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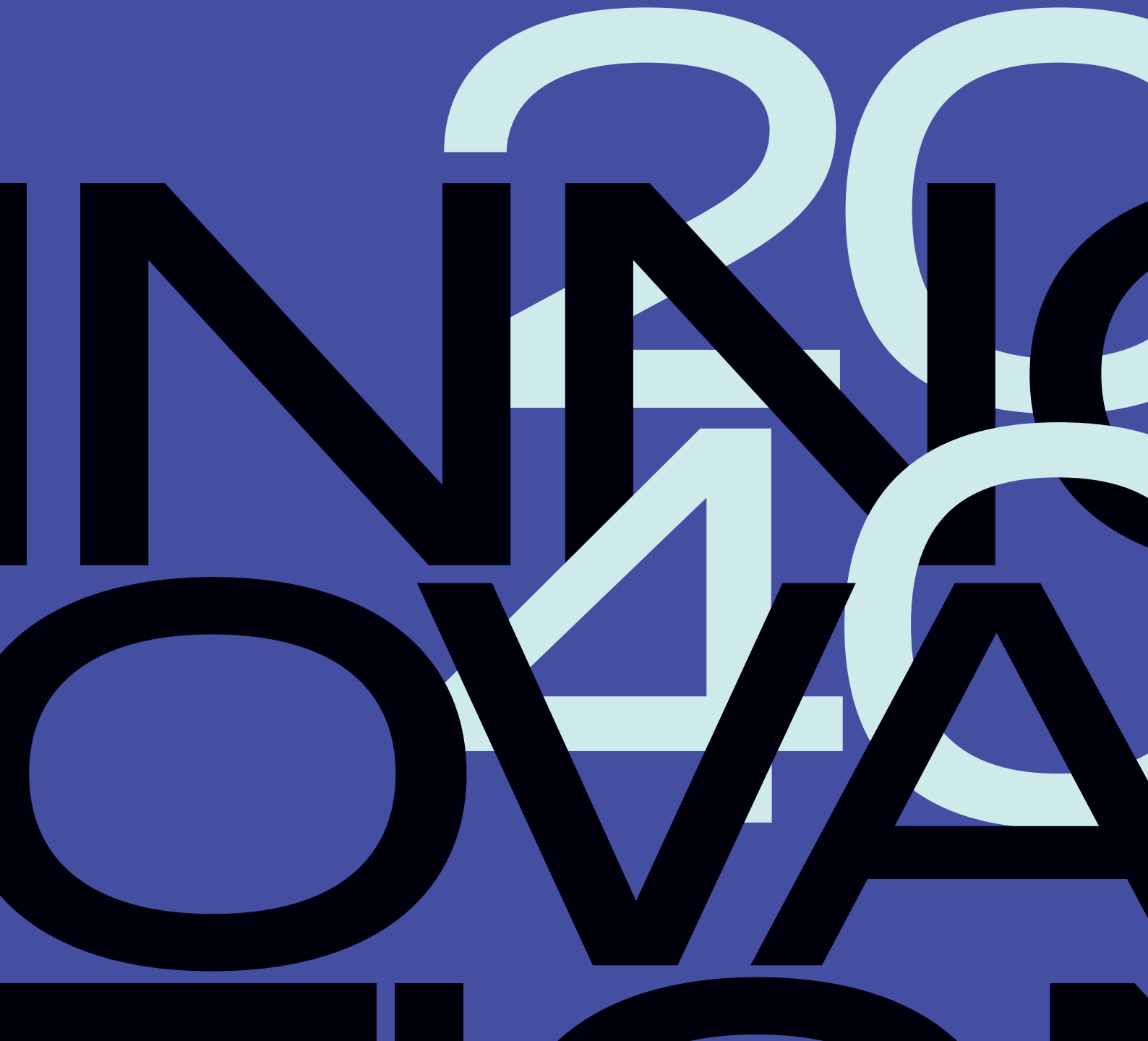
ΕΣΠΑ 2021-2027
Programme Central Macedonia

ONE STOP LIAISON OFFICE

REGION OF CENTRAL MACEDONIA

Exploring & monitoring changing conditions, trends and needs for the region of Central Macedonia

INNOVATION LANDSCAPE 2040



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changing conditions,
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INNOVATION LANDSCAPE 2040

ONE STOP
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CONSULTING

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Action: Innovation & Entrepreneurship Ecosystem Support Mechanism

Subproject Provision of Scientific, Research and Administrative-Technical Support Services of the Innovation and Entrepreneurship Ecosystem Support Mechanism

Program: Central Macedonia 2021-2027 ERDF co-financing

Action The action concerns the support of the operation of the Innovation and Entrepreneurship Ecosystem Support Mechanism in the RCM, which was created during the PP 2014-2020 and operates under the Independent Directorate for the Innovation and Entrepreneurship Support of the RCM.

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Programme Central Macedonia

2040 INNOVATION

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INTRODUCTION

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Rationale

The term "scenario" comes from the dramatic arts. The scenario is a story with plausible cause-and-effect links that connect a future situation to the present while depicting key decisions, events, and consequences. It is important to note that we should not confuse scenarios with predictions. Usually, the scenarios are captured at a specific time and a specific subject. In our case, the development of **four archetype and five future scenarios** for the future concerns **"Innovation in Central Macedonia in 2040"**.

Central Macedonia's innovation ecosystem can only meet the challenges of the future if it takes effective short-, medium- and long-term action. The scenarios, which were approached through a thorough scientific methodology and describe possible future prospects, enable the development of strategic alternatives, to better prepare through planning to the events that will affect Innovation over a fifteen-year horizon.

The design of scenarios aims to inform policy makers, both in the Region of Central Macedonia and at national level, so that, taking into account the uncertainties and drivers of innovation and change, which may have an impact on the dynamics of regional development, they can shape the future of Central Macedonia, with a view to improving competitiveness, economic growth and preparing and adapting it to the possible developments of the future.

Methodology

Strategic foresight, as part of a planning process, is characterized by the systematic collection of data, both from experts and from the wider community, to understand potential developments. In the present study, the methodology was based on a combination of quantitative and qualitative data. Data from bibliographic research as well as previous One Stop Liaison Office studies were used, while the main data collection tool was a specially designed participatory interactive workshop.

The strategic foresight approach followed the “Manoa” methodology, which was developed at the University of Hawaii. The Manoa Method is a structured framework for developing alternative scenarios for the future, based on Jim Dator's four archetypes of futures: Growth, Collapse, Discipline, and Transformation. This method is part of the broader field of future studies and offers a systematic process for exploring possible futures.

Phase one:
Implementation of the Workshop

Based on the question *"What are the main factors that will affect the innovation & entrepreneurship ecosystem in the region of Central Macedonia in the upcoming fifteen years (2040)"* and with the participation of 35 representatives of the quadruple helix of the RCM innovation ecosystem, divided into five groups, who explored four different futures and five scenarios in the context of the workshop:

01 The impact of nine (9) Megatrends (identified bibliographically) on the innovative environment of Central Macedonia was evaluated and analyzed.

02 Trends and weak signals or uncertainties, as well as their impact on the innovative environment of the region, were sought, with a time horizon of 2040.

03 Alternative futures were analyzed, and five scenarios were formulated, which examine the possible developments under conditions of Growth (2 scenarios), Collapse, Transformation and Discipline (1 scenario each).

04 Based on the previous findings, appropriate policies per Scenario were sought.

Phase two:
Analysis of Findings, Categorization, and Documentation

01 Appreciating the Past: In this step, the historical foundations of Innovation in Central Macedonia are understood and the decisive events and factors that shaped the current landscape are analyzed.

02 Understanding the Present: The current dynamics of innovation in Central Macedonia are recorded.

03 Forecasting Future Aspects: Long-term trends, technological developments, social changes and environmental impacts are explored, as well as emerging issues and possible reversals over a 15-year time horizon, as identified in the Participatory Workshop and upon a thorough investigation of the literature.

04 Experiencing Alternative Futures: The research team explores the factors that make up the archetypal scenarios from different futures, based on different assumptions of the working groups. This step involves creating detailed descriptions of each scenario and exploring the potential impacts and consequences.

05 Creating Pathways: The challenges of the area for each alternative future are documented and robust strategies are developed to achieve the strategic goals of the future and the steps to be followed to face the challenges are defined. Finally, the actions required to implement are prioritized.

Mapping

The report is developed in three main sections.

In the **first section**, a detailed presentation is given of seven (7) Megatrends (out of the nine (9) that were investigated), four (4) Drivers of Change with ten (10) identified Trends, and five (5) Uncertainties with seven (7) Weak Signals, whose conditions influence the alternative futures.

The **second section** outlines the five scenarios, which explore the possible developments in Central Macedonia over a fifteen-year horizon, considering the conditions identified by the working groups during the participatory workshop. In addition, the policies proposed for the challenges faced by Central Macedonia in each scenario are presented.

The **third section** proposes seven policies for the gradual development of strategic innovation resilience by policy makers in Central Macedonia. These policies are presented prioritized according to the weight given by the co-creators of the five Scenarios. In addition, a set of actions is proposed to support the achievement of these policies in the next fifteen years.

Ethics and safeguarding of personal data protection

Respecting the General Data Protection Regulation (GDPR), the data collected during the participatory thematic workshop was used exclusively by the working group for the purposes of the project and in no way where they associated with the personal data of the participants, and which were requested exclusively during the digital registration in the workshop for the reliability of the information they contained.

ONE STOP LIAISON OFFICE
REGION OF CENTRAL MACEDONIA

2040 INNOVATION

INTRODUCTION

Executive Summary

As innovation has a profound impact on many aspects of political, economic, social, and geostrategic environment worldwide, the Region of Central Macedonia closely follows the developments, trends and variables that favor and support it or negatively affect its development. Stakeholders, private and public sector executives and citizens, explored through a participatory and dynamic process (Thematic Participatory Workshop) the variables that will affect the innovation and entrepreneurship environment of the region by 2040, identified their dynamics and evaluated their interaction. The findings were the input of the working group for the development of five scenarios that will determine the future of innovation in Central Macedonia over the next fifteen years. Building upon scenario-driven insights, seven strategic policy recommendations have been formulated to systematically strengthen regional resilience mechanisms and prepare communities for diverse conditions across different alternative futures (five scenarios): Development, Collapse, Transformation and Discipline.

The seven examined Megatrends that directly or indirectly affect the region and may affect innovation developments are **Climate Change & Environmental Degradation**, **Resource Depletion, the Demographic Problem**, **Urbanization and Growth of the Middle Class**, **Technological Explosion**, **Hyperconnectivity and Cybersecurity**, the **Dawn of the Global South and Polarization**. Digital transformation, changes in the employment model, digital nomads, the rise of populist parties and woke agendas, trust in institutions, urban farming, a shift in urban agriculture, pressure on social welfare systems and the health sector, geopolitical turmoil, brain drain, crowdfunding, tightening of the legislative framework for the protection of intellectual rights and personal data, strict environmental regulations and greenwashing will be some of the effects of these forces.

In a narrow context, scanning the future identified four Drivers of Change that have a significant impact on the area of innovation and require the attention of policymakers: (a) **Political Unrest and Confused Democracy**, (b) **Employment 4.0: Transition to new work conditions**, (c) **The Era of Convergence: Digital Superiority and Skills**, and finally (d) **Social Values as a Lever for Legislative Change**."

However, the innovative environment in the future can be identified through a wide range of scenarios. The need to develop a set of distinct scenarios led to the study of uncertainties that affect the environment in an unpredictable way, interact with each other drastically and play a key role in understanding the conditions that will be created in the future of innovation in the region, and in choosing five uncertainties that their developments over time define the futures we chose, as most likely to shape the innovation and entrepreneurship ecosystem in the region of Central Macedonia. The five Uncertainties highlighted by the working group are:

[1] Political and Geopolitical Uncertainty: Buckle up, turbulence expected
[2] Business Uncertainty: Anticipated Outcomes and Corporate Transformations
[3] Regulatory Frameworks for Innovation: Ethics Considerations, Strategic Directions and Development
[4] Navigating the Era of Disconnection: Addressing Workplace Loneliness and Social Uncertainty
[5] The Impact of Climate Change on Tourism.

Glossary - Context

Megatrend
An important inevitable stream of developments, an identifiable group of phenomena with a clear direction of evolution (e.g. climate change) and wider impacts on many levels.

Trend
A long-term change that moves in a clear direction (e.g., the ageing of certain populations).

Uncertainty
Emerging issues that are observed but we cannot assess in the current phase of detection how they may evolve in the future.

Weak Signal
An event or phenomenon that can be seen as a first sign of change or a new trend under development.

Black Swan
An extreme event that - a priori - is considered impossible and difficult to predict, but has long-lasting and drastic consequences, changing the course of history. In retrospect, an attempt is made to explain it to make it sound less random.

In summary, the **Scenarios** and their conditions, heading towards 2040, are:

Bullfrog	Octopus	Bee	Pupa	Turtle
01	02	03	04	05

SCENARIO 01

Bullfrog

Bullfrog characteristics

Transformation, adaptability to the environment, rapid development, long-distance coverage with long-range jumps, flexibility and adaptation to the available resources for nutrition, a resounding call for his goal.

Growth Condition

Sudden and rapid growth, overcoming obstacles with great power. Rapid growth may be accompanied by high risk and uncertainty. Focus on specific sectors or technologies.

SCENARIO 02

Octopus

Octopus Characteristics

The octopus is intelligent, resourceful, social, adaptive, imaginative, observational, resourceful, and camouflaged / transformed to survive.

Growth Condition

Multifaceted and flexible development due to rapid adaptation to conditions, implementation of innovative solutions and creation of strong networks and expansion into markets. Growth is sustainable and resilient, based on continuous learning, and willing to change strategies when conditions demand it.

SCENARIO 2040 IN CENTRAL MACEDONIA

The Region of Central Macedonia is a developed innovative region in Europe, with a strong knowledge economy and supports innovative entrepreneurship with policies starting from school education. Advanced technology in the region is supported by attracting foreign investment and skilled human resources, while the region is an attraction for young workers and digital nomads. Central Macedonia places particular emphasis on green policies, social challenges, also, are not lacking. In this context, a start-up company operating in the green economy manages to respond to the trends of the time and becomes an integral part of the daily life of all citizens of the region.

Strong partnerships, academic background of entrepreneurship, Smart City technologies, circular business models and green transition are the key features of the thriving Region of Central Macedonia in 2040. Thanks to legislative reforms and strategies and despite political instability, the region has a high culture of innovation, while Open Innovation is mainstream. The circular economy and ethical consumption are priorities, and the region is a magnet for digital nomads and investment. Urbanization and desertification of rural areas remain pressing challenges. A local company responds to these conditions and showcases the local culinary tradition and entrepreneurship of the region, connecting producers and consumers through a technology platform that promotes sustainability.

SCENARIO 03

Bee

Bee characteristics

Collaboration and social organization, ability to communicate, saving and storing resources, resilience, industriousness and productivity, role readjustment, supreme ecological role, use of tools and materials.

Collapse Condition

Economy vulnerable and easily disturbed by external factors. Limited and slow growth prioritizes sustainability, social cohesion and resilience. Difficulty in adjusting.

SCENARIO 04

Pupa

Pupa characteristics

For a long time under protection, gradual development, complete reconstruction and final transformation, impressive change of shape or structure, adaptable to the environment, not engaging in direct competition[1].

Transformation Condition

Gradual development after a long-term phase of ‘protection’ and ‘maturation’, leading to restructuring of the economy and impressive transformation. The area adapts to the landscape, without direct competition, seeking collaborations.

SCENARIO 2040 IN CENTRAL MACEDONIA

Central Macedonia, reflecting the national conditions, is in economic, technological and social decline. Agricultural production, along with its value chain, is suffering from the devastating consequences of a shortage of raw materials. Intense urbanization and the outmigration of young professionals further weaken the economy, while a lack of innovation acts as a barrier to investment. The EU is currently weakened and unable to effectively support its regions. Nevertheless, there are positive developments, such as Thessaloniki emerging as a logistics hub. Following this model, a small hub is tackling the challenges in the apparel sector by establishing a collaborative innovation ecosystem.

Scenario 2040 in Central Macedonia: With the radical transformation, Central Macedonia emerges as a resilient region, capitalizing on digital transformation and sustainable practices. The economy and society are being reshaped, artificial intelligence and innovation create new opportunities. Industrial symbiosis and technology parks transform Thessaloniki into a technology hub that attracts investment and talent.
Despite harmonization with international standards and persistent challenges—such as greenwashing, social polarization, civic disengagement, and the woke vs. anti-woke agenda—the region is making environmental and social improvements. In this context, a traditional hotel is investing in digital transformation and responding to social pressures for environmental respect, evolving into a sustainable year-round tourist destination.

SCENARIO 05

Turtle

Turtle characteristics

Security, patience, durability and stability, temperature regulation according to the external environment, disciplined and peaceful animals.

Discipline Condition

Stable and resilient environment with responsible use of resources, where long-term planning ensures the faithful implementation of policies. There is respect for the rules, self-control and consistency in the fundamental principles.

SCENARIO 2040 IN CENTRAL MACEDONIA

With a conservative development course, the Region of Central Macedonia focuses on traditional industries and low-risk investments to maintain stability, security and social cohesion. It confronts change with investments in infrastructure and sustainable practices in the primary sector, but with little focus on research and innovation leading to slow growth and brain drain. The role of the church is strengthened, reforms target low-risk strategies, increased migration flows, and urbanization create new markets and employment opportunities. In this landscape, a local traditional building materials industry focuses on its reliability and the gradual integration of sustainable solutions and ensures its resilience.

The proposed policies were identified and prioritized by the innovation and entrepreneurship ecosystem of Central Macedonia, to address the alternative futures in 2040, as follows:

01 Human Capital and Skills Development

02 Enhancing Innovation and Technology Transfer

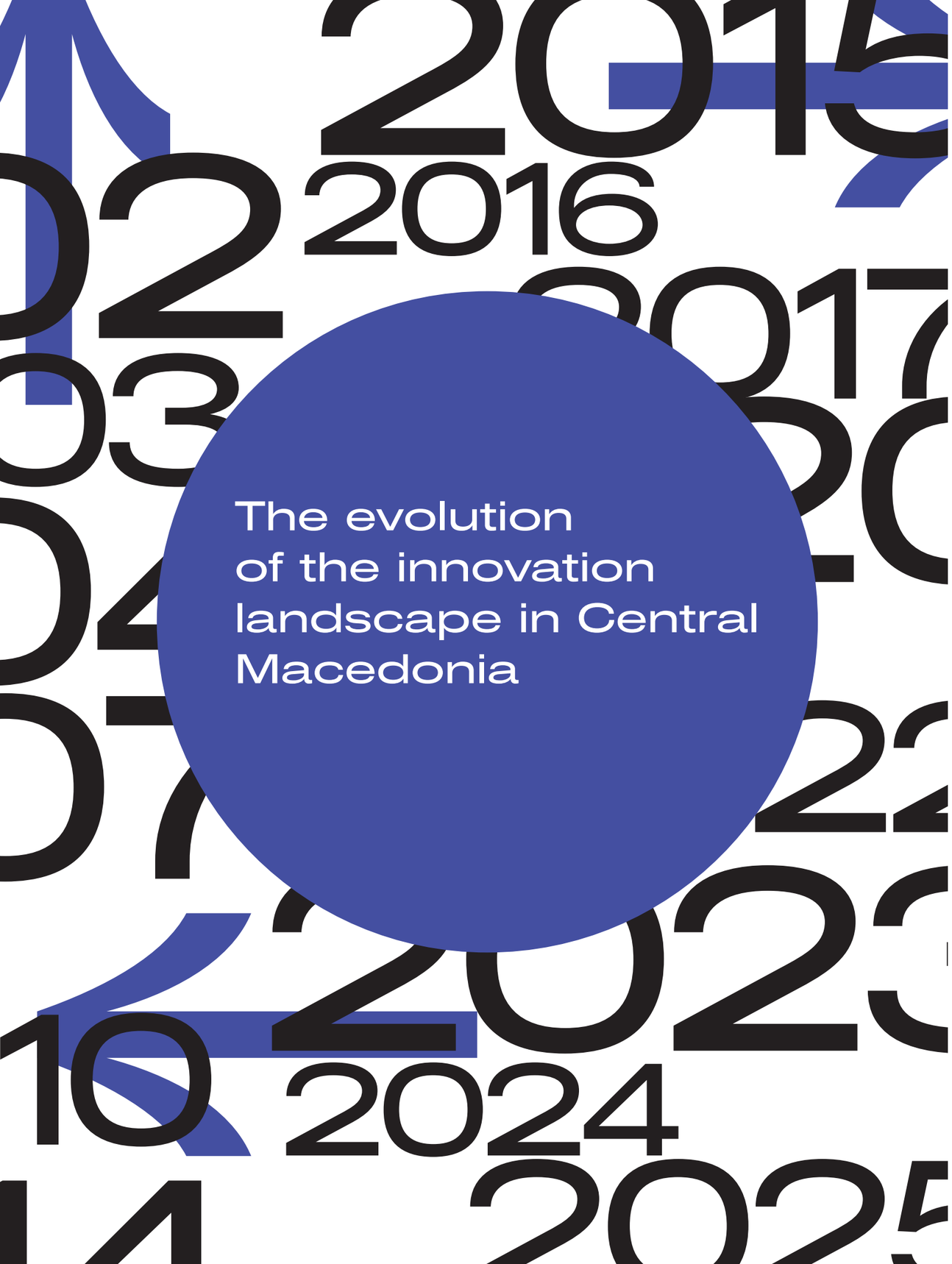
03 Supporting Entrepreneurship and Risk Taking

04 Strengthening Cooperation and Regional Advocacy

05 Attracting Investments

06 Attracting Qualified Personnel and Repatriation (Brain Gain)

07 Enhancing Open Innovation and Awareness.



INNOVATION IN THE REGION OF CENTRAL MACEDONIA IS BEING TRANSFORMED...

Innovation in Central Macedonia has experienced significant acceleration in the last twenty years, especially after 2013 with the inclusion of innovation in the European agenda and the adoption of the RIS3 strategy. The new institutional framework and European funding programs have encouraged entrepreneurship and research and created an enabling environment for transforming the innovation landscape at a rapid pace. The 2021-2027 programming period comes to seal the broad recognition of innovation as an important factor in the development of policies for employment, competitiveness, climate and environment, digital transformation, industry and energy.

The establishment of the Thessaloniki Technology Park in 1994 marked a new era for innovation in the region. With the presence of the Centre of Research and Technology, Hellas - CERTH, the Park has created a unique environment that encourages collaboration between academics, researchers and entrepreneurs. This results in the development of new products and services, the creation of high value-added jobs and the strengthening of the competitiveness of the Greek economy.

In 2001, the "Thessaloniki ICT Business Park - Thessaloniki Technopolis S.A." was established, which is an initiative of the Association of Information Technology Companies of Northern Greece and involves Information Technology and High Technology companies as well as public entities. To date, the Park has not been utilized to the expected extent despite the infrastructure it provides, as the State has not proceeded with the establishment of incentives for innovative entrepreneurship.

In 2003, the establishment of the first Innovation Incubators began after their inclusion in the ELEFTHO program of GSRT (i4G, Thermi SA) to support (incubate) new businesses in their first steps (3-7 years), providing them with a variety of services and/or capital.

In 2006, the Alexandria Innovation Zone (AZK) was established, as the managing body intended to promote the Thessaloniki Innovation Zone. In addition, the Regional Innovation Pole of Central Macedonia (RISC) is being developed, on the initiative of GSRT, an association of private and public organizations, with the aim of enhancing the technology, innovation and competitiveness of the RISC with the participation of 72 actors from the academic, research and business community of the ICT sector.

The programming period 2007 – 2013 was a catalyst for the active participation of the regional R&I ecosystem in European innovation programs (FP7), laying the foundations for the development of an innovation culture.

The Regional Smart Specialization Strategy (RIS3) **is adopted in 2015**.

In 2016, the Independent Directorate for the Innovation and Entrepreneurship Support is established by the Region of Central Macedonia, while five (5) bodies of the region are supported with 9.5 million euros through the EPAnEK for Research and Innovation Infrastructures. At the same time, 13 bodies from Northern Greece collaborate for the first time at the 3rd Technology Forum, promoting research, innovation and entrepreneurship[2].

In the next year **2017, a memorandum of cooperation is signed between the Region of Central Macedonia** and the leading European research organization CERN, with the aim of enhancing entrepreneurship, innovation and new technologies, as well as the participation of Greek companies in CERN procurement tenders. In the same year, the startup hub "OK!Thess" is set up in Thessaloniki, in order to mature business ideas through acceleration programs. At the same time, an invitation from the RCM RoP leads to the support of 19 bodies with €8.2 million in Public Research Infrastructures, while another (1) body is supported with €2.5 million through EPAνEK.

In 2018, RCM is one of the three 'European Entrepreneurial Regions 2018' – EER Award (following its nomination and award the previous

The evolution of the innovation landscape in Central Macedonia

year by the European Committee of the Regions) for its innovative business strategy. The Aristotle University of Thessaloniki, with its first Hackathon in the same year, lays the foundations for a series of corresponding innovative programming events, which continue dynamically to this day. In the same year, the RCM proceeded with contracts amounting to 7.6 million euros from its RoP for the Strengthening of Public R&I Infrastructures, while the Research and Innovation ecosystem of the region implemented 393 projects, securing a total funding of 127.7 million euros from Horizon 2020.

I**n 2019, the One Stop Liaison Office of the Innovation and Entrepreneurship Ecosystem Support Mechanism is created by RCM**, a mediation and networking structure between the academic and research institutions of Central Macedonia with the business fabric of the region. In the same year, a business mission organized by the RCM visits Silicon Valley, to get to know and meet with the technology giants based on it and with the aim of developing partnerships and acquiring know-how. At the same time, the "Research – Create – Innovate" program funded 607 projects out of the 4,293 proposals submitted, with a total budget of 130.7 million euros.

In 2020, a Memorandum of Understanding is signed between the Municipality of Thessaloniki, the Ministry of Development and Investment and the Ministry of Digital Governance for the creation of an "International Centre for the Acceleration of Digital Transformation and Digital Skills (DT&S)" in Thessaloniki, in cooperation with the technology giant Cisco, joining 15 other cities around the world in the club of metropolises that host similar centers. During this period, the Thessaloniki Innovation and Technology Center Thess INTEC SA is founded, a 4th Generation Technology Park, with shareholders from the private and public sectors. The planned facilities of Thess INTEC SA, which will extend over an area of 760 thousand sq.m., within the framework of six Mega Projects, will host innovative businesses, research institutions and startups. In the region, Pfizer is making a significant investment of 20 million euros, contributing to the development of the local economy[3]. At the same time, five clusters are included in the 'Clusters' project of RCM RoP, securing funding of 3.2 million euros.

2021 was marked by the creation of two Competence Centers, I4byDESIGN and Architectural Aluminum Academy, which brought together in a public-private partnership framework 24 and 8 partners respectively, to enhance innovation in the region. In the same year, the 1st International Exhibition of Digital Technology and Innovation BEYOND is inaugurated in Thessaloniki, which is now organized on an annual basis by HELEXPO-TIF. In addition, the Region of Central Macedonia conquers the 9th place in the Top 10 fastest growing regions (2014-2021)[4].

I**n 2022, the "Balkan Gate I"**, the first and largest carrier neutral and certified TIER III Data Center in Northern Greece, is established and operates. At the same time, the T-Digital, the technological hub of Deutsche Telekom, was created in the area.

In 2023, the operation of the **reception office of Elevate Greece** was launched at the premises of the AZK with the signing of a Memorandum of Cooperation and Understanding. In addition, the **Open Innovation Confluence action is organized by the two Innovation Centers I4byDesign and Architectural Aluminium Academy**, with three leading Greek industries looking for innovative solutions to their major challenges. An important initiative is the Innovation Centers **"Lighthouse Hub"** through the interlocal cooperation project "Knowledge and Innovation Lighthouses" to enhance local development and diffusion of innovation in rural areas. In the same year, the newly established **Center for Entrepreneurship and Innovation of the Aristotle University of Thessaloniki (Walk AUTh)**, starts the first acceleration cycles, creates a Talent pool, collaborates with Startup Greece and hosts the new **EIT Digital** office, which aims to enhance digital innovation in Greece and neighboring countries. AZK completes the planning steps for the creation of the **1st Host of Innovative Activities (HNS) Agri-food Sector Thess InnoFood Hub**, following the issuance of the Presidential Decree on Urban Planning . Finally, the integrated '**Innovation, Research and Development Investment Plans'** significantly exceeded the initial budget of 6 million euros, reaching 45.8 million euros in public expenditure from the Central Macedonia Programme 2014-2020.

In 2024, the **1st IFS Awards Open Innovation Competition** is organized by the Region of Central Macedonia, where 10 major companies pose their challenges, attracting the interest of 55 groups (researchers, start-ups, etc.) to find a solution. This year, in addition, the UNITE project is approved by the European Commission, which upon its completion, the Region will be declared a **Regional Innovation Valley in Digital Health**. Towards the end of the year, the **"TITAN Digital Accelerator"** is established by the Titan Group in collaboration with CERTH and the IHU, for applied research on digital solutions in the building materials industry, while the **Alexandria Innovation Zone is awarded the "Startup Ecosystem Star 2024"** international award in Paris, during the SES Awards.

In the 2021-2027 programming period Europe will continue to face unstoppable global competition for talent, ideas and capital. Achieving positive regional economic growth based on research and innovation depends on regions' ability to leverage their strengths, integrate new technologies into traditional industries, and tap into their 'smart' regional potential.

The course of innovation in RCM is illustrated in **Figure 1**.

2001
2002
2003
2004
2007
2009
2010
2014
2015
2016
2017
2020
2021
2022
2023
2024
2025
2027

2. In 2025, the bodies supporting Technology Forum amount to twenty-seven (27)
3. According to the IOBE special study on Pfizer's contribution to the Greek economy, the impact on the GDP of the Regional Unit of Thessaloniki is estimated at 1.14 billion euros in total for the period 2020 – 2030, supporting on average about 1,750 full-time jobs locally. https://www.newsit.gr/megales-epixeiriseis/Pfizer-sxedio-epektasis-ton-egkatastaseon-sti-thessaloniki/4226861/
4. Regional Innovation Scoreboard 2021, p.38, Publications Office of the European Union, https://ketlib.lib.unipi.gr/xmlui/handle/ket/3728?locale-attribute=en/ https://ketlib.lib.unipi.gr/xmlui/bitstream/handle/ket/3728/ETBC21001ENN.en.pdf?sequence=1&isAllowed=y
5. www.thessinnozone.gr/thylakas-agrodiatrofis-thess-innofood-hub/

2001 - 2006

Innovation Hubs establishment
Technopolis Thessaloniki SA
Innovation Incubators
Alexandria Innovation Zone (AIZ)
Central Macedonia Regional Innovation Pole

2007 - 2013

Ecosystem participates at FP7
Participation of the regional R&I ecosystem in European innovation programmes (FP7)

2015

RIS3 Launch
Approval of the Regional Smart Specialization Strategy (RIS3)

2016

New Directorate, Funding & Networking
Establishment of the new Region of Central Macedonia Aut. Directorate for the Support of Innovation and Entrepreneurship
Research and Innovation Infrastructure (€9.5m)
Cooperation of 13 stakeholders of Northern Greece at the 3rd Technology Forum

2017

CERN, OK!Thess & Funding
RCM – CERN Memorandum of Understanding
OK!Thess set up
Public Research Infrastructure (€8.2m)

2018

Distinction, Hackathon & Investments
RCM European Distinction with EER Award 2018
Initiation of Hackathons by AUTH
Reinforcement of Public R&I Infrastructures (€7.6m)
Horizon 2020: 393 projects (€127.7m)

2019

Innovation Bridges
Creation of the One Stop Liaison Office
Silicon Valley Business Mission
607 projects of Research-Create-Innovate program (€130.7m)

2020

Structures, FDI & Partnerships
DT&S: Thessaloniki in the Network of Digital Cities
Establishment of Thess INTEC SA
Pfizer investment in the region
RCM RoP funding 5 Clusters (3,2m €

2021

Competence Centres & Beyond
Competence Centres: I4byDESIGN & Architectural Aluminium Academy
Opening of the 1st BEYOND EXHIBITION

2022

Significant Investments
Establishment and operation of Balkan Gate I
T-Digital Technology Hub

2023

Innovation Initiatives
Elevate Greece Reception desk
Open innovation: Confluence
“Lighthouse Hub” Innovation Centres
Walk AUTh
Thess InnoFood Hub plan
Funding: Innovation Investment Plans (€45.8m)

2024

Competitions, Partnerships
1st RCM Open Innovation: IFS Awards
Unite RCM project for Digital Health
Establishment of "TITAN Digital Accelerator"
SES Award for AZK

Figure 1

Historical review of innovative developments in Central Macedonia 2001-2004

THE RIS3 STRATEGY OF THE REGION OF CENTRAL MACEDONIA CONTINUES TO EVOLVE...

After a thorough planning process that started in 2013 and involved the participation of many stakeholders, the Regional Smart Specialization Strategy (RIS3) of Central Macedonia was initially adopted in 2015. To ensure the effectiveness and validity of the strategy, the Region undertook a review completed in 2016, with the Regional Council approving the updated Action Plan and the Monitoring Indicators Framework.

With the aim of broad acceptance and effective implementation of the updated RIS3 for the period 2021-2027, the Region of Central Macedonia organized an extensive and broad consultation with key stakeholders, during which the views and proposals of the business and scientific community were collected, reflecting the needs and priorities of the local innovation ecosystem.
The RIS3 Strategy of the Region of Central Macedonia reflects the conditions and priorities of the region with emphasis on the areas in which it has a comparative advantage where it will focus its investments. The identified regional priority areas are aligned for the period 2021-2027 with the National ones and are:

- **Agri-food Value Chain**
- **Tourism**
- **Culture and Creative Sectors & Industries**
- **Textile & Clothing**
- **Materials (Construction)**
- **Information and communication technologies**
- **Energy**
- **Environment and Circular Economy**
- **Transport and Supply Chain**
- **Life Sciences and Health**

Innovation in RCM is particularly dynamic, thanks to...

The success of the design of regional RIS3 strategies relies on participatory processes and actions of all stakeholders that make up the innovation and entrepreneurship ecosystem. The Region of Central Macedonia has achieved significant successes in the 2014-2020 programming period, utilizing the cooperation of the quadruple helix[6] for the implementation of entrepreneurial discovery process, with the aim of creating a high-performance innovation ecosystem, capable of absorbing and utilizing new knowledge, promoting the development and extroversion of the Region. Briefly:

→ **13 Workshops** in the sectors of Cultural and Creative Industries, Life Sciences-Health and Parapharmaceuticals, Circular Economy, Agri-food, Textiles & Clothing, Transport & Supply Chain (415 participants, 54% Industry)

→ **2 primary surveys** (687 participants, 63% Industry)

→ **7 structured meetings** with industry sector and innovation support experts (133 participants) and 6 targeted interviews.

Central Macedonia, with the strong presence of prestigious educational institutions, such as the Aristotle University of Thessaloniki, the University of Macedonia and the International University of Greece, is emerging as a dynamic innovation hub. The area hosts important research centers, such as CERTH and ELGO Dimitra, as well as specialized schools, such as the American Farm School, that combine research with education. Innovation support is enhanced by an extensive network of incubators, pre-incubators and accelerators, such as Thermi SA, I4G/I4G Pro, Technopolis, Alexandria Innovation Zone and OK!Thess, which provide the necessary infrastructure and services to support start-up entrepreneurship.
In addition, Competence Centres (I4byDesign, Architectural Aluminium Academy - AAA), coworking spaces, private colleges, but also government agencies, development companies, market intermediaries, start-ups and industries and many other bodies compose a dynamic, cohesive and multifaceted innovation ecosystem, making Central Macedonia an attractive destination for investment and business development.

The Central Macedonia Region is positioned in the European Innovation Scoreboard at...

The Region of Central Macedonia, a "Moderate Innovator" within the EU27, notably ranks 9th among the "Top 10 fastest growing regions 2014-2021"[7]. According to the EU's Regional Innovation Scoreboard 2025 (RIS), it stands 166th out of 241 NUTS-2 level regions across 26 countries.
The region's innovation strengths, significantly propelled by SMEs and public investments, are evident in its high rankings: 15th for 'SMEs introducing business process innovations', 16th for 'SMEs introducing product innovations', and 32nd for 'Sales of new-to-market and new-to-firm innovations'. Strong performance is also observed in 'Employment in innovative enterprises' (47th) and 'R&D expenditure in the public sector' (59th)[8].
Furthermore, Central Macedonia's research landscape is expanding. Its total researcher count of 13,285 sees a consistent annual increase, with researchers in the business and state sectors growing by 23% and 25% respectively[9].

6. BES-enterprises, GOV-Governance, HES-T tertiary & post-secondary education, PNP- Private companies and non-profit institutions.
7. Regional Innovation Scoreboard 2021, p.38, Publications Office of the European Union, https://hetlib.lib.unipi.gr/xmlui/handle/het/3728?locale-attribute=en/ https://hetlib.lib.unipi.gr/xmlui/bitstream/handle/het/3728/ETBC21001ENN.en.pdf?sequence=1&isAllowed=y
8. Regional Innovation Scoreboard 2025, Greece, p.16, Publications Office of the European Union, https://ec.europa.eu/assets/rtd/ris/2025/ec_rtd_ris-regional-profile-el.pdf
9. EKT, 2021 Data, Researchers in the whole country by region (no. of persons) (last updated 02.08.2023), https://metrics.ekt.gr/datatables/201

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REGION OF
CENTRAL MACEDONIA

EXPLORING & MONITORING
CHANGING CONDITIONS,
TRENDS AND NEEDS
INNOVATION LANDSCAPE 2040

Trend Analysis

Trends
2025

1 1

REGION OF
CENTRAL MACEDONIA

EXPLORING & MONITORING
CHANGING CONDITIONS,
TRENDS AND NEEDS
INNOVATION LANDSCAPE 2040

Megatrends

Megatrends 2025-2040

MEGATREND 1

Climate Change & Environmental Degradation: **Need for action**

Impact on Central Macedonia: **Important**

The effects of climate change are already visible globally and are expected to intensify in the coming decades. The European Union has set ambitious targets to cope with climate change, such as achieving climate neutrality by 2050 and reducing greenhouse gas emissions by at least 55% by 2030. To achieve these goals, several policies and measures have been adopted. However, despite these efforts, Europe still faces significant challenges, exacerbated by geopolitical developments, affecting security, economic development and the natural environment, and posing a threat to people's well-being. Nevertheless, we continue to emit more carbon than nature can capture.

Temperatures each year set a new record, causing climate zones to move north, resulting in crop yields falling and agriculture reshaping. Glaciers in the Alps have receded, reduced snowfall has led to low water levels and river freight transport is under threat. The 2023 forest fires in Europe and Canada broke historical records, with 2024 continuing this trend in America[10], while widespread flooding affects the whole planet. Schools are closing in North Africa and Asia after temperatures reach 45°C, rain falls on top of the Greenland ice sheet for the first time and Antarctic flowers bloom with greater density. Borders are moving, and the governments of Switzerland and Italy are working together to redraw the alpine border[11]. Reducing glaciers and melting snow threatens hydroelectric plants[12], increasing the possibilities of geostrategic conflicts as well.
Climate change requires systemic solutions and innovation in all areas. From manufacturing to education, all industries must adapt to the new conditions. Countries worldwide are developing policies to address impacts and strengthen resilience. Scientists and experts are exploring technological and structural changes, such as resource efficiency and environmental protection. Investments in research, education and innovation are essential to support this transition and benefit all sectors of the economy. This trend is likely to be hugely influenced in the medium term by the new US administration and its current economic developments.

Main impacts on Central Macedonia[13]

Agriculture and Food Systems[14]
Climate change is putting enormous pressure on food production systems. Extreme weather events are undermining agricultural practices and increasing risks for crops, compromising food security in recent years. Risks in food production and supply chains lead to rising prices and scarcity, while interconnection with agri-food industries exacerbates the problem, as changes in climate affect the entire food production and consumption chain.

Tourism and Quality of Life[15]
Climate change is reshaping tourism standards as destinations in the region will be forced to adapt to new climate conditions. The role of the industry in the economic stability of many areas of the periphery is at stake, as extreme weather events will discourage travelers. Quality of life due to external weather pressures will affect the living standards of local communities dependent on tourism.

Economy and Innovation[16]
Although it poses significant challenges, the climate crisis creates an environment that favors the development of sustainable business models and innovation. Investors and consumers are increasingly placing an emphasis on sustainable investment, looking for businesses that adopt ESG practices and contribute to environmental protection. The circular economy and technological innovation open new horizons for entrepreneurship and economic growth, creating opportunities for innovative products and services. Industries, such as building materials, are facing changes in demand and practices such as demand for energy-efficient buildings and infrastructure that can withstand extreme weather events increases. SMEs might have a huge challenge though in adapting to new norms and competition from importing goods and EU standards.

In Research and Academic Community[17]
Climate change requires a new approach to research. The need to redefine research priorities and the evolving role of the academic community are critical to developing innovative solutions and addressing this global challenge. Research centers in the region can contribute to the development of new technologies to reduce greenhouse gas emissions, such as renewables and energy storage, and to adapt to the impacts of climate change, such as the development of resilient crops and the management of water resources.

In Infrastructure and systemic challenges[18]
Extreme weather events such as heat waves, floods, droughts and extreme rainfall threaten the infrastructure and put under pressure critical systems such as energy grids and water and sewerage systems. The costs of restoration and adaptation are high as strengthening infrastructure to withstand future climate change and developing new, more resilient infrastructure requires significant investments.

10. https://atmosphere.copernicus.eu/cams-global-wildfires-review-2024-harsh-year-americas
11. https://newatlas.com/environment/moving-borders-countries/
12. State of the future 20.0, Copyright © 2024 by The Millennium Project
13. Workshop Results
14. Effects identified by groups: Bee, Octopus, Bullfrog
15. Effects identified by groups: Bullrog, Octopus, Bee
16. Effects identified by groups: Turtle, Octopus, Pupa
17. Effects identified by groups: Turtle, Bee, Pupa
18. Effects identified by groups: Turtle, Octopus

MEGATREND 2

In search of solutions, the Resource Depletion

Impact on Central Macedonia:
Intermediate

Growing demand and business models have depleted the earth's resources, leading to a critical situation where humanity's long-term survival is threatened. Most of the land (75%) and sea (66%) on the planet has been severely altered by humans. Only 3% of the ocean is currently considered 'free from human pressure'[19]. Non-governmental Organizations (NGOs) warn of overconsumption of all natural resources that threaten the planet's future ability to regenerate resources[20].

Expansion of land use, due to deforestation, contributes to land degradation, especially in areas lacking sustainable agricultural practices. Lack of water and other natural resources is a growing threat to global security. Climate change is exacerbating the situation, particularly in regions such as sub-Saharan Africa and the Middle East. The extraction of minerals, the transition to clean energy sources, and the growing demand for critical metals, such as rare earths, pose new challenges and strengthen the geopolitical influence of the countries that possess them. At the same time, the security of energy infrastructure is threatened by cyberattacks and natural disasters, while competition for limited resources intensifies geopolitical tensions[21].

All of this occurs, while the demand for water, food and energy is expected to rise significantly in the coming decades." The growing global demand for energy, water and food, predicted to grow 40-50%, 20-30% and 60-70% respectively, by 2050[22]. In particular:
The risk to food includes both food security and food safety. Food security is due to the increase in the global population, urbanization, climate change, water scarcity, and competition for resources. Food safety refers to the conditions and practices that maintain food quality to prevent contamination and foodborne illnesses.

The World Health Organization (WHO) estimates that diarrheal diseases transmitted through food and water are one of the leading causes of death, especially for children in developing countries.

Around the world ecosystems are competing for their daily water needs. Approximately 70% of water resources are used in agriculture, 20% for industry and 10% for domestic use. In many parts of the world, groundwater is depleted faster than it can be replenished and becoming increasingly polluted threatening agriculture and urban water supplies over the next decade.
Global energy demand continues to grow. Despite the urgent need to limit CO2 emissions, fossil fuels will remain the most important energy sources in the coming decades. By 2050, renewables, while growing significantly, will only account for about 30-35% of global energy demand, continuing to increase CO_2 emissions[23].

Main impacts on Central Macedonia[24]

Renewable energy sources and resource development[25]

The Region of Central Macedonia, in the context of the Regional Operational Program, places particular emphasis on supporting the energy transition. This will be achieved through the promotion of Renewable Energy Sources (RES) and the development of new technologies, which aims to ensure a more sustainable energy future for the region, reducing dependence on fossil fuels and contributing to the achievement of the European climate neutrality goals. However, there will also be increased mobilizations regarding the impacts of RES, such as the opposition to wind turbines due to concerns about the natural landscape, biodiversity, and noise.

Economic and industrial diversification[26]

Diversifying production to reduce dependence on specific sectors, combined with boosting innovation, is an effective way for the Region to strengthen the resilience of the local economy against external risks, create new jobs and attract investment.

Environmental challenges[27]

Water security issues affecting some areas of Central Macedonia, exacerbated by climate change, undermine quality of life and economic development. Adopting sustainable practices and investing in technologies are essential to protect water resources.

Circular economy and tourism[28]

By integrating the principles of the Circular Economy into tourism practices, the creation of new tourism business models and the development of products and services with high added value are enhanced, the environmental footprint is reduced, and environmentally conscious travelers are attracted to the region.

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20. https://worldenergynews.gr/index.php?id=36222
21. 'Resource Scarcity and the Shifting Dynamics of Global Security', NATOS's Strategic Warfare Development Command, 30.01.2024 https://www.act.nato.int/article/resource-scarcity-and-shifting-dynamics-of-global-security/
22. Scarcity is a major global trend, https://www.hannover-re.com/en/property-and-casualty/emerging-risks-insights/environmental-risks/resource-supply/#increase-in-global-demand-until-2050
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24. Workshop Results
25. Effects identified by group: Turtle. Bullfrog
26. Effects identified by group: Octopus
27. Effects identified by group: Bee
28. Effects identified by group: Pupa

MEGATREND 3

The planet in demographic turmoil

Impact on Central Macedonia: **Important**

The world's population is expected to grow by two billion people, from 7.7 billion today to 9.7 billion in 2050, before reaching a peak of almost 11 billion by the end of the century, although fertility rates continue to decline[29]. This paradox is largely due to advances in medicine, reductions in global poverty, and increases in life expectancy. The global community should prepare for continuous population growth in the coming decades[30], which will create more food and housing needs, population movements, depletion of natural resources, urban misery, increasing pressures on the environment and climate change, energy needs. Increased food needs will mean a doubling of agricultural production in four decades, a 30% increase in water consumption by 2030, and three billion more people seeking accommodation in urban areas[31].

Europe has recognized that overcoming these complex and interconnected challenges requires research and innovative solutions in terms of production, consumption, processing, storage, recycling and disposal of biological resources[32]. In addition, the foreseen challenges can be addressed with the known and new innovative technologies of engineering and sustainable application in practice[33].

The demographic transition, i.e. the transition from high fertility and mortality to high life expectancy and low fertility, is not at the same stage in all countries of the world. As a result, the percentage of people aged 65 and over varies significantly both between and within continents: in East Asia it stands at 10%, in Europe it reaches 21% and in the EU 27.5%. In Greece in 2024, about 23% of residents have passed the age of 65, a figure that is expected to increase further in the coming decades[34], while, according to the World Health Organization, its population is expected to decrease by 14% by 2050 (from 10.25 million inhabitants to 8.8 million)[35].

The ageing of the population has created a new difficult reversible reality for the EU-27, leading to a contraction of labor supply and employment and confronting it with challenges for the economy. The ageing population, which has above-average purchasing power, will soon create new markets and contribute to an increase in demand for services in areas that require innovative interventions in the field of health systems, infrastructure, transport, communications and technology. It is noted that the consumer behavior of the elderly will be driven by the desire for an active and independent lifestyle, thus giving priority to products and services that support their health, well-being and social life[36]. The continuous expansion of the "silver economy" refers to the assumption that in the future people will be in good health, will live longer and the retirement age will gradually increase. The reduction of the workforce will be offset by strong automation & productivity growth.

Main impacts on Central Macedonia[37]

Labor Market[38]

Brain Drain, the migration of highly educated and intelligent people to foreign countries, combined with an ageing population, leads to a reduced availability of skilled personnel. At the same time, the skills gap has created in the labor market, as the required skills are not covered by the supply, resulting in a negative impact on economic growth. At the same time, ageing reduces the availability of domestic labor to meet seasonal labor market needs.

Adaptation to demographic trends[39]

The empowerment of Central Macedonia from the effects of global demographic changes is achieved by promoting new skills that meet the needs of the labor market and by changing social attitudes towards work and learning.

Shifting economic and social focus[40]

Growing awareness of prevention issues and adequate health care because of ageing puts health services high on the agenda. The market responds with the development of services and technologies to assist the elderly and are tailored to their needs, such as accessibility solutions and specialized products.

Opportunities from digital transformation[41]

Leveraging digital and technological transformation, digital nomads are a driving force for economies, as these workers tend to have higher than average incomes, boost consumption, and reduce dependence on seasonal tourism. In addition, they contribute to the development of a more dynamic and innovative business ecosystem.

29. https://www.un.org/en/un75/shifting-demographics
30. https://www.unfpa.org/world-population-trends#readmore-expand
31. https://www.nato.int/docu/review/articles/2011/02/14/population-growth-the-defining-challenge-of-the-21st-century/index.html
32. https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52012DC0060&from=EN
33. NATO Bulletin https://www.nato.int/docu/review/articles/2011/02/14/population-growth-the-defining-challenge-of-the-21st-century/index.html
34. https://indemography.gr/einai-anastrepsimi-i-giransi-tou-paghosmiou-plithysmou/
35. World Health Organization, https://data.who.int/countries/300
36. https://www.euromonitor.com/article/top-five-global-population-trends
37. Workshop Results
38. Effects identified by groups: Turtle, Bee, Pupa, Bullfrog
39. Effects identified by group: Pupa
40. Effects identified by groups: Turtle, Bee, Pupa, Bullfrog
41. Effects identified by group: Octopus

MEGATREND 4

Urbanization and the Middle Class: **The pursuit of prosperity**

Impact on Central Macedonia: **Intermediate**

Today, according to the United Nations, 55% of the world's population lives in urban areas, a number that is expected to rise to 70% by 2050. This rapid urbanization will take place mainly in Asia and Africa, where fertility rates remain high. Although cities occupy less than 2% of the planet's surface, they generate 80% of global GDP and are responsible for more than 70% of carbon dioxide emissions.

Urbanization imposes the need for effective management by national and local authorities. Its rapid growth poses challenges to housing, infrastructure, and transportation, and exacerbates poverty and marginalization. Nearly a billion people are classified as 'urban poor', and greater efforts are needed to ensure access to the digital economy for those living in rural areas and support for smallholders and livestock farmers who play a vital role in food production and the protection of natural capital[42]. Correspondingly, it is estimated that 75% of the 447 million inhabitants of the European Union, live in urban areas – cities, towns and suburbs. Europe will see a continuous increase in the urban population, which is expected to exceed 80% by 2050[43]. Urban management policies will have a significant impact on the sustainable development of the whole European Union and its citizens. The EU recognizes the key role of urban authorities and supports them, notably through cohesion policy tools and instruments, to develop and implement integrated strategies for sustainable urban development. During the period 2021-2027, the European Commission strongly supports an increased focus on integrated sustainable urban development[44].
Rapid urbanization has profound effects on the social and economic structure of modern societies, with one of the most important being the rise of the middle class globally. The concentration of population in urban centers creates new opportunities for employment and entrepreneurship, leading to the creation of a broad middle class with increased purchasing power and influence. 2018 was a landmark year according to a study by the Brookings Institution, as for the first time just over 50% of the world's population (or about 3.8 billion people), were ranked in the 'middle class', while it was predicted that 2030 would reach 5.3 billion[45]. However, COVID-19 pandemic, with its devastating consequences, reversed this trend, leading to a global contraction of the middle class and an increase in poverty, apart from China. According to a Pew Research Center survey, the middle class has shrunk by 54 million people worldwide, while recovery seems challenging. At the same time, developed economies have suffered the consequences, with a negative impact on consumption and a strengthening of populist movements[46]. In 2023, in most high-income countries over 80% of the population lived in urban areas. Correspondingly, in most upper-middle-income countries the rate is in the range of 50% to 80% of the population. In many low- and lower-middle-income countries, the majority still live in rural areas[47].

The mechanisms through which the middle class influences growth are indicatively: stable demand (stable demand works positively for investment and investment leads to growth), confidence (the stronger the middle class, the more trust and stability there is in society and the economy), virtuous governance (strong middle class encourages virtuous governance, the functioning of institutions, the fight against inequality), values (social responsibility, work ethic, intolerance to delinquency, etc)[48].

Main impacts on Central Macedonia[49]

Business prospects[50]
Increasing purchasing power and rapid urbanization create the right conditions to create new markets that will meet the needs of an ever-increasing and changing consumer audience.

The polarization of urban – rural areas[51]
Exacerbates regional inequalities and widens the economic and social gap between Thessaloniki and surrounding areas. This further contributes to the desertification and decline of villages leading to economic and social regional stagnation.

Housing crisis and infrastructure pressure[52]
Limited housing availability, coupled with rising demand in cities, is driving up rental and home prices, making access to affordable housing increasingly difficult. At the same time, increased population concentration is burdening urban infrastructure, creating increased demands on basic services such as water, sanitation, waste management, education and healthcare.

Environmental and social challenges[53]
Urban overpopulation, coupled with the development of the middle class, weighs on available resources and degrades the quality of life of residents.

42. https://www.un.org/en/un75/shifting-demographics
43. 2018 Revision of World Urbanization Prospects" Population Division of the UN Department of Economic and Social Affairs (UN DESA), https://www.urban-initiative.eu/online-guidance-innovative-actions/introduction-background/context
44. https://www.urban-initiative.eu/online-guidance-innovative-actions/introduction-background/context
45. https://www.brookings.edu/blog/future-development/2018/09/27/a-global-tipping-point-half-the-world-is-now-middle-class-or-wealthier/
46. https://www.realinstitutoelcano.org/en/commentaries/the-fall-and-stagnation-of-the-global-middle-class/ https://ourworldindata.org/urbanization
47. https://www.kathimerini.gr/economy/local/815562/apopsi-h-anaptyxi-kai-i-mesaia-taxi/
48. Workshop Results
49. Effects identified by group: Turtle
50. Effects identified by groups: Octopus, Pupa, Bullfrog
51. Effects identified by groups: Bee, Bullfrog
52. Effects identified by groups: Bee, Bullfrog
53. Effects identified by group: Bullfrog

MEGATREND 5

Technological explosion, hyperconnectivity and cybersecurity

Impact on Central Macedonia: **Important**

Technology is evolving at breakneck speed, constantly bringing new applications that are radically transforming operating methods, changing production patterns and business models. Automation is gaining ground, functions are decentralized, and interaction is largely transferred to remote or virtual environments requiring society to adapt its thinking and practices to this new reality.
The development and adoption of new technologies is accelerating rapidly, covering a wide range of areas, from digital and biotechnological developments to next-generation materials and clean technologies. A typical example is the explosive popularity of ChatGPT, which reached 100 million monthly active users in just two months[54], while 4 of the largest technology companies (Microsoft, Meta, Alphabet and Amazon) are expected to spend 1/4 trillion dollars on artificial intelligence in 2025 and the global AI market is expected to grow sixfold by 2030[55].

These developments, albeit in different areas, demonstrate the acceleration of technological progress and the huge potential that opens. Developments in research and innovation, economic and geopolitical ambitions, and political choices are driving this acceleration. Cutting-edge technologies, with their rapid development and impressive advances in technology, are projected to skyrocket to a $9.5 trillion market by 2030, demonstrating their pivotal role in the future of technology[56]. At the same time, the increasing hyperconnectivity of people, devices and data over the internet is accelerating the convergence of technologies and sectors, leading to a new generation of products and services. The number of connected devices[57] globally is projected to grow from 30.4 billion in 2020 to 200 billion in 2030[58] and connected IoT devices from 16.6 billion at the end of 2023 to 40 billion by 2030[59].

Increased connectivity and the rapid evolution and influence of technology have, however, transformed the cybersecurity landscape. In the modern digital age, constant vigilance and adaptation is required. According to 2024 survey data, cyber-attacks increased at an alarming rate in the second quarter of 2024, compared to the previous year, with Latin America showing the largest increase (53%), followed by Africa (37%) and Europe (35%)[60]. Phishing and social engineering attacks in the reported year increased by 42%, affecting many businesses, according to the World Economic Forum report[62]. 85% of cybersecurity professionals attribute the increase in cyberattacks to the use of artificial genetic intelligence by bad managers, with concerns focused on privacy (39%), the effectiveness of anti-phishing mechanisms (37%), and addressing the increased frequency and speed of attacks (33%)[63].

Main impacts on Central Macedonia[64]

New Possibilities for Research and Innovation[65]

in areas such as artificial intelligence, biotechnology, nanotechnology and energy. The availability of data and new technologies makes it possible to understand complex phenomena and address global challenges, while collaborations foster innovation and knowledge transfer from research to practice.

Competition is transferred globally[66]

Any inability to adapt to the conditions of global competition brought about by technological progress and hyperconnectivity, leads businesses in the region to a loss of competitive advantage and to a gradual retreat.

Utilization of technology is a one-way street[67]

The diffusion and interdisciplinarity of technology contribute to development by connecting the region with the center, which allows the development of bottom-up business models and products, based on innovation and local development, taking advantage of the specificities and needs of each region. In addition, technology has a strong impact on many sectors of the regional economy, improving productivity, creating new jobs and attracting investment.

Changes in the labor market[68]

Creating new job specializations requires specialized skills, while the need for new infrastructure becomes imperative. Enterprises are called upon to redefine their entrepreneurship and develop new skills, while the radical redistribution of the work pattern is now a reality. The automation and emergence of new professions create a complex landscape, where job losses in some sectors coexist with the creation of new opportunities in others.

Social impact[69]

Education in new technologies is essential to empower citizens, while combating digital illiteracy ensures digital inclusion. Increased connectivity, however, raises issues of lack of security and privacy security, requiring the protection of personal data. At the same time, technology can lead to Smart and resilient cities, while new services are emerging that improve the daily lives of citizens.

54. https://www.rolandberger.com/en/Insights/Global-Topics/Trend-Compendium/
55. https://carnegieendowment.org/emissary/2025/01/trump-population-climate-ai-megatrends?lang=en
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57. Connected devices include things like smartphones and computers, up to tablets, smart TVs, wearables, IoTwearables, connected vehicles, and smart sensors.
58. JRC Megatrends 2040
59. https://iot-analytics.com/wp/wp-content/uploads/2024/09/INSIGHTS-RELEASE-Number-of-connected-IoT-devices-vf.pdf
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64. Workshop Results
65. Effects identified by groups: Turtle, Pupa
66. Effects identified by group: Bee
67. Effects identified by groups: Octopus, Bee
68. Effects identified by groups: Bullfrog, Turtle, Pupa
69. Effects identified by groups: Bullfrog, Pupa

MEGATREND 6

The Global South is Rising

Impact on Central Macedonia: **Intermediate**

Geopolitical dynamics are shifting sharply towards emerging economies around the world, highlighting the redistribution of economic power and influence from traditional western centers to the Global South, owning 88% of the world's population. Arguably, many of his countries in Latin America, Africa, and Asia are no longer passive participants on the global chessboard but are acting with increasing independence from the West[70]. This is particularly evident in three areas: climate change, where countries of the Global South, vulnerable to its effects, promote climate justice and the recognition of the historical responsibilities of developed countries. In global trade, where they refuse to follow the West's trade policies towards China, in pursuit of a fairer economic order. And in geopolitical conflicts, where their neutral stance on Russia's invasion of Ukraine, despite Western pressures, expresses their emerging power.

The stance of the Global South is not perceived by everyone as anti-Western, but as an attempt to make the voices and interests of its countries heard, claiming a more equal position in the global dialogue. India's Foreign Minister, Subrahmanyam Jaishankar, articulated this position at the Munich Security Conference in February 2024: “Europe must move away from the mentality that Europe's problems are the world's problems, but the world's problems are not Europe's problems[71].”

Indeed, the recent expansion of the BRICS -including Saudi Arabia, the United Arab Emirates, and Egypt- underscores this shift in the world order. With the inclusion of the 'three major' Arab economies, the BRICS now[72] comprise 45% of the world population and 28% of the world economy, while their members contribute 44% of the world's crude oil production[73]. Already, GDP in terms of the purchasing power of nations in the BRICS+ group dominated by the Global South - Brazil, Russia, India, China and South Africa - exceeds that of the Global North Group of Seven (G7)[74]. The economic strength of the BRICS+ and Global South is reflected in the impressive increase in the number of millionaires in countries such as China (+92%), India (+85%) and the United Arab Emirates (77%). Indicatively, 862.4 thousand millionaires are active in China, including 2,352 multi-millionaires and 305 billionaires. However, although the picture is not the same for South Africa, Iran, Brazil, Russia and Egypt, the number of millionaires is one of the indicators that reflect the strength of the megatrend, the change in the global economic order and the emergence of new powers[75].

The BRICS coalition can use this leverage of power not only to demand a fairer international order but also to realize these ambitions, for example by creating a parallel energy trading system, deepening trade links between members, creating an alternative system of development finance, reducing dependence on the dollar in foreign exchange transactions, and deepening technological cooperation in areas from artificial intelligence to space. It is expected that BRICS+ will look for opportunities in each sector in the coming years[76].

Main impacts on Central Macedonia[77]

Tourism and Commerce[78]

The growing influence of the Global South can enhance Greece's image as a safe and stable destination, attracting tourists and investment from these countries. At the same time, the emerging economies of the Global South offer new markets for Central Macedonia's products and services, boosting exports and economic growth in the region.

Logistics and Development[79]

The geopolitical position of Central Macedonia, combined with the development of the Global South, can create opportunities for the development of the region of Central Macedonia as a commercial center and attract investment in the logistics sector. In addition, the growing influence of Global South may lead to the need to create new incentives and implement more effective management strategies to seize the opportunities that arise.

Trade and Deindustrialization[80]

Greece may lose market share to countries in the Global South that have less stringent regulations and offer lower production costs. In addition, the growing influence of the Global South may lead to greater dependence of Central Macedonia on imports and exacerbate the phenomenon of deindustrialization.

70. Effects identified by groups: Pupa, Bee
71. Effects identified by groups: Bullfrog, Turtle
72. https://ilyc.global/en/ideas/what-is-polarization-and-why-it-matters/
73. World Economic Forum, The Global Risks Report 2025 20th Edition, Insight Report, https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf
74. https://www.worldbank.org/en/topic/poverty/overview
75. Global Gender Gap Report 2023 | World Economic Forum https://www.weforum.org/publications/global gender-gap-report-2023/digest/
76. Global Gender Gap Report 2023 | World Economic Forum https://www.weforum.org/publications/global gender-gap-report-2023/digest/
77. GLOBAL TRENDS TO 2040, Choosing Europe's future, European Strategy and Policy Analysis System (ESPAS)
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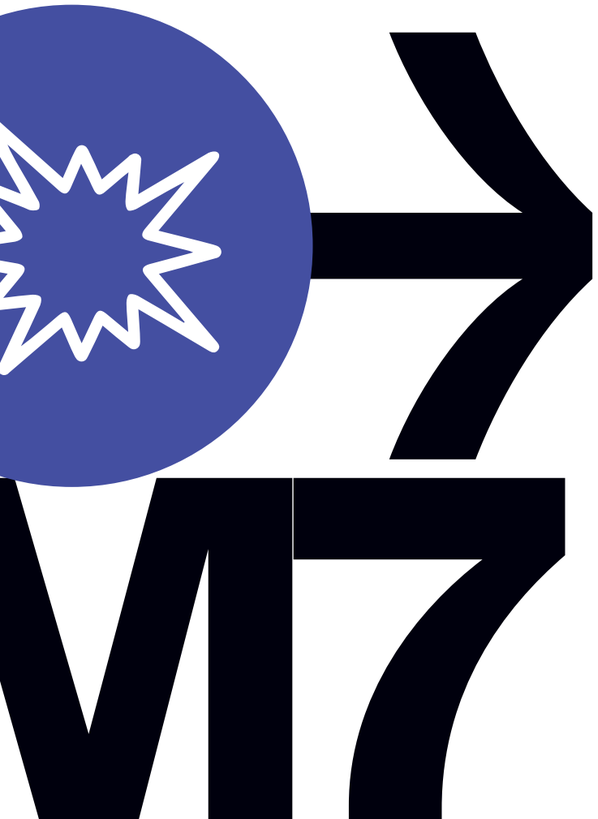
79. Territorial inequalities as drivers of affective polarization in Europe: disentangling within and between countries dynamics, https://ecpr.eu/Events/Event/PaperDetails/62912
80. Workshop Results

MEGATREND 7

Polarization: When opinions clash

Impact on Central Macedonia: **Intermediate**



Social polarization, a multidimensional phenomenon with interrelated causes and consequences, manifests itself with the exacerbation of ideological and cultural differences, leading to social instability, political deadlock, economic turmoil and growing mistrust. In addition, it is linked to disinformation, internal violence, and the erosion of human rights, while also making societies more vulnerable to global challenges, such as ecological transitions and pandemics[81]. The World Economic Forum's Global Risks Report 2025 identified Social Polarization as the fourth largest short-term global risk[82].

Widespread wealth inequality, which is increasing, fuels social polarization. Continued population growth has led 44% of upper and middle-income countries (i.e., about 3.5 billion) to live on less than $6.85 a day, a figure that has barely changed since 1990. At the same time, 8.5% of the world's population (almost 700 million people) now live on an extreme poverty line, with less than $2.15 a day - three-quarters of them living in sub-Saharan Africa or fragile and conflict-affected countries. The wealth gap is evident, with about a fifth of the world's population living in highly unequal economies, and only 7% enjoying a more equitable distribution[83].

Inequalities, however, are also observed at levels other than the economic, forming societies with conflicting interests and intensifying social polarization:

Gender equality in the labor market remains a major challenge. In a 2023 LinkedIn sample of 163 countries, women account for 41.9% of the workforce, yet the share of women in senior leadership positions is just 32.2%[84]. In different groups of society, progress in equality also varies. At the current rate of progress, it will take around 131 years to achieve full gender equality[85].

Although the diversity community has made significant progress with laws that prevent discrimination and violence, even today 63 countries have laws that criminalize homosexuality, including the death penalty[86].

Inequality observed additionally between generations is considered a critical issue for social polarization. Although young people benefit from various improvements of previous generations, they face new challenges: they have higher education but lower disposable income and face instability at work. In addition, they suffer from mental health problems amplified by social media and unpredictable conditions such as the pandemic. On the other hand, poverty, health issues, marginalization or discrimination are a reality for many elderly people[87].

In recent years, a series of political events have led to increased refugee and migratory flows, which by their nature touch on aspects of national identity and political ideologies, cause tensions and trigger polarization on many levels. This fact is the rise of populism and radicalism, resulting in an increase in votes for extreme political parties in many European countries (and not only). At the same time, it became apparent how territorial inequalities are linked to political polarization, which in turn interacts with emotional polarization[88].

Main impacts on Central Macedonia[89]

Economy and Entrepreneurship[90]

Increasing social polarization creates conditions or speculations of political instability, reinforcing mistrust and insecurity, which act as a brake on the development of entrepreneurship. The caution of entrepreneurs, combined with the lack of funding and the difficulty of finding talents, discourage partnerships and at the same time negatively affect their willingness to take risks, limiting investment in innovation and new technologies, thus affecting their sustainability and economic growth.

Research and Development[91]

The political and social consequences of a polarized society pose a serious threat to Research and Development, as they affect funding, make it difficult to attract talent, and lead to instability in research priorities with potential implications for the scientific integrity of the research ecosystem in the region.

Social Cohesion[92]

The continuous ageing of the population further worsens the prospects of young people, thus escalating social polarization and exacerbating inequalities between generations. Digital illiteracy isolates social groups, while lack of access to basic goods and services such as food, housing and health widens the divide and exacerbates urban unrest in the periphery, undermining the cohesion of society. At the same time, limited awareness and cooperation between social groups hinder collective action to tackle inequality.

81. Effects identified by groups: Turtle, Octopus
82. Effects identified by groups: Turtle, Octopus, Pupa
83. Effects identified by groups: Bee, Bullfrog, Pupa
84. Trend Detection by Groups: Turtle, Bullfrog, Bee & Pupa
85. Vision of Humanity, Trend of political disruption kickstarts again in 2025, https://www.visionofhumanity.org/trend-of-political-disruption-kickstarts-again-in-2025/
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DRIVERS OF CHANGE

Drivers of Change – DoC

Beyond the Megatrends that are widely known, and are examined for their effects in Central Macedonia, the identification of the relevant **Drivers or Forces of Change (DoC)** and **Trends (T)**, as well as those variables that involve a high degree of **Uncertainty**, but can potentially have significant and multidimensional effects, is of greater interest for the writing of the scenarios. Trends are very important for understanding the coming changes, as they act as a framework for evaluating the world and as a model for action.

Year 2025 begins with a wave of global political turmoil, as economic challenges such as inflation and inequality, along with geopolitical instability, have pushed the **T#1 Rise of populist and extreme political movements**[93]. Pandemic crises, high inflation stemming from Russia's invasion of Ukraine, increase in money supply during COVID, and massive population movements because of conflicts in the Middle East and Africa contributed to a growing sense of global instability reflected in escalating discontent with the policies pursued and the fall of traditional centrist parties: In Europe, a wider political adjustment is taking place, with Austria forming a coalition government with a far-right party and Germany, where the political internal disagreements of the coalition government led to early elections, resulting in a significant strengthening of the far-right party. Conservative parties are strengthening in Canada and the US, while political unrest continues in Latin America increasing protests over economic inequality and corruption, accompanied by the rise of extreme political factions. The Middle East and North Africa (MENA) region also remains a hotbed of political turmoil due to rising energy prices, migration, religious conflicts, and food insecurity.

DoC#1

Political unrest and democracy in confusion

In the coming period, as there are no signs that the trend will subside, it seems that the political landscape will be increasingly polarized and fragmented[94].

Polarization, however, is favored by **T#2 Abstention from politics**[95], as more and more voters reject the political system, discrediting parties and highlighting the lack of trust in democracy and political institutions. This behavior favors demagoguery, the division of society, nepotism and, of course, party extremism and antisystemism. The mass abstention in the 2024 European elections demonstrated the citizens' crisis of confidence in the political system, with almost half of voters (49.26%) in EU did not go to polls. Particularly worrying were the rates in Croatia (78.65%) and Lithuania (71.03%), while six more countries abstained by more than 64.5%. At the same levels, the abstention of Greek voters reached 58.76%[96]. It is worth noting the worrying decline in the participation of young people under the age of 25 in the 2024 European elections. Only 36% of eligible voters in this age group went to the polls, down 6% compared to 42% in the 2019 elections. The main reason was the lack of interest in politics (28%), which is higher than 20% of the total population[97].

Withdrawal from public life is a pathogen of the political system, it has emerged as a trend that has evolved into a major problem for modern democracies.

At the same time, **T#3 The 'Woke Culture' is shifting from an awakening movement to a symbol of polarization**[98], revealing deep social divides that intensify discussions on identity politics in Europe and USA[99]." The term "woke" in recent years has become a political obsession for news organizations and social media platforms such as Tik Tok, Instagram, and Twitter[100]. The concept, starting in USA, has spread and been integrated into global political reality, influencing newsrooms, university boards, and parliaments in Europe, Asia, and South America[101].

In any case, political factions, exploiting the movement for their own purposes, intensify the polarization in societies. The concept of "woke culture" translates, according to Merriam-Webster, sometimes into "empathy and awareness of systemic injustices", sometimes into "an agenda that promotes far-left priorities and gender ideology". Along the same lines, in Europe parties instrumentalize the movement, sometimes adopting the "woke agenda" and sometimes "anti-wokerism", depending on their ideology or aspirations. Undoubtedly, the anti-awakening pendulum comes back[102].

However, "woke culture" has been directed beyond the boundaries of race, gender and environmental concerns, and extends to a wide range of values and choices. A typical example is the absence of viewers from film adaptations of classic fairy tales, accused of promoting the "woke agenda"[103] and the connection of "woke culture" with eating habits has led to polarization and fanaticism among the various consumer models. While the "global food system transformation policy proposed by the EAT-Lancet Committee describes itself as a "woke food movement"[104], vegans are "treated with fear, envy, contempt and anger", according to recent research by the University of Vaasa[105]. At the same time, according to antiwoke views, vegans are "immoral because they eat almonds, which kill millions of bees"[106], while many companies exploit the vegan movement for greenwashing.

The rapid technological developments and the evolving dynamics of the workforce led to the **T#4 Change of the Working Model**[107] that is going to redefine the way organizations operate. A recent article in the Harvard Business Review[108] argues that 'the future of work is dominated by flexibility[109], demanding worker autonomy. After the pandemic, startups, small businesses and industry giants worldwide are experimenting with hybrid working models and adapting to the dynamic world of flexible working and new working conditions and market demands.

In 2023, 22% of employed people aged 15 to 64 in the EU worked from home, according to Eurostat data with the share of employees having increased by 8% since 2019 and the widespread adoption of remote work. The Netherlands had the highest percentage with 51.9% of people working remotely, the Nordic countries with an average of 43.3%, Greece 7.4% with the countries of Eastern Europe to have the lowest proportion of employees (about 3%) working remotely[110]. Surveys by Owl Labs and Global Workplace Analytics found that the remote workspace services market is expected to grow from USD 20.1 billion in 2022 to USD 58.5 billion by 2027 with a CAGR of 23.8%. The opinion of employees worldwide is clear: hybrid work is the ideal model for 83% of the workforce, while 59% of employees would choose an employer that offers remote work options, and 1 in 2 professionals (52%) are willing to accept a pay cut of up to 5%, or even 10% for 1 in 4, in order to enjoy flexibility in the workplace[111]. Moreover, the rapid increase of digital nomads[112], who in 2024 exceeded

DoC#2

Transition to new working conditions

40 million worldwide, is impressive, with 62% of them being men, American (46%) and highly educated (91%). The majority work from home (60%), hold traditional full-time jobs (62%), and is satisfied with its income (82%)[113]. Millennials make up 37% of digital nomads. It is worth noting that among 108 countries, the Global Remote Work Index 2023 ranked Greece 32nd, while, according to the Nomads List, our country ranks 29th worldwide. Athens comes first in the preferences of digital nomads who choose Greece, followed by Thessaloniki, Volos, Pelion and Crete[114].

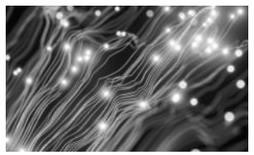
Carefully examining this generation reveals **T#5 the increased mobility of young workers**[115], as Millennials have the reputation of seeking jobs without being attached to organizations and institutions. According to a recent Gallup report[116], Millennials change jobs three times more often than previous generations and show less commitment to their current employers, with 60% saying they are open to a different job opportunity (+15% of non-millennial workers) and 36% saying they will actively seek a new position if the labor market improves. In the same context, most Millennials (71%) do not feel emotionally connected to their work, and an alarming 16% are actively disengaged, undermining productivity and morale. These findings place Millennials at the top of the list with the lowest rates of work engagement compared to all other generations, with Gen-Z seeming to follow the same trend[117]. For businesses though, hiring and replacing employees is expensive. The Society for Human Resource Management (SHRM) estimates that the cost of replacing an employee is, on average, 6 to 9 times their monthly salary[118].

Increased labour mobility, particularly among young people, is attributed to evolving working preferences, career development opportunities, and changes in the labour market landscape[119]. Technological advances, economic changes, and the ongoing green transition are leading to profound changes in the global labor market and required skills[120]. The Future of Jobs 2023[121] report found that by 2027, about 25% of jobs will be transformed, with 69 million new jobs created and 83 million existing roles displaced. The World Economic Forum's Framework for Preparing Workers for Dynamic Job Transitions proposes four key pillars to prepare workers for transitions at work: retraining and upskilling, improving employee-employer matching, employee safety nets, and collaboration among stakeholders. The public and private sectors are invited to work together to facilitate these transitions[122].

The combined use of data, technologies and processes leads to the development of new products, services and business models, which improves production and enhances collaboration between businesses and industries. The **T#6 Convergence of technologies is revolutionizing products**[123] and signaling a new era, which combined with increased global competition, innovation is accelerating the emergence of cutting-edge technologies and bringing about rapid changes in the way we produce and collaborate.

DoC#3

The Age of Convergence: Digital Excellence and Skills



The global technology convergence market is growing exponentially. A typical example, the convergence market of Information Technology and Operational Technology (IT/OT) is projected to exceed USD 1 trillion by 2030. In 2023, the combined IT, OT and OT hardware market, affected by IT/OT convergence, was valued at USD 720 billion[124]. Accordingly, the demand-led AR & VR market, driven by advances in immersion technology and increased investment in digital experiences across sectors[125], is projected to reach USD 200.87 billion by 2030 and potentially USD 589 billion by 2034, up from USD 59.81 billion in 2024[126]. At the same time, the number of users in the AR & VR market worldwide is expected to exceed 3.7 billion users[127].

In summary, the convergence of eight key technologies (Artificial Intelligence, Blockchain, IoT, AR and VR, Robotics, Drones, and 3D printing) is creating revolutionary products and models in a variety of areas, from digital trust and extended reality to labor autonomy and hyperconnected networks[128], and is leading to the 5th Industrial Revolution[129].

This convergence offers enormous opportunities for innovation and growth, but requires strategic investment in skills, organizational change and infrastructure. Without alignment, benefits may remain uneven, disproportionately benefiting certain sectors or regions[130]. Rapid and extensive digitalization has changed the nature of work and digital skills are now seen as essential to adapt to new markets and work environments. But while demand for digital skills is high, the supply is low[131].

T#7 Closing the digital divide in the labor market[132] will benefit companies and societies around the world and open doors of opportunity for groups disproportionately affected by economic inequality, such as women, ethnic minorities, the elderly, and people with disabilities. According to the World Economic Forum[133], accelerating progress in education and upskilling could add $8.3 trillion to global GDP by 2030.

Research by the World Economic Forum[134] estimates that half the global workforce may need re-skilling in the next two years and 1.1 billion jobs will be transformed by technology in the next decade. By the end of the decade, 680 million people are on their way to specialized education and skills and job prospects, with the economic impact of the initiative reaching USD 2.93 trillion.

In February 2025 the environmental charity ClientEarth filed a formal complaint against the European Commission accusing it of trying to undermine transparency and weaken public scrutiny in European Union decision-making. The NGO, which uses the legal avenue to push for environmental protection, says: “Transparent decision-making is one of the pillars of democracy and the rule of law, of which the Commission is responsible for safeguarding both[135].”

Accordingly, a new global task force, the Task Force on Inequality and Social-related Financial Disclosures (TISFD), will develop a global framework to address the financial risks posed by social issues for companies and financial institutions while addressing inequality[136].

DoC#4

Social Values Leverage Legislative Changes

These are two of the many examples where **T#8 Societies demand transparency**[137]. The desire for transparency in public administration, which ensures citizens' access to information and the accountability of public officials, reinforces reform and promotes fundamental elements of good administration[138]. In the same context, citizens seek to ensure that their data is used ethically, legally, fairly, and responsibly, and has led to the enactment of one of the strictest data protection laws[139] in the world, the GDPR Regulation, which emphasizes transparency and accountability[140]. At the beginning of 2025, the record fines imposed (Meta, Amazon, Tik Tok, LinkedIn, Uber, Whatsup, Google, H&M, etc.) reach a cumulative total of 5 billion euros[141]. On the other hand, a way to cultivate the trust of society and for businesses to demonstrate commitment to Environmental, Social and Governance (ESG) practices, which people hold modern businesses responsible, requires ensuring transparency. This means consistent reporting, accurate and validated data, alignment with recognized frameworks, and accessibility[142].

At this time, while social values of life, health and safety are emerging as paramount, Vision Zero is a strategy guiding policies in **T#9 Stricter road safety legislation**[143]. At its core, Vision Zero is the ethical perspective that there should be no life-long injuries or death because of traffic accidents[144]. Every year, road accidents cause nearly 1.2 million deaths and are the leading cause of death among 5–29-year-olds, while 90% of road deaths occur in low- and middle-income countries, where the risk is three times higher than in high-income countries, despite having only 1% of the global vehicle fleet[145]. In the list of the European countries with the highest rates of road fatalities in 2024, Greece ranks seventh, with 59.6 deaths per million inhabitants[146]. To address high road deaths, the UN is advancing global strategies aimed at “vision zero” deaths by 2050, with an intermediate target of a 50% reduction by 2030. In this context, the Marrakesh Declaration on Global Road Safety (Feb 2025) and the EU's 'Vision Zero' strategy call on governments to prioritize road safety, secure funding and take steps to achieve these goals[147].

In the same context, in February 2024, the EU proposed a 90% reduction in greenhouse gas emissions by 2040, compared to 1990, as an intermediate step towards climate neutrality in 2050, an objective enshrined in the European Green Deal and European Climate Law. The next step is to legislate the 2040 target, ensuring an appropriate policy framework to achieve it in a fair and cost-effective manner, alongside the already set 55% reduction target by 2030[148].

The society's need for radical change, which drives the EU towards increasingly ambitious climate goals, is expressed by **T#10 Extreme activism and stricter regulations resisting pollution**[149]. Social awareness of the environment has recently led various environmental movements in Europe to take activist action, destroying artworks such as Van Gogh's “Sunflowers” and Monet's “Les Meules” to highlight the criticality of global pollution and climate change. The Letzte Generation, destroying Monet's painting, stressed that the value of art is insignificant compared to human life and the destruction of the planet, warning of starvation, ecological collapse and the impossibility of life on Earth due to pollution by 2050. With the rise of NGOs, activism is gaining more publicity and transparency. Globally, ecological movements promote environmental protection, decarbonization, and the use of res, with green agendas embedded in policy agendas[150].

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UNCERTAINTIES & WEAK SIGNALS IMPACTING THE AREA

“A weak signal is the first symptom of change or a sign of an emerging phenomenon that may be important in the future (Hiltunen 2010). It is something that has already happened, but that seems strange, surprising, ridiculous or outrageous to the observer and can be interpreted as an indication of greater potential change[151]”.

Identifying “weak signals” **(Weak Signal - WS)** is the first step in preparing the Region of Central Macedonia for future **Uncertainties (U)**. Weak Signals are small indications of events that may occur in the future but have a large impact on an industry, an area, or the subject under study. Often, these indications are overlooked when planning because we are not sure if they will happen or have a significant effect. However, the important thing is not to make accurate predictions, but to consider possible scenarios for the future. By observing and analyzing weak signals, we can understand early potential threats and opportunities. Thus, our region will become more resilient, able to adapt to changes and find innovative solutions.

U#1

Political and Geopolitical Uncertainty: "Fasten your seatbelt, turbulence is expected."

For a long time, the day-to-day functioning of the European Union has followed the usual procedures for managing political situations, even when major crises threaten its very existence. The economic and state debt crisis of 2008, the migration crisis of 2015, the COVID-19 pandemic of 2020, the energy crisis of 2022, the pluralism about geostrategic conflicts in the Middle East and the instability in the Eastern Mediterranean, led to intense political debates and numerous emergency decisions. In addition, the announced trade policies of the new US administration may lead to trade conflicts and cause economic instability in the EU. However, the permanent shielding of the EU, which would lead to a close union or deeper integration, has not been achieved to date. On the contrary, it is experiencing a degradation of its international prestige, limited resources, strengthening of nationalist factions and pressures due to migration and competitiveness and there are now many voices that the **WS#1 Disintegration of the European Union**[152] is a realistic scenario. Greece, in particular, faces additional challenges, such as an investment gap, a trade deficit, high public debt, a demographic problem, defense needs and high migration flows. In 2024, a survey by diaNEOsis recorded intense concern and disappointment among Greek citizens (53%), amid global uncertainty and warfare in the region. In addition, a significant percentage of them believe in a future split (36.8%) and withdrawal of many member-states or even dissolution (10.3%) of the European Union within the next decade[153].

U#2

Business Uncertainty: High Expectations and Corporate Transformations

In 2024, the EU adopted the ‘Green Claims Directive’ to combat misrepresentation of companies or products as more environmentally friendly than they really are, while in the same year, European supervisors (ESMA, EBA, EIOPA) recorded an increase in greenwashing practices worldwide (21.1%) and in the EU (26.1%)[154]. According to EU surveys 53% of green claims from businesses provide vague, misleading or unfounded information, while 40% of claims have no evidence. Half of green labels offer weak or non-existent verification, while at the same time there are 230 sustainability labels and 100 green energy labels in the EU, with very different levels of transparency[155]. In addition, the Corporate Sustainability Reporting Directive (CSRD) introduces mandatory external evaluation and equal reporting of financial and non-financial data (ESG) to combat greenwashing. Its implementation starts gradually from 2024 for large enterprises and expands in 2025 to medium-sized ones. In 2027, small and medium-sized enterprises (SMEs), which constitute the vast majority of the market in Greece, and are already struggling to adopt the green transformation, while their immediate preparation for the collection and reporting of the relevant data becomes necessary[156]. Although micro-enterprises will be exempted from the mandatory implementation of the directive, they will face the **WS#2 Green suffocating pressures and transformative uphill for SMEs**[157] as consumers and suppliers continue to push for green transformation[158] and the need for sustainability, combined with the prospect of future compliance, will force them to resort to misleading greenwashing practices until they gradually transform their profile.

And while the green transformation will be of great concern to us for the next period, millennials and Generation Z, are pushing more and more, considering that socially responsible companies are more important. According to a recent poll[159], new American consumers are pushing for higher standards (80%) as they influence their purchasing decisions, while 74% of them are willing to boycott products that violate their moral values. At the same time, businesses are forced to promote their social action, as Millennials are interested in participating in initiatives and supporting socially conscious companies. Millennial and younger generation activism shapes changing trends in Corporate Social Responsibility (CSR) as well.

“'Doing business responsibly' is now one of the priorities of businesses, wishing to 'speak the language' of this group, which is very interested in the social impact of the brands it chooses[160].” Therefore, by adapting to **WS#3 Young People's**

Si

Requirements for Business Responsibility vol.2[161], they will continue to take a public stand on issues such as harassment, discrimination, diversity and social injustice, but also on political decisions that negatively affect the environment and threaten the protection of consumers' personal data. It is characteristic that 95% of businesses in Greece, according to a survey by ICAP[162], recognize the importance of Sustainable Development and Corporate Responsibility. However, despite the increase in related costs in 2022, most businesses (55%) consider that there is still room for improvement, with the main benefits of recognizing the creation of long-term value for all and the improvement of the corporate image.

U#3

Regulating Innovation: Ethics, Directions, and Development

At Christmas 2024, the new Coca-Cola AI ad caused a lot of reactions on social media, and many expressed concern about the increasing use of artificial intelligence in the creation of ads, and the growing threat to the livelihoods of artists, who are considered among the most 'vulnerable' professionals. The number of professionals who sound the alarm has now increased, since AI can produce art much faster and cheaper than a human, regardless of the quality of the final result[163]. In Europe, however, in August 2024, it was preceded by the Artificial Intelligence Act (AI Act)[164], which aims to promote responsible development and deployment of artificial intelligence in the EU and addresses potential risks to citizens' fundamental rights, health and safety[165]. While it is the world's first comprehensive AI regulation and sets new standards for safe and ethical AI, many companies and experts believe that **WS#4 Ethical AI Dilemmas are holding back European innovation dynamics**[166]. According to Kalaidos University of Applied Sciences, AI ethics has gone from initial high interest to concern, which in turn has led to a more pragmatic approach, with practical benefits and economic interests setting aside ethical concerns. To promote AI ethics, experts consider the following criticism: stricter regulations, incorporation of ethical principles into development, public education, independent audits, certifications, and international cooperation[167].

On June 2024, the European Commission, in its work on the Semi-Annual Report[168], attributed the EU's economic stagnation to low investment in R&I, the main policy tool for economic and fiscal policy coordination in the 27 Member States, and linked its productivity gap with the US to "the smaller size of the high growth sectors, insufficient scaling up of innovation, limited investment in research and skills shortages". As mentioned, for more than two decades, Member States have been urged to increase domestic R&D investment to at least 3% of GDP[169], but efforts to date have been subdued, with the EU average reaching 2.2%, well below the US, Japan and South Korea[170].

As part of the work, the **WS#5 'top-down' approach to technology and science was proposed**[171], aimed at aligning research funding flows, strengthening public-private partnerships, facilitating data sharing, pursuing open science while preserving research security measures, harmonizing EU R&I laws and much more, as "a voluntary bottom-up approach, as implemented for decades now, is wholly inadequate"[172]. However, while the R&I community in general accepted the report, there have been voices warning[173] that "the vision could evolve into a "misunderstanding of the value of R&I, which needs freedom and flexibility to develop new ideas, technologies and knowledge on which to build the EU's future competitiveness", and they are concerned that the" top-down approach "could affect EU R&I funding for the next programming period (FP10), starting in 2028".

U#4

The Era of Disconnection: Workplace Loneliness and Social Uncertainty

The Atlantic magazine recently published its much-discussed article "The Anti-Social Century," with the finding that the choice of loneliness may be America's most important social element of the 21st century[174]. In 2023, the World Health Organization (WHO) stated that loneliness is a pressing global health threat. This statement came after the Covid-19 pandemic halted economic and social activity that increased levels of loneliness, but also amid the realization of the great importance of the issue[175].

Gallup's State of the Global Workplace: the 2024 Report reveals that globally, one in five workers experiences intense loneliness. Accordingly, the Joint Research Centre of the European Union records that in Europe, the feeling of loneliness affects one in four citizens. Greece, although historically characterized by strong social connections, is facing the **WS#6 Shadow of isolation and work alienation**[176] and is experiencing very high levels of loneliness, gradually climbing to ever higher positions.

Loneliness is more prevalent in workers under 35, and there are no significant differences between men and women or between different hierarchical levels. Work location plays an important role[177], with full-time remote workers reporting higher levels of loneliness (25%) than those working exclusively in the workplace (16%), while hybrid workers are placed in between, at 21%[178]. The lack of work engagement significantly increases the feeling of loneliness with alienated workers reaching 31% and unfortunately, Europe holds the negative lead with the lowest level of work engagement in the world, just 13%[179].

Greece, although historically characterized by strong social connections, is facing the WS#6 Shadow of isolation and work alienation[176] and is experiencing very high levels of loneliness, gradually climbing to ever higher positions

U#5

When the Climate Shapes the Holidays

In January 2025, the European Travel Commission (ETC) published the "Roadmap for National Tourist Organizations towards Climate Action in Tourist Destinations – Climate Action Planning[180] Framework" to inspire and guide climate action in European destinations to achieve sustainability and resilience while maintaining their global competitiveness[181]. Tourism is vulnerable to climate change and is co-responsible for global warming, while the strategies planned are expected to transform the tourism product that will lead to the resilience of the sector.

Research by diaNEOsis indicates that the prevailing climatic conditions are a critical factor for the sustainability of tourist areas. It is estimated that during the summer tourist season, which largely supports tourism in our country, an increase in temperature and/or more frequent heatwaves will significantly degrade the quality of the tourist product. However, a positive effect that may occur in some areas is the lengthening of the tourist season, which will certainly affect the supply of tourism, but also the demand[182]. Under these circumstances, the region of Central Macedonia, which is experiencing seasonal tourism, is called upon to address the **WS#7 Climate Adaptation and Change the Tourism Product Offer**[183], as it shows moderate intensity in tourism (12% contribution to GDP - 7.6% in employment) and is dominated by the product "sun + sea" which has a small comparative advantage, while new forms of tourism are developing slowly, resulting in issues of carrying capacity and delaying, among other things, the extension of the period[184].

151. Source: Hiltunen, Elina (2010): Weak Signals in Organizational Futures, https://www.sitra.fi/en/publications/weak-signals-from-the-future/#what
152. Locating the weak signal: Turtle
153. https://www.dianeosis.org/wp-content/uploads/2024/04/TPE2024_Part_B.pdf
154. https://www.aoshearman.com/en/insights/greenwashing-the-analysis-of-the-european-supervisory-authorities
155. https://environment.ec.europa.eu/topics/circular-economy/green-claims_en
156. https://www.ot.gr/2023/05/22/green/esg/greenwashing-oi-mises-prasines-etikhetes-proionton-xoris-apodeiksi-gia-osa-ypostirizoun/
157. Locating the weak signal: Pupa
158. https://roumentakislaw.gr/arthra/greenwashing-protasi-odigias-2/
159. https://digitalmarketinginstitute.com/blog/corporate-16-brands-doing-corporate-social-responsibility-successfully#heading_52270
160. Siana Kyriakou, General Manager, COOKPMG in Greece, https://kpmg.com/gr/el/home/insights/2017/07/millenial-consumers.html
161. Locating the weak signal: Octopus
162. ICAP CRIF: Sustainable Development Primary Research & ESG Results in Enterprises, 18.05.2023, https://dir.icap.gr/mailimages/icap.gr/Posts/PR_EKE_2021.pdf
163. https://www.lifo.gr/lifoland/its-viral/deite-tin-proti-diafimisi-tis-coca-cola-poy-dimioyrgithike-me-tehnologia-ai-kai & https://digiorama.com/coca-cola-h-nea-ai-diafhmish-ths-porokalei-antidraseis/
164. Locate/Report: Pupa
165. https://commission.europa.eu/news/ai-act-enters-force-2024-08-01_en
166. Locating the weak signal: Bee
167. https://www.paltron.com/insights-en/ethics-and-security-in-ai-emerging-job-profiles-for-a-sustainable-future
168. 2024 European Semester - Spring Package, 19.6.2024, https://commission.europa.eu/publications/2024-european-semester-spring-pachage-communication_en

2—0

REGION OF
CENTRAL MACEDONIA

EXPLORING & MONITORING
CHANGING CONDITIONS,
TRENDS AND NEEDS
INNOVATION LANDSCAPE 2040

The 5 future scenarios

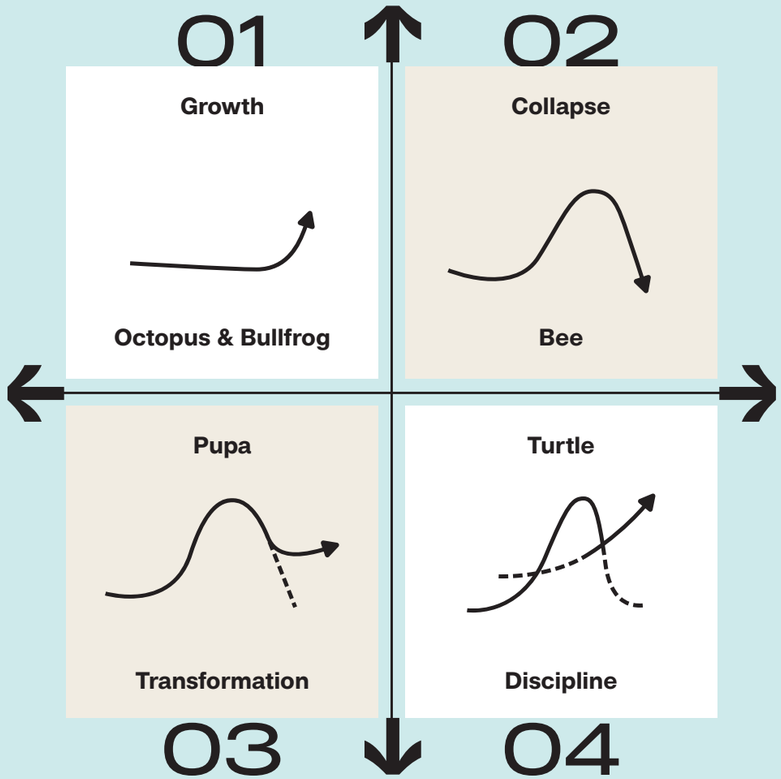
5

«If the rate of change on the outside, exceeds the rate of change on the inside, the end is near»

Jack Welch

Scenarios are like rehearsals for the future. In this section, we will bring to life five possible versions of Central Macedonia in four different futures (five scenarios): Growth, Collapse, Transformation and Discipline. The working team also chose to describe one story for each condition / scenario in which Central Macedonia will find itself, detailing the evolution of a protagonist entity, situated in its respective environment. The stories we present reflect the protagonist's journey through various decisions and events that occurred over time. Each scenario focuses on specific variables that the co-authors (participants in the Participatory Workshop) deemed significant. The optimistic nature of the working team gave a positive tone to each scenario.

Summarizing, based on the variables defined by the co-authors, the five different scenarios we present below describe four different situations for the innovation ecosystem in Central Macedonia, depending on the path we choose from 2025 onwards. The future was set at 2040.



2 — 1 MAIN VARIABLES OF THE SCENARIOS

		Growth Bullfrog	Growth Octopus	Collapse Bee	Transformation Pupa	Discipline Turtle
Major Drivers of Change		Connecting Research & Education with the real economy → Innovation hub → Development of SE Europe also entrains RCM, with emphasis on new trends and technologies in logistics & tourism → Consistent implementation of innovation policies with a long-term vision	→ Nature-based solutions and smart city technologies → Technology to harness the power of youth → 'Smart Materials & circular business models	→ Brain Drain → EU Collapse → Lack of investment	→ Digital Transformation → Attracting investment Sustainability, Resilience	→ Conservativization of society → Risk avoidance in the production model → Climate change
Politics	**General**	→ Geopolitical stability	→ EU obligation to use 70% circular materials → Skills development in new technologies from pre-school age → Strengthening Local Authorities → Political instability	→ Corruption	→ Alignment with international standards	→ Strengthen church role
	RCM	→ Implementation of an innovation map for the period 2025-2040, with the right of revision every 10 years	→ Observatory for Circular Activities Innovation → Culture & Ecosystem Partnerships	→ Cross-Border Policy Challenges	→ Secularization Mount Athos → AI Act	→ Reduced resources for research / degradation
Economy & Companies	**General**	→ Continuous establishment of New Technology Companies	→ Ethics in manufacturing → Entrepreneurial Skills for HEIs Communities → Flexible working models	→ Fewer Companies → Limited Culture of Innovation	→ Industrial symbiosis (collaborative development)	→ Introversion → Very low risk investments → Investing in traditional industries
	RCM	→ Annual International Conference on Logistics → ICT	→ Crowdfunding → Open Innovation is becoming a mainstream trend	→ Narrow scope for innovation → EU logistics hub	→ Fishing → Sustainable Tourism → Technology Parks	→ Reduced resources for enterpreunship Support
Society & Individual						→ innovative businesses relocate abroad
	General	→ Cultivating entrepreneurship and innovation	→ Slow food/Slow fashion → Turning to Responsible Consumptio → Forcing young people to take business responsibility,	→ Low Startup Rate	→ Circular Economy	→ Reducing the role of the human factor
	RCM	→ Organization of Student Competitions in Secondary Education → Innovation Support in Schools	→ Cooperative industrial ecosystems (Materials and Food) → Cooperative producer groups	→ Region becomes more conservative	→ Upshilling & Reshilling	→ innovative businesses relocate abroad → Braindrain
Technology & Innovation	**General**	→ Cultivating entrepreneurship and innovation	→ New/Smart Materials → Exploitation of new technologies → Convergence of technologies	→ Research-driven innovation → Enhancing Digital Skills	→ AI and Automation	→ Oversupply of sites → Slowing down of research activity
	RCM	→ Increase collaborations of Research Institutions with businesses	→ Cooperative industrial ecosystems (Materials and Food) → Cooperative producer groups	→ Low TRL in most research activities → Elderly assistance services and technologies → Rise of greenhouse technologies	→ Thess Intec → Tech Transfer → Technological Parks	→ Difficulty in linking research and economic activity → Reduction of resources for research
Legal	**General**	→ Easy and inexpensive way to register intellectual property → Free patent registration	→ New / Smart Materials → New legislation for entrepreneurs <18 years old		→ Regulatory frameworks	→ Stricter legal and institutional framework → New tools to control the legal and institutional framework
	RCM	→ Reducing bureaucracy in innovation	→ Strict road safety legislation		→ Reduction of Bureaucracy	
Environment	**General**	→ Emphasis on circular and green economy everywhere	→ Upgrading skills, especially in green and digital transition → Terrace Gardens → Self Cleaning systems	→ Climate change	→ ESG regulatory → frameworks in practice → Lack of resources	→ Primary sector high risk from climate change
	RCM		→ New tourism models	→ Average temperature rise	→ Thermaikos Gulf Pollution → Effect on Fisheries → TIF Regeneration – Park	
Additional variables in the future of 2040 per Scenario		→ Increased mobility of young workers → Work Loneliness → Abstinence from the commons → Citizens' demands for transparency → Digital nomads → New departments in multinationals supporting employees	→ Digital nomadism → Opening new markets → Difficulty finding talent → Political instability complicates entrepreneurship → Urbanization and desertification of rural areas	→ Pressure on agricultural production → Water security → Lack of skills → Generational inequalities → Housing pressures → Urbanization → Global competition → Thessaloniki metropolis of SE Europe	→ EU Policies & Sustainability → Regulations → Reporting → Requirements → Woke (Antiwoke) → Agenda → Greenwashing → Abstention from public affairs Industry 4.0 → New Technologies → Renewables → Biofuels → Culture change	→ Populism → New markets from urbanization → Trust in institutions → Social Economy → Migration flows → Renewables → Automation → New research priorities → Focus on Health → multi-speed EU

TABLE 1 MAIN VARIABLES AFFECTING THE 5 SCENARIOS

SCENARIO

01

Bullfrog

In a reality in 2040, Central Macedonia...
is on the European map of the most innovative regions, since for a decade it has been implementing policies with a long-term vision, linking research and education with the real economy and gradually transforming itself into a "knowledge economy".
The SEE 2030 Strategy has borne fruit, and the development of Southeastern Europe is a fact, which has swept away the ecosystem of entrepreneurship and innovation in Central Macedonia as well. The Region, paying particular attention to new trends and technologies, has shown rapid growth rates, and has improved its development indicators, with particular emphasis on the Supply Chain and Tourism sectors.
An Innovation Roadmap for the period 2025-2040 - reviewed and revised often - provides a stable framework for the development and resilience of the economy of Central Macedonia. Geopolitical stability guarantees security and attracts foreign investment, while the continuous establishment of new technology companies in the region has made it a thriving innovation hub. At the same time, focusing on the circular and green economy, the policies it implements respond to the demands of its citizens for tackling pollution and transparent procedures. Despite the rise of extreme activism, however, abstinence from civic life remains a crucial socio-political challenge despite the Region's initiatives to increase the participation of citizens and especially young people.
A culture of entrepreneurship and innovation is cultivated in society from school age, by organizing a plethora of student competitions, which emphasize the practical application of knowledge and the development of entrepreneurial skills, while at the same time highlighting new talents and promoting creative thinking. The working climate follows global trends, Thessaloniki and other major cities of the region attract digital nomads, the working environment is lonely and highly mobile, and experts are constantly called upon to explain their impact on the economy. Technology and innovation are finding fertile ground, with an increase in collaborations between research institutions and businesses, an easy and cost-effective way to patent intellectual property, free patenting and a reduction in bureaucracy when it comes to innovation.

GROWTH

AmphiBio, a success story of 2040...
On a hot August day in 2040, a digital nomad working from a mountain resort in Chalkidiki uses AmphiBio[185].net to shop online for a product with a low environmental footprint. The app automatically connects him to two local suppliers and provides with the necessary information. At the same time, a 28-year-old Gen Z, a former employee of a growing Logistics company, is checking potential reach with local suppliers in the new address where he is about to relocate, in light of his hiring by a large multinational company in the area. Choosing to move on to the new job was an easy decision. The multinational created a mental health department for its employees.
AmphiBio is now an integral part of the daily life of citizens in Central Macedonia. It has developed an application that supports the circular economy with a wide package of services to citizens, such as locating nearest recycling or reuse points. The application guides the user to the point, provides them with information about the recycling process, informs them about the progress of the object and rewards them with points they can redeem in businesses participating in the network.
AmphiBio, a start-up founded three years ago by two student activists, started from an idea born during their internship at a large recycling company in the area, which worked closely with their faculty's research laboratory. The idea quickly took shape, with the development and consolidation of its intellectual rights. Today is European election day, but the two start uppers are not thinking about exercising their voting rights, since they must prepare for tomorrow's meeting with a European fund interested in buying a stake in their company. Their entrepreneurial culture is rewarded, but they must admit that it is due to their active participation in student entrepreneurship and innovation competitions, which have been actively supported for about ten years with funding from the Region of Central Macedonia.

185. Amphibian, Bio (synthetic that refers to organic products and environmental protection)

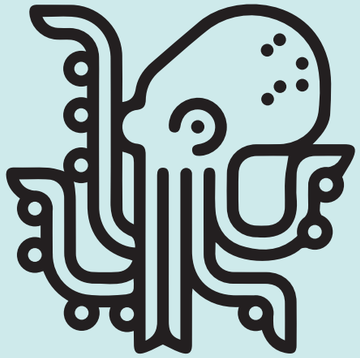
Bullfrog

Shaping a resilient innovation landscape from 2025 to 2040
Research - Market - Talent Bridges, Development of Entrepreneurship Culture, Financial Support for Start-ups

CHALLENGES	POLICY ACTIONS
Lack of commercial exploitation of research results (Research does not translate into products and services)	Enhancing research-industry collaboration Providing incentives for commercial exploitation of research by the industry (to act as a disincentive to the emphasis placed on subsidies)
Low entrepreneurial spirit and limited appetite for innovation	Establishment of entrepreneurship education programs at all school levels Student innovation competitions and their wide visibility Promoting examples in the media of successful business innovation
Difficulty accessing capital from start-ups and insufficient development of innovative products and services	Provision of financial grants for start-ups Funding investment projects for the development of innovative products Zero VAT rate applied for innovation Tax exemptions for investments in start-ups Reduced social security contributions for employment or self-employment in start-ups
Need for repatriation of scientific personnel (Brain drain)	Repatriation incentives by creating attractive job opportunities and promoting research and innovation

SCENARIO

02



Octopus

In a reality in 2040, Central Macedonia...

following a legislative reform that strengthened Local Authorities, accelerated economic growth in its territory, focusing on Smart Cities technologies, financing innovative products and circular business models.
Central Macedonia is a thriving region, where technology, innovation, sustainability coexists harmoniously. Despite the political instability that threatens entrepreneurship, HEIs with the support of the new legislation for young entrepreneurs cultivate entrepreneurship.
As the European Union 5 years ago imposed the mandatory use of 70% circular materials, the Region of Central Macedonia has set up an Observatory for circular activities. As the environment is very high on the citizens' agenda, in large cities the rooftops are greening, cleaning systems are constantly improving, ethical consumption is imposed, and young people are pushing for ethical production and taking on business responsibilities. Movements such as slow food and slow fashion are constantly gaining ground.
In this context, the green and digital transition is in full swing, which has led the education system to adapt accordingly and the development of skills in new technologies to start from pre-school age, and to shape citizens familiar with the new digital reality and skilled human resources.
In this environment, flexible working models have been developed, while at the same time digital nomads choose the cities of the region, as they combine high-speed broadband services, Idyllic summer, and a high level of road safety that has improved the quality of life, especially in cities.
The culture of innovation and cooperation, the convergence of technologies and the development of new tourism models create new opportunities, expand markets, with Crowdfunding and Open Innovation established as mainstream policies in Central Macedonia. However, the urbanization and desertification of rural areas remain challenges that the Region must face.

GROWTH

PloQ, an innovation story of 2040...

On a typical day, a student uses the PloQ[186] platform to learn about today's college cafeteria lunch, famed on campus for the ethical production of its dishes and the use of recycled appliances. In the morning, the chef of the restaurant used the platform to search for fresh raw materials for his menu and examined the information provided by the suppliers on the origin and quality of the products. At noon, a housewife, taking advantage of PloQ's rich database of recipes from the local culinary tradition, prepares the food, after ordering the ingredients from the nearby organic store. Early in the afternoon, an office complex posted on the platform the leftover fresh vegetables from its rooftop garden, informing employees working remotely that today it will offer them to affiliated charitable institutions in the area. Besides, the Region, with road safety measures and infrastructure, guarantees fast and safe distribution.
The platform emerged as a solution three years ago, in a challenge posed by PloQ Foods in the annual Open Innovation Competition of the Region of Central Macedonia for the agri-food chain. As a Challenge Owner, PloQ Foods set itself the challenge of integrating the principles of slow food into its production process. The solution came from a team of researchers, who proposed an integrated technology convergence platform that would connect the business with local producers, consumers and value chain professionals in a strong network of collaborations. Despite the political instability that hindered investment, the company made it.
2040 was an excellent year for PloQ Foods, having consolidated its position as a strong brand in the European market and at the same time boosted its sales. Citizens and professionals of the value chain initially with caution and then with enthusiasm, led with their needs to the development of the platform and PloQ Foods to transform the competent department into independent spin-off PloQ. This year, overcoming bureaucratic hurdles, the platform recruited young digitally competent scientists from local universities.
The Chairman of PloQ Foods has every reason to be happy today. As he drives to an important business meeting at the city traffic light, an impressive 3D advertisement of PloQ appears in the digital sky, following brief road safety guidelines provided as sponsorship.

186. Plokami, Quality

Octopus

Shaping a resilient innovation landscape from 2025 to 2040
Partnerships, Skills Development, Social Cohesion and Regional Balance, Attracting Investment

CHALLENGES	POLICY ACTIONS
Unable to Collaborate & Transfer Technology	Strengthening University-Business Cooperation through Corporate PhDs Organization of Collaboration and Networking Events Establishment of Innovation and Technological Transfer Awards Creation of Innovation and Technological Development Hubs
Lack of qualified staff	Digital Skills Enhancement and Continuing Vocational Training Retraining & Lifelong Learning Programs and Green Skills Development Establishment of Policies to Attract and Support Digital Nomads Development of Infrastructures to Enhance Digital and Technological Education
Socio-economic Inequalities between Urban and Rural Areas	Creating Social Innovation Platforms to Strengthen Urban-Rural Communities Cooperation Creation of Innovative Rural Testbeds Enhancing Transparency and Citizen Participation in Decision-Making Processes
Restricted Access to Finance for Business Development	Attracting Foreign Direct Investment (FDIs) to Boost the Local Economy Promotion and Enhancement of Cooperative Finance to Support Small and Medium Enterprises

SCENARIO

03

Bee

In a reality in 2040, Central Macedonia...
is faced with a series of interrelated crises that threaten its economy. Global changes are perceptible. Climate change has affected agricultural production, as the rise in average temperature and water scarcity has shrunk agriculture, with devastating consequences for the agri-food sector, once a key driver of the economic development of the region.
The cities of the region, and especially Thessaloniki, suffer from the consequences of urbanization and the pressure on housing. The country is experiencing an alarming wave of emigration of young scientists, similar to the economic crisis about three decades ago, which deprives the region of valuable human capital.
The limited innovative culture and lack of investment, from both domestic and international businesses, stand in the way of attracting talent and risk-taking innovative business ideas. Although innovation, mainly at the research stage (low TRL), does not translate into products, has limited connection with the market, production and ultimately with the needs of society, it contributes to new services and technologies that improve the quality of life of the elderly.
The European Union, weakened and in the process of collapse, is adjusting its priorities, resulting in low support in its regions. Cross-border policy is problematic, and common challenges are not addressed through partnerships. In fact, as global competition intensifies, the region of Central Macedonia loses its competitiveness, affecting also the sectors that were distinguished at the international level for their resilience.
However, visionary policies are beginning to emerge in Central Macedonia. Thessaloniki, despite the difficulties, lays the foundation to become a logistics hub of SE Europe, taking advantage of its geographical location. Digital skills are strengthened as society reacts and adapts to the digital age. Greenhouse technologies are gaining ground, offering solutions to tackle climate change.

COLLAPSE

Kentri.Co Point, a survival alliance in 2040...
On the premises of Kentri.Co Point[187], a young clothing designer bends to the digital design and examines its details. Next to it, a unisex clothing manufacturer carefully examines the recycled fabrics and checks their texture and durability. It must be cotton, but cotton producers have been facing increased challenges over the past five years due to climate change. At the edge of the workshop, a tailor works a part of the garment on a previous generation sewing machine. The idea of incorporating biomarker monitoring sensors is not a pioneer and they know it, but applying them to measure depression in older people is an innovative idea that emerged in response to the increase in psychological problems in old age.
Focusing on the environment and the circular economy, the three partners utilize raw materials from local production, and create innovative garments for the elderly, offering a solution that improves their quality of life.
Kentri.Co Point is not just a laboratory. It is a small ecosystem, with smart ideas for innovation, sustainability and resilience of the Clothing industry. In the adjacent space, a mentor and an IT engineer share their knowledge with a team of five young designers. The group absorbs all information, but their joy is overshadowed by the departure of two of its members, whose housing impasse and lack of work force them to leave the country. Despite the weakening of the European Union and the difficulties they know they will face; they have been forced to seek a better future abroad.
However, in the unfavorable economic environment of the region and the country, Kentri.Co Point, a small clothing hub, continues to be a dynamic center for the development of the industry. The idea for its creation was born out of the need for survival. A team of Clothing value chain professionals decided to join forces, collaborate, innovate and react to the negative climate. Inspired by the success of the mega. Logistics Center of Thessaloniki, which turned the city into a hub of the European Union and a metropolis of Southeastern Europe, aspires to be a vital center of fashion and attract investment, giving the industry its old glory.

187. Sting (survival, defense but also danger condition), Collaboration, Point for point of contact, cooperation, alliance

Bee

Shaping a resilient innovation landscape from 2025 to 2040
Enhancing human capital, financing innovation, attracting FDI and further specializing RIS3

CHALLENGES	POLICY ACTIONS
Brain drain	Incentives to Attract and Reserve Qualified Personnel Housing Policy Design to Strengthen Professional Installation Implementation of Reskilling Measures
Insufficient Culture Development and Innovation Strategy	Funding Enhancement for the Commercialization of Innovative Products/Services Promoting Innovative and Effective Development Projects
Limited Investment Attractiveness	Expanding Funding Sources for Business Development
Revival and Modernization of Industrial Production in Central Macedonia	Specialization of the Regional Smart Specialization Strategy (RIS3) by Sector

SCENARIO

04

Pupa

In a reality in 2040, Central Macedonia...
has taken important steps to transform itself into a dynamic and resilient region by harnessing digital transformation and sustainable practices, creating new opportunities.
Industrial symbiosis has reshaped the innovation ecosystem, while creating a network of technology parks creates new growth opportunities and attracts investment and talent. ThessIntec, a breath away from the metropolitan center of Thessaloniki, plays a crucial role, while technology and innovation are at the forefront of the region's development.
Artificial intelligence and automation have reduced bureaucracy, modernized many sectors, and ensured accessibility for all citizens. The radical change of the education system and the labor market with retraining and lifelong learning programs has created an adequate skills workforce, prepared for the demands of the new era.
On the positive side, alignment with international regulatory frameworks for artificial intelligence, intellectual property rights, and data protection has ensured the ethical and responsible use of technology.
The region, however, is also an area of contrasts.
The implementation of ESG principles stumbles in greenwashing, as large industries project investments in renewables and biofuels as an -already- big step.
The recent redevelopment of TIF in a park, after a long period of discussions and consultations, because of the woke culture, leads to the cleaning up of pollution and the improvement of the quality of life of the citizens of Thessaloniki. Recently, the mobilization of citizens has brought results, and the cleaning of the Thermaikos Gulf has begun, where indifference and constant pollution have had a devastating impact on fisheries.
As civic disengagement intensifies, society is polarized in intense controversies over significant issues, with a recent example being the discussion surrounding new ways for Mount Athos to contribute to society. This debate has sparked a broad dialogue and divided public opinion.

TRANSFORMATION

Nymfes Resort, a 2040 transformation path...
Somewhere at an airport in Europe, a family is waiting for the departure of their flight to Greece to be announced. Parents take advantage of the wait time and confirm their arrival time in the 'Nymfes[188] experience' app. They personalize their profile and plan a daily hiking excursion to Mount Olympus, proposed by artificial intelligence, considering the preferences and capabilities of each member.
Nymfes is a 4-season standard coolcation[189] tourist unit, offering refreshing experiences on the slopes of Mount Olympus. Guests come here to experience the ultimate connection to nature, without sacrificing comfort and the digital experience. The hotel, five years ago, struggled to survive as it tried to adapt to digital transformation and growing environmental pressures.
The hotel manager, after a three-month seminar on new technologies that awakened her, proposed to the owners of the hotel to convert it into a model sustainable tourism unit. With the cooperation of a team of young scientists from a technology park in the area and the sponsorship of a funding program of the Region of Central Macedonia, the Management adapted the hotel to the new era.
The first step was to introduce artificial intelligence and automation into all resort operations, but also to train all staff in their use.
Upon arrival, a digital assistant greets the family, leading them to their room, providing information about the area and urging them to take a ride in one of the autonomous electric vehicles, so they can admire nature with the help of a digital guide. Their room is renovated with bioclimatic materials and equipped with smart devices, which regulate temperature, lighting and air quality. The energy used comes from renewable sources, while the waste is recycled and reused. One of the suggested activities for the visitors concerns the cruise on the coasts of Mount Athos, a journey of intense experience.
The local community puts other challenges first. It is imperative for businesses in the region to adopt responsible practices and incorporate ESG principles into their operations.

188. Nymph, chrysalis: the caterpillar of insects in the last stage of their evolution. It also refers to Central Macedonia (Nymph of Thermaikos) and Greek mythology.
189. "Coolcations" or "cool vacation"

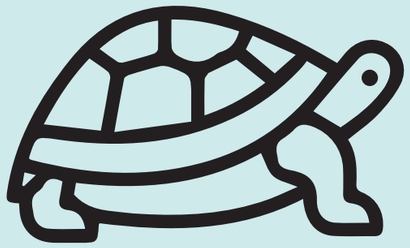
Pupa

Shaping a resilient innovation landscape
Skills, Open Innovation, Attracting Investment and Enhancing Extroversion, Partnerships with the EU

CHALLENGES	POLICY ACTIONS
Lack of Specialized Human Resources	Enhancing Skills in Digital and Green Technologies through Retraining and Upgrading Programs Providing Incentives for Business Development and Employment throughout Central Macedonia
Low Innovation Productivity	Promoting Open Innovation Enhancing Innovation and Entrepreneurship Awareness and Awareness
Limited Access to Financial Resources	Creating an Attractive Investment Environment with Tax and Financial Incentives Attracting Foreign Direct Investment through Targeted Promotion Programs Enhancing the Extroversion of Local Businesses through Export Support Programs
Limited Influence on Decision Making Centers	Strengthening Regional Advocacy through Strategic Lobbying in the European Union

SCENARIO

05



Turtle

In a reality in 2040, Central Macedonia...
has opted for a path of growth and stability, is slow-moving and follows conservative policies, focusing on traditional industries and low-risk investments, maintaining a sense of security and predictability in society and the economy.
Despite the pressures faced by the primary sector from climate change, Central Macedonia is coping with its impacts by investing in infrastructure, such as flood control and water management systems, that enhance resilience, the implementation of sustainable agricultural practices and the adoption of new cultivation practices, resistant to extreme weather events. After all, sustainable agriculture and the protection of natural resources are a priority.
Its long-term protectionist strategy has led it to an inward-looking economy, avoiding direct competition and prioritizing local production. However, this approach has resulted in the allocation of reduced resources to research and innovation, which has degraded the competitiveness of businesses, with the natural consequence of the slow growth of innovative businesses and the flight of talent abroad.
Strengthening the role of the church and rigorous institutional reforms have ensured an environment of stability and social cohesion. However, it limited the opportunities for adopting new growth models to the standards of Europe's most competitive regions. Oversupply of infrastructure, while serving basic needs, absorbs significant resources, not necessarily for the development of R&I. But traditional and secure investments slow down the creation of collaborations between universities, research and the market.
In the context of increased populism, Central Macedonia has chosen to strengthen the social economy and promote trust in institutions. Social cohesion and the provision of basic services, such as health, are considered more critical. The region benefits from increased migration flows and urbanization, creating new markets and employment opportunities.

DISCIPLINE

Kely.fos, an endurance journey of 2040...
As spring approaches, an experienced contractor, owner of a construction company, checks the Kely.fos Select application, to order the appropriate tiles and exterior cladding panels for the construction of the new cooling chambers of an agricultural cooperative in Pella. The planning defines the delivery of the project before the start of the summer. The high temperatures prevailing during this period make the work difficult and the contractor takes it seriously, both because of the relevant legislation and his social sensitivity to working conditions. After all, the products are particularly effective, since the company has incorporated photovoltaic technologies, and they have earned their trust.
Kely.fos Systems[190], a historic company in the production of building materials in the industrial area of Thessaloniki, has chosen a stable and careful development path. Although it has not adopted radical innovations, it constantly adapts and improves its products to the needs of the market, with technologies that have been tested in countries with similar climatic conditions, allowing it to evolve without taking risks. Protected in this way from intense competition and with reduced investment in research and innovation, it consistently secures an important position in the market. Oversupply of infrastructure in the region is not a problem. Renovations are being carried out continuously.
Over the past five years, Kely.fos Systems has seen many of its highly skilled executives looking for better opportunities outside Greece. This limited its ability to develop innovative products, especially due to its few contacts with research in the area. But the industry is on a steady path of growth. Construction companies do not face any problems, since they have ensured the continuous flow of work with manned crews, thanks to craftsmen coming from the increased migratory flows in the region. The construction industry is booming again, as urbanization has created additional housing needs.
In the afternoon, the Board of Directors of Kely.fos must decide on a new investment move: The expansion of its production facilities. Besides, the announcement of the new subsidy program by the Region of Central Macedonia to strengthen its traditional sectors is an important incentive for the implementation of the investment. However, its agenda also includes the consideration of a possible meeting with a research laboratory for the gradual development of innovations. Is it not time to pave the way for innovation?

190. Kely.fos, a reference to the turtle's shell, the protected environment, but also to the "light" on the exploitation of which (solar) photovoltaic systems are based.

Turtle

Shaping a resilient innovation landscape
Open Innovation, Open Procurement, Mentoring, Access to finance

CHALLENGES	POLICY ACTIONS
Low interconnection of Research with the Market	Organisation of Innovation Competitions for the Commercialisation of Research Results Promotion of Public Procurement of Innovation for the Purchase of Innovative Products and Services" (Innovation Procurement)
Avoiding Taking Business Risk	Provision of Legal and Business Counseling / Mentoring to Enterprises with High Risk Enhancing Access to Microcredit to Support Startups Organization of Training Programs for the Development of Business Skills and Risk
Limited Competitiveness	Specialization of Regional Development Strategy in High Value-Added Sectors
Division of responsibilities	Creation of Interregional Action Plans for the Effective Implementation of Common Objectives Strengthening Regional Advocacy through Strategic Lobbying at National and European Level

REGION OF
CENTRAL MACEDONIA

EXPLORING & MONITORING
CHANGING CONDITIONS,
TRENDS AND NEEDS
INNOVATION LANDSCAPE 2040

Black Swans

"Rare, unforeseen events that have a huge impact on our lives and are only explained in retrospect[191] ". A black swan is an extremely rare event with potentially serious consequences

Black swan events can cause catastrophic damage to an economy by negatively impacting markets and investment, but even the use of strong models cannot prevent a 'Black Swan' event[192]. Often cited examples of Black Swan events were the housing market crash in 2008, which led to the Great Depression, the COVID-19 pandemic, and the 9/11 terrorist attacks.
The working groups were asked to think about events that could overturn the world as we know it today and the results are included in the picture below:
In the context of the Innovation 2040 Workshop and starting from the concept of 'black swans' – that is, unforeseen events with significant consequences – the five working groups were asked to predict possible events that could cause radical changes in the world and to experience their consequences. The results of the exercise present a wide range of possible reversals, from technological developments to geopolitical upheavals.

SATURDAY 11.08.2040 / No 568

INNO · NEWS

NUCLEAR WAR ZERO HOUR

Fusion: Abundant Energy Comes to Central Macedonia PAGE 4

The **intense seismic activity** in Central Macedonia, with the great deadly earthquake of March, and the **extensive fire in Sheikh Sou** a month ago, have recorded significant losses and damage in our region, which is still counting its wounds. At the same time, **geopolitical tensions between major powers have escalated, increasing the likelihood of a nuclear war**. This conjuncture, with the successive events, creates an environment of increased uncertainty and risk for a global event. PAGE 2-3

Thessaloniki:

GATEWAY TO CHINA'S 2040 EUROPE VALUE CHAIN

With its port and airport functioning as gateways, Thessaloniki has become a hub for the movement of goods, technology and investment, boosting the economic development of the region. Thessaloniki's strategic location, combined with investments in infrastructure and technology, have made it an integral part of the global supply chain, enabling the rapid and efficient movement of goods from Asia to Europe and vice versa.
PAGE 7-8

Artificial Intelligence Dominates:
The Findings from Central Macedonia

From industry automation and medical diagnosis, to art making and data analysis, AI has crossed human boundaries PAGE 5

Digital Corruption: New Forms of Fraud in 2040

From identity theft and cryptocurrency fraud, to data manipulation and digital bribery, corruption has found new, more insidious ways to infiltrate society. PAGE 4

Digital Identity: The New Face of Humanity

In 2040, digital identity is not just a tool for accessing services or making transactions. With its mandatory implementation after the recent **global human and animal pandemic of 2038, which lasted until early 2040**, it has evolved into an extension of human and animal existence, a digital incarnation of our soul. It can talk, think, feel. It can learn, evolve, change. And yet, as we look at this digital version of ourselves, we can't help but wonder: Who are we really? PAGE 7

The Financial System in Free Fall

Banks are collapsing like paper towers, stock markets are sinking into unprecedented losses, and citizens are watching in horror the dematerialization of their savings. The digital age, once promising prosperity and progress, has turned into a nightmare.
PAGE 4-5

EUROPEAN UNIONS' NEWS & COLLAPSE

Once a symbol of unity and progress, Europe has now become a mosaic of divided nations, faced with the consequences of their own failure. Internal dissent, the economic crisis, and the rise of nationalism laid the foundations for collapse, while digital corruption and fraud accelerated disintegration. PAGE 6

PAGE1

News headlines in a combined future with Black Swans in 2040...

If the BlackSwan events predicted by the teams had made headlines the local newspaper **INNONEWS of August 11, 2040,** would potentially look like this:

191. Nassim Nicholas Taleb
192. https://www.investopedia.com/terms/b/blackswan.asp

3—0

REGION OF
CENTRAL MACEDONIA

EXPLORING & MONITORING
CHANGING CONDITIONS,
TRENDS AND NEEDS
INNOVATION LANDSCAPE 2040

Innovation
2025-2040

SHAPING RESILIENT STRATEGIC INNOVATION POLICIES

Based on the development of the Scenarios and the analysis of the local innovation ecosystem and in the light of the Region's Vision for Innovation, the Strategy Policies are listed, whose implementation can support the approach to this Vision.

These policies can and should be formulated and combined appropriately, depending on the Scenario presented in the previous chapter or on actual future developments.

The resilience policies and actions that we present below resulted from the elaboration of policy proposals per Scenario, defined by its co-creators, and prioritized by all participants in the INNOVATION 2040 workshop:

01

Human Capital and Skills Development

Score:
77 points

- → Enhancing Skills in Digital and Green Technologies.
- → Development of Infrastructures to Enhance Digital and Technological Education
- → Retraining and Upskilling Programs
- → Incentives to Attract and Reserve Qualified Personnel
- → Establish Policies to Attract and Support Digital Nomads
- → Establishment of entrepreneurship education programs at all school levels
- → Student innovation competitions and their wide visibility
- → Promoting examples in the media of successful business innovation

02

Enhancing Innovation and Technology Transfer

Score:
76 points

- → Organization of Innovation Competitions
- → Promotion of Innovation Procurements
- → University-Business Cooperation Strengthening
- → Organization of Networking and Collaboration Events
- → Establishment of Innovation and Technological Transfer Awards
- → Creation of Innovation and Hubs
- → Incentive Provision to Commercialize Research
- → (Further) specialization of the Regional Development Strategy in Sectors and Sectors of High Added Value
- → Fostering and promoting Open Innovation
- → Enhancing Innovation and Entrepreneurship Awareness and Orientation

03 Supporting Entrepreneurship and Taking Risk

Score:
20 points

→ Provision of Advisory (legal and financial) Services to Enterprises with High Risk

→ Enhancing Access to Finance with a focus on start-ups (e.g. microcredit)

→ Expand Funding for Mass Media (e.g. cooperative finance)

→ Education and Development of Entrepreneurship Skills and risk perception

→ Provision of Tax and Insurance Incentives

04 Strengthening Cooperation and Regional Advocacy

Score:
15 points

→ Creation of Interregional Action Plans for the effective implementation of common objectives

→ Strengthening Regional advocacy at national and European level (Lobbying)

→ Creating Social Innovation Platforms to strengthen urban-rural communities' cooperation

→ Creation of Innovative Rural Testbeds

→ Enhancing Transparency and Citizen Participation in decision-making processes

05 Attracting Investments

Score:
14 points

→ Creating an Attractive Investment Environment

→ Attracting Foreign Investments

→ Enhancing Business Extroversion

06 Attracting Qualified Personnel and Repatriation (Brain Gain)

Score:
12 points

→ Incentives to Attract and Reserve Qualified Personnel

→ Repatriation incentives by creating attractive job opportunities and promoting research and innovation.

→ Housing Policy Design to Strengthen Professional Installation of the returnees

07 Enhancing Open Innovation and Awareness

Score:
8 points

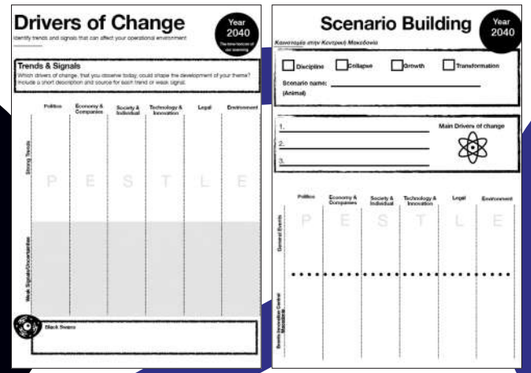
→ Fostering and promoting Open Innovation

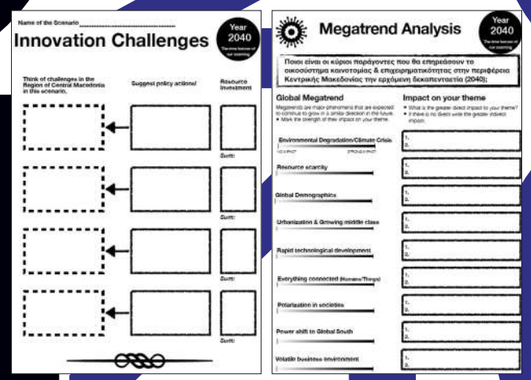
→ Enhancing Innovation and Entrepreneurship Awareness and Orientation

ANNEX I

THEMATIC WORKSHOP

On November 11, 2025, the One Stop Liaison Office, the Region of Central Macedonia's supporting mechanism with the support of the UNESCO Chair on Futures Research, organized and implemented a Thematic Workshop at the Museum of Contemporary Art in Thessaloniki, in order to explore scenarios and strategies that will further enhance the competitiveness of the innovation ecosystem of the region of Central Macedonia in the coming fifteen years until 2040.
The 35 participants came from the innovation ecosystem of the region representing Research, Education, Governance and Market bodies (businesses, development, intermediaries).
The event lasted from 11.00 to 16.00, coordinated by Stavros Mantzanakis, CEO of Helenos Consulting and Dr. Epaminondas Christofilopoulos, chairholder of UNESCO Futures Research.
Participants had A3 forms at their disposal for completion in each phase of the workshop, depending on the question they were asked to answer and the necessary stationery, while promotional material from the One Stop Liaison Office was distributed to them.
The Workshop was conducted in three phases:
In the first, the objectives and methodology of the methodology were presented and then the effects of megatrends on the innovation ecosystem of the region were detected. The second identified trends and weak signals/uncertainties and evaluated their impact on the region. In the third phase, the variables of the scenarios and the interaction between them were developed, while the workshop was completed with the brainstorming of strategic action ideas for 2040.
In a game of creativity that reinforced cohesion between groups, and based on specific variables given to each group, each participant chose to paint an object of the near or distant future. Emotion magnifying masks, watches that diagnose and treat diseases, hats that identify and activate the appropriate area of the brain for maximum efficiency, oxygen supply implants under water, but also glasses for communication with all living beings, are just some of the products imagined and painted by the participants.





ANNEX II

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04. **Chrysovergis Byron**, Mechanical Engineer, Co-founder Metatopia
05. **Dimitriadis Apostolos**, Head of Business Development Unit & FORTH Technology Transfer Office
06. **Dimitriadis Ilias**, Researcher Datalab & Co-Founder at Exanta
07. **Fotoglou Lizetta**, Founder & Business Owner at Relak by Lizetta Fotoglou
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09. **Kakderi Christina**, Assistant Professor at AUTH, Member of URENIO
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20. **Papantos Christos**, Spatial Engineer, Innovation Consultant, Helenos Consulting
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25. **Sermpezis Pavlos**, Data scientist, Researcher, Co-founder Exanta
26. **Spyroglou Odysseas**, Research & Innovation Consultant, International Development Ireland (IDI)
27. **Themelis Georgios**, Physicist, Innovation Consultant, Helenos Consulting
28. **Tramantzas Kostas**, Mechanical Engineer, General Manager at Alexandria Innovation Zone S.A.
29. **Tsanaktsidou Evgenia**, Chemical Engineer, Research Scientist at CERTH
30. **Tsiomos Spyridon**, Electrical and Computer Engineering Student at AUTh
31. **Tsitsamis Dimitrios**, Senior Innovation Manager at Port of Thessaloniki - ThPA S.A.
32. **Valais Efthymis**, Chemical Engineer
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REGION OF CENTRAL MACEDONIA

2040