VLAAMSE RAAD
VOOR WETENSCHAP
EN INNOVATIE

FLANDERS IN TRANSITION

Priorities in Science, Technology and Innovation towards 2025

Content

Preface

By 2020, Flanders aims to rank among the top five knowledge regions in Europe, with an employment rate of 76% and an R&D expenditure of 3% of GDP. This target is the compass of my policy as Flemish Minister of Work, Economy, Science and Innovation from 2014 to 2019. In the framework of the European agenda for new growth through smart specialisation, I will also support further development of future-oriented clusters in Flanders.

This brochure presents a concise overview of seven priority transition areas for Flanders with a time horizon up to 2025: Digital Society 2025; Food 2025; Health and Well-Being 2025; Smart Resource Management 2025; Urban Planning, Mobility Dynamics and Logistics 2025; New Energy Demand and Delivery 2025; and Society 2025. These areas are the result of an intensive foresight process by the Flemish Council for Science and Innovation (www.vrwi.be/en), involving over 230 stakeholders from industry, research, government and civil society. Starting from the grand societal challenges, each transition area presents a number of science, technology and innovation priorities, creating the business opportunities of tomorrow.

These transition areas should be used as a source of inspiration by stakeholders, both in Flanders and abroad, to establish promising clusters.

I would like to make a call to all potential partners out there: Join forces with our innovative companies and excellent centres of knowledge in Flanders. By doing so, today we can co-create crucial links for the global value chains of tomorrow.

Philippe Muyters
Flemish Minister of Work, Economy, Science and Innovation

VRWI Foresight 2025

The VRWI Foresight 2025 ran from May 2012 to May 2014, as a follow-on from the earlier foresight of 2006. VRWI Foresight 2025 is based on three crucial questions that lie close to the heart of every policymaker: 'What are the challenges facing us?'; 'In which areas is Flanders currently strong?'; and 'Where do the opportunities lie for creating societal and economic value?'.

VRWI Foresight 2025 aimed to come up with a well-defined set of priorities for science, technology and innovation in Flanders. If researchers and policymakers jointly focus on these priorities, Flanders will be better positioned to meet the societal challenges of the future and to translate these challenges into societal and economic value.

The research project consisted of three phases.

Preliminary Study - Phase 1

The first phase involved an inventory of national and international societal trends as well as developments in the areas of science, technology and innovation. The horizon was set at 2025. Parallel to this inventory, we performed a strength-weakness analysis of Flanders, assessing our scientific, technological and economic strengths in an international perspective. Finally, we put together a set of societal indicators for Flanders.

Ambition for 2025 - Phase 2

Based on this preliminary study, a Steering Committee consisting of Captains of Industry and Captains of Society formulated a clear ambition for Flanders 2025.

> 'Flanders evolves towards an innovative knowledge society in 2025 by creating welfare and wellbeing in a smart, innovative and sustainable fashion, in a social, resilient and internationally-oriented Flanders.'

Achieving this ambition calls for a systems approach and requires joining forces at all levels: internationally as well as across sectors and disciplines. To this end, the Steering Committee came up with a 'flywheel' model, consisting of one transversal transition area – Society 2025 – operating as a socio-economic engine driving forward six vertical transition areas: Digital Society 2025; Food 2025; Health and Well-Being 2025; New Energy Demand and Delivery 2025; Urban Planning, Mobility Dynamics and Logistics 2025; and Smart Resource Management 2025.

From Transition Areas to Priorities - Phase 3

As a small region, Flanders cannot possibly cover all areas at the same time. For this reason, for each of the seven transition areas an expert panel selected a limited number of science, technology and innovation priorities. Additionally, they put forward which critical success factors should be kept in mind if we wish to realise our ambitions for Flanders 2025.

This brochure summarises the seven transition areas and their respective priorities.
More detailed information on the foresight process, its methodology, the transition areas and priorities can be found in VRWI Study 26 - VRWI Foresight 2025 (only available in Dutch). Further contact information is provided in the final section of this brochure.

Transition Areas

DIGITAL SOCIETY

Digital Society

We live in a hyper-connected digital world, that is evolving ever more rapidly and where information is available 'any time, any place, any device'. In our interactive digital society, ICT is a crucial enabling technology: It acts as a driver that converts societal and economic challenges into opportunities.

From Challenges to Objectives

Thanks to its well-performing ICT sector, Flanders has every advantage needed to bring about the interactive Digital Society 2025. ICT is essential to meet the challenges posed in numerous domains, such as care, food, materials, energy and environment, cities and housing, mobility and logistics, media and manufacturing. Flemish businesses therefore face the task of finding the right niches and becoming global leaders in these areas. We also face a number of sector-specific challenges, such as bringing about a drastic fall in energy consumption, improving security, and standardisation.

Priorities

The following six closely intertwined ICT drivers are needed to bring about an interactive digital Flanders by 2025.

Next Generation Networks

Private individuals and organisations send and consume ever larger amounts of data. The number of communicating and connected electronic devices per user is growing steadily: ranging from laptops, tablets, smartphones on the one hand to clothes, cars, fridges, domestic robots, etc. on the other. As a consequence, there is an ever-growing need for more bandwidth and wireless networks.

When it comes to availability of and access to high-performance networks, Flanders currently occupies a leading position in Europe. Continued investments and commitments are needed to maintain this position. The ongoing growth of big data, cloud computing and mobile applications also poses new challenges when it comes to the storage and processing of large datasets.

Smart Devices

Incorporating electronics and software into products makes these products ‘smart’. Such smart devices use sensors to autonomously gather, share, analyse and interpret information and then make decisions that lead to action. In this manner, smart devices become aware of themselves, their environment and their user. The development of these smart products offers real prospects for innovation and valorisation in traditionally strong sectors.

Big Data

Increasing digitisation implies that more and more data become available. This data is generated by interactions between people, machines, applications - and combinations thereof. We stand on the verge of an explosion of data and the speed at which it is generated. New understandings gained by analysing these large datasets offer significant added value for statistics, diagnostics, economic forecasts, market research and travel information, among others. The possibilities for new services, products and processes are legion.

Cloud Computing

Cloud computing makes hardware, software and data available over the internet. The trend towards cloud computing leads to radical changes in a range of sectors. Cloud computing is a significant driver of innovation as a growing number of cloud-based products and services are being created and used.

Mobile Applications

Increasingly, information becomes available and is consumed 'any time, any place, any device'. The growing number of mobile applications for smartphones, tablets, domotics and games supports this trend. Mobile applications are heading towards maturity: simple apps make way for complex mobile applications from which the user can receive personalised information. Thanks to these applications, both individual and device can make decisions quickly.

Also, more and more 'traditional' devices integrate mobile applications: smart TVs, smart watches, smart billboards and wearable computing radically change our experience. The market for mobile applications offers many investment opportunities.

Encryption Technology

Ongoing digitisation calls for higher security standards, making electronic security a transversal priority.

When it comes to encryption technology, Flanders occupies a strong scientific position and has a solid reputation internationally. This is clearly a niche where Flanders can add societal and economic value. Furthermore, it is of strategic importance to have the ability to protect sensitive information without having to rely on foreign players.

The above ICT drivers will only impact on Digital Society 2025 provided they fulfil the following seven criteria. They must:

- be user-friendly and smart;
- contribute to the Internet of Things;
- guarantee privacy and security;
- be affordable and profitable;
- pose less burden on the environment through Clean ICT;
- be invisibly interwoven in our everyday environment through miniaturisation;
- integrate hardware and software.

VISION 2025: INTERACTIVE DIGITAL SOCIETY

CHALLENGES & OPPORTUNITIES

MANUFACTURING	ENERGY & ENVIRONMENT	CARE	NUTRITION	MEDIA	MATERIALS	CITIES & LIVING	MOBILITY & LOGISTICS

OBJECTIVES

INTERNET OF THINGS	MINIATURISATION	PRIVACY / SECURITY	CLEAN ICT
USER-FRIENDLY & SMART	HARDWARE - SOFTWARE INTEGRATION	PROFITABLE & AFFORDABLE	

SCIENCE, TECHNOLOGY AND INNOVATION PRIORITIES

BIG DATA

SMART DEVICES

CLOUD

NEXT GENERATION NETWORKS

MOBILE APPLICATIONS

ENCRYPTION TECHNOLOGY

CRITICAL SUCCESS FACTORS

LONG-TERM VISION & STABILITY, JOINING FORCES

DEMONSTRATION PROJECTS, FAVOURABLE BUSINESS CLIMATE

FOOD

Food

There are a number of societal challenges of fundamental importance to the food industry. The population growth is set to increase demand for food by 70% by 2050. In addition, climate change will lead to a shortage of fresh water and a decrease in the amount of arable land. Diseases of affluence will continue unabated.

For these reasons, the experts' vision of food in Flanders in the year 2025 focuses on the development of a responsible food sector that develops along sustainable lines, strengthens its export position and increases its investment in R&D. This will enable Flanders to continue to produce tasty, high-quality products with an international reputation. The slogan 'Small country, great food' sums up this ambition well.

From Challenges to Objectives

The food industry is the second largest industry employer in Flanders. The Flemish food industry also plays an important role when it comes to export value. To consolidate and develop this powerful position, the Flemish food industry must continue to differentiate itself.

More particularly, the Flemish food sector must keep looking for ways to add high(er) value. The experts therefore propose that the challenges be tackled in these areas:

- Food quality and safety;
- Food sustainability and security;
- Food and health;
- Optimal interaction within the food supply chain and with consumers.

Priorities

Flanders produces great food and, of course, this is something we need to continue doing. However, a small region like ours cannot tackle all priorities at once.

This is why the food experts drew up a longlist of business opportunities. This list was then refined according to importance and according to those areas in which Flanders is currently strong. We narrowed it down to eight priorities for Food 2025.

Reducing Food Losses and Food Waste

It is estimated that one third of the world's food production goes to waste. These losses occur along the entire food supply chain. Technical limitations are the main cause of losses at the start of the supply chain. Consumer behaviour results in food waste at the end of the food chain.

Europe has the ambition of halving food waste by the year 2020. Drastic measures are required if the Flemish food sector is to maintain its position. Avoiding food losses contributes towards greater food security and more sustainable consumption. It saves money throughout the food supply chain and for the consumer and it stimulates innovation.

Valorisation of Secondary Flows and By-Products

Large quantities of rest fractions are created in the production and processing of raw food materials. Of these, about 90% are secondary flows which are still of use. At this time, such secondary flows are already being re-used as animal feeds, soil improvers or for energy production.

However, even greater added value can be achieved by closing loops more efficiently. To this end, the valorisation of secondary flows and by-products must be part and parcel of the business strategy. We will have to apply a 'cascade of maximum value retention' (or: 'Waste Management Hierarchy') to secondary flows. Secondary flows will be directed first towards human food, then animal feed and then raw materials for industry, and so on.

Supplying Functional Foods

Functional foods are those to which ingredients are added or subtracted to improve the product's health value. The ingredient might increase health or reduce the chances of disease. Examples include functional foods to lower blood pressure, slow down bone loss or improve the immune system.

There are high expectations for functional foods, especially in meeting the challenges in healthcare. The market is growing rapidly and presents opportunities for the Flemish food industry. It does, however, require further basic scientific research in areas such as bioactive materials. It also fundamentally relies on (international) cooperation between the pharmaceuticals industry, the food industry and retail.

Offering Balanced Nutrition

Food purchases are often made rapidly and habitually. Nonetheless, if the consumer is to have a balanced diet, good choices are required. The food industry must aid consumers to choose well. It must do this by promoting healthy staple products and by offering food products that comply with the nutritional guidelines on sugar, fat, salt and fibre content.
Uniform labelling currently guarantees consumers that the product satisfies a number of requirements. However, the gulf between consumer and producer reveals that there is room for greater awareness-raising. The sector's communication and information in this regard must complement that of the Government (of Flanders).

Going for Natural Ingredients with Process Stability

The demand for foods composed of natural ingredients is rising among food manufacturers and consumers alike. These are foods free from synthetic aromas, colourings and flavourings, antioxidants and preservatives. However, the supply of natural alternatives is still quite limited. There is still a lot of work to be done on the stability of these substances: for example, natural colourings lose their colour more rapidly than the synthetic varieties.
The Flemish food industry must therefore develop natural ingredients with process stability. We might consider here, for example, existing natural processes such as fermentation. Production techniques are also in need of further development.
The final three priorities chosen by the experts relate to the entire food transition area. They are also more

supportive in nature: if it does not act in these three areas, Flanders will be unable to take advantage of the remaining business opportunities.

Supplying High-Quality and Safe Food

Flanders can differentiate itself by going for high-quality food products. Automation can contribute towards food quality and safety, including through the use of advanced sensors and third generation robotics. Microbial safety also plays a leading role. The use of rapid detection methods to analyse food products is therefore of great importance.

The demand for sustainable products is also rising. As a result, new and sustainable processing technologies are becoming ever more important because they help guarantee freshness, quality and safety.

Informing Consumers Objectively and Interactively

It remains important to inform consumers objectively and interactively about food and balanced nutrition. This is why a top-down approach is no longer recommended: innovations must emanate from the consumer and will require a greater understanding of consumer behaviour and wishes. Companies must use new interactive business models and take advantage of the opportunities presented by e-commerce and e-communication.

Creating Transparency in the Food Supply Chain

There is a huge gulf between consumer and producer in the modern food supply chain. Consumers do not have an adequate 'feel' for the food products and are not always prepared to pay for quality and sustainability.

The Flemish food industry must therefore, as a matter of urgency, work towards greater transparency throughout the food supply chain and re-familiarise the consumer with the producer and with the other links in the food supply chain: 'from farm to fork'. Work must also be done to improve transparency between the other links in the food supply chain, which is currently fragmented and complex.

VISION2025: SMALL COUNTRY, GREAT FOOD

CHALLENGES & OPPORTUNITIES

POPULATION GROWTH	AGEING POPULATION	GROWING MIDDLE CLASS	URBANISATION
CLIMATE CHANGE	PANDEMICS	UNDERNUTRITION VERSUS DISEASES OF ABUNDANCE	GLOBALISATION

OBJECTIVES

OPTIMAL INTERACTION WITHIN THE CHAIN & WITH CONSUMERS	FOOD QUALITY & SAFETY
FOOD SUSTAINABILITY & SECURITY	FOOD & HEALTH

SCIENCE, TECHNOLOGY AND INNOVATION PRIORITIES

REDUCING FOOD LOSSES AND FOOD WASTE	VALORIZATION OF SECONDARY FLOWS AND BY-PRODUCTS	NATURAL INGREDIENTS WITH PROCESS STABILITY	OFFERING BALANCED NUTRITION	SUPPLYING FUNCTIONAL FOODS
SUPPLYING HIGH-QUALITY AND SAFE FOOD				
CREATING TRANSPARENCY IN THE FOOD SUPPLY CHAIN				
INFORMING CONSUMERS OBJECTIVELY AND INTERACTIVELY				

CRITICAL SUCCESS FACTORS

LONG-TERM VISION & STABILITY, JOINING FORCES

DEMONSTRATION PROJECTS, FAVOURABLE BUSINESS CLIMATE

HEALTH
WELL-BEING

Health and Well-Being

The transition area of Health and Well-Being is based on a new vision of health and well-being for 2025, in which we aim for a better quality of life for all. This enhanced quality of life will be achieved through innovation in an international setting. Moreover, this improved quality of life must remain affordable.

From Challenges to Objectives

In the area of Health and Well-Being Flanders enjoys a good reputation internationally. Our medical sector can rely on strong strategic basic research and high-quality clinical research. Knowledge centres and university hospitals provide an excellent breeding ground for the intense industrial activity in the sector. For instance, Flanders ranks number 1 in the world when it comes to the amount of medicines in clinical development per capita.

However, the experts expect that a number of challenges and trends will come to play an ever more pertinent role in our society in the coming decade. This will place a strain on the traditional models of healthcare. Therefore, Flanders must pursue the following five objectives:

- greater focus on prevention and early detection;
- breakthrough of personalised medicine;
- patient-centered disease management;
- longer independent living with maximal quality of life;
- valorisation in Flanders, Europe and internationally.

Priorities

With these objectives in mind, the experts propose the following nine innovation priorities. As the first priority is transversal, it is crucial to the other eight.

Sustainable Financing of Healthcare

The financing model currently used in healthcare is no longer financially viable, not even for the next decade. In addition, the current system inhibits the introduction of innovations in some domains. Disruptive system innovation must lead to a new financing model that relies on a balance between solidarity, affordability and quality.

New Healthcare Model

Nowadays, hospitals play a central role in our healthcare. In decades to come, the patient will become ever more central. Personalised quality care will become the rule. Radical changes in, amongst others, the organisation of healthcare, its funding and the training of care professionals, are needed to realise this new healthcare model.

Central Electronic Health Record

Functional patient-oriented care hinges on a centrally managed electronic health record, which allows care providers to monitor each patient in a more individualised way. Privacy concerns should obviously be taken into account when developing such centralised electronic health record databases.

Remote Patient Monitoring, Treatment and Intervention

Technological evolutions are bringing remote treatment within closer reach. These techniques are also becoming more affordable. Applications include remote monitoring of the effectiveness of any treatment and optimisation of the given doses. Epidemics can be better and more rapidly detected and monitored, for example. Remote medical interventions are also on the horizon. These trends present Flanders with a great many opportunities to explore and exploit various niches.

Innovation in Research and Innovation Processes and Training Approach

Complementary co-operation across various disciplines is crucial to the transition area of Health and Well-Being. This is because the real innovations can be expected at the intersections of different disciplines. This calls for 'technological multilingualism' on the part of doctors, engineers, behavioural scientists, etc. Today's curricula pay insufficient attention to this multilingualism.

In addition, medical research must increasingly take place from a translational perspective, through ongoing interaction between lab and clinic. This will give patients faster access to tangible results. Finally, research funding must use a much longer time horizon to ensure that promising leads can also be funded in subsequent phases. The economic features of the healthcare model and the associated care budget have to be clear from the outset.

Clinical Big Data

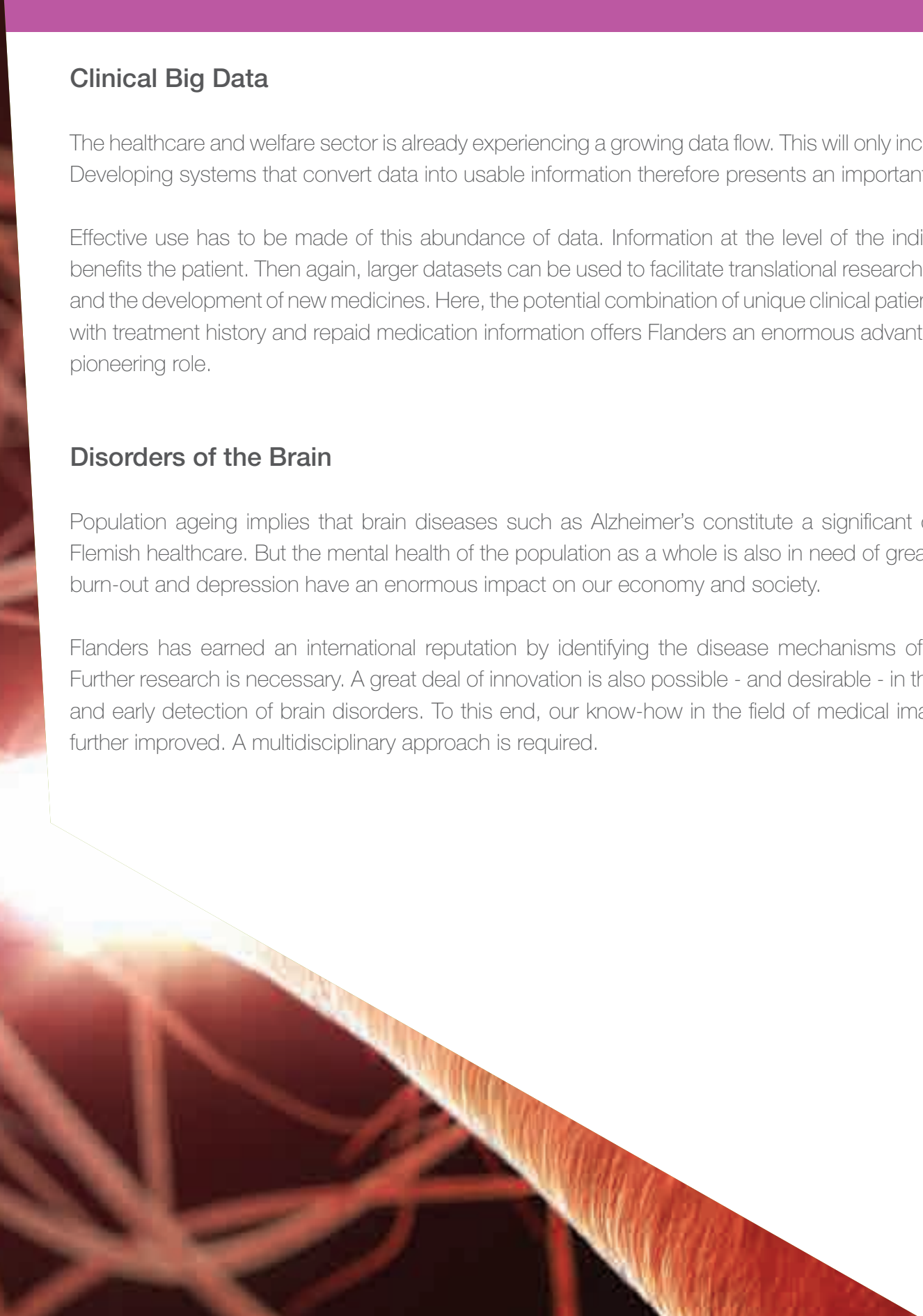
The healthcare and welfare sector is already experiencing a growing data flow. This will only increase further. Developing systems that convert data into usable information therefore presents an important challenge.

Effective use has to be made of this abundance of data. Information at the level of the individual mainly benefits the patient. Then again, larger datasets can be used to facilitate translational research, clinical trials and the development of new medicines. Here, the potential combination of unique clinical patient information with treatment history and repaid medication information offers Flanders an enormous advantage to play a pioneering role.

Disorders of the Brain

Population ageing implies that brain diseases such as Alzheimer's constitute a significant challenge for Flemish healthcare. But the mental health of the population as a whole is also in need of greater attention: burn-out and depression have an enormous impact on our economy and society.

Flanders has earned an international reputation by identifying the disease mechanisms of Alzheimer's. Further research is necessary. A great deal of innovation is also possible - and desirable - in the prevention and early detection of brain disorders. To this end, our know-how in the field of medical imaging can be further improved. A multidisciplinary approach is required.



Personalised Therapy with New Markers

A number of new diagnostic techniques and therapeutic remedies can grow from our genetic and molecular knowledge of disorders. A better understanding of disease mechanisms and new biomarkers, substances that can be used as an indicator of disorders, will become the cornerstones of tomorrow's healthcare and personalised medicine. One important precondition here is the development of inexpensive diagnostics for use outside the hospital environment.

In Flanders, we have the academic and business strength needed to play a significant role in this rapidly emerging international market.

Cell and Immunotherapy

This priority covers a wide range of disciplines in which we set out to both cure diseases and prevent them. Common examples include gene therapy, stem cell therapy, development of functional biomaterials and so-called tissue engineering, tissue culture, specific cellular therapies and stem cell transplantation.

Flanders has also seen a renewed interest in the broad field of immunotherapy, in which it holds a historically strong position. With further development and support, this research area can become an essential building block in the evolution towards personalised medical care and prevention, using the patient's own immune system as a weapon.

VISION 2025: ENHANCING QUALITY OF LIFE IN AN AFFORDABLE WAY THROUGH INNOVATION WITHIN AN INTERNATIONAL CONTEXT

CHALLENGES & OPPORTUNITIES

FOCUS ON PREVENTION	BREAKTHROUGH OF PERSONALISED MEDICINE	PATIENT-CENTERED DISEASE MANAGEMENT	LONGER INDEPENDENT LIVING WITH MAXIMAL QUALITY OF LIFE	VALORISATION IN EU AND INTERNATIONALLY

SCIENCE, TECHNOLOGY AND INNOVATION PRIORITIES

NEW HEALTHCARE MODEL	CENTRAL ELECTRONIC HEALTH RECORD	REMOTE PATIENT MONITORING, TREATMENT AND INTERVENTION	CELL & IMMUNOTHERAPY
INNOVATION IN RESEARCH & INNOVATION PROCESSES AND TRAINING APPROACH	PERSONALISED THERAPY WITH NEW MARKERS	DISORDERS OF THE BRAIN	LARGE DATA SETS, STORAGE AND PROCESSING (BIG DATA)
SUSTAINABLE FINANCING OF HEALTHCARE			

CRITICAL SUCCESS FACTORS

LONG-TERM VISION & STABILITY, JOINING FORCES

DEMONSTRATION PROJECTS, FAVOURABLE BUSINESS CLIMATE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URBAN PLANNING

Urban Planning, Mobility Dynamics and Logistics

As this transition area is concerned, Flanders is facing three major challenges. By 2025, the Flemish population will grow from six to seven million and its composition will continue to change. This will put new demands on space and mobility. Secondly, our space will be affected by climate change. Cashing in on our unique geographic location poses a third challenge in the context of further internationalisation.

As a matter of fact, developments in mobility, urban planning and logistics are highly interwoven. Solving mobility issues for instance often involves action in the area of urban planning. The vision for the transition area Urban Planning, Mobility Dynamics and Logistics 2025 therefore departs from a holistic approach: 'Metropolis Flanders 2025: linked in a smart and sustainable way'.

From Challenges to Objectives

Flanders has a unique location at the heart of Europe with major international economic gateways and a strong logistics sector. Flanders must continue to benefit from this unique position. Another advantage is Flanders' historically rooted small scale.

By contrast, the urbanised area in Flanders is highly scattered and thus open space is fragmented. Mobility is becoming increasingly hampered. Flanders must therefore take action.

This is why long-term policy plans have recently been worked out in the areas of mobility and urban planning. Examples include the draft Flanders Mobility Plan (2030) and the White Paper on Space (horizon: 2050) (awaiting publication). With this foresight the VRWI wishes to contribute to these plans' outcome, which is why we took them as our starting point. We distilled seven objectives from this to make Flanders a metropolis linked in a smart and sustainable way.

- Connect Flanders with the rest of the world;
- Use proximity and accessibility as guiding principles;
- Strengthen spatial resilience;
- Make transport user-oriented;
- Improve the transport system's cohesion and robustness;
- Guarantee efficient and safe use of the transport system;
- Make the transport system more environmentally friendly and energy efficient.

Priorities

In the transition area of Urban Planning, Mobility Dynamics & Logistics, we define eight science, technology and innovation priorities: five vertical and three horizontal.

The five vertical priorities are:

Sustainable Smart Cities

By 2050, 70% of the population will be living in cities. To remain liveable and sustainable in the future, Flemish cities will have to be organised as smart cities. A smart city combines and supports its various functions such as housing, employment, recreation and servicing in a strategic way, through for example smart ICT and mobility solutions.

Currently, in Flanders, we already develop and apply technologies that put us on the way to achieving smart cities. However, we need to do more.

Increased Spatial Efficiency through Smart Densification

In the future, demographic pressure will force us to make better use of our space, but without affecting the quality of life. Spatial efficiency must therefore improve appreciably in Flanders. This is possible for instance by means of smart densification and 'Transit-Oriented Development' (TOD). In TOD, public transport serves as the backbone and catalyst of urban development.

In Flanders, spatial efficiency can be increased through innovation in areas such as architecture, construction, sustainable building, precycling and ICT. In turn, smart densification facilitates innovation in other areas, such as energy.

Synchromodality

Synchromodal transport is the use of different transport modes in a directed fashion. Goods and passengers are moved from point A to point B based on criteria such as cost, quality and time. Only these criteria make up the transport choices.

Synchromodality allows us to use all the existing forms of transport more efficiently, more flexibly and more sustainably. Transport is optimally adapted to the environment and the user. Potentially, synchromodality could make the car less obvious as a means of transport. In order to seize those benefits, Flanders must fully explore synchromodality.

Spatially Resilient Systems

To be less vulnerable to the effects of climate change, it is necessary that we strengthen Flanders' spatial resilience. A resilient space is more able to absorb shocks and changes, thereby reducing societal costs in the future.

In order to make our space and cities more resilient, firstly we must better design them. This will help us curb problems such as flooding and the urban heat island effect. We will also need to aim for innovation in all areas that help strengthen this resilience. Urban food production is a perfect example.

Green Mobility and Logistics

If we want a more environmentally-friendly and energy-efficient transport system, we need to make each trajectory more sustainable or even unnecessary. Thus, green mobility and logistics can be summarised by: avoiding, rescheduling and making transport more sustainable. To implement this, we need to focus on both technological developments and behavioural changes.

There are three horizontal priorities underpinning the five above:

Intelligent Transport Systems

The term 'Intelligent Transport Systems' (ITS) relates to the application of information and communication technologies to keep the mobility system functioning optimally. These IT applications are implemented at every level: the vehicle, the driver, the user and the infrastructure. If we want a safer, more reliable and more environmentally friendly transport system, Flanders must certainly turn its attention to ITS. By doing so, we will be able to connect with smart transport networks in neighbouring countries.

Behaviour and Lifestyle

Citizens can also be the 'drivers' of innovation towards more sustainable mobility and urban planning. Intensive research on citizens' behaviour and choices can provide leverage for far-reaching societal changes. New research subjects of this type can make technological innovations advance. Since these innovations count in the human factor they will be better supported and more easily achieved.

Big Data

New, complex datasets also play an important role in Urban Planning, Mobility Dynamics and Logistics. The translation of big data into usable information and new applications allows us to develop new services, products and processes. Traffic, for example, can be guided by self-learning traffic lights which take their data from video cameras.

VISION 2025: METROPOLIS FLANDERS: LINKED IN A SMART AND SUSTAINABLE WAY

CHALLENGES & OPPORTUNITIES

POPULATION GROWTH	CLIMATE CHANGE	GLOBALISATION

OBJECTIVES

CONNECT FLANDERS INTERNATIONALLY	PROXIMITY AND ACCESSIBILITY AS GUIDING PRINCIPLES	SPATIAL RESILIENCE	USER-ORIENTED	COHERENT AND ROBUST TRANSPORT SYSTEM	EFFICIENT AND SAFE TRANSPORTATION	ENVIRONMENTALLY-FRIENDLY TRANSPORT SYSTEM

SCIENCE, TECHNOLOGY AND INNOVATION PRIORITIES

GREEN MOBILITY AND LOGISTICS	SUSTAINABLE SMART CITIES	INCREASED SPATIAL EFFICIENCY THROUGH SMART DENSIFICATION	SYNCHROMODALITY	SPATIALLY RESILIENT SYSTEMS
INTELLIGENT TRANSPORT SYSTEMS				
BEHAVIOUR AND LIFESTYLE				
BIG DATA				

CRITICAL SUCCESS FACTORS

LONG-TERM VISION & STABILITY, JOINING FORCES

DEMONSTRATION PROJECTS, FAVOURABLE BUSINESS CLIMATE

SMART RESOURCES

Smart Resource Management

The grand societal challenges such as population growth, climate change and globalisation are exacerbating the shortage of raw materials and putting pressure on resource management in Flanders. Therefore, with a view to the future and the promotion of welfare and well-being in Flanders 2025, sustainable resource management is crucial.

From Challenges to Objectives

Flanders has a good starting position when it comes to sustainable resource management. We have a number of strengths, such as our expertise in waste management, in increasing process efficiency and in processing complex material flows.

But our competitors do not remain idle either. Therefore, a concerted innovation drive remains necessary; not merely to maintain the position we have acquired, but to further develop and consolidate it. The experts concretised the grand challenges in six priority objectives:

- Efficient use of resources;
- Reduction in energy consumption (by at least 30% by 2030);
- Minimal environmental impact;
- Growth and employment;
- Education and training;
- Competitive industry.

Priorities

With these challenges and objectives in mind, we selected a number of science, technology and innovation priorities for Smart Resource Management.

Disruptive Process Innovation throughout the Life Cycle

Global competition is forcing Flemish companies to adopt a new approach. Gradual innovation no longer suffices to excel. Disruptive process innovations are essential if the Flemish (manufacturing) industry is to remain competitive.

Flanders cannot continue to muddle along with step-by-step innovations; existing processes must be completely rethought. There is a need for continual investment in state-of-the-art technologies which enable us, for example, to minimise waste flows and substitute those materials that cannot be easily recycled.

Use of Alternative and Renewable Resources

The pressure on traditional raw materials continues to increase. They are becoming increasingly scarce, are not always reusable and generate large amounts of CO_2 emissions. Alternative raw materials such as biomass, micro-organisms and even CO_2 will therefore grow in importance. But this calls for changes in the whole manufacturing and production process. At the same time, there is a need to reduce the number of different raw materials in each final product, as this makes subsequent recycling that much easier.

Flanders already has several players who occupy a leading role in this area - even worldwide. Policy must do the utmost to anchor these key players in Flanders and strengthen their position.

Lighter, Better Performing and More Sustainable Materials

Demand for lighter, better performing and more sustainable materials is booming. The benefits are legion: lightness, malleability, energy absorption, corrosion resistance. Composites in particular will be put to greater use in the decades to come. These are best developed in a multidisciplinary environment of business clusters, knowledge institutes and Original Equipment Manufacturers (OEMs).

The plastics and textile industry in Flanders are best placed to play a pioneering role. They should ensure to involve the SMEs in this innovation narrative.

Additive Manufacturing

In Additive Manufacturing (AM), products are custom-made and produced on-site. A prosthesis made by 3D printing is the perfect example. With a number of specialist companies, Flanders has acquired a leading position in this area: 8% of the world market. But the competition is tough. This is why it is an absolute must to further develop AM in Flanders in the coming decade.

AM helps to advance the circular economy and in this way it supports sustainable resource management. AM also benefits a new manufacturing industry. This is because AM creates a competitive edge, such as making small (personalised) series on-site, as and when demand arises.

Emerging Technologies

Three emerging technologies may well lend support to the development of sustainable resource management in Flanders. These are nanotechnology (using the material properties at the atomic level), bio-systems engineering (changing material properties by means of micro-organisms) and micro-reactors (reactors placed in parallel to handle small volumes cost effectively).

Given that these technologies have yet to mature, their potential is unclear for the time being. They do, however, deserve our attention with a view to sustainable resource management in 2025.

Closing Loops

Increasing scarcity of resources and materials forces us to develop a circular economy. This places not only recycling of materials centre stage, but also reducing our consumption of raw materials and energy at the outset – i.e. the design stage.

The circular economy is a long-term ambition and can only succeed if the respective partners pull together. Good business models are crucial, as are awareness-raising and consumer involvement.

Flanders is already strong in materials technology and recycling and enjoys a well-developed and evolutive policy framework. But there is a need to further develop this position and take on a leading role in Europe.

Implementing the Factory of the Future Programme

Rising costs, a relative stagnation in production and outmoded production machinery constitute an explosive mix. The installations that were state-of-the-art 30 years ago are in urgent need of an upgrade, if our highly export-driven Flemish industry is to remain internationally competitive. This is precisely the ambition of the Factory of the Future programme, which links economy and ecology together.

The Factory of the Future programme aims to halve the consumption of resources and energy by Flemish industry and double the flexibility of the Flemish production apparatus, so that it can respond to market dynamics with twice the speed.

Developing and Introducing New Business Models

A lot of important product and process innovations are created at the intersection of different sectors. They give rise to new value chains and call for entirely new business models. For example, products will not, by definition, change owners in a circular economy, as the customer no longer purchases products, but briefly ‘borrows’ them.

The government can facilitate here. It can support intensive multi-sectoral collaborative partnerships and testing grounds. Testing grounds allow innovations to germinate and grow into economically viable products and services. It is therefore essential to support companies that sow these grounds.

VISION 2025: ENHANCING WELFARE AND WELL-BEING THROUGH SUSTAINABLE RESOURCE MANAGEMENT

CHALLENGES & OPPORTUNITIES

POPULATION GROWTH	SCARCITY OF RESOURCES	CLIMATE CHANGE	GLOBALISATION

OBJECTIVES

RESOURCE EFFICIENCY	ENERGY DEMAND REDUCTION (-30% IN 2030)	MINIMAL ENVIRONMENTAL IMPACT	ECONOMIC GROWTH AND JOB CREATION	EDUCATION AND TRAINING	COMPETITIVE INDUSTRY

SCIENCE, TECHNOLOGY AND INNOVATION PRIORITIES

CLOSING LOOPS				
FACTORY OF THE FUTURE				
NEW BUSINESS MODELS				
DISRUPTIVE PROCESS INNOVATION THROUGHOUT THE LIFE CYCLE	USING ALTERNATIVE AND RENEWABLE RESOURCES	LIGHTER, BETTER PERFORMING AND MORE SUSTAINABLE MATERIALS	ADDITIVE MANUFACTURING	EMERGING TECHNOLOGIES

CRITICAL SUCCESS FACTORS

LONG-TERM VISION & STABILITY, JOINING FORCES

DEMONSTRATION PROJECTS, FAVOURABLE BUSINESS CLIMATE

NEW ENERGY

New Energy Demand and Delivery

The energy issue is one of the greatest challenges at the moment. Our energy requirements are growing steadily, while reserves of fossil fuels - coal, gas and oil - are diminishing. In addition, generating power by burning fossil fuels constitutes a heavy burden on our environment.

Towards Flanders 2025, we will have to make the transformation to a new, more efficient energy system, using cleaner and more sustainable energy and in line with the European system.

From Challenges to Objectives

In 2013-2014, the European Commission took the initiative to draft an integrated European roadmap in order to accelerate the development and deployment of cost-effective, low-carbon energy technologies. It is crucial to make this our number one priority if we are to create a sustainable European energy system. With this European ambition in mind, experts have set five objectives, specific to Flanders, for the transition to a new energy system:

- The transition must be characterised by sustainable and efficient use of energy, raw materials and other natural resources.
- The supply of energy must be guaranteed at all times.
- The transition to sustainable energy must remain socio-economically viable and affordable, even for the most vulnerable groups in society.
- The energy transition must not hamper the competitiveness of our Flemish industry. If anything, it should strengthen it.
- We must strive for maximal valorisation of the technological innovations that emerge during the transition, also internationally.

Priorities

Holistic Approach

It is impossible to simply redesign the Flemish energy system from scratch. According to experts, we need a holistic approach and must meticulously scrutinize each of the four cornerstones of the system: energy generation, energy consumption, energy storage and energy transport.

At the same time, we should aim for technologies that provide us with sustainable solutions for these four cornerstones at each level at play.

Saving energy on a small (residential) scale calls for technological innovations that differ from those used for large-scale, long-term energy storage at the industrial or national level. Then again, sustainable energy generation at the local level (e.g. wind turbines) calls for technologies other than those at the level of Metropolis Flanders (offshore wind farms). As the four cornerstones are highly interconnected and require different solutions depending on scale, a systems approach is needed.

Technologies for Sustainable Energy Supply

A new energy system hinges on an adequate supply of sustainable energy. Sustainable, low-carbon energy generation is therefore the starting point. If Flanders is to meet the 2020 and 2030 European targets, we will have to tap into every renewable energy source available. It will be a matter of combined efforts: drawing on technologies to harness solar, wind and tidal energy, as well as geothermic energy and 'waste-to-energy', at the small and large scale alike.

Technologies to Reduce Energy Demand

Energy supply is inextricably linked to demand. One of the core priorities of the energy transition is therefore to drive down demand. Flanders should start by renovating its existing buildings to make these more energy-efficient.

At this moment, renovation projects are often ill-considered. Successive, uncoordinated actions sometimes cancel each other out, so that the planned energy gains are not always achieved at the end of the process. To prevent this, we need to develop renovation packages, which combine a variety of techniques and technologies. These can subsequently be applied to both individual buildings as well as quarters and districts.

There are also large (energy) gains to be made in our energy-intensive Flemish industry. We must therefore aim for technologies that reduce the energy requirements of industry and make production processes more energy-efficient. This might be done by developing more efficient machinery, recuperating heat from waste, employing heat exchangers and other technological innovations.

Technologies for Energy Storage

Energy storage technologies are crucial to bring energy supply and demand in line with each other. This is especially the case with decentralised and discontinuous energy conversion, such as solar or wind energy. However, energy storage remains a challenge and is still the weakest link in energy transformation. This is why technological breakthroughs in this area offer so much (valorisation) potential. Reason enough for Flanders to draw this card.

Currently, it is still unclear which technologies we will turn to for small and large scale energy storage. For this reason, we must invest in a number of potential winners. It is in our interest to do this selectively, by only considering those technologies where Flanders has expertise and strong players.

Technologies for Energy Grids

Between energy supply and demand, we find new 'end users' who both generate and consume energy. These 'prosumers' have a growing influence on how and when the network is loaded. At some times, they consume a lot of energy, at other times they produce too little. The distribution and transmission grids of the future will have to connect all these large and small prosumers. They will have to integrate them, even on an international scale, and always maintain the balance between supply and demand. After all, in a sustainable energy system, we cannot allow the lights to go out.

In Flanders, we are already doing excellent research on various grid technologies (on transmission and distribution, on interconnectivity and interoperability, on demand control etc.). This R&D effort must continue unabated, and be tested in real time in so-called virtual power plants where various technologies interact and communicate with each other.

Public Support for New Business Models

Our energy transition will only be successful if we develop new business models that allow us to finance the transition in a sustainable and socially equitable manner. If not, it may be difficult to gather support for the transition.

Economic growth and employment also help generate public support. Therefore the energy transition must serve to strengthen the competitiveness of Flemish enterprise. At the same time, the transition can lead to the development of new value chains, on the services as well as the production side.

A flourishing Flemish industry boasting plenty of jobs would not only increase support for the energy transition, it would actually become one of the forces driving this transition. All the more reason for rethinking our existing business models.

VISION 2025: TRANSITION TO A NEW ENERGY SYSTEM WITHIN EU CONTEXT

CHALLENGES & OPPORTUNITIES

POPULATION GROWTH	SCARCITY OF RESOURCES	CLIMATE CHANGE	URBANISATION	GLOBALISATION

OBJECTIVES

SUSTAINABILITY OF ENERGY (2020/2030), RESOURCES, LAND, ...)	SECURITY OF SUPPLY	SOCIO-ECONOMIC FEASIBILITY AND AFFORDABILITY	COMPETITIVE FLEMISH INDUSTRY	VALORISATION ON EU AND INTERNATIONAL LEVEL

SCIENCE, TECHNOLOGY AND INNOVATION PRIORITIES

HOLISTIC APPROACH
WITH ECONOMIC MODELLING, NEW BUSINESS MODELS AND CREATING PUBLIC SUPPORT

	SUPPLY		DEMAND	STORAGE		GRID	
BUILDING	SUSTAINABLE ENERGY TECHNOLOGIES	INTEGRATION RENEWABLE ENERGY	RENOVATION FOR ENERGY DEMAND REDUCTION	SMALL SCALE	SHORT, MEDIUM AND LONG TERM	INTEGRATING/BALANCING GRIDS	
DISTRICT		HYBRID SYSTEMS	COLLECTIVE RENOVATION APPROACH				
METROPOLIS FLANDERS IN EU CONTEXT		DECENTRALISED VERSUS CENTRALISED	MATCHING SUPPLY AND DEMAND		INTERACTION VARIOUS ENERGY VECTORS		
INDUSTRY		HYBRID SYSTEMS	ENERGY DEMAND REDUCTION MOMENT OF CONSUMPTION	LARGE SCALE			SYNERGY BETWEEN COMPANIES

PROSUMERS

CRITICAL SUCCESS FACTORS

LONG-TERM VISION & STABILITY, JOINING FORCES

DEMONSTRATION PROJECTS, FAVOURABLE BUSINESS CLIMATE

Society 2025

Science and technology on their own do not suffice to achieve radical breakthroughs and innovations in our society. The promising developments in science and technology will have to be combined with new understandings from a socio-economic and societal perspective.

The vision for Society 2025 focuses on smart, innovative and sustainable creation of welfare and well-being in a social, resilient and internationally-oriented Flanders.

From Challenges to Opportunities

Flanders seeks answers to the societal challenges by focusing on research and innovative technologies – and rightly so. But we must not lose sight of the important areas of overlap that exist in these domains. Society 2025 aims to bring these together. It adds a socio-economic perspective to the analysis, as investments in each of the transition areas call for parallel and far-reaching modernisation of the socio-economic structures.

The focus on combining efforts is the result of an intense cross-pollination between experts from business, civil society, centres of knowledge and government. By confronting ideas from different perspectives, we can bring new insights and pathways for innovation to tomorrow's knowledge society.

Ultimately, it will be up to human beings to realise these pathways and transitions. Therefore, knowledge on people and society, emanating from the social sciences and humanities, will be indispensable.

Priorities

Social and Intellectual Capital

The science, technology and innovation priorities from the vertical transition areas have greater chance of success in a society that stands open to them. It is then paramount that these priorities reflect the experiential world, needs and culture of the community that will have to assimilate them. Therefore the message must be to invest the required social and intellectual capital beforehand.

Three levers are needed to generate a return on social and intellectual capital:

1) A modernised and adaptive education system, which gives attention to: combatting inequality and unqualified dropouts; the standard of qualification and the quality of the teacher; achieving a balance between generic competences and specialist knowledge; and incorporating practical experience in courses.
2) A modernised education policy and dynamic labour market policy in which we move from job security to career security. Here, it is essential to achieve buy-in from the social partners.
3) Social innovation that overlaps several policy domains and that seeks the answers to economic and societal challenges. Moreover, we need to take into account that a social innovation that impacts positively in a given domain, may result in new challenges in other areas.

Favourable Business Climate

International studies confirm that an internationally-oriented and competitive business climate facilitates the emergence of new companies. Furthermore, it invigorates innovation and socio-economic development.

Above all, creating a favourable business climate requires a change of mindset in Flanders. Like many other regions of Europe, Flanders is characterised by a risk-averse attitude when compared to the United States and the emerging economies. This is detrimental to entrepreneurship, so it is high time for a change. A stimulating business climate implies recognising the successes of entrepreneurs, and not begrudging them.

Greater attention must therefore go to: (1) ambitious entrepreneurship, (2) better guidance for start-ups, (3) positive image-forming, (4) entrepreneurial attitude in education, (5) a larger and faster flow out of the 'golden cage' formed by the knowledge centres to enterprise, (6) growth of Flemish SMEs, (7) attracting international companies, (8) diffusion of knowledge.

Systems Approach

An individual technical innovation is relatively easy to copy. It is however much more difficult to copy the ecosystem in which this innovation takes place. In the longer term, therefore, the development of ecosystems could provide Flanders with a lasting competitive edge. Developing ecosystems is best done through a systems approach.

In addition, strategic plans stretching beyond the legislative term of government also play an important role in preserving the balance needed between stability and flexibility. This balance is required to give innovations every chance of success. To create these ecosystems, it is essential to join forces across borders, sectors, policy domains and disciplines.

Innovative Financing

The economic and social development of Flanders hinges on the availability of public and private capital for scientific and technological development and innovation. What characterises innovation pathways is that they require long-term financing and that the returns are highly uncertain. This economic reality would tend to suggest that sustained funding is appropriate.

Such sustained funding can best be made to measure, as the target groups - SMEs, spin-offs, large companies - all have different needs. It is up to government to improve the efficiency with which these funds are made available to companies and knowledge centres. Government needs to simplify its funding mechanisms, and make them more transparent and better known.

The priority action points are as follows: creating a stimulating framework for the provision of venture and growth capital; developing innovative collaborative funding platforms to leverage private capital; continued attention to the labour costs of R&D personnel; better protection of revenues from innovation; investigating the possibilities of a tax shelter; incorporating commercial activities in testing grounds from the outset; and more innovation-oriented invitations to tender.

Innovative Legislation and Regulation

Careful legislation helps justify the spend of public resources. And yet it is important that we find a better balance between public justification and lowering bureaucracy. Finding this balance will create room for creativity, entrepreneurial spirit and innovative work. It will allow entrepreneurs to effectively bring innovations to the market.

Innovative legislation and regulation is therefore a must if we are to support the development of (small) businesses and the innovative capacity of enterprise in general. Regulation becomes a stimulus to innovation when it is stable (legal certainty), transparent, and flexible. To accelerate innovation, we can experiment with limited-regulation environments. We might also consider a charter for a career in innovation, and a permanent network of lawyers, economists, etc., that can perform an ‘innovation test’ on existing and new regulations.

VISION 2025: WELFARE AND WELL-BEING IN A SMART, INNOVATIVE AND SUSTAINABLE WAY IN A SOCIAL, RESILIENT, INTERNATIONALLY-ORIENTED FLANDERS

INNOVATIVE KNOWLEDGE SOCIETY 2025

CHALLENGES & OPPORTUNITIES

DIGITAL SOCIETY 2025	FOOD 2025	NEW ENERGY DEMAND AND DELIVERY 2025
SMART RESOURCE MANAGEMENT 2025	URBAN PLANNING, MOBILITY DYNAMICS & LOGISTICS 2025	HEALTH & WELL-BEING 2025

SUB-TRANSITION AREAS

- SOCIAL AND INTELLECTUAL CAPITAL
- FAVOURABLE BUSINESS CLIMATE
- SYSTEMS APPROACH
- INNOVATIVE FINANCING
- INNOVATIVE LEGISLATION AND REGULATION

Last, but not least...

The transition areas in this brochure are the result of an intensive process. Over 230 stakeholders participated, thinking and debating about the future. Today we can shape the future. To make progress we have to get our feet wet addressing the needs of our societies in an economically fruitful way.

This is a call to all potential international partners: entrepreneurs, scientists, investors and governments to create cross-border alliances, building the leading innovation hubs of tomorrow.

If you wish to get in touch with the experts involved, please feel free to contact us at: info@vrwi.be.

Would you like to order the full report of the VRWI Foresight 2025?
(in Dutch only)

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