Interreg
EUROPEAN UNION
Danube Transnational Programme
EcoInn Danube

JOINT STRATEGY ON ECO-INNOVATION IN THE DANUBE REGION

Project co-funded by European Union funds (ERDF and IPA)
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2018

WP6	Strategy for eco-knowledge
ACTIVITY 3.3	Elaboration of Strategy and Action Plan
DELIVERABLE 3.3.5	Final joint strategy

Project number	DTP1-191-1.1
Title of the project	Eco-innovately connected Danube Region (EcoInn Danube)
Version	Final
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Country	Slovenia
Date	14.04.2018

CONTENTS

LIST OF ABBREVIATIONS:

- EU - European Union
- EUSDR - European Union's Strategy for the Danube region
- PCT - Patent Cooperation Treaty
- ICT – Information Communication Technology
- GDP – Gross Domestic Product
- R&D – Research and Development
- SME – Small and Medium Size Enterprise
- CO2 – Carbon Dioxide
- DMC – Domestic material Consumption
- WP3 – Work Package No. 3
- OECD – Organisation for Economic Co-operation and Development
- ETS – Emission Trading System
- GHG – Green House Gas
- NGO – Non-governmental Organization
- EIC – European innovation Council
- ICLEI – Local Governments for sustainability
- NALAS – Network of Associations of Local Authorities of South-East Europe
- FEDARENE – European Federation of Agencies and Regions for Energy and the Environment
- EIP-SCC – The European Innovation Partnership on Smart Cities and Communities
- EGCA - European Green Capital Award
- EBAE- European Business Awards for the Environment
- SEUA - Start-up Europe Awards
- nZEB – Nearly zero-energy buildings

1. EXECUTIVE SUMMARY

The Danube region is a highly heterogenous area extending along the Danube river basin from its spring in the Black forest to the Black sea, connecting countries of contrasting stages of development and highly distinctive cultural backgrounds. Forming a common vision for countries with such vastly different perspectives, priorities and needs, one that holds substance and can be implemented in practice is a considerable challenge that can only be addressed by increased transnational integration, addressing the people and their respective territories directly, dismissing the logic of small nations that are by themselves unable to contend in ever more efficient international markets.

The concept of eco-innovation addresses all the key challenges that societies of the Danube region will have to overcome in the next decades and shows a clear way forward for companies, public institutions, education as well as the general public. Implementing support measures for eco-innovation on a systemic level, be it policy adaptation, entrepreneurial development, educational reform, energy transition and so forth will be essential in achieving inclusive, robust and sustainable growth for the long term. This process will have to be all encompassing to engage and facilitate requirements of literally all types of institutions and individuals, from legislative to judiciary and executive branches of government, research and educational institutions to companies, from producers to consumers.

Creating a better environment for enterprise, innovation and the citizens in general, while prioritizing sustainable development will among other things require increasing the level of awareness among final consumers, improving the quality of obtained skills amongst the regions human resource pool as well as creating market opportunities in areas crucial to the future wellbeing of the Danube region societies (ecology-environmental protection, waste/resource management, energy supply, transport etc.). A swifter move towards a new economic model of a circular economy that will allow for the decoupling of economic growth from negative environmental effects, decreasing energy and resource dependency of the region, reducing labour intensity by increasing labour productivity and prioritizing industries that demonstrate high value-added and long-term sustainability, not only from an economic point of view, but rather based on the complete life cycle impact, taking into account the wider benefits that it implies for the society as a whole. Achieving a practical implementation of such an economic model will require substantial effort and engagement of various stakeholders across all levels, by applying the quadruple helix approach, focusing in particular on the interconnectivity amongst relevant actors as well as to increase the flow of information and knowledge across transnational channels within the Danube region.

The joint strategy on eco-innovation in the Danube region (representative of particularly countries actively included in the project activities inclusive of 8 member states: Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Slovakia, Slovenia and 2 pre-accession countries: Bosnia and Herzegovina and Serbia)is one of the final developments of the 3rd thematic work package of the EcoInn Danube project, whose main goal is to identify and analyse main challenges and requirements for eco-innovation (as one of the key elements of the circular economy), both from a supply and demand side perspective. The strategy is based and directly developed upon findings from national stakeholder meetings (organized twice in each partner country), an international survey with key stakeholder categories as well as extensive research on the potentials, opportunities, challenges, barriers in addition to supporting structures with reference to key metrics and indicators portraying the national outlooks in the areas of innovation, energy, environmental protection and economy.

2. VISION

To advance eco-innovation within the Danube region, a comprehensive approach taking into consideration a plethora of different impacts both from a supply (from the production of energy, supply of raw materials to the development of products and facilitation of services) and demand (accessibility, purchasing power, consumer awareness) perspective.

The countries of the Danube region will:

Innovation	**… achieve a higher level of territorial integration with the common goals of creating a knowledge society that will increase the areas global competitiveness and support sustainable economic growth, while at the same time protect and recover the natural assets of the territory by supporting green growth and resource efficiency (product from problem). Escalate the innovation culture by adapting educational systems in line with latest discoveries and available technologies. Explore biorefinery-based holistic approaches. Abandon synthetic-industry-paradigms by supporting discovery/development of nature-based alternatives**
Economy	**… improve prosperity of its inhabitants and consolidate the level of economic disparities between wealthy and less-wealthy areas, thus mitigating negative migration of human resources and focusing on decentralized development including smaller urban settlements and rural regions.**
Ecology	**… maintain the immaculate environmental heritage with rich diversity of its ecosystems and improve upon actions for minimizing the effects of climate change. Decrease waste by creating market opportunities in packaging, distribution, construction and recycling and upcycling of products.**
Energy	**… increase its energy independence and energy productivity by utilizing vast capacities of renewable energy sources and investing in best available technologies (BAT) on the supply side, as well as substantially decrease the energy demand by fostering product, process and organizational innovations on the level of production (renewables), distribution (smart grids) and consumption (products and services that increase energy efficiency).**
Resources	**… Improve resource efficiency and substantially improve waste management schemes by determining a "fair" price for waste in terms of their life-cycle impacts. Explore and revise educational approaches on formal and informal levels and promote activities with little or no impact on resource consumption**

2.1 Context and relevance

The joint strategy on eco-innovation in the Danube region is in line with the targets set out in the European Union's Strategy for the Danube region (EUSDR), most directly concerning priority areas 7 - *develop the Knowledge Society (research, education and ICT)* and 8 - *support the competitiveness of enterprises*, however it also involves other priority areas in the fields of sustainable mobility, resource efficiency and energy (PA`s 1B,2, 4, 5, 6 and 9). The strategy is evolved around all three priorities of the European strategy for **smart** (developing an economy based on knowledge and innovation), **sustainable** (promoting a more resource efficient, greener and more competitive economy) and **inclusive** (fostering a high-employment economy delivering social and territorial cohesion) growth.

The strategy focuses on achieving the goals of the Europe 2020 development strategy of a 3% of GDP invested in research and development, achieving at least a 75% rate of employment for the active age group (24-64) and fully realize its energy saving and emission reduction targets.

Compatibility instead of contradiction among those goals requires a mind shift from conventional economies that don`t easily allow the decoupling of economic growth with increased environmental hazards. The common denominator is eco-innovation as the main driver of sustainable economic growth in the foreseeable future which needs to fully encompass the circular economy paradigm at is core. The long-term goal is to improve key indicators of countries against Germany as the only, so called *innovation leader* in the selected group of countries (achieve at least a Strong Innovator status in Croatia, the Czech Republic, Hungary and Slovakia as well as to advance the status in Bulgaria from a Modest to - at a minimum- Moderate Innovator status with reference to the methodology on national reports - Deliverable D 3.2.1)

3. THE CURRENT ENVIRONMENT

The national economies of the Danube region vastly diverge in terms of development, problematic areas and future priorities. In terms of GDP, German federal states of Baden-Württemberg and Bayern contribute almost one half of the entire region. The divide grows substantially larger when comparing economic output of member and non-EU states. As a result, employment rates vary from 70 to about 75% in the West and are generally below 55% in Eastern countries. With increased mobility of people in the region, this leads to substantial loss of human capital in countries from the Eastern part of the Danube region (brain drain). Future economic cohesion strongly depends on maintaining a very high growth rate of GDP in the Eastern part of the region in order to reduce disparities by primarily, putting a halt to the extensive outflux of human capital. An equilibrium of development in key areas of education, business and employment (preferably in knowledge-intensive industries) needs to be achieved.
The Danube region is strongly reliant on micro-, small- and medium-sized enterprises, which produce about one-quarter of total GDP. The countries of the Danube region share an essential transport and migration (from rural to urban areas, cross-border and international) corridor. Accounting for the high level of biodiversity and excellent environmental indicators, increasing mobility and connectivity, also in terms of macro-regional cooperation and knowledge transfer should be viewed as a relevant resource for overcoming future challenges.
The economies of the region are strongly reliant on SMEs, but they are still not able to fully exploit the existing potential because of the structural difficulties, lack of internationalization of their activities and internal disparities related to research and innovation fields and low-intensity (efficiency) of knowledge transfer from the scientific sector towards the potential beneficiaries on the commercial level. Disparities are observable both in terms of allocated resources but also in available structures and human resources. In the region there is a significant potential regarding energy efficiency and renewable energy that is mainly linked to the large availability of natural resources in the countries (such as solid and gaseous biomass). This potential is – by far – not yet sufficiently exploited for several reasons including for e.g. because of the lack of applicable strategies for better mobilisation of local energy sources, lack of adequate infrastructure, prohibitive legislative/administrative environments and so forth.
Reducing energy needs and increasing the share of energy produced at the local level (including small-scale energy production) would be beneficial for all consumers in the region. Countries should have an interest in improving the situation in their neighbour countries, as environment (and environment pollution) knows no political borders.

Research and development

Public expenditure for research and development activities in the analysed countries of the Danube region reached 0,6 % of GDP in 2015 (European Innovation Scoreboard 2017 – indicator 2.1.1), marking an almost 23% increase since 2008. Nevertheless, this value is far below the 0,89% and 0,93% of GDP allocated to R&D in Austria and Germany respectively, as well as in comparison to the 0,71% share of GDP as an average for the European Union.

R&D expenditure as a share of GDP in the business sector for the analysed countries was 0,99% in 2015 (European Innovation Scoreboard 2017 – indicator 2.2.1), compared to 2,18% in Austria and 1,95% in Germany, keeping in mind that the GDP itself was lower in absolute terms. Furthermore, private co-founding of public R&D expenditures (indicator 3.2.3) amounted to only 0,04% of GDP, with reference to the innovation leader benchmark, Germany, in which this rate achieved 0,12% in 2015. It must be noted that the trend for countries in the Danube region for this indicator has also been either stagnant or declining, indicating that the “catching-up” of less developed economies can never be achieved without substantial effort on the national policy and administrative levels.

The rate of expenditure into R&D activities in 2015 was therefore still far behind the 3% objective outlined already within the Lisbon treaty and reiterated in many forms in subsequent strategical objectives of EU member states and candidate countries. The effect of this underspending is clearly visible across all fields of innovation output. For example, with respect to international scientific co-publications (1.2.1) expressed as a value per million of countries

inhabitants was only 596,3 or about 44% of the co-publications published by Austrian experts, even though the countries of the Danube region have been able to achieve a larger increase compared to the average of the EU. The picture becomes even bleaker while observing the scientific publications that were amongst the 10% most cited (indicator 1.2.2) in expert spheres worldwide (measured as a share of all scientific publications from the national level) where the Danube region achieved only 7%, compared to the 10,6% documented for the European Union as well as 11,7% and 11,4% reported in Austria and Germany. This indicates that albeit the total scientific co-publications have risen much more in the countries of the Danube region than in the EU in general, the lack of the international relevance of such publications points to lower penetration, questionable quality and/or limited experience in data presentation, or even limited self-confidence or stamina to publish in higher-impact journals

Education

New doctorate graduates per 1000 population (indicator 1.1.1) achieved on average 1,88 in 2015, exceeding the EU average and coming close to the rate documented in Austria at 1,90, but still falling short of the 2,85-rate observed in Germany. This marked a notable, on average an almost 50% increase in the Danube region countries, compared to for example Austria, in which the number of doctorate graduates decreased in the same period by 5% from 2008. In terms of all levels of tertiary education completed by persons within the age group from 25 to 34 (indicator 1.1.2), the countries from the Danube region on average recorded a share of 33,36%, which is still well below the European average which stood at 38,2% in 2016, however managed to achieve a growth of more than 42% since 2008, overshadowing the EU average growth of less than 20%. Austria on the other hand documented 39,7% in 2016, achieving an outstanding 89% increase from 2008. Lifelong learning activity (indicator 1.1.3), expressed as the share of total population in the age bracket from 25 to 64 at 6,6% in 2016 was also well below the EU average in all observed countries except Austria and Slovenia. Unsurprisingly, the share of foreign doctorate students as a percentage of the total (indicator 1.2.3) exceeds 10% only in Austria and Germany, restating that universities in these two countries are recognized by foreign students to offer better future outlook in terms of skill development and employment opportunities, not even considering that a substantial share of universities from other Danube region countries don`t even offer competitive educational curricula in foreign languages, at least not in the extent that would be sufficiently relevant to the fields of study for future international experts.

Business

Although the supporting structures for start-ups and SMEs in general have been rigorously integrated into business support structures available on the national level, opportunity-driven entrepreneurship as such (indicator 1.3.2) also known as the motivational index) has been on a steady decline since 2009 and dropped to its lowest level in the countries of the Danube region in 2016 at 1,9 (with respect to the index value of 3,1 in the EU, 3,2 in Austria and 2,9 in Germany). From all of the countries analysed, only the Czech Republic at 2,7 in 2016 was able to approach this value, documenting a stable increase ever since 2009. Even more so, venture capital as a share of GDP (indicator 2.1.2) in the Danube region has also substantially declined from 2008 onwards and was on average only 42% of that documented for the EU. Excluding Austria and Germany, the share further drops to only 0,165% of GDP for the other analysed Danube region countries, clearly indicating a lack of trust and stability into the political, administrative and business environments of these countries for carrying out such investments, considering also other economical limitation such as the substantially lower purchasing power of their residents.

Innovation

The observation of several indicators around innovation impacts points to systematic deficits in most observed countries. As the regional economies are strongly reliant on economic activity of SMEs, most countries are not successful in providing a supporting environment for innovations. For example, the share of SMEs introducing any kind of product or process innovations (indicator 3.1.1) was only 24,6%, while this share was 40,7% in Austria and 41,6% in Germany. Comparatively Romania and Bulgaria only achieved 4,9% and 14%, representing only slightly less than 16% and 46% of the EU average (30,9% in 2015) respectively. The same can be concluded for SMEs introducing marketing or organizational innovations (indicator 3.1.2), where the Danube region achieved a share of 28,3% in 2015 (down by more than 20% since 2008) compared to the 34,9% average of Europe. The share of SMEs innovating in-house (indicator 3.1.3) was on average 21,6% for the Danube region in 2015 (down from 26,2% in 2008) and 28,8% for the EU, while Austria and Germany as strong innovators/innovation leaders achieved 35,0% and 37,9% in 2015. PCT (Patent Cooperation Treaty) patent application per billion GDP measured in terms of purchasing power standards (indicator 3.3.1) has also been comparatively very low across the Danube region. In this area, the countries of the region on average only managed to secure 2,08 PCT patent applications per billion GDP (in PPS), more than 40% less than the EU average of 3,70. Again the disparities between strong innovators such as Austria and Germany, which managed to publish 4,95 and 6,35 patents and moderate/modest innovators such as Croatia (0,65), Slovakia (0,45) and Romania (0,26) are excessive. In terms of trademark applications (indicator 3.3.2) measured by the same metric (per billion GDP in PPS) the divergence between the Danube region and the total of the EU is less evident, as they reach on average 6,58 compared to the 7,6 in the EU. When excluding Austria (12,91) and Germany from the calculation, the remaining region´s average drops to 5,44. Furthermore, the quantity of design applications is also at a comparatively low level when taking into account the EU average of 4,33 (2,96 average for the Danube region), however some countries even from the category of modest innovators have been able to make extensive progress in this area from 2009 onwards. For example, Bulgaria achieved 7,02 design application per billion GDP in 2016, which concluded an almost fivefold increase from a starting point of only 1,41. Most analysed countries however fall well behind this value and have in the clear majority observed a stagnant or declining trend in the observed period, contributing to a 2,04 average while excluding Austria (7,10) and Germany (6,18). Employment in knowledge-intensive activities as a share of total employment has ranged from 11,3% in 2008 to 12,2% in 2015, which is far below that of the EU (13,4% to 14,1%), Austria (14,3% to 14,6%), Germany (15,4% to 14,8%) and some other countries like Slovenia. Furthermore, in terms of exports of medium and high technology product given as a share of total product exports, the Danube region despite marking an increase of about 6% from 2008 to 2015, is well below the 60,4% average for countries included in the Strong innovator group, in addition to still falling behind the average of the entire EU.

Energy

The Danube region demonstrated a lower level of energy dependence in the period from 2007 to 2015, compared to that of the EU and even more so compared to the countries in the Strong innovator category. Energy dependence (calculated as net imports divided by the sum of gross inland energy consumption) declined in the observed period from 47,18% in 2007 to 43,02% in 2015, while it has grown for the EU. On the contrary, energy intensity of the Danube region, measured as the gross inland consumption of energy and GDP for a given calendar year, was still at a very high level in 2015, even though that a substantial decrease from 2007 (290,89) to 2015 (249,76 kg of oil equivalent per 1000 EUR) was documented. The energy intensity of the EU economy ranged from only 138,4 to 106,4 in the same period. In terms of renewable energy in gross final energy consumption, the Danube region improved substantially in the observed period and achieved 22,72% in 2015, mainly because of high shares of renewables in countries like Austria, Croatia and Romania. A similar picture is portrayed when observing the electrical energy generated from renewable sources (as a share of gross electricity production), where the Danube

region achieved a share of 33,51% in 2015, compared to the EU average of 28,8%. Again, countries like Austria (70,3%), Croatia (45,4%), Germany (30,7%) and Romania (43,2%) demonstrate very high levels of electricity production from renewables, while on the other side there is Hungary (7,3%) and the Czech Republic (14,1%) with very low shares. Intensity of energy consumption with respect to greenhouse gas emission equivalents, the Danube region has notably improved (reduced GHG intensity of consumption) compared to 2007, achieving an index value (2000 benchmark is 100) of only 89,12, which is only slightly above the EU average. A similar situation is observed in the values of energy consumption of transport relative to GDP, where the Danube region achieved an index value (2010 benchmark) of 95,04 compared to 93,20 for the EU and 110,10 for Bulgaria. Energy productivity (productivity of energy consumption expressed as the ratio between GDP and gross inland consumption of energy) remained at a low level throughout the observed period. Electricity prices with regards to the lower living standard was at a high level compared to the EU average, especially for industry.

Ecology (Environmental protection)

Expenditure of the public sector on environmental protection as a share of GDP in the Danube region has been at a higher level to that of the EU and more developed countries in relative terms (due to lower GDP). In terms of GHG intensity (tonnes of CO2 equivalent per capita), the Danube region was below the EU average throughout the observed period, principally characteristic of less developed economies (Austria (9,44 t/CO_2 Germany 11,41 t/CO_2). Revenues from environmental taxes have been at a comparable level to that of the EU over the observed period. Resource productivity, measured as the GDP divided by domestic material consumption (DMC - annual quantity of raw materials extracted from the domestic territory of the focal economy, plus all physical imports minus all physical exports) and expressed in EUR per kilogram (chain linked volumes 2010, for comparing the changes in one country over time), has been at a very low level, indicating a high level of inefficiency in production and distribution processes. Germany for e.g. was able to produce 2.22 EUR of GDP for each kilogram of material used (EU average 2,07), while the Danube region only managed to produce 1,45 EUR. Domestic material consumption expressed in tonnes per capita was in 2016 at a higher level (15,95 tonnes) compared to the EU (13,02 tonnes). Recycling rates (in 2015) for packaging waste were a bit lower than in the EU on average and much lower than ones in developed economies of Western Europe. The recycling rates for municipal waste at 26,72% were well below the EU average (45%) in 2015. Exposure to hard particles (PM2,5 and PM10) were at a very high, often health-threatening levels.

3.1 COUNTRY OVERVIEW

AUSTRIA

Austria is seen by many as a best practice example on how countries in the Danube region should organize their decision-making processes, especially in terms of securing a predictable and stable environment for conducting business in particular with respect to enforcement of existing legislation through a robust judicial and penal system. The country has the second highest intensity of R&D of all EU member states in terms of allocated GDP, albeit not as clearly expressed regarding actual innovation output. All forms of eco-innovation activity are well represented, particularly from the side of companies that are introducing environmentally relevant innovations within their internal business processes, as well as in terms of output of patents and publications. The country's economy is characterised by a traditional business structure with a focus on the medium-tech and low-tech segment, while the high-tech sector is smaller than in innovation leaders. Employment in eco-oriented industries, circular economy activities as well as revenues (for e.g. sales of new-to-market and new-to-firm innovations) from these are actually below the average of the EU. The effort and resources allocated towards supporting R&D, excellent educational system, strong human resource base in STEM fields, patent output, etc. on the national level are not as evident in sales and employment as would be expected. Therefore, it is necessary to improve the efficiency of the innovation system, particularly at the stage of innovation transformation, capitalization and marketing.

Even though the level of awareness in the field of sustainability, environmental protection, energy efficiency and resource management is very high amongst the general public, which also translates to strong political support on the local, regional and national levels, Austria has the largest ecological footprint (per-capita) amongst all the Danube region countries. This demonstrates the difficulty of decoupling strong economic activity from environmental impacts even in highly developed countries with a long political tradition.

The ambition of Austria is to join the group of Innovation leaders by 2020, for which more financial input might be needed, as well as to address the issues regarding the inefficiency of the transformation of relevant innovations into market-ready products and services. Additional financial input should be sought by securing easier access to venture capital financing.

BOSNIA AND HERCEGOVINA

Bosnia and Hercegovina has been characterized by a complex and inefficient political composition with very poor coordination and communication between key institutions on basically all areas of decision making since its inception. This is perhaps even more evident in the fields of ecology and innovation, especially in terms of a clear deficit and mechanism for facilitating cooperation with the economy. Even obtaining comprehensive and up-to date statistical data can often provide a challenge since the Federation of Bosnia and Herzegovina and the Republika Srpska have their own statistical offices, with a third region, the Brčko District, governed under local government. Lack of statistical data in itself is a major obstacle in any attempt of a systematic approach to the future development of the country and should be considered a priority amongst national decision makers. Not surprisingly, the country is characterized by frail capabilities for carrying out research and development in both public and private institutions. The limited scope of activities that are carried out for e.g. on the level of national universities often have a questionable relevance to the industry and are therefore not providing the national economy with either disruptive innovations from basic research nor marketable value propositions from applied research activities. The level of communication and interconnection between academia, research and industry are very low, as the bulk of the economy itself is structured around low-tech (to medium-tech) sectors. Research in general is greatly underfunded, even funding from the government is marginal. A major consequence derived from this is poor commercialization of research results and underdeveloped human resources in general. The institutional framework is insufficiently aligned with good European practices and adds to the overall unsatisfactory level and low quality of scientific productivity. Moreover, the interdisciplinary approach in research is not sufficiently represented while the introduction of external evaluation of work of individuals and organizations is dismissed or even opposed on every step.

Despite this difficult situation, compliance with environmental regulations as defined in relevant EU legislation has been achieved to a certain extent. It is necessary to hasten the completion of the harmonisation process with EU legislation in the area of environmental protection on the level of all 3 entities jointly. Technological development is also negatively affected by low awareness of decision-makers about the importance of innovation and the necessity of using best available technology as well as their low motivation for carrying out necessary reforms. One of the most evident issues is a complicated and poorly defined legislative framework, however several improvements have been made in terms of its adjustment to EU requirements in the past year. The very low level of development in practically all aspects of innovation support can also be seen as an opportunity, to design and establish a new system from the ground up, based on experience and best practice examples of successful countries from the Danube region. Considering the significant potential to produce energy from renewable energy sources, encouraging both basic and applied research on new/improved energy systems presents one of the greatest potential for economic and societal development in the country. Significant opportunity for faster development and implementation of eco-innovation in Bosnia and Hercegovina are funding programs, particularly framework programmes for research and development, such as Horizon 2020 (and FP9 within the next multiannual financial framework), which offer engagement in international cooperation on research, providing access to modern scientific and research equipment for a relatively modest financial contribution. An important factor of change, with strong multiplier effect would also be the establishment of
centres of excellence, technology transfer offices and resulting "spin-off" companies by the research community and many other forms of cooperation of the economy and science / innovation.

International cooperation within the context of an accelerated adhesion to European integration processes is vital to the future stability, economic growth and wellbeing of citizens of Bosnia and Hercegovina as well as the entire Western Balkan region.

BULGARIA

Bulgaria has made substantial improvements by undergoing a transformation from its heritage of a highly centralized/planned economy to a market-oriented, upper-middle-income economy of the EU. The rapid advancement with respect to very high economic growth triggered by structural reforms, introduction of the currency board and EU accession has been hampered by the 2008 economic crisis as well as a period of political instability in the period from 2013 to 2014. Today, Bulgaria is faced by two key challenges of raising productivity and addressing the country's rapid demographic change. Higher productivity growth is critical to accelerating convergence, as Bulgaria's income per capita is only 47% of the EU average, the lowest in the EU. Productivity will need to grow by at least 4% per year over the next 25 years for Bulgaria to catch up with present day average EU income levels and thus boost shared prosperity. In terms of the grim demographic outlook, the population of Bulgaria continues to decline since its peak of 9 million in 1986 (7.1 million today). With a high death rate, low birth rate, and negative net migration, the decline is expected to continue throughout the 21st century. Interestingly, Bulgaria (along with Latvia) is one of only two countries with a lower population today than in 1950.

Bulgaria`s energy supply is, as the Danube region, reliant on the imports of fossil fuels. Energy production is based on nuclear energy, solid fuels and/or coals such as lignite and small quantities of gas. The role of renewable energy sources (wind, solar, biomass, and hydro) has increased dramatically in recent years whereby today renewables represent nearly 20 percent of Bulgaria's electricity production. Energy prices on the regulated market are fixed, by reference, or formula- based, indicating low levels of competition in the energy sector. The country's strategic geographical location makes it a major hub for transit and distribution of oil and gas from Russia to Western Europe and other Balkan states. Bulgaria's spends less money on education compared to EU and Danube region. The data shows that Bulgaria invested most in education in 2009, since then, the values are decreasing, which is a tendency of EU and Danube region. This underspending is made apparent in Bulgaria PISA results, in which it scores below the OECD average.

The main opportunity for eco-innovation in Bulgaria lies in the clean energy transition, shifting towards a low carbon economy and promoting resource efficiency (promoting efficient use of resources by achieving high energy efficiency (especially in homes and building infrastructure), further developing renewable energy sources, and improving sustainability practices within the transport sector). Since 2013, energy efficiency and the use of renewable energy has improved, slowly reaching the level agreed upon with the European Commission for 2020, that is to say: a 50% reduction in energy intensity of gross domestic product (GDP) by 2020, resulting in approximately 25% improved energy efficiency. Regarding renewable energy, the objective of 16 % share of RES energy in the gross end energy consumption by 2020 has already been reached. The challenges related to the transport sector and the development of green technologies include achieving the objective of 10 % share of the energy from renewable sources in transport as of 2020 and developing the R&D sector so that it represents 1,5% of GDP by 2020. In this context the adhesion of the City of Sofia as well as Bulgarian port authorities in the FCH JUs Cities and Regions initiative, presenting ambitious plans for zero emission transport can be seen as a very important step forward.

The main challenge of the country is to facilitate increased investment into eco-innovative support structures, providing hire appropriations from the government which should be matched by co-financing from relevant industries. The legislative environment, for supporting and prioritizing eco-innovation should be further developed and revised. Bulgaria is placed in the modest innovator group while its strategic goal is to obtain moderate innovator status by 2020. Key drivers of future development will be the rise in awareness from both business, citizens and government on the benefits of green products and technologies, high skilled human resource and knowledge capital and Bulgaria's leading regional position in the information and communications technology (ICT) sector.
The relative strengths of the country's innovation system are in the innovation-friendly environment, and the human resources, while the relative weaknesses are in the innovation activities, and in the public and private investment in research and innovation. Several existing innovation policies and financing mechanisms are being implemented in the present that should improve the countries performance by means of all innovation indicators.

CROATIA

Croatia obtained its independence with the secession from the SFR Yugoslavia the same year as neighbouring Slovenia in 1991 and became a member of the EU in 2013, in midst of the aftermath of the 2008 financial crisis. Croatia managed to restore growth in 2015, following a six-year long recession. The country still faces high national and private sector debt, a low employment rate (especially amongst the young), a restrictive investment climate and very unfavourable demographic trends. Croatia is categorized as a moderate innovator and can be compared to developing countries in several metrics. However, spending on R&D/supporting innovation is well below the EU average. R&D intensity in general is below the EU, due to lack of innovations (and innovators), lower GDP per capita, a lower and negative growth rate of GDP, lower and negative growth rate of population and lower population density. Innovation potential in Croatia is far from being fully exploited. Similar as in Slovenia (Eastern-Western), there are also sever differences in development between the Jadranska (Adriatic) and Kontinentalna (Continental) cohesion regions. In general, the economy is to a high degree dependant on tourism, that is cyclical and seasonal (summer season). Besides increased revenues from tourism, the current recovery is also driven by exports and strengthening of the internal market demand including investments, which are very much supported also by European funds.
Engineering and science is underrepresented amongst highly educated persons (preferred university programmes in social sciences), which is already being expressed as a clear deficit of human resource for these profiles, creating a severe obstacle in improving/expanding intensity of R&D and manufacturing sectors with higher value added. Migration of skilled workforce has also continued and increased since the adhesion to the EU, due to the lack of gainful employment within the country, exacerbating the issue of the shrinking human resource poll even further.

Croatia has a high rate of electricity production from renewables, mostly by large hydropower station, while it also relies on thermal power plants on fossil fuels. Croatia imports about 50 % of the total of about 350 PJ (petajoules) of energy consumed annually. It imports 80 % of its oil needs, 40 % of gas, 35 % of electricity, and 100 % of coal needs. Croatia has an import dependency similar to the EU28 average for fossil fuels. The import dependency is much lower for gas, although it increased over the last seven years. Croatia and Slovenia also share the production capacities of the Nuclear power plant Krško. The country has an outstanding potential to install additional capacity for energy production from renewables, particularly wind and solar PV.

Environmental protection investments and current expenditure made by the public sector accounted for an EU-28 average of 2,0 % - 2,2 % of GDP during the period 2006-2015. Croatia is far below this average, with less than 2 %. Expansion of transport and tourism, increased energy consumption, social and physical processes are interconnected and correlated factors that put increasing demands on the environmental structure in Croatia, particularly high quality and reliable environmental services, such as water supply and the disposal of waste water, the management of solid waste, maintaining of clean air environment, clean sea and preserving the natural habitat.
Over the past years, the environmental protection system in Croatia has been continuously improving. However, considerable investments in the environmental infrastructure are still needed to reach adequate levels of environmental services and standards and to be fully in line with the acquis.

Croatia's main economic challenges will be to maintain macroeconomic stability while promoting exports and private sector productivity and competitiveness to create jobs and growth. Reducing high public-sector debt and the large state presence in the economy (privatization) will also help improve growth potential.
The projected population decline, due in part to emigration, and the rapidly aging population present risks to growth and higher living standards, as well as to fiscal sustainability. Croatia also needs to continue modernizing its public services, the judiciary, and the governance of state-owned enterprises, including the network industries.

CZECH REPUBLIC

The Czech Republic was a part of Czechoslovakia that was under the communistic regime for 40 years until the Velvet revolution of 1989. Czechoslovakia divided peacefully into the Czech Republic and Slovakia in 1993.
The transformation to the highly advanced, high income and export-oriented social market economy, based on manufacturing, innovation and services in the present day, is remarkable and can be considered a true example of excellent statesmanship and entrepreneurships. Investment in innovation has been increasing from both the public and private sectors. However, the national innovation rating is has still not (yet) reached the EU average. Availability, flexibility and allotment of human resource is seen as one of the biggest obstacles hindering further advances. The labour market lacks flexibility, especially in these times of record low unemployment rates, therefore ensuring a transition from low to high-knowledge intensive employment opportunities of labour force is essential. Moreover, while the total number of university graduates has been constantly rising, the share of graduates that continue their careers in academia and even more so, in research and development has not improved. As a result, the country doesn`t provide the extent of innovative solutions that would be comparable to its strong economic performance (for e.g. in the number of PTC patent output). In order to improve its innovation output, a higher share of citizens should be employed in either R&D and/or knowledge intensive industries, which is one of the main goals of the country. In this context, the cooperation between the public and private organizations that engage in innovation activities must also be strengthened.

With the environmental policies being adjusted to European standards, Czech energy and economics are making the transition from fossil fuels to renewable sources of energy, as is expected by the member of the EU and developed economies in the world. With growing interest in new eco-innovative technologies, it is again the number of people after graduation devoted and motivated by both public and private sector to further involve themselves in eco-innovative research that is being the biggest challenge of the country. While research and innovations are supported when they happen, the support needs to come to involve human resources in the R&D in the first place.
The overall environmental care awareness is the European trend, causing the decrease of energy consumption, taxation of environmentally challenging activities and reusing of waste and resources. While Czech Republic is leading in the recycling, the taxation concepts are outdated. Combining the lack of environmental taxes and the coal burning energy production, Czech Republic has a clear opportunity to focus on in the next decade.
Czech economy is still growing and the R&D sector is getting more and more attention. With the increased public and private funding supported by cooperation of the two, it may be a question of time until Czech Republic further develops a broader hub of experts, increasing its merit in the international community and becoming the innovative leader together with the strongest economies in the region.

GERMANY

Germany has a modern and growing economy, very high GDP, a high rate of both public and private investment in innovation and R&D activities, an excellent standard of living and stable public finances. Germany is the world leader in terms of cleantech development and deployment, climate protection and more specifically, expanding the use of renewable energy. The country has been a pioneer in backing up ambitious political goals with action (for e.g. Energiewende) however have encountered several technical issues in the process of its implementation, for example a large quantity of curtailed energy in several regions. This has not deterred the country to reiterate its ambitious goals to increase the share of renewables to 80% by 2050, which will require the introduction of new technologies that are being considered (hydrogen as an energy carrier, power to gas, hydrogen storage, fuel cell mobility).

In addition to the commitment of the Government, such measures will require in fact a high commitment and engagement of the final consumers. In introducing an environmentally compatible, extensive and climate neutral energy supply also the commerce and industry have a significant role to play. The data available shows that the energy transition will only succeed in Germany if the industry and other big players will significantly expand their investments in energy efficiency and renewable energy in the future, along with private households.

Germany is in a unique position within the Danube region countries (and to a large extent also within the EU), that it benefits from less developed countries in terms of market presence (modern and advanced means of production excludes less developed competition despite higher labour intensity), human resource pool (higher renumerations and better working conditions attracts skilled personnel, talent, mostly educated on the financial burden of the country of origins) and demography (excellent standard of living fosters emigration from poorer countries) to only name a few. Germany should continue and advance support mechanisms to less developed countries in the Danube region, in order to foster decentralized stable growth across all countries and increase social cohesion of the population.

HUNGARY

Though Hungary is a highly-developed country there are some issues on which we hope this study could shed some light, and there also some strongpoints which require to be highlighted.
The eco-innovation performance leaves something to be desired, as the Eco-Innovation index had been decreasing in the period of 2010-2016, starting from below the EU average and had been descending even farther. Hungary is lagging behind in most of the eco-innovation-related indicators, some are looking however worse than others. The eco-innovation outputs: related patents, academic publications and media coverage put Hungary on the end of the list, which hopefully marks and end to the continuous decline in these departments. Hungary still performed remarkably well in eco-industries mainly due to the strong presence of remediation, environmental monitoring and instrumentation and nature protection.
The performance in innovation indicators is varying heavily. Hungary does not contribute in a large proportion to the R&D sector, the privately owned business however save the day in that sector which activities in turn are heavily supported by the government, The inadequate amount of PhD-graduates poses a serious challenge in finding R&D personnel, and the dwindling expenses on education can further deepen this issue. Unsatisfactory ICT knowledge and labour shortage can slow down the expansion of an otherwise fast-growing and innovative sector. SMEs are also having difficulties coping with new challenges and their innovation performance is lacking. There are however opportunities, which can be exploited, namely the strong presence of venture capital in Hungary, and the good examples, such as Prezi, LogMeIn, which operate in Hungary can further advance the spread of start-up businesses, while Budapest gives a nice and attractive environment for entrepreneurs with its thriving social life.
Hungary also fares well in knowledge-intensive industries and services, meaning that even though domestic capital may be not very efficient in inducing new innovations and state-of-the art businesses, foreign enterprises can take advantage of the highly skilled and solution-oriented workforce. The employment rate, the value added and the export share of these industries and services could be considered to be very good in a European comparison.
Hungary does not seem to sticking out in energy-related issues apart from a few examples, such as the share of renewable energy sources in electricity production, which is far below the EU-average. The country is performing well regarding greenhouse gas emissions, and the constitution of the primary energy supply is well-balanced.
The socio-economic indicators describe a rather average country, which achieved very nice results in employment: the employment rate finally paired the EU average, and youth unemployment is a considerably more modest issue than in other countries. The low level of hourly labour costs can be interpreted as an opportunity and an obstacle in same time, depending on the viewpoint. The two major problems are the increase of corruption and the decreasing amount of money spent on education.

SERBIA

There are many critical areas in Serbia that should be improved in order to achieve progress in eco-innovations. Even with significant advances in the development and modernization of Serbia's R&D and innovation system, the country must overcome important challenges before it can realize the full potential of the reforms. First, public and private investment in research remains low, with Gross Expenditures for Research and Development (GERD), at less than 1 percent of Gross Domestic Product (GDP), significantly lagging the EU average. Moreover, investments are based in favour of basic, as opposed to applied, science, and are weakly linked to the needs of the business sector, disconnected from areas of revealed competitive advantage, and, too often, seem distributed on the basis of backward looking criteria. Second, the number of researchers has been steadily declining, due to brain drain and aging of the research population. Finally, the present system for the allocation of funding underrates the importance of the nexus between research and business, as well as the need for early stage innovation financing. A systemic (public and private) approach to the R&D and innovation system, its functioning, and its financing levels could help lift Serbia out of a pattern of low growth by increasing the scope for a modern technologically advanced and dynamic private entrepreneurial sector.116

However, there are few opportunities that Serbia should use in order to join eco-innovation activities. First of all they are various budgets from local level up to the governmental one with revenues originated from environmental taxes. These budgets should be used for their purpose – environmental issues and not to be spent to solve problems in other areas. Secondly, relatively strong indices that could be assessed as opportunity for eco-innovation concept promotion and implementation in Serbia is related to general impression on domestic industry services, consumers, retail trade as well as construction that is relatively good, according to businesses and consumers as well. This impression, articulated as a confidence is still high in spite of relatively low aggregate economic variables.

As a general conclusion could be stressed that Serbia is out of numerous joint official statistics available at Eurostat. This way, the country is not comparable with other EU and non-EU countries relating to numerous indicators that this organization follows. Statistical office of the Republic of Serbia as a national organization has available only basic indicators for the country neglecting numerous in-depth indicators particularly in innovation and environment protection.* This is the main reason why this report is not prepared in full scale. However, based on available data, some conclusions have been made.

SLOVAKIA

Slovakia belongs to the group of economies whose eco-innovation index does not reach high level and it is still lagging behind the average of the EU. The only exception is the resource efficiency outcome index, where Slovakia scores high above the average of the EU and the Danube region countries. This represents a clear opportunity for Slovakia to ensure long-term benefits for all - the government, businesses and people. Lower production costs and a lower dependency on imports could stimulate further economic growth. Lower expenditure on the mitigation of environmental degradation and lower health-related costs due to improved environmental quality may save the public finance.

Companies could increase their productivity and competitiveness thanks to lower dependency on virgin materials, more efficient production processes and lower input costs. However, the innovations do not produce the expected positive result, which should be the higher competitiveness of Slovak enterprises because the current innovation system fails in transforming new knowledge into advanced materials, products, processes, technologies and services. Further weaknesses in the development of eco-innovations in Slovakia include insufficient funding of research and science, low demand for the corporate sector after the results of domestic public research and science and a weak emphasis on innovation policy within the framework of economic policies and its coordination within individual sectors. Innovation activity in Slovakia is lower compared to economies in other European countries as well as the Danube region countries. Unsatisfying conditions for scientists and researchers on one hand results in a low share of the highly educated persons in the field of engineering and science and a brain-drain. Better conditions, international exposure and creation of the more competitive environment could improve the representation in the highest fields of knowledge, technical development and specialization. On the other hand, rather stable employment in knowledge intensive activities in both manufacturing and services and higher share of employment in medium-high and high-tech manufacturing (as a share of total national employment) creates an opportunity for Slovakia in future development in eco-innovative products and services.

Energy sector in Slovakia requires long-term vision and strategy. Progress in terms of specific policies and projects need to be translated in its effective implementation. A combination of well-targeted policies that are reasonably using EU funds together with private investments could contribute fulfilment of the major goals of the energy policy - reliability and stability of energy supply, efficient use of energy for optimum cost and adequate environmental protection.

SLOVENIA

Slovenia is one of the smallest and most diversified countries in Europe in terms of its landscape (including Alpine, Mediterranean and Pannonian), climate, biodiversity (flora and fauna) as well as the people that occupy it. It has a high share of private economy with a liberal market and it is highly integrated in European and international markets. It's by far the most advanced economy of the former Yugoslavian countries from which it gained its independence in 1991, as well as in comparison to all other countries with transition economies (except to the Czech Republic in some instances). The countries main natural resources are abundant fresh water reserves, large forest areas (58.4% of its landscape), clean environment and biodiversity as well as a long tradition of industrial production, a substantial body of knowledge, relatively good education and great capacity for sustainable tourism.
Awareness of the general public on the topics of sustainable development and environmental protection is at a very high level, which is partly a result of national campaigns carried out since the 1980s, even before Slovenia was able to obtain its independence. There is strong public and political support for the energy transition and circular economy concepts in general. However, few citizens understand the scope of investment that the transition itself would require, so increased prices of for e.g. invoices for energy (contributions for renewables) and utilities are very unpopular. The country is making substantial efforts to meet the energy saving targets, which are expressed as the maximum threshold for primary (7.125 Mtoe) and final energy (5.188 Mtoe) consumption. To this extent, Slovenia is supporting a wide array of measures, from energy renovation of the existing buildings stock to waste management and zero-emission mobility.
Several companies from Slovenia have in the past developed new, innovative products and solutions for their own manufacturing processes, which often represent good practices in green business also on the international level. Besides private companies, local public authorities and non-governmental institutions have taken an important role in promoting sustainable living and eco-innovative development. Several local decision makers have taken the transition towards sustainability very seriously and have taken the initiative to make the necessary steps, in a large extent by accessing EU structural and cohesion funds.
The national economic situation has improved drastically since the onset of the 2008 financial crisis, but even today, the aggregation of funds for research and development as well as product development and market penetration for "green" products/services is very difficult. One of the effects of governmental attempts to stabilize the national budget was also reduced funding for high-level scientific research, which is still being continued till this day.
The national banking sector has been saved from insolvency by sizable financial aid from the taxpayers, which was the foundation for much controversy in public debate. Despite this, the sector is still not sufficiently flexible in supporting eco-innovation by providing efficient and attractive financing instruments. For e.g., today it is relatively easy for natural persons to obtain a real-estate loan with very favourable conditions. In the case of companies, in particular SMEs and start-ups, it`s very likely that the creditor will not even begin the negotiation process as the risk factors considered are too high. In the age of quantitative easing and so called "helicopter money", the liquidity or lack thereof from the side of the conventional banking sector for small enterprises is inconceivable. This negative impact is paired by an ever decreasing governmental expenditure on research and development, taking into account that also several private companies had to limit their expenditures for internal R&D because of the for restructuring brought about by the new economic reality "post Lehman". The major sources of funding where thereby sources from abroad, mostly EU structural funds.
Several micro, small and medium sized enterprises specializing in the areas associated to eco-innovation have also been very vocal in the past year about the evident disparity between the declaratory support of the government to the transition towards sustainability and on the other side a complete lack of systemic solutions, particularly dedicated financial mechanisms that would actually facilitate and bring about this transition in the real economy.
Notwithstanding some positive advancements, non-effective exchange of knowledge from higher education (which is deficiently adjusted to the actual requirements of the economy) to the private sector remains an imperative hindrance for eco-innovation. This can be observed with the inconsistency of an above-average number of workers employed within eco-oriented enterprises, which don`t actually create many marketable products and services with relevant eco-advancements.

4.SWOT ANALYSIS

This section provides an assortment of key findings about fundamental strengths, weaknesses, opportunities and threats identified for the Danube region countries, acquired within the process of national analysis carried out within activity 3.2 – Analysing the environment for eco-innovation in partner countries carried out under the third thematic work package WP3-strategy for eco-innovation. The SWOT analysis reflects the overall situation in the majority of the countries analysed in the Danube Region. As previously underlined, the performance of Austria and Germany in many of the indicators considered differs significantly from the other countries. Nonetheless, the results of the SWOT analysis convey the average situation in the region and do not necessarily reflects the situation in specific country (for instance, while labour costs are very low on an average in many countries of the Danube region, this is not true for Germany and Austria). The first table demonstrating general findings for the Danube region as a single entity considers both governmental and business perspectives, while country specific SWOTs are presented in the following chapter.

Internal factors – GENERAL FINDINGS	
+	-
STRENGTHS - Significant activity in the area of supporting research and development. - Research and development as well as innovation in business is considered a priority in terms of mid to long-term strategical objectives. - Public sector expenditure for research and development have grown more relative to the EU. - Private sector expenditure on research and development have grown faster relative to the EU. - Total intramural expenditure on research and development have grown faster relative to the EU. - Energy dependence is much lower compared to the EU average. - Share of renewable energy in gross final energy consumption and share of produced electricity is at a high level. - Environmental tax revenues are comparable to the EU average. - Real gross domestic product growth is high. - Labour costs are very low in many Danube region countries	**WEAKNESSES** - Scientific activity measured as international co-publications have been increasing slower compared to developed economies. Publications amongst top 10% most cited have been well below the EU average. - Opportunity driven entrepreneurship have been far below the EU average. - Venture capital relative to the regions GDP is at a very low level. - Innovation activities expressed as SMEs introducing product, process, marketing and/or organizational innovations have been on the decline. - In-house innovation within SMEs have been on the decline. - Patent applications have stagnated. - Exports of medium and high technology products have not grown as fast as the average of the EU. - Turnover from innovation in industry is at a low level. - Energy intensity of the economy is very high. - Energy productivity is at a low level.

+	-
- Labour productivity is high. - Real effective exchange rate (measure of competitiveness) is well above the EUs average. - Competitive tax rates overall.	- Wholesale price of energy is low. - Energy taxes are at a low level. - Public sector expenditure for environmental protection is at a low level. - Resource productivity is very low. - Domestic material consumption is at a high level. - Recycling rate of waste is low. - Gross domestic product is comparatively low. - Perception of corruption is very high.

External factors – GENERAL FINDINGS	
+	-
OPPORTUNITIES - Employment in knowledge intensive activities and medium/high-tech manufacturing have increased more than the EU average. - Several priority areas (ICT, renewable energy, waste management, resource productivity, new materials) are shared by multiple countries within the region. - Relatively good quality of education and high number of tertiary educated graduates that could potentially form future human resource capacity in research and development.	**THREATS** - Sales of new-to-market and new-to-firm innovations have declined substantially. - The region ranks very low on the eco-innovation scoreboard. - The share of scientists and engineers of active population in have grown more slowly that the EU. - Expenditure on education is very low. - High level of investments in research and development in China and India. - Relocation of private innovation activities to countries with more developed infrastructure and labour markets.

Overview of country specific SWOTs:

STRENGHTS	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
General										
Favourable geographical position providing easy access to regional and EU markets	■	■	■	■	■	■	■	■	■	■
Favourable climate conditions for tourism			■	■					■	■
Excellent transportation and logistics system	■					■	■			1
Appreciation of new products / services from the consumer's point of view	■					■			■	■
Wide-spread and accessible public funding programs	■			■	■	■	■		■	■
Excellent potential for tourism	■	■	■	■	■	■	■	■	■	■
Natural resources										
Abundant agricultural land							■	■	■	
Forests/ woody biomass	■	■					■		■	■
Abundance of fresh water	■	■			■	■	■		■	■
Presence of mineral and/or thermo mineral waters	■		■	■	■	■	■	■	■	■
Presence of raw materials					■	■		2	3	
Environmental awareness, behaviour and policy										
Environmental awareness and environmentally-friendly behaviour is well established	■			■		■			■	■
Waste management/ecological agriculture has strong political support and acceptance among the population	■			■	■	■	■		■	■
Consumers are willing to spend more money on ecological products (for e.g. agriculture from eco-farming)	■					■				
High rate of governmental environmental investments	■				■	■	■			
High rate of recycling of packaging waste					■		■			
High rate of e-waste recycling							■			
Investments for improving waste water treatment, waste treatment and drinking water quality				■	■		■			■
Resource efficiency at a high level					■				■	

1 Outdated railway system, substantial investment required
2 Inclusive of certain CRMs (copper, antimony, magnesite, fireproof and ceramic clay)
3 Magnesite, cement materials, rock salt, high-purity limestone, bentonite, zeolite, ceramic clays, gypsum, anhydrite and talc

STRENGHTS	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Environmental awareness, behaviour and policy										
Resource efficient low carbon economy is a governmental priority										
Energy efficiency and renewable energy										
Energy production from renewables receives support and funding.										
Energy efficiency receives support and funding										
High share of hydroelectric power utilization										
Strong potential for wind energy										
Strong potential for solar energy										
Strong potential for energy from biomass										
Strong potential for energy for geothermal power										
Innovation, R&D and education										
High governmental support for R&D and innovation activity										
High patent output										
Strong education base for providing well-trained human capital in the STEM fields *	[4]									
High share of the population with secondary and higher education										
Good accessibility of support structures for eco-innovation										
High share of the tertiary level graduates										
Strong base for fundamental and/or applied research					[5]					
Qualified researchers in the field of natural sciences, computer technology, engineering and medicine					[5]					
Making substantial progress towards implementing a circular economy.										
Internationally recognized scientific institutions and universities										
Excellent national innovation strategy										
Good protection of intellectual property (e.g. patents)										
Strong presence of eco-innovation related industries										

[4] Secondary schools with an engineering focus five-year programmes - (Austria best practice)
[5] Strong focus on applied research in nanotechnologies and biotechnologies

STRENGHTS	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Innovation, R&D and education										
High amount of government BERD spending						■	■			
Excellent accessibility of education	■		■	■	■	■	■	■	■	
Administrative, business and tax environment										
Highly educated and skilled workforce	■			■	■	■	■	■	■	
Good business environment and culture	■				■	■	■		■	
Favourable environment for foreign business investment	■	■			■	■	■	■	■	
Stable macroeconomic environment	■		■	■	■	■	■	■	■	■
Sound and predictable (stimulating) fiscal policy	■			■	■	■	■	■		
Liberalized trade through signed different trade agreements		■					■	■		
High level of usage of public e- services by businesses			■			■	■			
Good environment for companies and start-ups targeted at eco-innovation	■				■	■			■	
Government support for circular economy, smart cities and eco entrepreneurship	■				■	■	■			
Easily accessible venture capital							■			
High amount of green early stage investment							■			
Knowledge-intensive activities: manufacturing and services are widespread					■	■	■			
Tax allowances encourage eco-innovation related investments	■					■	■	■		
Low unemployment rate	■				■	■	■			
Low (cost-competitive) labour costs		■	■	■	■		■	■	■	
Energy and environmental legislation in line with EU recommendations and standards	■		■	■	■	■	■	■	■	

WEAKNESSES	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Society and demography										
High national debt				■						■
Poor access to finance		■		■				■		
High level of risk of poverty and significant social problems			■	■			■	■		
Unfavourable demographic trends			■	■	■	■	■	■	■	■
Low national GDP		■	■	■				■		
Low income of the population		■	■	■				■	■	■
Low economic activity of the working age population			■							
High share of unemployed youths and discouraged people			■						■	
Low level of diversification of the economy			■						■	■
Lack of IT skills and demand for innovative IT products amongst the public			■							
Eco-innovations are not at a high level in main industrial sectors			■		■				■	
High job vacancy rate					■	■			■	
Brain-drain effect					■			■	■	■
Natural resources										
High dependence on raw material imports			■			■				■
Poor possession of raw materials			■			■				■
Large-scale agriculture is a major polluter and monocultures reduce biodiversity						■				
Environmental awareness, behaviour and policy										
Environmental awareness and environmentally-friendly behaviour is at a low level		■	■	■	■		■	■	■	
Lack of a national policy for adaptation to climate change			■							
Inadequate provision of facilities for treatment of potable and waste water			■							
Inadequate waste treatment infrastructure			■					■		
Poor understanding of the concept and low visibility of eco-innovation [6]		■				■		■	■	

[6] Expression is virtually unknown, low level of related media coverage and scientific publications, only sporadic presence of events

WEAKNESSES	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Environmental awareness, behaviour and policy										
Low levels of environmental protection expenditures							■	■	■	
Low resource productivity							■	■		■
High share of potable water not suitable for drinking										
Poor level of enforcement of environmental regulation		■						■		■
Energy efficiency and renewable energy										
Lack of eco-innovation policy								■		■
Outdated energy infrastructure			■					■		
High energy losses in transmission and distribution			■				■			
High dependence on energy imports		■	■			■				■
Low level of energy efficiency on the level of final consumers			■							
Insufficient number of experts in the energy sector		■								
Centrally regulated public energy tariffs										
Innovation, R&D and education										
Low overall spending on R&D activities		■		■				■	■	■
Low level of cooperation between education, R&D and companies	■	■	■	■	■		■	■	■	■
Low company expenditures on R&D			■	■				■	■	■
Limited innovation dynamics as demonstrated by global patenting and high- tech exports;			■	■					■	■
Lack of reliable data (statistics) on fields relevant to eco-innovation		■						■		
Low number of eco-innovation related patents							■		■	■
Inefficient educational system			■	■					■	■
Shortage of qualified work force (despite the high share of graduates)			■	■			■		■	
Insufficient financial resources for support of eco-innovations			■	■				■	■	■
Low level of participation of the population in lifelong learning activities			■	■				■	■	■
Inadequate investment into educational infrastructure			■						■	■
Outdated and insufficient infrastructure for R&D			■						■	■

WEAKNESSES	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Innovation, R&D and education										
Rigid educational system (difficult to reform and introduce best available approaches)			■						■	■
Deficiency of teaching personnel at technical faculties		■							■	
Majority of innovation activities funded by EU funds		■			■			■		
Low amount of doctorate graduates per year (compared to the EU and the Danube region)							■	■		
Administrative, business and tax environment										
Restrictive legislative environment		■	■	■						
Low labour productivity and resource efficiency of the economy			■	■						■
Slow and rigid administrative procedures			■	■	■			■	■	
Inadequate institutional framework [7]								■		■
Business support infrastructure lacks high added value services to support innovation processes				■					■	■
Low level of production of high added value goods			■							■
Insufficient broadband Internet access in some country areas			■							
High overall tax burden		■		■			■			■
Lack of political commitment to carry out reform				■						■
Frequent changes in legal framework create instable investment climate				■						
Poor reliability of property registers				■						
Slow adoption of e-government services				■					■	■
Inefficient administrative procedures				■	■	■				■
Low level of entrepreneurial culture and motivation for establishment and development of new companies		■			■					
Presence of venture capital is on a low level								■		■
Lack of risk capital, high interest rates on equity loans for start-ups								■		■
Employment policies do not favour training and employment incentives										
Energy efficiency, renewable energy not integrated into the business support system					■	■				

[7] Property rights, intellectual property protection, judicial independence, favouritism in decisions of government officials, burden of government regulation, efficiency of legal framework in settling disputes, efficiency of legal framework in challenging regulations, protection of minority shareholders' interests

WEAKNESSES	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Outdated means of production (old technology, depreciated infrastructure) - industry										
Lack of a comprehensive business incubation network										
Inefficient judicial system										
Underdeveloped market for eco-innovation products and services										
Poor level of enforcement of employment regulation										

OPPORTUNITIES	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Society and demography										
Safety	■	■	■	■	■	■	■	■	■	■
Common history and culture, former economic union		■		■			■	■		■
Natural resources										
Possession of raw materials (including certain CRMs) Potential for agro-mining & phytoremediation								■	■	
Taking advantage of the favourable climate conditions and natural resources (mineral water)			■				■			■
Validating the country as a producer of organic agricultural products			■				■	■	■	
Development of alternative forms of tourism and new tourism products	■	■	■	■	■	■	■	■	■	■
Environmental awareness, behaviour and policy										
Strong domestic demand for nZEB buildings	■								■	
Strong production of environmental technologies 1	■								■	
Launching of motivation mechanisms in the field of eco-innovations			■				■		■	
EU ecological trends, directives and international environmental protocols/agreements	■	■	■	■	■	■	■	■	■	■
Better implementation of environmental protection measures							■	■		
Energy efficiency and renewable energy										
Administration of local/regional/national funds for energy efficiency		■				■	■		■	■
Administration of local/regional/national funds for renewable energy		■				■	■		■	■
High share of untapped capacity of renewable energy production								■	■	■
Increase presence on foreign markets (international visibility)	■									■
Low energy prices										
Increasing primary production of renewable energy sources							■	■	■	■
Further integrate renewable energy into production					■	■	■	■		■
Reduction of subsidies for fossil fuels					■	■				■
Increase of competition and competitiveness in energy sector								■		■
Development of electricity and natural gas market in the country and region							■	■		

OPPORTUNITIES	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Innovation, R&D and education										
High tax premium for R&D	■									
Harmonising the cooperation between engaged institutions			■						■	■
Upward trend in student's number in electrical and mechanical faculties		■								
Excellent infrastructure for R&D					■		■		■	
Highly skilled human resources					■		■		■	■
Long industrial tradition					■				■	■
Favourable tax policy for R&D					■				■	
Private business incubators are growing in numbers					■		■			
Fostering international cooperation in science and technology	■	■	■	■	■	■	■	■	■	■
Administrative, business and tax environment										
Improving the efficiency of public spending	■	■	■	■	■	■	■	■	■	■
Development of financial instruments in the country			■				■			
Increasing the priority and role of public-private partnerships and concessions			■							
Administration of European structural and investment funds for economic growth				■			■			■
Administration of pre-accession funds and international programs		■								■
Accessibility of regional venture capital		■					■			
More efficient business operation of public energy utilities and other economy entities in the energy field								■		
Attraction of foreign partners, banks and investors						■	■	■		■
Increase support for higher education focused on eco-innovation and research									■	
Focus government R&D on emerging environmental areas that boost long-term competitiveness									■	■
Continue research of new materials									■	
Further increase of BERD expenditure									■	■
Further expansion of the European Union (joining the EU)		■						■		
Increase networking and clustering of companies (joint undertakings)						■			■	■

THREATS	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Society and demography										
High national debt and financing				■						■
Sustainability of public finances [8]			■				■	■	■	■
Deepening of social and economic crisis, poverty, indebtedness and slow development		■						■		
Slow-down of economic growth of trading partners	■		■							■
Continuation of the Brain drain effect		■	■	■			■	■	■	■
Depopulation of large parts of the territory of the country		■	■	■				■	■	■
Continuous political instability		■						■		
Natural resources										
Increased pressure on mineral resources to accelerate economic development								■		
Significant increases in the prices of resources	■	■	■	■	■	■	■	■	■	■
Energy efficiency and renewable energy										
Instability of energy supply										■
Termination of feed-in tariffs could hinder uptake of RES							■			
Environmental awareness, behaviour and policy										
Effects of climate change	■	■	■	■	■	■	■	■	■	■
Natural disasters	■	■	■	■	■	■	■	■	■	■
imposition of EU sanctions in case of non-compliance with environmental commitments			■							■
Significant increases in food prices			■							■
Low level of financial investment in ecology								■	■	■
Mutually incompatible legislation in the field of mining and environmental protection, water and soil										
Unable to achieve the GHG emission reduction targets						■				■
Pollution of watercourses will not be substantially decreased [9]					■	■				■
No advancement in increasing the recycle rates of waste						■			■	■

[8] Negative demographic trends such as for e.g. aging of the population
[9] Metals, pesticides and medicinal products, oversupply of nutrients (eutrophication) in rivers, lakes and seas

THREATS	AT	BiH	BG	HR	CZ	DE	HU	RS	SK	SI
Innovation, R&D and education										
Difficulty of protection of intellectual property					■					
Large companies are not eligible for EU funding support					■					
Half-hearted approach to National Environmental Technology Innovation Strategy							■			
Bureaucracy and administrative complexity hinder absorption of EU funds among SMEs					■					■
Lack of financial support to research and development									■	■
Low commercialization of R&D results								■	■	■
Regional discrepancies in R&D activities									■	■
Insufficient emphasis on ecology related issues	■							■	■	■
Lack of funding for basic research [10]	■								■	■
Administrative, business and tax environment										
Loss of markets due to competition from countries outside the EU			■							■
Low competitiveness of companies		■		■						■
Fragility of the economy (Strong seasonal effect, low diversification)				■					■	
Deepening inter-regional and intra-regional differences		■	■	■				■	■	■
High level of corruption		■	■	■				■		■
Confusing and convoluted legal environment								■		
Slow legislative response to new challenges							■			■
Small size of the domestic market							■		■	■
Structural changes in EU funds after the year 2020		■		■	■				■	■
Poor financial potential for re-investment in domestic companies								■		
Underinvestment into production means (manufacturing)										■

[10] May hinder the development of radical innovation in the future

5. PESTLE ANALYSIS

This section provides an assortment of key findings about advantages and disadvantages in the context political, economic, social, technological, legal and environmental considerations threats identified for the Danube region countries.

	POLITICAL	ECONOMIC
PROS	- Common history of some several countries from the Danube region (established networks, market experience, shared culture, etc.). - Experience of Danube region countries in mutual cooperation in previous funding programs. - Stable and predictable political situation in countries from the western part of the Danube region - Political commitment on the transnational level (EU member states) to increase expenditure in research and development activities at least until 2020. - Innovation, energy and environment presents cornerstone of all key development strategies (Europe 2020, EUSDR, Smart specialization, etc.). - The EUSDR will be implemented with strong support from Danube region countries:	- All countries from the Danube region except Germany and Austria have substantially lower labour cost compared to fully developed economies of Western Europe. - The new programming period has secured increased funding for R&D and innovation and will presumably continue to do so beyond 2020. - The targeted 3% (GDP share) increase of spending in research and development should create evident synergistic effects. - Germany as the main driver of the national economies from the Danube region is relevant on the international level and has the potential to spearhead further development of the region's economy

	POLITICAL	ECONOMIC
CONS	- Cyclical nature of political commitments (local and national level) – recurrent changes in administration and management of research and development activities. - Unstable political situation in several Danube region countries. - The Danube region is a formation of EU member states, candidates and non-member states not an independent, unified entity. - Non-uniformity and lack of existing strategical documents on the national level. - Research and development can be a politically unpopular issue. Lack of public support especially evident in countries with low transparency of fund allocation.	- Severe underfinancing of research and development in most countries within the Danube region. - Most countries economic indicators are well behind those of Western Europe. - Indicators associated to impacts and outputs of innovation notably lag more developed countries. - Public expenditures on research and development are in jeopardy to be further reduced within economic downturns (particularly in countries with a high debt to GDP ratios). - Funding programmes from the EU are not accessible to several countries from the Danube region in a comparable extent. There are no alternatives that could cover the difference. - Several Danube region countries are plagued with corruption on highest levels of national and local authorities.

	SOCIAL	TECHNOLOGICAL
PROS	- Existing ties amongst several countries of the Danube region with common history. - Social diversity of transnational cooperation impacts socio-cultural enrichment.	- Potential gains from synergies and joint undertakings from research and innovation on technologies used by individual countries.
CONS	- Substantial gap in overall quality (and consequently international ranking) of R&D activities carried out by scientific/academic institutes within the region. - Loss of highly skilled and/or highly educated workforce to countries with better working conditions and more developed labour markets (brain drain). - Language barriers. - Geographical barriers and cultural differences (work ethics, approach to solving problems, etc.).	- Large disparities in terms of available infrastructure and equipment for carrying out research and development activities (different rates of progress development, potential hindrance to international cooperation).
	LEGAL	**ENVIRONMENTAL**
PROS	- Harmonized legislation within EU member states.	- Common environmental challenges.
CONS	- Low level of legislation enforcement in many countries from the Danube region. - Non-harmonized legislation in outside EU member states	- Different environmental priorities across countries from the Danube region.

6. OPERATIONAL PLAN

This section provides an overview of proposed measures identified as crucial for the further creation, development and commercial uptake of eco-innovations in partner countries. Each operational measure is equipped with a concise explanation of the specific issue it addresses. Each set of measures is associated to a particular field relevant to eco-innovation, such as education, research and development activities, environmental legislation and so forth. Project partners will outline their unique approaches to addressing the particular challenges within their respective national plans. The operational plan of the joint strategy for eco-knowledge is divided into two fundamental sections, with the intent of taking into consideration both immediate activities to be implemented, as well as complex issues that require the cooperation of multiple stakeholders with different interest as well as strong political support with a long-term focus.

The first section provides a general outlook on which problematic areas, identified and reaffirmed within the process of national analysis, public surveys and consultation with key stakeholders associated to eco-innovation should be addressed up to and past 2020. The main purpose is to assist all subsequent attempts to improve the areas linked to eco-innovation. These measures are critical and specific, however cannot be realistically implemented within a short timeframe. The second section describes short-term, immediate actions that are designed to be implemented already within the scope of the EcoInn Danube project or within follow up activities of the project and present a small part of the overall course of action the Danube region must embark upon in order to, together with the rest of the European Union, remain competitive in the fields of knowledge intensive industries and sustainable development on the global stage. The strategy elaborates, for each area of interest, 4 key building blocks for substantiating, quantifying, planning and monitoring of proposed actions and is as such structured as follows:

6.1 LONG-TERM OUTLOOK

6.1.1 RESEARCH AND DEVELOPMENT

Research and development activities were not adequately financed (nor through public or private sources) in most countries of the Danube region in the past decade. The quality and potential of the research carried out to support the development of value propositions for eco-innovative products and services is often at an inadequate level. The national innovation systems clearly lack mechanism to objectively evaluate the quality of research and development activities carried out and which areas of research should be supported by additional funding. Better communication, cooperation and transdisciplinary approach between the universities, R&D institutions and industry is key for eco-innovation development and uptake. Establishment of a favourable environment for faster development of scientific baseline research and integration with industry, needs adequate funding and structured approach, supported by national (regional) governments.

Goals:

Tactics:

A 1.1:	**The level of financing for research and development, particularly in STEM (science, technology, engineering, and mathematics) field is inadequate.**
T 1.1	- Increase public budget appropriations for R&D on the national level
Lev.	Policy adaptation (National government)

A 1.2:	**The working conditions for researchers (young researchers as well as those with international references) are dire. Researchers are not likely to be drawn to job openings where they are not provided with the means to carry out R&D activities, nor with remunerations appropriate for their level of knowledge and education.**
T 1.2	- Provide competitive job opportunities and benefits for researchers in public institutions
Lev.	Policy adaptation (National government)

A 1.3:	**Companies, especially SMEs which should be considered a priority in terms of developing and facilitating market uptake of eco-innovations are not motivated to participate in R&D activities**
T 1.3	- Provide tax incentives for enterprises that are willing to jointly cooperate (and co-finance) research and development activities within universities chairs and committees
Lev.	Policy adaptation (National government)

A 1.4:	**Companies should benefit directly and instantaneously from the activities associated with tertiary education**
T 1.4	- Increase the share of diploma thesis that directly address specific industry challenges
Lev.	Policy adaptation (National government) Educational programmes/curricula (Universities)

A 1.5:	**Companies, in particular SMEs don`t have good access to forming or utilizing public research and development activities**
T 1.4	- Provide coordination platforms for informing companies on how to acquire support for R&D activities in public institutions
Lev.	Initiatives (SMEs, universities, R&D institutions, local authorities, chambers of commerce/engineering/construction, etc.) Events (Chambers of commerce/engineering/construction, etc., start-up incubators, development agencies) Trainings (Chambers of commerce/engineering/construction, etc., start-up incubators, development agencies)

***Objectives*:**

Prioritize funding of R&D activities - Increase R&D expenditure in the public sector to 0,9 % of GDP by 2020 (50 % increase compared to the reference year 2015) – I.2.1.1

Attract private capital into R&D activities - Increase R&D expenditure in the business sector to 2 % of GDP (100 % increase compared to the reference year 2015) – I.2.2.

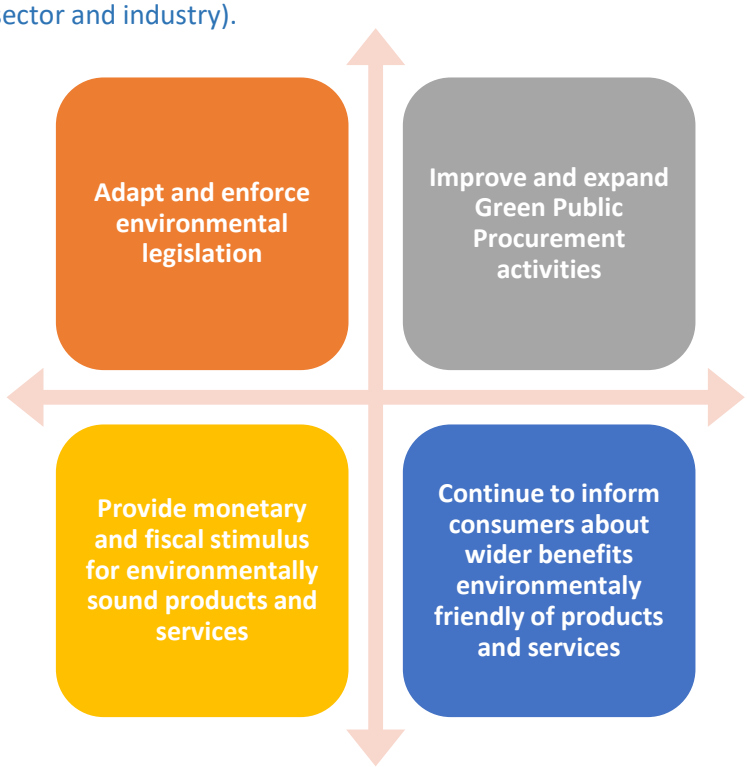
6.1.2 ECOLOGY (ENVIRONMENTAL PROTECTION)

Strict environmental policies and legislation have direct effect on improvement of behavioural patterns of industry and people. Yet, at the same time, according to for e.g. the OECD, it doesn't significantly affect the international trade patterns, but shifts the comparative advantage from pollution intensive industries towards more sustainable ones. To facilitate market uptake of environmentally sound products and services, the life cycle environmental impacts must be quantified and appropriately priced into the total cost of ownership within the products life cycle.

Moreover, the public sector is considered to be more inclined to use and foster eco-innovations and is often the initiator of ecological projects and eco-innovations. Eco-innovations and general paradigm shift in industry will occur if stimulated by public sector – by providing examples, financial stimulations and also by complying with presumably (ever)stricter environmental policies. The public-sector institutions in the EU present an enormous creator of market demand and in terms of consumer groups it is the easiest to influence and engage (one of the best practice examples confirming this would be the facilitation of energy renovation investment projects). Taking this into account, it is essential to channel their collective consumer power to purchase sustainable goods and services through the mechanisms of Green Public Procurement. Green Public Procurement also supports the eco-innovations by helping sustainable goods and services to enter the market. Green Public Procurement is currently a "voluntary" instrument in the EU, with different levels of implementation by EU member states.

National environmental policies, as well as others, related to sustainable development, should address also the civil society, as the co-creator and eco-innovation users, representing the demand side and mass environmental benefits of "innovation in use" in the future circular economies and societies. The civil society represents the fourth helices, equally important actor (besides the Government, Industry and Universities in the *Quadruple Helix*[11] approach to the stimulation of eco-innovation. Implementation of national environmental policies should be implemented through a mix of efficient policy instruments (Strict control of polluters, efficient eco-taxation and subsidization and voluntary self-regulation of public sector and industry).

Goals:



[11] As described in the report to the Commitee of the Regions: Using the Quadruple Helix Approach to Accelerate the Transfer of Research and Innovation Results to Regional Growth; European Union, 2016.

Tactics:

A 2.1:	**Monitoring and consistent enforcement of environmental legislation is at a very low level**
T 2.1	- Increase personnel, equipment and remuneration (funding) of environmental inspectorates
Lev.	Policy adaptation (National government)

A 2.2:	**Judicial procedures are often slow, rigid and ineffective for prosecuting non-compliance with environmental policy**
T 2.2	- Abolish limitation periods for all types of corporate and environmental crimes
Lev.	Policy adaptation (National government)

A 2.3:	**Environmental awareness of the general public has improved substantially over the course of the preceding decades. However, in terms of consumer behaviour, a substantial part of the population will still usually opt for the slightly lower price not taking into account the environmental impacts of the products and/or service. Civil society (individuals, interest groups, NGO's) is an important stakeholder, providing the demand side and feedback for the eco-innovations to Industry, University and Government. Public awareness needs to be raised to higher level. Civil society should become more empowered, aware of existing problems, outlooks, eco-solutions and stimulated to use it, co-create it.**
T 2.3	- Continue and enhance public information campaigns promoting informed and virtuous consumer behaviour.
T 2.4	- Provide efficient national or regional (digital) communication channels and tools to foster the communication and cooperation tackling the environmental issues and eco-solutions, between Civil society, Government, University and Industry.
Lev.	Policy adaptation (National government) Carrier of the information campaign (National consumers associations), National media; NGO's

A 2.4:	**Public sector (Government) on all levels present enormous consumer power that could be channelled to purchase more sustainable good and services and thus support the eco-innovation, present the positive example of sustainable behaviour and cause positive spill-over effect across sectors and markets.**
T 2.5	- Elaborate the methodology and adapt the procurement legislation to favour the purchase of sustainable goods and services and to shift tender focuses from lowest prices to lowest environmental impacts.
Lev.	Policy adaptation (National government) Strict Green Public Procurement implementation

Objectives:

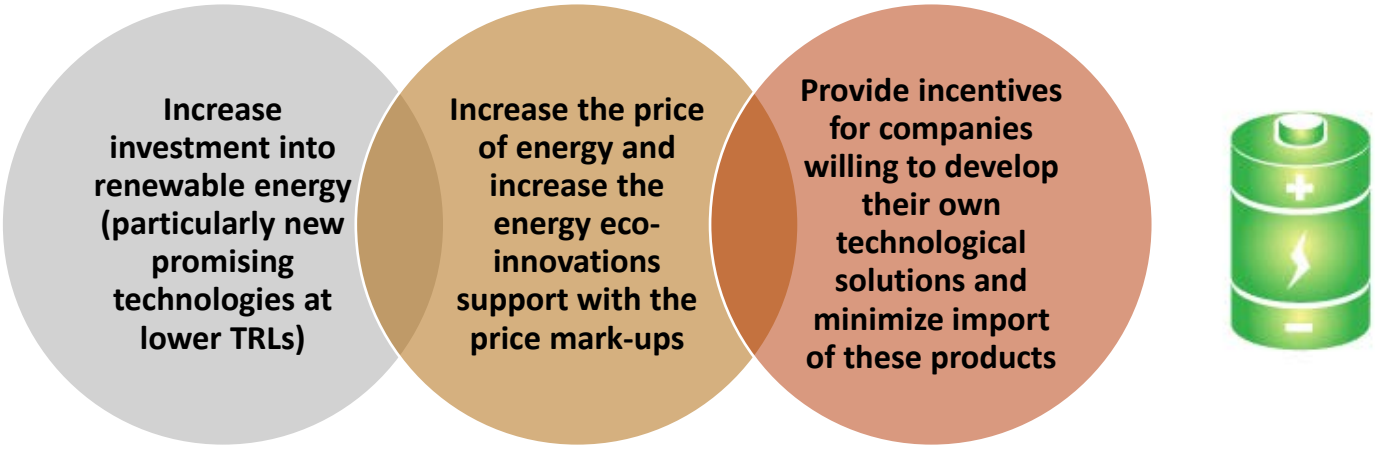
- **Efficient implementation of environmental policy instruments**: improved capacity of environmental inspectorates and simplified legal procedures resulting in an increased rate of +5% final executable convictions for crimes against the environment and workers.
- **Increase market share of environmentally friendly products and services**
- **Green Public Procurement stimulation:** Establishment of Green Public Procurement as a mandatory (currently voluntary) common practice on EU markets by 2020.

6.1.3 ENERGY

The future energy production and consumption should be sustainable from environmental, social and economic point of view. EU member states are progressively approaching the targets from Renewable energy directive which sets the 2020 renewable energy targets - 20% final energy consumption from renewable sources by 2020. The targets for 2030 are already agreed between the member states – at least 27% of total energy consumption should be renewable energy. Increasing the share of renewable energy production and consumption demands huge technological innovation e.g.: energy storage, smart production and smart grids. Together with energy efficiency targets, policies and support mechanisms, the renewable energy sector creates many business opportunities which are also attracting direct investments.

Wholesale energy prices (gas, oil, electricity) have decreased significantly in recent years, due to economic crisis induced lower demand and increased energy supply (US shale gas, etc). The retail prices, however, were not following the wholesale price movements but have rather stagnated or slightly risen. This energy market inconsistency makes the products and services for reduction of energy consumption economically less attractive. This should be addressed by efficient mechanisms that would provide additional financial source for stimulation of energy-eco innovation and support schemes for renewable energy sources.

***Goals*:**



Tactics:

A 3.1:	**Energy market inconsistencies between whole-sale and retail prices should be used to stabilize energy markets and channel profits to energy eco-innovation.**
T 3.1	- Increase or introduce additional contributions within the wholesale price of energy that should be used for increased investment into energy efficiency, renewable energy and sustainable mobility.
Lev.	Policy adaptation (National government)

A 3.2:	**Green House Gas emissions continue to accelerate the climate change processes. Emission Trading (ETS) system, started in 2005 was meant to be an EU's main mechanism for stabilization and lowering of GHG emissions and thus tackle the climate change. The general impression is that the ETS had failed to meet its goals. The 4th Phase of ETS revision was recently agreed between the member states, introducing new Innovation Fund and Modernization Fund to support the decarbonization of the EU industry. Yet many critics claim, that ETS should be more ambitious to reach the climate goals of e.g. Paris Agreement.**
T 3.2	- Re-evaluate the price GHG emissions and urge the operational reform of the European Emission Trading (ETS) system.
Lev.	Policy adaptation (National governments, EU bodies)

A 3.3:	**Transport relies too heavily on fossil fuels that are in the majority imported to the EU. To overcome this challenge and future risk, countries should attempt to adhere to and employ the Directive on the deployment of alternative fuels infrastructure**
T 3.3	- If not already in place, develop national policy frameworks for the market development of alternative fuels and their infrastructure (Article 3)
Lev.	Policy adaptation (National governments, EU bodies)

Objectives:

- Increase the wholesale energy prices by 20% and stimulate the RES and RUE Innovations;
- Establish the national policy framework for alternative fuels/sustainable mobility
- Make ETS more efficient in stimulation of decarbonization of energy sector and other industries in the ETS to reach Paris Agreement climate goals.

6.1.4 RESOURCE EFFICIENCY AND WASTE RECUPERATION

Resource efficiency and holistic approach to circular economy in the sense of “closing the loop” of products lifecycle. The more circular economies get, greater results they can achieve. In terms of environment benefits are seen in lower amounts of waste, reduced carbon emissions and better used raw materials. Positive economic effects are seen in terms of greater productivity, establishment of new markets. Last but not least, circular economy presents also positive effects on communities in terms of creating of new jobs and giving people more options to produce and consume products and services on more sustainable way, thus creating opportunities for greater social integration.

EU had set ambitious goals or roadmap towards truly circular economy in EU Action Plan for the Circular Economy. Research and innovation are key to enabling the transition to a circular economy and to boost the competitiveness of EU industry. Research and innovation are key to enabling the transition to a circular economy and to boost the competitiveness of EU industry. Multi sectoral approach is needed to stimulate the national economies to become more “circular” and thus more sustainable. New business models are being developed, as well as new policies and instruments and sustainable behavioural patterns of businesses and citizens are being evolved. All these aspects require technological, political, organisational, social and financial innovation.

Goals:

Tactics:

A 4.1:	**The main focus of eco-innovation should be directed towards circular economy. Resource scarcity and low resource efficiency and improper waste prevention policies and waste management, presents huge eco-innovation potentials.**
T 4.1	- Increase taxes on non-renewable and environmentally problematic packaging.
T 4.2	- Introduce IoT into waste management and increase the waste separation and recycling.
T 4.3	- Increase awareness raising efforts by general population and industry.
Lev.	Policy adaptation (National governments, EU bodies); Stimulation of innovation (National governments, EU funding programs, Private investments); Continuous efforts in awareness raising (National, regional, local governments, public media, NGO's)

***Objective*:** Improve recycling rates for packaging waste to 80 % and municipal waste to 70 % by 2020.

6.1.5 BUSINESS ENVIRONMENT

The brain drain phenomena, moving of mostly young and highly educated and skilled people from eastern part of EU (particularly Danube Macro Region) to the more developed western part of Europe which is offering better professional development opportunities, better working conditions and higher wages, is increasingly problematic issue that will very soon have cumulative devastating effects on national economies. Brain drain presents loss of skilled and innovative labour, loss of income and loss of taxpayers. The brain drain in the Danube Macro Region needs to be minimized or even reversed by attracting the foreign experts and skilled workers. This could be achieved through creation of favourable economic and institutional frameworks to keep the domestic and attract the foreign experts, such as strengthening regional education possibilities, development of innovation hubs with easy accessible capital, reduce the wage inequalities between the countries and impose favourable taxation policies.

Goal:

Establish new innovation friendly environments and new legal entity form that supports eco-innovations.

Tactics:

A 5.1:	**The brain drain remains huge problem in South-Eastern part of the Danube Macro Region. Due to the Brain Drain experts and their innovations move to the countries where they have better opportunities for self-realization and better earnings. The Brain Drain prevention policies and mechanisms for attracting international experts needs to be implemented.**
T 5.1	- Apply a low, uniform (flat) income tax category for all workers.
T 5.2	- Offer incentives (for e.g. tax benefits, accommodation, free day-care, etc.) for international experts willing to work in the region.
T 5.3	- Offer incentives and benefits to attract expatriate experts back to their home countries.
T 5.4	- Reduce the wage inequalities between the South-East and North-West parts of the EU.
Lev.	Policy adaptation (National governments, EU bodies); Taxation policy modification (National governments,); Wage inequality (EU Commission);

A 5.2:	**Business development environments should provide the attractive conditions for expert professionals. One of the measures is creation of innovation hubs, using the EU structural funds (e.g. Digital Innovation Hubs program). Risk of failure presents major obstacle in the innovation culture and processes. These risks should be mitigated through favourable tax measures for innovators and researches.**
T 5.5	- Establishment of special legal form or legal entity for eco-innovation organizations or individual eco-innovators, with tax and incentives "safe nets", which would reduce the fear of failure.
T 5.6	- Establishment of new innovation hubs (according to national RIS3 strategies)
Lev.	Policy adaptation (National governments, EU bodies); Taxation policy modification (National governments); Innovation hubs (national/ regional/local governments, EU bodies and private sector)

Objectives:

- Introduce a uniform flat-tax income of no more than 25 % for all workers.
- Cut and reverse the brain drain effect (increase migration back to the countries of origins by 10%)

6.1.6 FUNDING PROGRAMMES

A plethora of funding opportunities to support the particular eco-innovation is available through various EU programs and instruments. For e.g.: EIC Pilot instruments; SME instrument; Fast track to Innovation, Future and Emerging Technologies, EIC Horizon Prizes, H2020, etc. these funding opportunities, backed also by national development funding are often unused due to structural difficulties on various levels. Complicated administrative procedures and lack of experts in this area are the main reasons for low rate of utilization of available funding opportunities.

A 6.1:	**National economies of South-Eastern parts of Danube Region are facing many financial difficulties. Structural and Investment funds are presenting the very much needed funding sources which are underused due to many factors, including barriers such as complicated administrative procedures within public calls and tenders.**
T 6.1	- Simplification of administrative procedures on the national level.
T 6.2	- Optimize organization and funding of national controllers.
T 6.3	- Establish national and regional / local task-forces that will facilitate the absorption of EU funding.
Lev.	Policy adaptation (National governments); Taxation policy modification (National governments); EU funding task forces (national/ regional/local governments, EU bodies and private sector).

A 6.2:	**Many eco-innovative projects fail to reach the market maturity due to inefficient funding systems. Innovative concepts manage to get enough sources for successful early development stages, but further the development, less support it gets from public support schemes. Three main problems were identified: scarcity of public development funds, huge bureaucratic hurdles, lack of entrepreneurship knowledge of researchers and innovators.**
T 6.4	Establish systematic (national or regional) public funding of eco-innovative projects through the whole product / service development stages till the market maturity development stage. This support should be exclusively intended to support innovative projects with demonstrated sustainability aspect.
Lev.	Policy adaptation (National governments); Taxation policy modification (National governments); EU funding task forces (national/ regional/local governments, EU bodies and private sector).

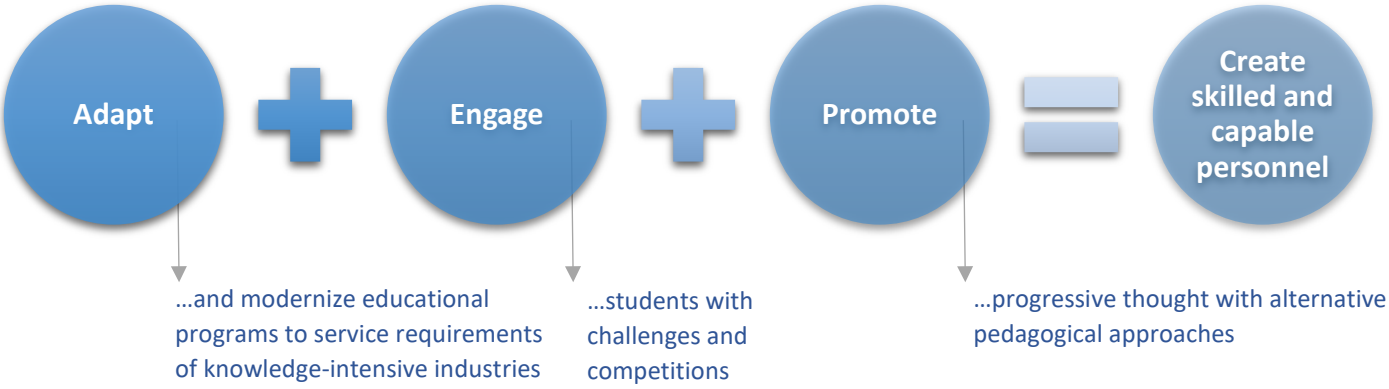
Objectives:

- Increase the survivability of eco-innovative products and services that reaches the market.
- Increase of absorption rate of Structural and investment funds to 85% of allocated funds on average per Danube region country in current financial perspective.

6.1.7 EDUCATION

Education determines individuals in terms of how they co-operate, solve problems as well as to learn by observing the environment and is as such the foundation of how we choose to build our economy and the crucial factor of developing the next generation of thinkers and innovators. There is a notable divergence between the potential offered by modern educational approaches/tools and the way formal education is being carried out today, what students are learning across the Danube region. A revision of educational curricula is needed in order to better address particular industry requirements, improve connections of the formal education with on the job experience within the scope of studies, to devote thesis's and dissertations to specific industry challenges, obtain work experience, smooth the process from classroom to employment and increase the value added of each young employee joining the workforce.

Goals:



Tactics:

A 7.1:	**Poor level of communication between industry requirements and output of educational systems**
T 7.1	- Organization of round tables and networking events between industry representatives, national decision makers in the area of education and education providers
Lev.	Initiatives (SMEs, universities, R&D institutions, local authorities, chambers of commerce/engineering/construction, etc.) Events (Chambers of commerce/engineering/construction, etc., start-up incubators, development agencies) Trainings (Chambers of commerce/engineering/construction, etc., start-up incubators, development agencies)

A 7.2:	**Misalignments of educational programs with specific industrial challenges**
T 7.2	- Promote study grants for specific skill-sets provided by industry (instead of employment subsidies for young educated adults, that don`t have relevant skills) - Re-introduce, extend practical work in studies and organize a part of formal education as challenges in which students attempt to solve existing problems with human environmental impact
Lev.	Policy adaptation (National government) Financing programmes (Development funds)

A 7.3:	**Tertiary education as a social corrective (for e.g. students applying to studies merely for student benefits).**
T 7.3	- Introduce financial penalties for pro-longed or uncompleted studies - Provide subsidies for on-the-job learning (more effective than semi-relevant studies of theory)
Lev.	Policy adaptation (National government) Financing programmes (Development funds) Educational programmes/curricula (Universities)

A 7.4:	**Reduce (slow-down) brain drain in less developed countries within the Danube region, by binding young talent for a short time period to work within the country of origin/studies, provided that gainful employment is available.**
T 7.4	- Introduce a mandatory work period of students in their home country upon completing studies (provided that their skill is required and sought). Introduce tuitions for those that wish to continue professional carers abroad right after completed studies.
Lev.	Policy adaptation (National government)

A 7.5:	**A substantial share of graduates does not obtain a competitive level of relevant skills for which there is high demand, especially in the areas of fast evolving industries. The evaluation process of the quality of obtained knowledge and skills of graduates could be improved by obtaining feedback from future employers.**
T 7.5	- Introduce benchmarking standards in the evaluation process of academics, not only including feedback from students, but also following up by surveys of the students, employers (industry) and use the obtained knowledge to observe shortcoming hence improve the educational process.
	Policy adaptation (National government) Educational programmes/curricula (Universities) Operational management (Chambers of commerce/engineering/construction, etc.)

A 7.6:	**Young academics (junior researchers, assistants, etc.) are motivated and capable to absorb (and pass-on) new knowledge in rapidly evolving technological fields and have (for the most part in countries within the Danube region) unacceptably poor working conditions (from low remuneration, poor access to research equipment, substantial burden with administrative assignments, etc.). Senior academics enjoy substantial benefits and have no true motivation to improve on their work. There is very little flexibility in terms of stimulation, financial rewarding for exceptional achievements.**

T 7.6	- Re-evaluate employment arrangements with university lecturers and provide greater upward mobility (opportunities for promotion, reward systems) for younger successful academics.
Lev.	Policy adaptation (National government) Internal organisation and systemization of job openings (Universities)

A 7.7:	Existing approaches to formal education are still too much based on memorization and repetition, which does nothing to promote innovative thought.
Tactic 7.7	- Introduce tools and institutions for modern learning approaches as part of the formal curricula. Complex topics can be transferred more effectively by utilizing demonstration, trial and error testing and evaluation tools, particularly digital tools and content.
	Policy adaptation (National government) Internal organisation and systemization of job openings (Elementary schools, high schools, universities)

A 7.8:	**It`s well understood by the educational community that a standardized testing regime stifles creativity and innovation in classrooms. The focus of education (or lack thereof) in this form is to merely pass a test, ignoring key aspects of critical though and the needs (as well as unique talents) of individual students by enforcing a one-size-fits-all curriculum.**
Tactic 7.8	- Discontinue all types of standardized testing on the national level. If not yet established, universities should re-introduce entrance exams in their adoption procedures, that should be adapted in such a way that they promote specific talents relevant to that particular field.
Lev.	Policy adaptation (National government) Internal organisation and systemization of job openings (Elementary schools, high-schools, universities)

A 7.9:	**One of the main reasons for low level of cooperation and co-creation of research institutions and industry (SME's) is lack of entrepreneurial knowledge mindset by researchers and innovators. This argument is also backed by findings of the Transnational Eco Stakeholders Platforms meetings**.
Tactic 7.9	- Integration of entrepreneurial teachings and trainings to all levels of education, from primary to tertiary levels.
Lev.	Policy adaptation (National government) Internal organisation (Elementary schools, high-schools, universities)

Objectives (compared to benchmark in 2015):

- Achieve a reduced number of applicants for tertiary level of education by 10 % by 2025
- Decreased number of applicants for human/social studies by 5 % until 2025
- Increased number of applicants in natural sciences and engineering by 5 % until 2025
- Introduction of clear evaluation mechanism for professors and other educational workers (from the perspective of students and the perspective of the future employer(s) – how well was the student for e.g. mechanical engineer prepared to work in the company by 2020
- (Re)-Introduction of entrance exams for universities by 2020

6.2 IMMEDIATE ACTION

Increasing the cooperation of innovation actors through developing new and strengthening existing informal networks is seen as an action that promises high potential gains with minimum input of active facilitation. A bottom-up approach to mobilizing public and political support should be applied when addressing the topic of eco-innovation. This section provides proposals of immediate action which can be implemented by partner organizations from the EcoInn Danube consortium and by organizations within their respective networks. This section follows the same structure as the previous section, with the exception that it doesn`t introduce specific objectives as a result of planned actions. Project partners, with their unique understanding of the national situations and the actual ability to foster change amongst relevant stakeholders will introduce specific objectives, as required, within their own national action plans.

6.2.1 Promote eco-innovation within own organizations (become green ambassadors)

Create and support awareness and virtuous behaviour amongst own personnel. Motivate them to become ambassadors for informed purchases of ecologically friendly products and services also within their personal life. Include employees in the discussion and the implementation of activities and establish a reward system for their engagement.

T 1.1	- Endorse eco-innovation in public appearances and events
Lev.	Internal organisation and action

T 1.2	- Apply ICT tools for monitoring and improving consumer behaviour (open source, low cost sensor systems)
Lev.	Internal organisation and action

T 1.3	- Apply best practices for Green public procurement (start small – think big)
Lev.	Internal organisation and action

T 1.4	- Use experience from internal processes for Green public procurement to facilitate dialog with national decision makers (pinpoint specific issues you have encountered)
Lev.	Internal organisation and action Policy adaptation (National government)

T 1.5	- Organize roundtable discussion with personnel on what additional measures can be taken by the organisation and reward good ideas and ambition
Lev.	Internal organisation and action

Goals:

- Introduce visual materials to organization premises and
- Introduce eco-innovative products and services[12] within the work processes of the organization
- Use and test eco-innovative products and services and share your experience (publications, webinars, events, etc.)
- Obtain feedback from employees about their opinion about the impact of implemented measures.
- Establish and/or improve low cost monitoring systems for energy and water consumption of the organization (monitor invoices, use available tools such as online software platforms for energy management, identify potential savings, search for eco-innovative products that can assist the process)
- Identify products and services used by your organization that could be environmentally friendly and discuss possible procurement on the level of organization management.
- Learn from the process of supporting GPP in own organization for dialogue on policy development on the national level.
- Foster routine dialogue with personnel and gain their input on how to support eco-innovation on the internal level of the organization
- Set up reward mechanisms (can be of symbolic nature) for employees exceeding the organizational ambitions of supporting eco-innovations

[12] For e.g. products that optimize energy use (energy counters, shut down on standby, dimmers, mobile applications), material use (repurposed and recycled products, electronic waste collection services,), mobility (carpooling apps and services), etc.

6.2.2 Support the adhesion of municipalities, towns and regions into transnational initiatives

Actively engage with peers and likeminded people representing territories that share the same vision of future development. Connect through conferences, workshops, webinars and online platforms and take advantage of our connections with businesses, financial institutions and other implementation partners that help strengthen innovation and resourcing. Create opportunity for eco-innovation on the local level

T 2.1	- Support adhesion of partner municipalities, towns and regions into transnational initiatives on energy, environment and innovation. Communicate topical issues and encourage local decision makers to support the implementation of eco-innovations within their local communities.
Lev.	Internal organisation and action Local and regional decision makers (political support)

Initiative proposals:

Covenant of Mayors – Energy efficiency and renovation

Energy Cities - Energy Transition of Cities and Towns

ICLEI – Local Governments for sustainability

NALAS – Network of Associations of Local Authorities of South-East Europe

FEDARENE – European Federation of Agencies and Regions for Energy and the Environment

Regions and Cities initiative FCH JU – Hydrogen and fuel cell deployment initiative

EIP-SCC – The European Innovation Partnership on Smart Cities and Communities

Goals:

- Identify initiatives that most valuable to partner entities and present findings to key stakeholders
- Communicate and identify political will to adhere to valuable transnational initiatives (technical meetings, events, campaigns)
- Gain participation of key target groups: prepare and establish signatures of Memorandums of Understanding, Memorandums of Agreement, Letters of Intent and Letters of Support
- Include the goals and targets of joining identified initiatives into local and regional strategic plans.

6.2.3 Inform and promote participation of towns, cities, municipalities and regions as well as enterprises and individuals in European award competitions

Creating awareness amongst decision makers about opportunities to compete in award competitions on the European level has substantial benefits for participants in terms of developing the culture and identity of a settlement to constantly strive to achieve ambitious goals, learning through the exchange of knowledge and best practices amongst representatives from other settlements in a transnational environment, the ability to network and establish long-lasting co-operations between cities and regions (especially relevant for smaller settlements that aren`t able to deploy larger more ambitious project alone) as well as the ability to achieve recognition of their past efforts and achievement and excellent media coverage. Support positive change in political culture and support the development of a stronger and more successful business community throughout Europe while improving the cohesion of the European Union.

T 3.1	- Support participation of towns, cities, municipalities and regions as well as enterprises and individuals in European award competitions
Lev.	Internal organisation and action Local and regional decision makers (political support) External information campaigns (enterprises, students, general public)

Award competitions proposals:

European Green Capital Award (EGCA)

European Institute of Innovation & Technology awards (EIT Venture, EIT Innovators, EIT Change, EIT Woman award)

European Business Awards for the Environment (EBAE)

Start-up Europe Awards (SEUA) – Join SEUA Alliance

European Business Award

Goals:

- Identify award competitions most valuable to partner entities and present findings to key stakeholders
- Communicate and identify private party support and/or political will to adhere to valuable international competitions (technical meetings, events, campaigns)
- Gain participation of key target groups: prepare and establish signatures of Memorandums of Understanding, Memorandums of Agreement, Letters of Intent and Letters of Support
- Include the goals and targets of participating in international awards competitions into local, regional and business strategic plans.

6.2.4 Raise awareness, inform and facilitate public dialogue on eco-innovation on the level of national decision makers

A comprehensive adaptation of national policy is required in many sectors, which is a complicated and long-term process that starts with acquiring support from relevant actors and fostering strong public support. Significant effort should be made to reopen (or facilitate a continuous negotiation process with key stakeholders) the dialogue with national policy makers to incorporate eco-innovation into new smart strategies that will provide a basis for future structural fund targets. The role and importance of eco-innovation and the support of its implementation should be also persistently communicated to managing authorities in the process of developing future donor funding programmes.

T 4.1	Communicate and network with established influential organizations with strong media outreach (national chambers of commerce and industry, energy, agriculture and forestry)
Lev.	National chambers of commerce and industry, energy, agriculture and forestry Local, regional and national decision makers (political support) Research and development institutions External information campaigns (enterprises, students, general public)

T 4.2	Create and adhere to petitions that address policy change on issues relevant to environmental considerations (waste management, water use policy, energy policy)
Lev.	External information campaigns (enterprises, students, general public) National chambers of commerce and industry, energy, agriculture and forestry Local, regional and national decision makers (political support) Research and development institutions

T 4.3	Establish grass roots initiatives that strive to achieve specific goals/problems of improving areas relevant to eco-innovation (for e.g. limiting vehicle emissions in city centres)
Lev.	Internal organisation and action Local, regional and national decision makers (political support) External information campaigns (enterprises, students, general public)

T 4.4	Address national decision makers directly (media appearances, social media – Twitter, online platforms)
Lev.	External information campaigns (enterprises, students, general public)

T 4.5	Organize meetings with local/regional/national decision makers and key stakeholders from the side of industry, R&D, education and the public – communicate about issues outlined in the national analysis
Lev.	External information campaigns (enterprises, students, general public) National chambers of commerce and industry, energy, agriculture and forestry Local, regional and national decision makers (political support) Research and development institutions

T 4.6	Facilitate open dialog to nation policy makers to incorporate the concept of eco-innovation into new smart strategies which will form the future structural fund priorities/goals and communicate

	the eco-innovative aspect, (the role of eco innovation aspect and support of eco innovation implementation) to policymakers involved into development of future funding programmes,
Lev.	External information campaigns (enterprises, students, general public) National chambers of commerce and industry, energy, agriculture and forestry Local, regional and national decision makers (political support) Research and development institutions

Goals:

- Establish and/or participate in public initiatives;
- Establish and/or participate in public petitions that tackle specific environmental problems;
- Increase communication between representatives of the quadruple helix;
- Organize and attend thematical events linked to eco-innovation.

6.2.5 Engage the enterprises and the general public and endorse eco-innovation on the local and national level

Continue and amplify awareness raising and information campaigns in sectors relevant to eco-innovation from environmental considerations to energy and business environments. Apply existing tools such as existing networking and knowledge sharing platforms.

T 5.1	Organize and/or actively participate in topical events and information campaigns
	National chambers of commerce and industry, energy, agriculture and forestry Local, regional and national decision makers (political support) Research and development institutions External information campaigns (enterprises, students, general public)

T 5.2	Apply existing media channels of the organization to inform and gain support for the wider uptake and dialogue on eco-innovation
	National chambers of commerce and industry, energy, agriculture and forestry Local, regional and national decision makers (political support) Research and development institutions External information campaigns (enterprises, students, general public)

T 5.3	Make use of and promote existing networking platforms for researchers, innovators, businesses and public bodies (virtual lab)
	Local, regional and national decision makers (political support) Research and development institutions External information campaigns (enterprises, students, general public)

Goals:

- Organize and participate in thematically relevant campaigns and events
- Increase awareness of main target groups through existing media channels
- Promote existing tools and materials and increase sustainability of European projects

7. RISKS

This chapter is intended to identify and qualify potential risks associated with the implementation of proposed tactics in chapter 6. Every tactic and activity in the previous chapter bears its own risks of being not possible to implement in practice. Due to very broad spectrum of proposed tactics and activities in this chapter only general risks are being analysed. Majority of measures need a substantial amount of policy changes which is totally dependent on the political will or resistance of current and following governments and economic situations.

Risk	Detail	Likelihood	Impact	Mitigation
Governance: Non-uniformity and lack of existing strategical documents on the national level.	Lack of strategic documents or inconsistencies between the different policies cause governance confusion, instability, funding problems, bureaucratic confusion and excuse for passiveness of responsible stakeholders.	Medium	Large	Analysing the governance bottlenecks and barriers. Reaching the national consensus on mid to long term development priorities, based on sustainable development. Setting up of an umbrella strategy and resulting sectoral strategies, aligned to EU strategic framework.
Severe underfinancing of national R&D and innovation support	Major increase of national support for R&D and innovation is necessary in Danube macro Region countries. Failing to do so threatens that negative spiral of brain drain and developmental backlog will accelerate.	Medium	Large	Raising the awareness and reaching general consensus of all stakeholders, Government, Industry, University and Public Society on necessity on stimulation of R&D and eco-innovation. Organize media actions, Lobbying
Low market penetration of eco - innovative products and services.	The demand side (public society, industry and public sector) for the eco-innovative products and services needs to be stimulated in order to ensure faster times to market and establish firm markets for eco-innovative products and services.	Medium	Large	Mandatory Green Public procurement system for public sector. Positive / negative labelling of eco / non eco products and services. Subsidies for purchasing of ecological / sustainable products and services for general public and industry.

Environmental criminality of individuals and industry remains unsanctioned to a large proportion.	Unsanctioned criminal behaviour against the environment of industry sets bad example to all stakeholders. Thorough investigation with severe and strict sanctioning of environmentally unacceptable behaviour would have a significant impact on reducing of occurrences of unacceptable behaviours.	Large	Large	Increase the competences and capacities of the environmental inspectorates (establishment of "eco-police") Policy adaptation in terms of unconditional criminalization of actions against environment and it's sanctioning.
Public expenditures on research and development are at risk to be further reduced within economic downturns (particularly in countries with a high debt to GDP ratios).	Majority of Danube Macro Region countries invest around or below 1% of GDP for R&D. The trends show slow but progressive growth by majority of countries. The economic crisis usually means downturn of public R&D expenditures. In relative terms downturns are not very obvious, but due to reductions of GDP and growing public debts, the public R&D expenditures in nominal terms decrease although there is a clear correlation between the public R&D investments and GDP growth.	Large	Large	Adoption of long-term development strategies with progressive shares of public R&D budget shares. Usage of fiscal policies for securing the levels of public R&D financing. Issuing and selling public bonds for financing of R&D.
Funding programmes from the EU are not accessible to several countries from the Danube region in a comparable extent. There are no	Due to lacking knowledge, competences especially in SME and public sector, large proportions of available structural funds remain unutilized in the Danube macro Region Countries	Large	Large	Establishment of EU project management task forces on all governance levels. Provision of support to SME's in terms of trainings, voucher systems, etc. Simplification of tender/call

alternatives that could cover the difference.				procedures and elimination of bureaucratic barriers.
Brain drain	Cumulative negative socio – economic effects on national economies are high and long-term. These are: Losing tax income, competitiveness downturn, shortage of skilled workers and entrepreneurs, etc. which causes general confidence in national economies and consequently lower growth.	Large	Large	Focused implementation of general economic development measures such as investments in national /regional education systems and institutions and other public services (healthcare, public transport). Rise of EU investments (cohesion policy) to countries of origin. Harmonisation of average incomes between Eastern and Western part of EU.

8. CONCLUSION

The present challenges of the Danube region are shared by most of Europe and the rest of the developed world. It has become clear that these challenges are more of a systematic/structural nature than purely cyclical. The economies of the European Union are ill prepared to counter against a significant slowdown of demand on the global level and the inevitable scarcity and price volatility of resources. The geopolitical situation presents a substantial threat to the integrity of the Danube region and Europe as a whole, being that they are highly dependent on the import of raw materials and energy.

Raw materials are essential to the European industrial base in which the manufacturing and refining industries dwarf extractive industry. Securing a reliable and unhindered access to raw materials of critical importance will be an increasing challenge, whereby the global use of resources could potentially double between 2010 and 2030[13]. Moreover, certain raw materials are critical for the production of high technology products and emerging innovations, which determine the future development and achievement of targets across different sectors. In terms of measures for battling climate change and environmental protection, the before mentioned critical raw materials don`t have a realistic substitute in products like wind turbines, solar panels, electric vehicles and energy efficiency products such as lighting systems. To mitigate this effect, it`s essential to redesign the way raw materials are consumed and substantially increase the recycling/repurposing rates.

Countries of the EU-28 had an energy dependence of 54% (meaning that over one half of the Union energy needs had to be met by imports) in 2016. While the energy dependence of the Danube region is notably lower in comparison (over 40%), the risk of relying on external suppliers to such a large extent is very high.

Furthermore, a high proportion of said imports, of which about two thirds were represented by petroleum products, gas (24%) and solid fuels (9%), are still concentrated amongst very few exporting partners. The majority of energy imports were in fact provided by Russia, with which the EU has been engaged in an unproductive diplomatic showdown in recent year, exacerbating the associated risks even further.

The increased share of people engaging in higher education activities doesn`t reflect in an increased level of skill and quality of personnel, according to the enterprises in which they eventually gain employment. A clear lack of linkages amongst education, R&D and industry has been documented in the analysis, calling for a complete re-design of educational programs, that remain rigid, not willing to introduce latest findings of effective educational approaches and aren`t able to keep up with the rate of advancement in cutting edge technologies. As such the level on which they actually serve the requirements of industries based in the region is not satisfactory. In general, public expenditures on research and development have either stagnated or have been notably decreased from the onset of the financial crisis onward, which must be addressed immediately.

Most countries within the Danube region are not successful in providing a supporting environment for innovations. Although several support mechanisms are in place across the region for enterprises, from business incubators, training programs, employment subsidies to information offices, mentorship/trainee programs and scholarships, the output in terms of innovation is not apparent apart from some countries from the western/northern part of the region.

The Danube region will need to consolidate the level of economic disparity between regions of divergent development levels and improve prosperity and wellbeing of all its residents in order to maintain and increase territorial and societal cohesion. The region will achieve a higher level of sustainable growth if this development is decentralized across all countries. The current situation in which less developed countries invest in human resources

[13] Decoupling natural resource use and environmental impacts from economic growth. A Report of the Working Group on Decoupling to the International Resource Panel. UNEP

that are eventually applied in more develop countries in the west, due to the fact that gainful employment is often unachievable, either because companies strive to reduce operating and production costs on all fronts or due to high tax burdens of a national entity that must service their public sector in an ever-declining demographic and economic circumstances, presents a negative spiral and will further impoverish the less developed countries, while the high developed exporting countries will lose important markets, putting a halt to their own economic growth. Advancement of social and territorial cohesion, that is urgently required to maintain competitiveness on a global scale will be impossible by following this scenario. The region must strive to increase prosperity of all, increasing competitiveness through cooperation, while considering that labour cost as such should follow the increase of labour productivity to maintain the regions international cost competitiveness. For this to happen the economic growth, powered by domestic and foreign investment will have to increase or remain at very high levels in the countries with the lower GDP per capita. Further improvements of the business environment and investment climate, particularly by securing political stability, will be quintessential. The advancement of transport connections and network connectivity already underway will also play an important role in increasing the competitiveness of the region. Through appropriately targeted investment and development, the region will increase energy productivity through the application of renewable energy sources as well as substantially decrease the energy demand on the level of the final consumers and industry.
An excellent opportunity for the Danube region is to more aggressively engage into the establishment and advancement of the Trans European Transport network, both in terms of infrastructure development and even more so in terms of focusing research on possible modes of transport. A very relevant field that will be more and more relevant in the upcoming decades is hydrogen and fuel cell technology. Since the Danube region has the capacity to introduce high levels of renewable energy production, hydrogen in terms of energy transport (gas grid), energy storage (even seasonal) and mobility (zero emission transport) applications could potentially provide a common ground for future development of countries in the region. Many of these countries also poses operational systems for research and development and capable innovation support structures, thus such a vision could even help in drawing back some of the top talents that most of the countries have lost perpetually over the last years. Individuals, especially highly educated experts with intellectual width, social intelligence and a desire to assist society are not merely motivated by renumerations. Even improving working conditions on the most basic level of interpersonal communication between employees, by removing problematic and divisive elements through positive selection (improved system for monitoring the effectiveness of carried out work, more transparency in employment selection procedures, objective responsibility of managers and directors, etc) could improve the situation drastically. Countries like the Czech Republic have excellent experience in making large transformations possible in only few decades, while the level of communication and cooperation with Slovakia can also be considered as something that the majority of neighbouring countries, for example Croatia and Slovenia should strive for.

To successfully address the countless challenges in the future, international cooperation and social integration must be prioritized. This is particularly true on the level of cross-border cooperation, where the current rise of conservative fascist political options frequently apply convenient external enemies to draw attention from issues that are relevant and critical to their citizens. This type of political dialogue facilitates fear, animosity and hatred amongst people, which is the exact opposite of the direction each individual country must take to achieve a tolerant knowledge society, built on cooperation instead of exclusion, structured on arguments and facts instead of old ideologies, personality cults and irrational though. National territory disputes between neighbouring countries should be settled and nationalistic policy between trade partners should be opposed on all levels.

Finally, the most important resource the Danube region possesses is the rich and unspoiled natural environment, that must be the primary factor when considering the way forward. A systematic integration of ecologically oriented innovation into all sectors of society, that simultaneously addresses the critical issues presented above, is the key to the prosperous future of people living in the Danube region.

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