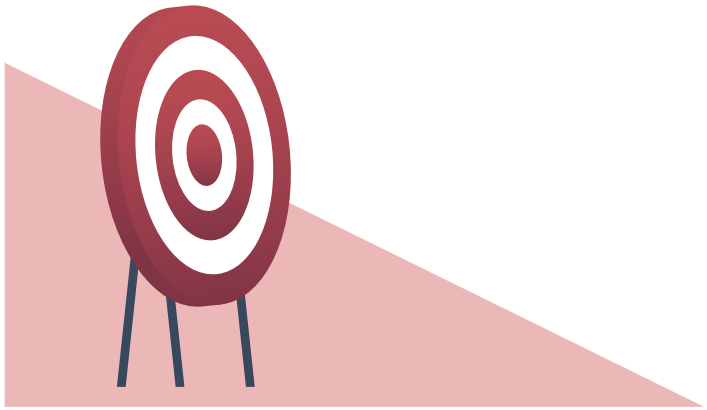
In the Coalition Agreement 2014-2019, the Flemish Government announced a targeted cluster policy that (translation) *"is business-driven, corresponds with the strengths of Flemish industry and knowledge institutions, is focused on the marketing of innovation, and could make the difference internationally for Flanders"*. With this policy, the Flemish Government intends to unlock untapped economic potential and increase the competitiveness of Flemish companies through sustainable partnerships. Active involvement and management by the companies is the starting point. Clusters focus on eliminating common hurdles and on untapped shared business opportunities. They make the link between market-driven and demand-driven knowledge building on the one hand, and marketing and implementation of knowledge on the other. The focus of the renewed cluster policy is on a limited number of spearhead clusters, namely Catalisti, Flanders' Food, Flux 50, SIM, VIL and more recently the blue cluster. The spearhead clusters develop and implement an ambitious long-term strategy and competitiveness programme in a strategic domain for Flanders, in a partnership between companies, knowledge institutions and government (triple helix). The renewed cluster policy also includes innovative business networks (IBNs). These are smaller and are intended to create a dynamic within a group of companies. There are currently 20 IBNs.

Also in implementation of the Coalition Agreement 2014-2019, the Flemish Government has taken important steps towards rationalising and simplifying public support, and making it more accessible. The merger in which the IWT (Flemish Agency for Innovation through Science and Technology) and AO (Agency for Enterprise) were consolidated into VLAIO (Flemish Agency for Innovation and Entrepreneurship), and the Hercules Foundation, together with a number of IWT instruments, were added to the FWO as a 'new FWO', lays the foundation for a two-part, target-

group-oriented structure with VLAIO as a one-stop shop for entrepreneurs and the renewed FWO as the one-stop shop for knowledge institutions.

Since then, the FWO has implemented various reforms. For example, the fundamental research and the Strategic Basic Research (SB)[7] PhD fellowships were aligned in a process-oriented manner, with a similar timeline and a similar evaluation and selection procedure, while retaining the unique features of the two systems in terms of content. The existing programmes for international research infrastructure, Big Science and ESFRI (European Strategy Forum on Research Infrastructures), were also consolidated in one integrated regulatory decree (IRI, International Research Infrastructure). The evaluation procedures for the FWO fellowships and fundamental projects were revamped. Both on the financing and the application side, work was done to increase the success rates. The audit will show where there is room for improvement.

Changes have also been made at VLAIO. The SME portfolio has been radically simplified. The different support instruments within VLAIO have been further streamlined and a new front office has been created. By bringing the five provincial innovation centres together in the 'Team Bedrijfstrajecten' (Business Pathways Team), a single point of contact for entrepreneurs regarding advice, support and subsidies has been operational since April 2018. VLAIO has also launched an overarching digital platform on which entrepreneurs can centrally follow up their applications. The support modalities within the so-called R&D decree were divided into three parts with a clear, substantive focus: 1) support to companies for research and development with a knowledge-intensive character, 2) support to companies for development and innovation and 3) support to companies for research projects with a view to carrying out doctoral or postdoctoral research in collaboration with research organisations.



The new initiatives and reforms are still too recent to draw clear conclusions regarding their impact. In any case, the first signs are positive. More research is needed to ascertain whether, in the long run, the instruments and programmes are better aligned and have evolved towards a truly integrated support framework as recommended by the VRWI in its advisory report on the restructuring of the EWI landscape[8].

At any rate, it is advisable to continue monitoring and evaluating the effectiveness of the support instruments, both individually and as part of a system. Are the instruments in their existing form, with the existing 'modalities' and the existing financial 'distribution', sufficient to continue to adequately support the various Flemish actors in an increasingly globalised world? Do they effectively achieve the objectives that the policy aims to achieve at the time? Well-functioning instruments need to be retained, less effective instruments need to be improved or phased out.

Funding is a powerful instrument to achieve the stated goals: as such, use output parameters and KPIs (Key Performance Indicators) intelligently, according to these goals. For example, if excellence is crucial, the tools need to reflect 'top performance', if more cooperation is the goal, they need to measure cooperation, etc. Depending on the goal, the weighting given to each of the parameters and KPIs needs to be examined.

The output parameters and KPIs need to be complementary; the setting of one KPI should not hinder the achievement of another. In addition, more emphasis should be placed on quality than quantity.

This is why it is important to continually refine and update the KPIs on the basis of the ever improving data analysis (e.g. bibliometry) and monitoring systems.

Continuously benchmark against the best performers in the world.

[7] The former IWT grants Strategic Basic Research
[8] VRWI Advisory Report 199A 'Nieuwe AOI en vernieuwd FWO' (New AOI and renewed FWO) (27 November 2014)

5.
WHICH IS EVIDENCE-BASED

A good policy is a substantiated policy, based on empirical data and on valid and reliable evaluation and control mechanisms. STI indicators (science, technology and innovation) have therefore become an essential part of innovation policy, both at the macro level (aspects of the EWI policy, in an international context) and at the micro level (individual institution). Data is collected by various bodies, including ECOOM (Expertise Centre R&D Monitoring), the EWI department, STORE (Policy Research Centre Entrepeneurship & Regional Economies) and Statistiek Vlaanderen.

VARIO asks the Flemish Government (1) to make even better use of the available data and advisory reports in its decision-making, (2) to incorporate periodic evaluations and (3) to follow up, enhance, adjust or, if necessary, stop its policy accordingly, taking into account that some initiatives take time to achieve results. VARIO calls for an open data platform where the necessary data for monitoring and evaluation are available to policy makers.

An important condition for a substantiated policy is that the government administration itself has sufficient substantive expertise in this area. In-house knowledge and capacity building are crucial for correctly interpreting the data and evaluation reports provided by external parties, and translating them into policy. This needs to be done in complete independence and transparency.

In addition, advisory councils (for the EWI policy domain, this is VARIO and SERV) not only contribute to a substantiated policy, but also monitor the long-term vision over consecutive legislatures. VARIO appreciates the fact that the current Minister of Economy and Innovation recognises VARIO's role as an advisory council.

In this context, VARIO asks:

- To organise the consultation between the advisory council and the responsible minister even more structurally, at the beginning of each term of office, in order to discuss the work programme of the advisory council and the policy agenda of the minister, and then during every working year. As such, the advisory council endorses the relevant SERV recommendations[9]. On the one hand, VARIO can then indicate which topics it wants to tackle proactively and how this can filter through to the policy, and on the other hand, the Minister can indicate which priority policy dossiers she/he wants to receive advice on. This will better facilitate and encourage consultation at an early stage of decision-making (draft notes, green and white papers);
- Due to the strong policy domain-crossing character of innovation, VARIO sees this consultation more broadly, and it can be extended to other ministers according to the agenda;
- Furthermore, VARIO also calls for continued attention to the response in the consultations between the Minister and his/her advisory council, not only for advisory reports on request, but above all those produced on VARIO's own initiative.

[9] SERV Advisory Report 'Voorontwerp bestuursdecreet' (Preliminary draft administrative decree) (6 February 2017)

II.
DEVELOP TALENT: OUR MOST IMPORTANT 'RESOURCE'

II. DEVELOP TALENT: OUR MOST IMPORTANT 'RESOURCE'

A dynamic science and innovation system rests on people. People are the backbone of our knowledge-based economy. Flanders is already evolving into a 'bottleneck economy', with an ever-increasing demand for talent, in a world where competition for talent is only growing stronger. Talent shortages cause serious damage to the economy. The availability of sufficient and sufficiently-skilled workers is therefore crucial.

Most of our 18-year-olds will later end up in a job which does not exist yet, in companies that have yet to be founded. In this context, it is not enough to give talent a good basic education. In addition, the right framework also needs to be provided to keep that talent up-to-date.

6. GEAR TALENT TO THE LABOUR MARKET VIA 21ST CENTURY SKILLS AND PRACTICAL EXPERIENCE

The speed with which society and business are evolving, and with which innovative developments are finding their way to the working environment, means that not only does the technical content of education becomes outdated more quickly, but it also makes it difficult to gear education to the needs of the business community. This requires a clear vision and a distinction between short and long-term needs, taking into account (expected) social challenges and international developments.

Skills that are becoming increasingly essential are working together; interacting with people; critical, creative and problem-solving thinking; working independently and gaining new knowledge independently; clear and persuasive communication; an enterprising outlook, etc. The increasing use of digital technology, broadly defined, also requires the skills to handle this technology safely and efficiently. Technology and ICT skills are particularly important in reducing the gap between technological literacy and illiteracy.

> In an ever rapidly changing society and labour market, it is high time for a recalibration of Flemish education. This will require new educational strategies that not only teach content, but above all a continuous learning attitude that goes beyond acquiring a skill in a given area[10]. Give generic skills, the so-called '21st century skills', an equal footing alongside the necessary technical and specialist knowledge, to allow graduates to adapt faster and more effectively.

Openness to the world is crucial in this respect, which is why we need to anchor ourselves as much as possible in global networks. In higher education, international experience helps enhance the '21st century skills'. The well-known Erasmus+ programme fits in that framework. This year, around 10,000 Flemish students participated in Erasmus+.

> VARIO supports the Flemish Government's ambitious goal of getting up to 30,000 students a year to participate in Erasmus+ from 2021. This objective is part of the 'Brains on the move' action plan (2013), which aims to achieve the ambitious target of one in three higher education graduates having completed part of their training or internship abroad, within or outside Europe, by 2020. The ongoing evaluation of the action plan will show to what extent the next Flemish Government will have to step up a gear.

Workplace learning also offers various advantages, and helps solve some of the existing problems. Training institutions keep close ties with the business world, and training courses and the

[10] For example, see Dr. Shirley Malcom, director AAAS, in: www.cxotalk.com/episode/ai-impact-jobs-training

people attending them are better attuned to (needs in) the labour market[11]. Moreover, learners often have access to the latest technologies and infrastructure.

> Practical experience needs to be given greater importance in the curricula. VARIO advocates incorporating more practical work and internships in higher education - including more workplace learning, which should also be given more emphasis in training courses. As such, a legislative framework for workplace learning in higher education needs to be set up in the first instance, based on best practice from abroad. Workplace learning can be promoted in its various forms by the government for educational institutions, employers and employees alike.

As regards the equivalent in vocational and technical secondary education, so-called dual learning, the reform will officially start in September 2019 following a three-year pilot project. For some of the companies involved, this project has already proven to be a success, and they are asking to continue and expand dual learning. It is still too early to assess to what extent the Flemish Government is succeeding in making dual learning a positive and full-fledged alternative to a conventional school career, such as in Germany and Switzerland, and whether dual learning is also good for the long-term employment opportunities of students.

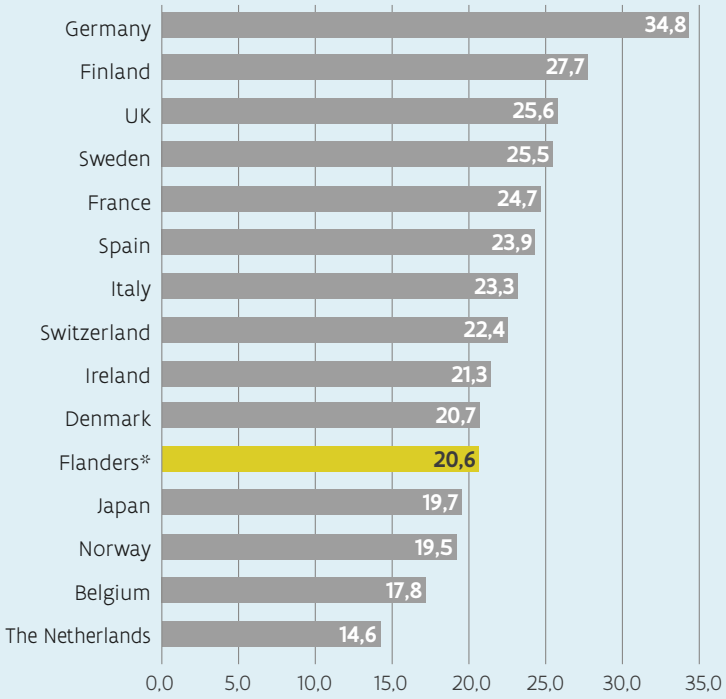
> In any case, VARIO considers dual learning a promising avenue to pursue, thanks to its potential to help eliminate the shortage of technical profiles.

7. STEM AND BEYOND STEM

There is no doubt that, these days, STEM (Science, Technology, Engineering and Mathematics) forms the basis for the fastest growing job categories. The Future of Jobs Report by the World Economic Forum (2018) shows that the next four to five years will witness the biggest demand for data-related specialists, together with specialists in the field of AI and machine learning. Existing jobs will not simply disappear, but the various tasks within a job will change. In contrast to previous technological/industrial revolutions, not only will this have an impact on low-skilled jobs, but also on highly-skilled jobs.

Flanders is taking steps in the right direction thanks to initiatives such as the STEM platform, the STEM action plan and the further strengthening of STEM in the new attainment targets for secondary education. Despite all this, we are still lagging far behind compared to other industrialised countries. In Flanders, only one in five higher education graduates comes from a STEM discipline, in Germany this is more than one in three (Figure 4).

FIGURE 4 Share of STEM (in %) in relation to all higher education graduates in Flanders, compared internationally (graduated in 2014).



*: Flemish Community

Source: Vlaams Indicatorenboek 2017

> Flanders needs to make its ambition more compelling, and the goal should be that by 2024 one in three higher education graduates studied STEM.
>
> In the short term, VARIO is asking for a review of the mechanism for financing university colleges, which is disadvantageous for STEM courses, and which therefore hampers the influx of students in those courses[12].
>
> In addition, actions will be needed in the longer term to promote science and technology to inspire young people to consider STEM studies and professions, and to make public opinion aware of the importance of technical and scientific talent for Flanders' prosperity. In this context, VARIO highlights the fact that a number of recommendations made in the VRWI Study series 25 'Kiezen voor STEM' (Choosing STEM) from 2012 are still relevant, including the importance of teachers with a background in the field they are teaching, and more opportunities for students joining STEM studies via lateral entry routes.

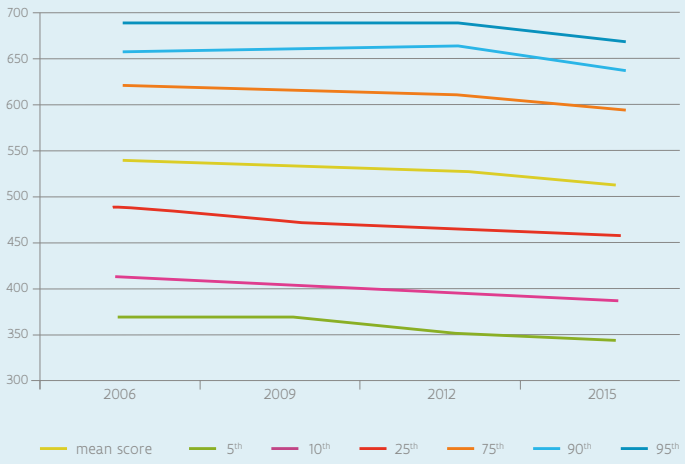
[11] SERV Advisory Report 'Duaal leren in het hoger onderwijs' (Dual learning in higher education) (2 July 2018)

[12] On the basis of so-called Educational Workload Units (OBEs) where different types of students are assigned different points weightings, which are supposed to reflect the cost price differences of the educational activities in the different disciplines. OBEs are the lowest for economic and technological training.

To stimulate young people, STEM needs to be offered more as part of an integrated vision. On the one hand, technology and ICT skills need to become a part of all studies, from primary to higher education. Rather than making them separate subjects, we need to integrate these skills into the more programme-specific subjects, and include them in the curricula. We can draw inspiration from abroad in this respect. For example, in his report '21 Mesures pour l'enseignement des mathémathiques' (21 Measures for Mathematics teaching) (2018), French mathematician and member of parliament Cédric Villani intended to stimulate the use of AI in every branch of education, starting with primary education. On the other hand, we also need to stress the importance of the humanities in STEM courses. This was also recently advocated by Martha Nussbaum in her book 'Not for Profit. Why Democracy Needs the Humanities' (2010). In conclusion, we can assert that multidisciplinarity is becoming crucial in education, both in compulsory education and higher education[13]. *"The most valuable people of all will be those who combine technical knowledge with the skills and sensibilities built by study of the humanities"* (Colvin, 2015).

VARIO calls for the drafting of the new STEM action plan be based on this integrated STEM vision.

FIGURE 5 The average PISA (Programme for International Student Assessment) score on mathematics of Flemish 15-year-olds, broken down according to the relative level compared to the total group of pupils for the period 2006-2015[14]. The scores for all groups have declined over the past ten years, but most strongly among the 10% top performers (90th and 95th lines). Reversing this specific decline is also part of the current STEM action plan (see 7).



Source: PISA 2015.

8. ALLOW TOP TALENT TO EXCEL

Even though it remains difficult to reach all target groups, the democratisation of higher education has ensured that Flanders has ever more highly educated people. This not only has a positive impact on the lives of the educated people themselves, who for example have better job opportunities, but having more highly educated people is also positive for a region's innovative capacity and economy. One pitfall in this positive process of democratisation is the levelling out of the quality of higher education. There are already indications of a levelling out in our primary and secondary education (Figure 5).

Attention needs to be given to top talent, because they are the people who will help shape the knowledge-based economy. Good initiatives in this respect are the summer schools for excellence that already exist in our country, or the double Bachelor's and Master's, and the liberal arts programmes in the Netherlands.

The government needs to develop a systematic policy for cognitively strong young people, who have to be challenged and encouraged to excel and reach their full potential. A policy of excellence does not need to be at the detriment of a policy of inclusion. Providing programmes of diversification and of excellence, allowing combinations of several courses, can be part of such a policy. Adequately challenging the brightest students is a point of attention not only in higher education, but also in secondary and primary education. Moreover, to allow our top talent to excel, we also need to look beyond our borders and provide more incentives for stays at leading foreign institutions.

9. KEEP TALENT UP-TO-DATE THROUGH LIFELONG LEARNING

Employees of the future will not be able to rely solely on their knowledge gained at school, and must continue to learn throughout their lives. A culture of lifelong learning will become increasingly important as a result of the changing job market, due to

[13] In concrete terms, multidisciplinarity in higher education can be encouraged, for example, by projects such as the Product Innovation Project (PIP) of KU Leuven (http://pipleuven.lcie.be/nl/). This is a course unit in which an interdisciplinary team of students with different backgrounds come up with solutions (prototypes, business case) together during a full academic year for a project that is provided by a project sponsor.

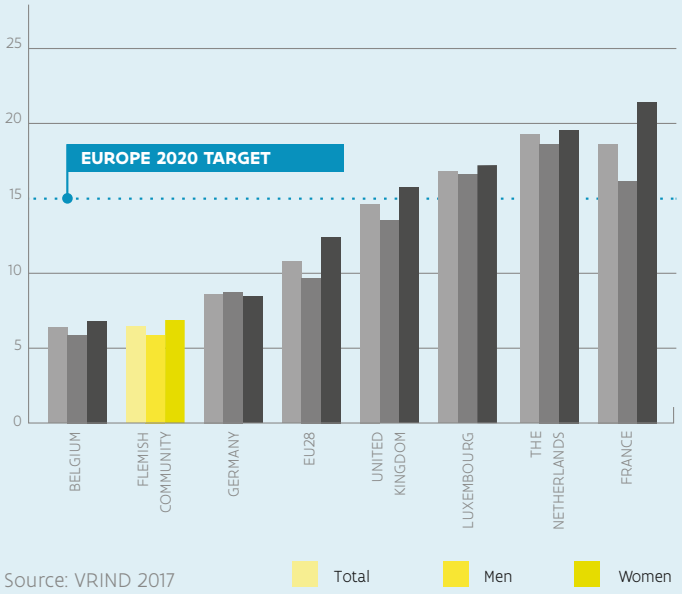
[14] More recent data are not yet available.

the ever growing level of digitisation, and the fourth industrial revolution that is increasingly taking shape. In addition, lifelong learning has been shown to reduce socio-economic disparities and increase productivity, innovation and economic growth[15].

However, in the Regional Innovation Scoreboard, Flanders scores lowest in the area of lifelong learning. In 2016, 7% of the Flemish respondents surveyed followed a course in the month prior to the survey, which is significantly lower than the European average of 11% (Figure 6). Most of our neighbours are good students: France, the Netherlands and Luxembourg exceed the European 2020 target of 15%; the United Kingdom is slightly under. Only in Germany participation in education and training is close to the Flemish (and Belgian) figure.

As part of Vision 2050, the Department of Education and Training and the Department of Work and Social Economy are developing a new vision for Flanders ('Transitie Levenslang Leren', Transition to Lifelong Learning). In addition, the Flemish Skills Strategy, supported by the OECD, was rolled out in early 2018 and aims, among other things, to increase participation in lifelong learning. Finally, in Vizier 2030, in which 49 objectives have been formulated, translating the United Nations' Sustainable Development Goals (SDGs), the Flemish government has stated that it intends to triple the number of adults attending training courses by 2030.

FIGURE 6 Percentage of 25-64 year olds (in %) participating in education or training in the four weeks prior to the survey (2016) compared internationally by gender.



Source: VRIND 2017

VARIO supports this objective, but it needs to be achieved more quickly, i.e. by 2024. Given the strong policy domain-crossing nature of lifelong learning, it is clearly a good idea to closely involve other departments, in particular the Department for Economics, Science and Innovation. VARIO proposes conducting a benchmark study on how governments in other countries organise lifelong learning, and how they obtain the necessary resources.

The needs relating to a transition to lifelong learning are increasingly met by private actors in Flanders. One possible reason is the lack of (sufficient) funding for this in higher education institutions. Post-initial Bachelor's programmes (Bachelor's-after-Bachelor's) are now funded by the government at the rate of half an initial Bachelor's programme; no funding is provided for Master's-after-Master's. The reason for this was that a Master's degree guarantees a successful entry into the labour market, and in principle the government has already made its financial contribution. Master's-after-Master's courses also have a high private return and justify a private investment.

However, universities and university colleges have an important role to play in the context of lifelong learning. Since Master's-after-Master's and Bachelor's-after-Bachelor's courses are increasingly becoming part of a lifelong learning culture, and for employees in some fields the only training courses which ensure they are 'up-to-date', they do justify a public investment. As such, VARIO recommends funding by the government for those Master's-after-Master's courses that are in line with its long-term vision on R&D&I (see 1). Universities and university colleges, for their part, need to develop a vision on lifelong learning.

Since achieving a work-life balance has proved to be the main obstacle to lifelong learning[16], higher education institutions also need to provide more flexible and short pathways, combined with distance learning using new technologies (see 10). In this sense, workplace learning (see 6) can also be a more feasible form of, or access to, lifelong learning.

Also stimulate enterprises to enable lifelong learning for their employees. This can be achieved by making it fiscally and financially attractive, and by simplifying workplace learning in organisational terms for employers and employees.

[15] Van Damme, D. (2018). OECD Skills Strategy Flanders. Diagnostic Workshop.
[16] Van Damme, D. (2018). OECD Skills Strategy Flanders. Priority areas Flanders, based on OECD (2017). Survey of Adults Skills database (PIAAC) (2012, 2015).

10. INVEST IN INNOVATIVE FORMS OF EDUCATION AND IN TEACHERS FOR THE FUTURE

Encourage the implementation of innovative forms of education and in particular, embrace the most recent digital techniques, with a continuous focus on the quality of education. This makes it possible to focus on distance learning, which casts the net further for students (both local and international) and at the same time offers a solution to the increasing demand for flexible education (see 9). The government needs to be a stronger partner in this inexorable process of digitisation in education.

It is not so much the technologies themselves which will improve the quality of education, rather the well thought-out combinations with 'traditional' face-to-face education (with its inestimable wealth of personal and social contacts and experiences), such as the so-called 'blended learning'[17]. The 'Edulab' at the Kortrijk campus of KU Leuven is an example of an interesting test environment for new technologies that can make learning more efficient[18]. The Smart Education @ Schools initiative, funded by the Flemish government, is a broader research programme into educational technology. Within the project, scientists from imec, KU Leuven, VUB and UGent are working together on smart educational applications, based on specific questions from practice[19].

In addition to techniques, the Flemish government also needs to invest in teachers, from primary to higher education, who are still the key to excellent education, and who deserve the necessary appreciation in this regard. This requires structural investments to upskill the current teaching cadre ('teach the teacher principle') so that their professional knowledge remains up-to-date - this is particularly necessary for technical profiles - but also so that they are familiar with the latest (digital) educational techniques and are guided in their changing role from teacher to coach.

Nobel Prize winner and Stanford professor Carl Wieman states in his book 'Improving How Universities Teach Science. Lessons from the Science Education Initiative' (2017) that creativity needs to become an essential part of academic education. He advocates an active education system in which the teacher is a cognitive coach ('Socratic' teacher) who teaches the students to solve problems with a kind of 'evidence-based-active-learning' approach.

11. ATTRACT AND RETAIN TOP INTERNATIONAL TALENT

In addition to developing local Flemish talent, attracting and retaining top international talent is a vital condition for further building our innovation capacity as a knowledge region, regardless of the status of the labour market. If Flanders wants to be in the Top 5 of innovative knowledge regions, top international talent also needs to be higher on the agenda. Currently, Flanders is lagging behind in attracting and retaining highly educated talent from abroad. There are no figures for Flanders, but Belgium as a whole clearly scores much weaker for attracting foreign talent than for developing its own talent (Table 2). Switzerland is in 1st position in terms of attracting talent, but Luxembourg and Germany are also doing significantly better than Belgium in this area.

That is why VARIO devoted its very first report to this issue. In its Advisory Report 'Attracting and retaining top international talent' (December 2017), VARIO highlighted the fact that Flanders has no systematic, overarching policy in this area. VARIO requested the Flemish Government to urgently work on an integrated strategy to increase our innovation capacity and the available pool of top talent in Flanders. One year later, this advice has already been implemented on a few, nonetheless important, elements of the strategy, including admissions policy, but no overall strategy has yet been adopted. VARIO welcomes the extension of the duration of work permits from one year to a maximum of three years, making it easier to change employer, as well as the extension to students' right of residence by one year so that they can look for a job, and the fact that internships for foreign students in Flanders have been extended. In addition to admissions policy, the strategy also includes other pillars such as strong branding, target group policy, language policy and monitoring.

The start of a new Flemish Government is an ideal moment to prioritise the recommended integrated strategy. A superintendent reporting to the Minister-President needs to divide the roles between the various relevant Flemish ministers, coordinate with the local and federal policy levels, centralise all information in one point, and supervise and monitor the implementation of the plan. A crucial part of the strategy is relaxing the language policy at universities and university colleges, with a larger choice of English-language Master's and Bachelor's programmes, and a relaxation of the Dutch language requirements for foreign teachers.

[17] Van der Perre, G., Van Campenhout, J. (e.a.) (2015). Hoger onderwijs voor de digitale eeuw (Higher education for the digital century). KVAB-reflectiegroep "Blended Learning", Koninklijke Vlaamse Academie van België voor Wetenschappen en Kunsten, Standpunten 34.
[18] https://www.imec-int.com/nl/artikelen/smart-education
[19] https://www.imec-int.com/nl/artikelen/smart-education

TABLE 2 Top 12 positions according to the IMD World Talent Ranking 2018, together with the scores on the three subcategories: talent investment and development, talent appeal and talent readiness.

Country	Overall rank	Overall score	Position according to investment and development	Position according to appeal	Position according to readiness
Switzerland	1	100.00	4	1	1
Denmark	2	91.97	1	7	8
Norway	3	86.37	3	12	10
Austria	4	86.10	2	13	18
The Netherlands	5	85.25	15	10	3
Canada	6	84.50	19	3	5
Finland	7	83.00	6	21	7
Sweden	8	82.45	9	9	15
Luxembourg	9	81.63	18	4	11
Germany	10	81.11	10	6	21
Belgium	11	80.54	8	16	14
United States	12	79.22	28	2	23

12. STIMULATE MOBILITY BETWEEN SECTORS AND INSTITUTIONS

Future employees will need to be mobile, between the public and private, profit and non-profit sectors, between industry and services, and between companies and sectors, given the fact that the boundaries between traditional sectors are blurring.

There needs to be more circulation of people between knowledge institutions on the one hand and companies, the service sector and the non-profit sector, including the government, on the other. The current bottlenecks affecting this mobility, such as the different employee statutes, the fact that a temporary break in an academic career is not (or negatively) rewarded, but also the perception of conflicts of interest, need to be eliminated.

For doctoral researchers there are the hybrid doctoral fellowships Baekeland, and for post-doctoral researchers there are the innovation fellowships. These systems are suitable for promoting the flow of people to industry, but also vice versa, from the business world to the academic world. VARIO welcomes the fact that more resources will be allocated to these instruments in 2019, following the recommendations of the VRWI in 2016[20]. Furthermore, the Baekeland mechanism needs to be made more attractive to SMEs. VARIO also recommends organising a comprehensive stakeholder survey to see what further improvements can be made to these mechanisms.

Mobility of researchers and professors between Flemish knowledge institutions also needs to be encouraged. We want to evolve towards a system in which this mobility within Flanders pays off, since it fosters cooperation (see 18). International mobility is already prized, but it clearly needs to be encouraged further.

In education, more emphasis needs to be given to crossover programmes with industry, government, and the cultural and social sectors. At all levels of education, there need to be sufficient opportunities for people from the business world to teach, both on an occasional and more structural basis, for example in the form of temporary postings. More visiting professors from non-academic practice also need to be employed in universities. In this context, VARIO has observed that where employing teachers with business experience in the former two-cycle courses such as commercial sciences and industrial engineering was a common and valued practice, it appears to be blurring with academisation (see 17).

[20] VRWI Study series 27 'Doorstroom doctoraathouders naar de niet-academische arbeidsmarkt' (Transition of PhD holders to the non-academic labour market) (February 2016)

13.
FOSTER EVEN MORE AMBITIOUS ENTREPRENEURSHIP

Despite the positive trends, with a clear increase in the number of people starting a new business and a growing confidence in their own entrepreneurial skills up to the level of the European average[21], Flanders is not yet exemplary in the area of entrepreneurship. Compared to other Europeans, the Flemish still expect fewer opportunities to start a business, and have more fear of failure. Ambition needs to be higher if we want to make it to the Top 5 of innovative knowledge regions.

Steps are being taken to bring this about, from various policy areas. Fostering (ambitious) entrepreneurship was designated by the current Flemish Government as one of the four explicit core tasks of VLAIO. This includes a range of initiatives at various levels, both in terms of people's perceptions of entrepreneurship, stimulating an entrepreneurial spirit in/via education and the support/guidance of entrepreneurs throughout the entire lifecycle of their business, etc. VLAIO plays a director, connector, and facilitator role in this respect, and works together with a large number of partners.

Since 1 September 2018, the requirement to have a basic knowledge of business management has been abolished for entrepreneurs who want to set up in Flanders. Related to this, VLAIO is working with the Department of Education and Training to develop a dynamic 'entrepreneurial skills' action plan, with training and coaching programmes. New initiatives have recently been taken in the 'Work and Social Economy' policy domain, including the transition bonus, which has been awarded since 15 March 2018 to unemployed jobseekers aged 45 and over who are making the leap to entrepreneurship after following a recognised 'pre-starter' course. Within the 'Education' policy domain, the 'Entrepreneurial Education 2015-2019' action plan forms a policy framework for stimulating entrepreneurship and enterprise.

VARIO proposes to closely monitor the effectiveness of these initiatives, and to focus on those initiatives that score well, and that any areas for improvement be addressed. Policy domain-crossing coordination and alignment of the various initiatives should ensure that these initiatives are mutually reinforcing.

In this context, we also refer to a VRWI study[22] in which recommendations are made to foster ambitious entrepreneurship.

[21] Andries, P., Rijssegem, L., Roelandt, J. (2017). Ondernemerschapscultuur en ondernemend gedrag in Vlaanderen: situatie 2017 (Entrepreneurial culture and behaviour in Flanders: the situation in 2017). Steunpunt Ondernemerschap en Regionale Economie – UGent Beleidsrapport STORE-18-003.

[22] VRWI Study series 23 'Ambitious Entrepreneurship. A review of the state of the art' (January 2012)

III.
STRENGTHEN THE FOUNDATIONS: KNOWLEDGE INSTITUTIONS AND ENTERPRISES

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14. ENSURE STRONG UNIVERSITIES AND UNIVERSITY COLLEGES

The question arises as to whether the Flemish universities and university colleges are (financially) sufficiently prepared to meet the needs and requirements in the field of education, research, and infrastructure, and for the international competition. There are a number of possible indications that education is underfunded. Belgium scores lower than the OECD average, with public and private resources combined[23]. Moreover, the students to staff ratio for Flemish universities (between 30 and 40) is very high in comparison with the rest of the world and, for example, twice as high as that for Dutch universities (between 15 and 20)[24].

Over the past twenty years, the government has created various new funding channels to provide a short-term solution to the specific needs and problems in the field faced by universities (e.g. BOF-ZAP mandates or 'tenure track'). However, this makes the whole financing mechanism complex and relatively opaque. In 2015, the system of core funding was evaluated under the responsibility of the Minister of Education. The evaluations of the BOF and the FWO were recently completed, together with a meta-evaluation of both instruments, under the responsibility of the Minister of Innovation.

> Based on the recent evaluations, VARIO calls for a review of the funding system of higher education in its entirety, namely first and second budgetary flow and their complementarity and/or mutual reinforcement. This needs to be complemented (from the universities and university colleges themselves) by data on the third and fourth budgetary flow. Only through such transparency we can determine whether any adjustment is necessary in function of their international competitiveness. In any funding model, the principles of excellence, cooperation, interdisciplinarity and internationalisation must be paramount.

15. ENSURE STRONG ENTERPRISES

The Flemish economy has a robust, highly export-oriented industrial base, with a large number of SMEs ranging from sole traders to large companies, which are very diverse in terms of their level of innovation. It is important that these companies can survive in a rapidly evolving context.

> Continue to support these companies in their necessary and continuous transformation.

Many companies are part of multinationals/larger groups, in which the internal competition between the different locations for capturing R&D investments is often fierce. Since most of our multinationals have their decision-making centres abroad, the return for Flanders is not always guaranteed. For a small region like Flanders, local entrepreneurship that anchors knowledge is therefore all the more important. The focus needs to be on prosperity-creating companies; it is not enough to stimulate the emergence of new companies per se. In recent years, the number of start-ups in Flanders has risen sharply and the chances of survival of Flemish start-ups are high. However, there are few start-ups in Flanders that can scale up and grow into larger companies. Encouraging innovative high-growth companies is a focus of attention according to the RIO Country Report (RIO, Research and Innovation Observatory) for Belgium in 2016. Innovative high-growth companies, young companies, but also more mature companies in a new growth phase, are crucial for job creation, and for a vibrant and dynamic economy.

> In its Advisory Report 'Innovative high-growth firms with impact' (November 2018), VARIO proposes an integrated strategy to increase the number of successful and innovative high-growth companies in Flanders. VARIO has requested the new Flemish Government to roll out this strategy and focus on the following four closely interrelated policy objectives:

[23] OECD (2017), Benchmarking higher education system performance: Conceptual framework and data, Enhancing Higher Education System Performance, OECD Paris.
[24] https://www.timeshighereducation.com/world-university-rankings/2019/world-ranking#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/stats

- Increase the number of ambitious entrepreneurs (see 13);
- Develop effective entrepreneurial ecosystems;

Entrepreneurial ecosystems offer the advantage that they are more difficult to disrupt than a single company; indeed, moving or transferring (professional) networks is particularly difficult.

In order to develop and strengthen entrepreneurial ecosystems, a policy aimed at five growth drivers is needed: (1) make sufficient (also international) talent available, (2) improve leadership capacity by introducing MBA programmes for growth managers, (3) involve PMV (Flanders Holding Company) more actively as a matchmaker for growth capital, (4) give FIT (Flanders Investment and Trade) a more active role for guidance towards international markets, (5) invest in infrastructure.

In addition, business accelerator programmes need to be structurally embedded in entrepreneurial ecosystems. Furthermore, efficient and professional TTOs (Technology Transfer Offices) need to be developed with the necessary management autonomy, operational strength and critical mass. 'Flipped technology transfer' plays an important role in this respect, in which ambitious entrepreneurs are more central and interact with academic researchers from a demand-driven perspective, from the market and from social needs.

- Create a generally stimulating environment (see 22, 23, 24 and 25);
- Strengthen the monitoring instruments and introduce policy interventions based on careful evaluations (see 4 and 5).

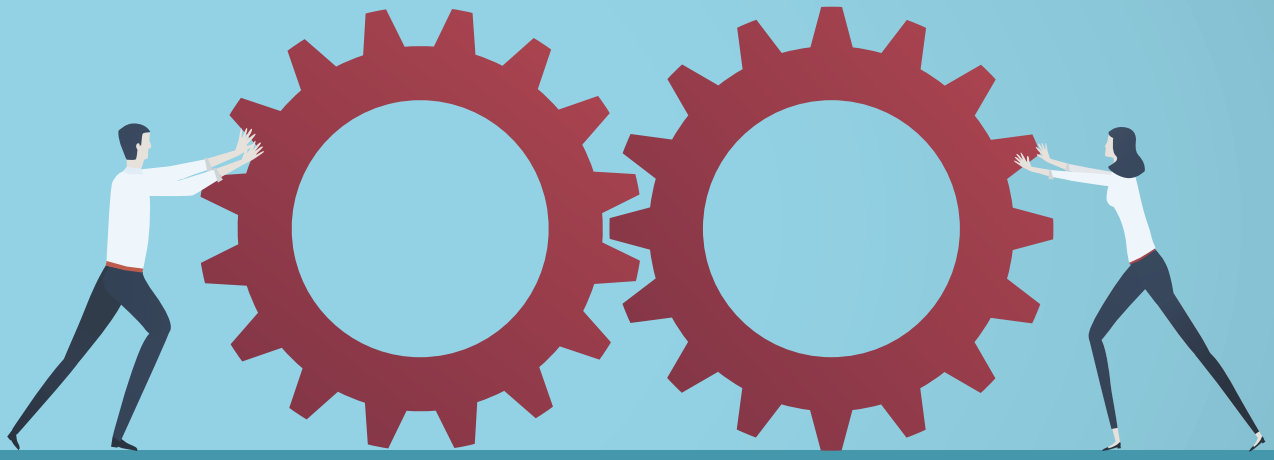
16. ENSURE STATE-OF-THE-ART RESEARCH INFRASTRUCTURE

State-of-the-art research infrastructures are vital for both the science and innovation base. Indeed, cutting-edge research is only possible if the most advanced infrastructure is available. As such, research infrastructures are also crucial for maintaining local top talent, and attracting foreign top talent. With the transfer of the Hercules programme to the FWO, the latter has a structural financing channel for heavy and medium-sized equipment for fundamental and strategic basic research to the Flemish public knowledge institutions.

Research infrastructures are increasingly exceeding the financial capacity of individual countries or regions. Within Europe, ESFRI (European Strategic Forum on Research Infrastructures) offers a common international framework within which countries can cooperate on setting up, managing and participating in international research infrastructures. It is paramount that Flemish researchers actively engage in these collaborations as a lever to improve the quality and performance of research in Flanders. This would also give Flemish researchers the opportunity to help coordinate large-scale international research and shape leading research programmes.

Early 2018, the Flemish Government's decree on International Research Infrastructures (IRI) laid the structural basis for participating and investing in such international research infrastructures. This decree specifies that periodic calls may be organised. Such commitments involve not only one-off investments but also long-term structural operational and personnel costs. This means that committing to new infrastructures also requires a growth path.

Given the expected increase of demand within the IRI channel, there is an urgent need for a Flemish roadmap for research infrastructure with an investment plan, drawn up with a strategic long-term perspective. Work on this together with the relevant actors.



IV.
MAKE THE INNOVATION ECOSYSTEM A FERTILE SOIL FOR VALUE CREATION

IV. MAKE THE INNOVATION ECOSYSTEM A FERTILE SOIL FOR VALUE CREATION

The innovation ecosystem - which can consist of various subsystems - is essential for the economy and well-being of a country or region. It is one of the main drivers of GDP. A healthy innovation ecosystem provides a fertile soil for growth and cooperation, meaning that we can turn new knowledge into new products and added value faster and more effectively, and that we can take on global competition and the challenges of the future.

That is why the Flemish innovation ecosystem needs to be organised as efficiently as possible. This requires not only solid foundations (actors and structures), but also their optimal positioning in the R&D&I landscape - with a clear demarcation of tasks and thematic focus - and a strong, broad and focused joining of forces across borders, sectors, disciplines and policy domains. It will also require a set of government instruments that are flexible and that give trust. 'Leading ecosystems' implies that the best components can work together - wherever they are geographically located.

17. SHARPEN THE OBJECTIVES AND THEMATIC FOCUS OF R&D&I ACTORS

Over the years, the Flemish innovation ecosystem has grown a lot and is very diverse. In addition to companies, universities and university colleges, the major players are the so-called hybrid structures, including the four SOCs, and the six spearhead clusters and twenty IBNs that have been created more recently in the context of the new cluster policy (see 4). All these players differ in size, mission, background, impact and operation. They have their unique features and role in the Flemish R&D&I system and on the TRL[25] scale.

The increasing multidisciplinary character of research brings about that the thematic focus of the various actors is expanding and there is a risk of overlap. There is also growing overlap in the core missions (research, knowledge transfer, valorisation, etc.) of the universities, university colleges, SOCs and clusters and in the TRLs in which they operate. As a result, they increasingly end up in a competitive position..

> VARIO recommends that, in addition to the standard KPIs, the justified evaluations and monitoring of the individual actors, the innovation ecosystem as a whole should be scrutinised. The objectives and thematic focus of the various actors in the system need to be sharpened, so that undesirable overlap and competition are avoided. In today's complex, interdisciplinary R&D&I environment, a certain degree of overlap is inevitable and justifiable. Nevertheless, crucial questions arise, such as what is the optimal number of actors in the Flemish landscape that would allow a healthy form of competition and bot-

[25] Technology Readiness Level. Indicates the level of development of a technology. The scale ranges from 1 to 9, with TRL 1 representing technology at the start of development (basic research) and TRL 9 representing technology ready for the commercial market.

tom-up initiatives, what is the optimal size and critical mass of the actors and how to avoid monopoly positions, and how to ensure the complementarity of the various players, so that they reinforce each other rather than compete.

SOCs and clusters need to remain at the service of the economic and innovative web in Flanders, and in this respect have a wide range of functions to fulfil, such as supporting companies to valorise scientific knowledge. The Flemish government must ensure that they do not evolve into 'companies' that strive for their own profit maximisation. In order to avoid competing with their own ecosystem, these structures should therefore not be active at the highest TRLs and not make the switch to commercial production (not on the basis of subsidised projects, nor on the basis of their own activities).

In 2013, the academisation process was completed, in which the two-cycle programmes of university colleges were integrated in the universities. A key objective of the reforms was to create stronger links between the training courses and the research base. Although we can observe a positive influence on some university programmes in terms of networking and cooperation with the business community, VARIO questions whether academisation is positive in all respects. Has it not shifted the focus too much to theory, blurring the distinction between theoretical and application-oriented education? One example is the academisation of the industrial engineering programme, where there is a danger that the 'business-oriented' individuality of the latter programmes gets lost. One of the reasons is that the emphasis in lecturer recruitment is now primarily on their proven track record based on publications and citations, and less on business experience.

Five years after the integration of the two-cycle programmes of university colleges, VARIO believes that the time is ripe for a first evaluation of the impact of the academisation process, and for possible revision. One point for attention in this respect is the individuality of the training profiles. Both theoretical and application-oriented education is indispensable, and both are equally valuable and have a role in society. A revaluation of relevant business experience among lecturers is therefore essential. Also within university colleges, emphasis is increasingly on recruiting people with a research affinity. Here academisation should be avoided. Studying at university colleges should provide students with professionally-oriented, state-of-the-art knowledge.

Is there also sufficient distinction and complementarity in the role and mission of the current universities and university colleges? How can they complement and reinforce each other? Between university colleges and universities, similar courses are ideally complementary, i.e. with a different level of detail and purpose, and with a different underlying focus (theoretical/practical).

It should also be questioned whether certain university Master's programmes and their supporting research should not be concentrated. geographically, leaving it up to the universities to differentiate within disciplines, which is also a good starting point for creating focus and critical mass. Dutch universities are more successful in this respect. At university colleges, research is more often driven by a concrete (social) challenge, which is conducive to interdisciplinarity. The geographical spread of university colleges is positive, as they are physically closer to companies, social profit organisations and students.

18. STIMULATE COOPERATION FOR VALUE CREATION

Cooperation between the Flemish R&D&I actors (universities, university colleges, SOCs, clusters and companies, etc.) is crucial to achieving value creation, and this is the subject of a VARIO Advisory Report[26]. Due to the explosion in knowledge and the increasing complexity of innovation trajectories, individual players often no longer have the necessary skills/knowledge in house. This increases the need for partnerships between companies, knowledge institutions and governments. Research specifically for Flanders[27] has shown that government-funded forms of

[26] VARIO Advisory Report 'Waardecreatie door samenwerking' (Value creation through cooperation) (in preparation)
[27] Faems, D., Van Looy, B., Lecocq, C. (2011). De impact van nationale en internationale technologische samenwerking op de innovatiekracht van Vlaamse ondernemingen (The impact of national and international technological cooperation on the innovative strength of Flemish companies). In: Grenzeloos ondernemen in Vlaanderen (pp. 216-231) Gent: Steunpunt Ondernemen en Internationaal Ondernemen

cooperation between knowledge institutions and companies have a positive influence on the innovative capacity of companies. The pooling of complementary skills also provides a fertile environment for fundamentally new projects which result in major progress for the economy and society as a whole. Promising research and successful valorisation are increasingly taking place at the intersection of disciplines, domains and sectors. Successful R&D&I requires sufficient critical mass, especially in a globalised world where international competition is only getting more fierce. As such, it is crucial that the Flemish institutions/structures strive to join forces, which in turn will ensure sufficient critical mass and additional value creation.

Flanders scores well in the area of cooperation. 17% of the R&D expenditure of the higher education institutions in Flanders is financed by companies, which puts us among the best in the world[28]. Only Germany achieves a comparable figure. As such, on this basis, it appears that higher education institutions and companies cooperate effectively.

> The question arises, however, as to what kind of cooperation this is. Cooperation does not mean mere contract research. This is just one aspect of it. There is a greater need to develop a common long-term vision regarding research, in interaction between knowledge institutions and the business community, while respecting the individuality and role of each of these.

The 2017 CIS survey shows that around 40% of innovative enterprises in Flanders cooperate in the context of an R&D&I project[29]. However, this means that the remaining 60% do not cooperate. 43% of innovative enterprises indicated that they have some difficulty in finding cooperation partners[30]. The complex research landscape in Flanders is a deterrent. Finding a good cooperation partner can also be complicated by a mismatch between the demand for knowledge from the companies and the supply of knowledge by the knowledge institutions.

In addition, there remains a significant group of non-innovative enterprises in Flanders. These are primarily SMEs. We need to make them aware of what innovation can do for them, make them more innovation-oriented and increase their innovation capacity, while increasing the pool of innovative companies.

> VLAIO has an important role to play in bringing the group of innovative companies that do not yet cooperate, and non-innovative companies, into the innovation pool - via the 'Team Bedrijfstrajecten' (Business Pathways Team) and the VLAIO Network. Although the cluster pacts also focus on this area, VARIO still sees a lot of opportunities (both for clusters and for SOCs) to identify companies from the above mentioned groups and to initiate cooperation.
>
> In order to respond adequately to the needs of industry in the medium term roadmaps for SOCs and clusters are drawn up. To make knowledge creation sufficiently relevant for the Flemish industrial web, both the scientific and the industrial actors must be heard in drawing up these roadmaps. However, academic/scientific freedom must be safeguarded.

The original SBO programme was an instrument to promote cooperation between knowledge institutions and companies. Since its transfer to the FWO, companies remain part of a supervisory committee and need to show an interest, but they are no longer actively involved in the project definition. They also only need to make very limited financial commitments. This is a weak point. SBOs with more involvement by the companies in early phases of the projects are possible within the spearhead clusters, via the so-called cSBOs. However, access to these remains limited to the members of the spearhead clusters, which shuts out a lot of companies.

> In the regular SBO channel, the business world needs to become more actively involved once again in project creation. Companies first indicate their strategic interests and long-term needs, and knowledge institutions then respond to these. This increases the chances of economic or social valorisation of the project results. Returning to the original concept would also avoid duplication via cSBOs.

The ICON programme (Interdisciplinary Cooperative Research) is an instrument for demand-driven, cooperative research in which multidisciplinary research teams of scientists, industry partners and/or social profit organisations work together to develop innovative solutions that then find their way into the market supply of the participating partners. It is open to companies that collaborate with the SOC's imec or Flanders Make, or that are members of spearhead clusters. One of the requirements is to include at least three Flemish companies. The disadvantage is that for some sectors of industry in Flanders this is not feasible.

> ICON should also admit and fund foreign partners (maximum 20% in accordance with VLAIO regulations). It needs to be further examined whether ICON can also be opened up more broadly to other actors.

[28] Vlaams Indicatorenboek 2017
[29] Delanote, J., Hoskens, M., Verheyden, L., Wursten, J., Van Criekingen, K. Innovatie-inspanningen van de Vlaamse ondernemingen: kernresultaten van de Europese innovatievragenlijst van 2017 (Innovation efforts of Flemish companies: core results of the 2017 European innovation survey).
[30] 27% experience minor problems, 13% have moderate problems and 3% report major problems

Bringing together the unique expertise of the four SOCs also offers great potential for real breakthroughs. In addition to concrete collaborations in R&D&I, the SOCs can also learn a lot from each other. However, it is striking that in practice, the SOCs still only cooperate to a limited extent, despite the existence of a SOC forum. Within the cluster policy, resources have been provided for setting up cooperation projects between clusters (with earmarked funds). However, it is still too early to draw any conclusions in this respect.

> A continued effort on creating effective mechanisms for cooperation between SOCs is needed. So far, the SOC forum has had too little impact. The forum needs to focus on mutual cooperation as well as on exchanging best practice and international experience, in order to increase the joint (systemic) impact. Also for clusters, the government needs to continue emphasising mutual cooperation. Besides setting up collaborations, the quality (and potential impact) of the projects is of course also important in these intercluster activities. The new policy initiative 'Moonshots' appears to be a good start in this respect. Smart KPIs for SOCs and clusters are an excellent way of enhancing cooperation incentives (see 4).

In the future, VARIO also wants to see more cooperation between individual researchers from Flemish knowledge institutions. Such cooperation across institutions is important in generating and maintaining excellence. This global excellence also makes knowledge institutions attractive for companies to work with. At the institutional level, the current funding formulas for allocation of public funding provoke internal competition, have a detrimental centrifugal effect and make mutual cooperation difficult. At the FWO, there are no instruments to incentivise cooperation between Flemish actors. Nevertheless, the FWO is the ideal setting for cross-institutional cooperation. The lack of specific FWO funding for bottom-up partnerships in larger teams is seen as a drawback. The lack of funding channels for large projects makes it difficult to bring together sufficient critical mass needed for certain types of (cutting-edge) research.

> Remove barriers and generate incentives for collaboration between individual researchers. At the FWO, this could be done by making larger fundamental research projects possible with multiple PIs (Principle Investigators) and a larger budget, as is currently the case with SBO projects. At institutional level, it is important to include cooperation in the KPIs (see 4).

19. GIVE INTERDISCIPLINARITY MORE CHANCE

Most progress is made when disciplines intersect. Interdisciplinary cooperation, however, is still often based on a problem defined within one discipline where another one is needed to find a solution. There is no commonly-defined problem. Often these are also one-off collaborations, and the knowledge remains concentrated with the researchers from the individual disciplines. Effective interdisciplinary research goes one step further. It is driven by a specific and urgent problem, with deep integration across disciplines. The National Science Foundation uses a new term 'convergence'[31] in this respect.

The current organisational structure of the Flemish universities, with discipline-related division into faculties and departments, is not conducive to interdisciplinarity. Nor are there strong incentives for interdisciplinary cooperation.

The FWO's application and evaluation system is not conducive either to funding research projects involving several disciplines. Out of a total of 31 panels, there is only one interdisciplinary panel. Moreover, such projects need to score high in each of the disciplines involved, and consequently fizzle out already in the subject-specific panels.

> The government and the institutions involved need to take steps to remove the remaining barriers to interdisciplinary research and encourage interdisciplinarity, for example through smart KPIs or output parameters, or through appropriate selection procedures.

20. GIVE TRUST AND TOLERATE MORE RISK

Throughout the support instruments, there are indications of a generally risk-averse and conservative selection and evaluation process. In addition to risk aversion, the terms for government funding also often demonstrate a lack of trust in the applicant. An important bottleneck of this is that successful, new concepts are difficult to assess in advance for knowledge institutions, companies and the government (in terms of impact, for example). The scientific world is evolving at a rapid pace. Innovation will continue to emerge in unexplored terrain between disciplines. Continuing

[31] From 1 to 4 October 2018, a delegation from VARIO paid a working visit to two top American universities, Carnegie Mellon University in Pittsburgh and MIT in Boston. In both, 'convergence' is deeply embedded in the way they work and divisions into disciplines are only purely administrative.

to invest broadly and 'bottom-up' is necessary, in order to take the lead in suddenly emerging, completely new developments, rather than opportunistally investing in what already exists.

In the first instance, the FWO supports research that can lead to important scientific breakthroughs. We need research into the foundations of given phenomena, in order to understand them and ultimately arrive at applications with economic or social added value. The inherent characteristic of original and high-risk research is that there is a significant chance that this research will not produce the desired results.

Currently, the emphasis in FWO projects is still strongly on the applicant's track record and the output of the applicant's previous research. Moreover, the term 'research result' is rigidly interpreted. The 'feasibility' criterion used in the applications is not conducive to high-risk research either. Completely new and innovative ideas, within young or experimental domains ('high risk-high gain'), therefore have too few opportunities in practice at the FWO. The risk-averse behaviour also often extends to the researchers, which means that they do not submit riskier projects.

> Ask the FWO to give more scope to bold breakthrough projects at the initiative of the researcher. High risk-high gain applications should be granted more often. In addition to past performance, more value must be attached (once again) to qualitative factors such as creativity, drive, ideas and personality, especially for people at the start of their career.

For a VLAIO application, ideas need to fit into a rigid framework, which requires people to make too many uncertain estimates of future results. This has a demoralising effect and, moreover, creativity is not rewarded. More and more companies feel obliged to solicit specialised consultancy agencies to draft project applications. As a result, the Flemish subsidy apparatus will, de facto, increasingly subsidise this sector.

Although the valorisation requirements 'on paper' have become less strict - the multiplier requirement[32] is only retained for international companies, and has been reduced from 25 to 10 - the new method of project evaluation has not yet sufficiently permeated the minds and day-to-day operations of VLAIO. This means that the valorisation requirements remain an obstacle for companies. This is because it is important to keep the existing R&D centres here, attract new R&D (and production) centres, and start new disruptive activities where there is as yet no prospect of valorisation output.

> Give more trust to the companies and consequently incorporate more flexibility in the current VLAIO instruments.

21.
LOOK BEYOND OUR BORDERS

To safeguard its position as a knowledge region, Flanders needs to profile itself at the international level. Problems and social challenges, but also solutions, ideas and knowledge, do not have borders. Especially given the limited size of Flanders, expertise is often not available locally. In addition, international cooperation and mobility is a lever for excellence. At the same time, economic value chains can no longer be filled at local or regional level.

> For Flemish companies and knowledge institutions, engaging in international networks is a must in order to succeed and grow in a global economy. Go along with this international dimension and adapt the terms of the policy instruments accordingly, at all levels. Stimulate internationalisation also through output parameters and KPIs (see 4).

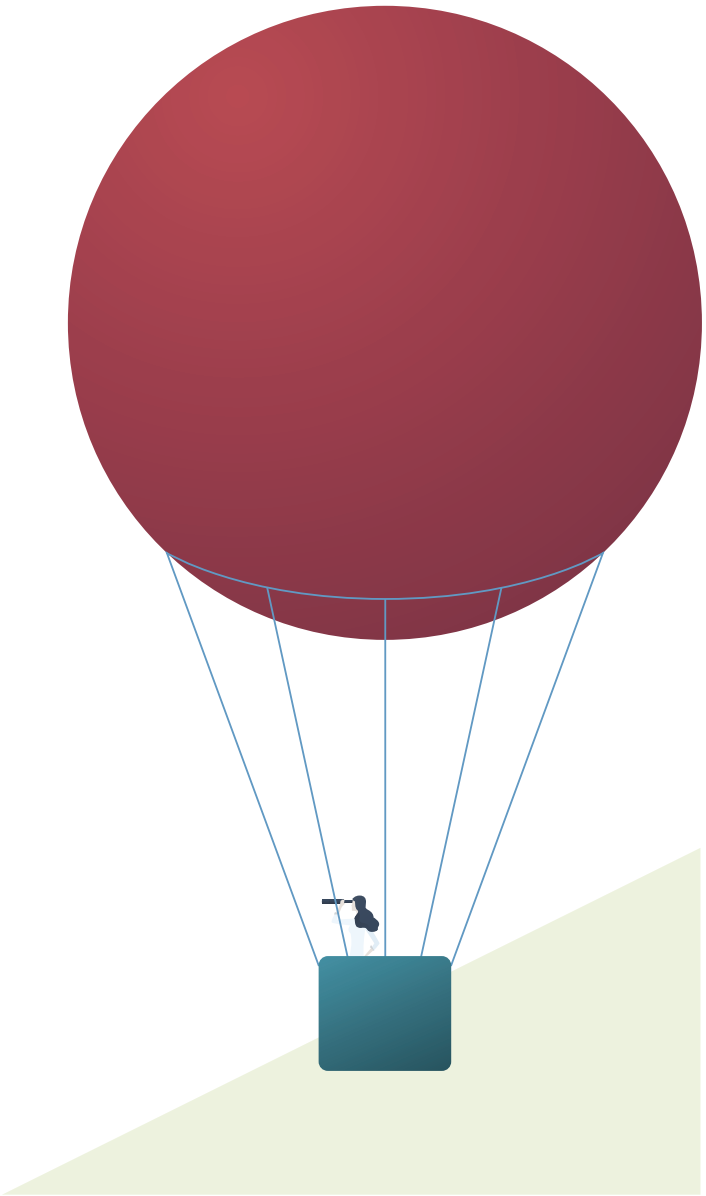
When international cooperation is discussed in a policy context, it is usually within the framework of the European Union. This is logical, because of the size of the budgets involved and for which our knowledge institutions and companies can compete.

> During the next legislature, the Horizon Europe programme will be rolled out. If Flanders wants to take advantage of this and other programmes to the fullest, it will need to prepare itself as much as possible and act more proactively before the implementation phase. Despite the fact that the 'return' for Flanders from European funding programmes is positive at present[33], the threshold to European funding is often still too high for knowledge institutions but especially for companies and certainly SMEs, and Flanders can raise its ambitions. One specific and relatively straightforward measure is strengthening the National Contact Points (NCPs) for (proactively) informing and supporting (potential) applicants.
>
> Flanders also needs to focus more on both the ESA (European Space Agency) and the European Space Programme, as well as on the European Defence Fund, as VARIO emphasised in its Advisory Report 'Flanders' Space: a strategy for the Flemish Space Economy' (February 2018) and 'Government support for Dual Use and Military R&D&I' (April 2018) respectively.
>
> For participation in European decision-making, the Flemish Government needs to develop a better governance framework with an efficient decision-making path, maximum use of existing consultation channels and structures at and between the regional, community and federal levels, maximum

[32] The relationship between potential economic added value in Flanders and subsidy granted
[33] Source: EWI Speurgids (Budget browser) 2018.

use of Flemish representatives in European forums, and better flow of information.

International developments require a broader perspective than Europe alone. It is high time to give more attention to partners from outside Europe, including the United States, Canada, China, India, Israel, the emerging economies and so on. If the best partner is outside Flanders, it should be possible to work with them.



V.
CREATE A FAVOURABLE ENVIRONMENT FOR INNOVATION

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In addition to direct support measures, i.e. subsidies, an overall favourable environment is crucial.

22. WITH A GOOD POLICY MIX

In recent years, Belgium has developed an attractive fiscal framework to stimulate additional investments in R&D. Measures such as the renewed innovation deduction and the reduced withholding tax for researchers have enhanced the innovation landscape. In particular, the tax exemption from withholding tax for scientific researchers with a specific Master's or doctoral degree is an important trump in putting our country on the international map as a leading location for research and development.

> A good policy mix, with the right balance between tax measures and subsidies, is advisable. In this respect, it is crucial that the federal government maintains the effective tax measures for R&D. In addition, there is also a need for non-financial instruments, such as regulation.

23. WITH AN INCENTIVISING LEGISLATION

The legislative framework often does not adapt quickly enough to the new reality (Table 3), and sometimes acts as a hindrance rather than an incentive for innovative companies. Flanders has already missed the boat in terms of the sharing economy and e-commerce. The licensing policy is also too rigid and too slow.

> Regulation becomes an incentive for innovation when it is stable (legal certainty), transparent, straightforward and easy to enforce, but at the same time flexible enough to keep pace with social changes. Experiment with limited-regulation or innovation-enhancing environments (e.g. testing sites for autonomous vehicles) to accelerate innovation pathways, ensuring that ethical aspects are respected.

24. WITH A MINIMAL ADMINISTRATIVE BURDEN

The professional field also prefers a government that does not interfere in business, but rather facilitates business. (Start-up) companies in Flanders struggle because of too much paperwork. Although they refer to Belgium as a whole (Table 3), figures from the World Economic Forum show that the margin for improvement is still very large. The digitisation policy is not following global developments fast enough.

> The government needs to limit the administrative burden and obligations as much as possible and work towards more and better interaction with citizens via 'e-government'.

Submitting a project application requires time and expertise. Companies do not always have these resources in house, especially SMEs which have no separate R&D unit. In any case, in the application and reporting phases, the administration should not be so burdensome that it becomes a barrier to competing for funding.

> For companies, access to the VLAIO instruments should be easily accessible in the first instance. The recent expansion of the VLAIO front office with the 'Team Bedrijfstrajecten' (Business Pathways Team) appears to be a step in the right direction, as is the recently launched digital counter for entrepreneurs 'VlaanderenOnderneemt.be'[34]. However, it is still too early to see the fruits of these initiatives.

[34] Via VlaanderenOnderneemt.be, one can apply for and follow up subsidies, grants, accreditations and permits from VLAIO, the Department of Work and Social Economy, FIT and Syntra Vlaanderen.

TABLE 3 Ranking of Belgium out of 140 countries, and countries with comparable scores, for a number of pre-conditions for innovation (World Economic Forum, Global Competitiveness Index 2018)

Description	Ranking	Countries with a similar score
Burden of government regulation	92	Philippines, Moldova, etc.
E-participation index	58	Rwanda, Albania
Legal framework's adaptibility to digital business models	54	Mexico, Tanzania

25. WITH A MORE ACTIVE ROLE FOR THE GOVERNMENT

There are no figures for Flanders, but Belgium as a whole does not score well at the international level when it comes to government procurement of innovative technologies. The government already involves SMEs/start-ups in public tenders, but still to a limited extent, and primarily for small or risk-free projects. Moreover, under the current rules, a company can only be involved in a public tender if it has been set up for at least three years.

Through an effective policy of innovative procurement, the government can play an active role. The Programme for Innovative Procurement, which is internationally recognised as best practice, is a good start in this regard.

Act as first buyer more often. The government as an important reference customer, gives Flemish entrepreneurs credibility in gaining the trust of other large potential customers. The programme 'Buy from start-ups' that is currently in preparation, wants to remedy the obstacles for start-ups to get involved, and it appears promising.

Thirdly, the government should also act as a responsible payer. This is crucial for the financial capacity of companies, but all the more so for start-ups.

Colophon

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