

## **ESEE Education Concept Note** – a report on how to increase innovation capacity of ESEE region through education activity in the raw material sector

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## Foreword

The ESEE region is a rapidly developing part of Europe, which is home to some 180M people, many of which belong to the young generation that very much wants to align with ‘western’ countries and are a source of tremendous human capital. Despite that, owing to the lasting legacy of former communist times, which affected the bulk of this region and only came to a halt in the 1980s-1990s, many countries of the ESEE region are significantly delayed in their economic development with respect to their western-European counterparts. This is also clearly visible in the realm of higher-level education, no matter what the field is. As these countries share many common traits and constitute a distinct educational ‘ecosystem’, it makes great sense to consider them as a group and design for them a specially-tailored approach in raw material-themed education, aimed at aligning them with the newest trends in education. To be objective, one needs to emphasize as well that many of the ESEE countries have a very long history of higher education, with some universities being as old as 600 years and others being much larger than ‘typical’ western universities, e.g., the 72,000-strong university of Zagreb. In addition, from the raw materials perspective, the ESEE countries have an unusually rich endowment in natural resources and are heavily industrialized, therefore, they also have unquestioned strengths in the raw materials sector, a centuries-old expertise, and a huge potential to be built upon.

Based on the above-mentioned circumstances, ESEE region become strategically important for the EIT RawMaterials community and a dedicated education strategy, part of the overall RIS approach of the KIC appeared to be as a community demand. The drafting of this current document was started in 2017 by Michał Młynarczyk former educational officer of ECLC and evolved further from its initial form.

The current version of this document is largely a collection and analysis of publicly available information related to the higher education in ESEE region and in the raw material sector. The study was also looking for evidence if University-Business Cooperation (UBC) exist and in which level and how higher education institutions addressing the so called “third mission” of the universities. We examined our current education portfolio by ECLC partners participation and were looking for good practices within our KIC and in other KICs as well. Last but not least latest Innovation Scoreboard and its methodology were also studied to identify mechanisms possible to affect the innovativeness of the ESEE region through education activity.

According to this, the main goal of this document to draw up our vision about ESEE region and compile related information into one corresponding document to help our organization and our partners through a pool of examples creating actions and programs successfully achieve results in terms of impact on innovativeness of the ESEE region through raw material related education.

In order to broaden the added value, the intention is to contribute towards a systemic transformation of the education landscape in ESEE countries and region. The long-term intention to modernise the ESEE education landscape is important and shall be reflected in every education project developed in the region.

Imre Gombkötő, PhD  
Education Manager, ECLC

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## Executive Summary

From its very start educational activities have been a major concern of the EIT. The EIT has always underlined the role of high and entrepreneurial skills as drivers of innovation. A basic assumption underpinning the educational activities of the EIT is that human capital development is at the heart of approaches to fostering growth and creating jobs.

Nevertheless, Europe is characterised by considerable disparities in terms of research and innovation performance. This has resulted in classification of the European countries as innovation leaders and strong innovators to ‘moderate and modest innovators’ in the annual European Innovation Scoreboard (EIS). One reason for lower innovation performance is missing or weak linkages among the key players—businesses and research institutions and academia, as well as between private and public sectors, including a lack of know-how of innovation schemes and a structured, systematic approach towards innovation. As a response to this challenge, the EIT Regional Innovation Scheme (EIT RIS) was introduced by the European Parliament and the Council as part of the EIT’s Strategic Innovation Agenda (SIA) 2014-2020. Consequently, in line with the SIA, the EIT RIS is designed **to share good practices and experience** emerging from the EIT Community’s activities, as well as to **widen participation in KIC activities**.

The EIT RIS **serves the purpose** opening up the KICs to entities that cannot (yet) become KIC partners, as well as providing targeted support to individuals and entities from EIT RIS eligible countries to take part in KICs activities and benefit from KIC services and programmes. In addition, the EIT RIS provides a framework for transferring KIC good practise and know-how of the Knowledge Triangle Integration (KTI), thus **ultimately increasing the impact of the EIT Community at the European level**. Furthermore, it is expected that activities carried out under the EIT RIS will lead to stronger participation of entities from EIT RIS eligible countries in KIC core activities. Ultimately, the EIT RIS will help raise the capacity of local actors to potentially apply to become full KIC partners.

In line with the overarching aims of EIT RIS objectives, EIT RawMaterials has designed and deployed its RIS Strategy with the aims at extending the geographical reach to those countries where it is not yet present or weakly represented by establishing fruitful partnerships and sharing of knowledge, best practice and innovative technologies with the respective ecosystems. Based on this strategy and the implications given in the initial country gap analysis, EIT RawMaterials has clustered the EIT RIS-eligible countries into five (slightly overlapping) groups with **Eastern and South-Eastern European (ESEE) region** (covering Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Hungary, Kosovo, Macedonia, Montenegro, Romania, Serbia, Slovakia and Slovenia) among them. The **ESEE region has been identified as an EIT RawMaterials priority outreach region from the very beginning**. The region has unique raw materials potential: the availability of various resources (both primary and secondary), its specific industrial history with state-owned enterprises, and its geopolitical situation and importance. As there are existing partnerships of EIT RawMaterials in the ESEE region and first EIT RawMaterials HUBs are established (so far in Croatia/Slovenia, Greece, Slovakia), conditions for both sharing good practices and experience and widening participation activities are set.

On the other hand, education and learning activities – as one of the main pillar of EIT RawMaterials activities – have a major role and strategic importance for fostering innovation and facilitating the innovativeness of a region, and as such plays an important role in all activity tracks of KIC EIT RawMaterials Innovation System (KIS) highlighted in the EIT RawMaterials Strategic Agenda. The **aim of this document** is to **define specific objectives** for the education and learning activity line under the umbrella of the EIT RawMaterial Academy within the ESEE region **aligned with strategic objectives** based on background analysis of the current education scenario: to **design activities addressing specific targets** and **list related KPI target groups to be able to measure the impact** of those activities **to the innovativeness of the ESEE region**.

The strategic objectives of the RIS ESEE Education Concept Note, as an integral part of the overall EIT RawMaterials Strategic Agenda being in line with the EIT RawMaterials RIS Strategy and the EIT RawMaterials Academia Consolidation Action Plan are the followings:

- Generate impact in the ESEE region by contributing to enhancing the innovation capacity of the countries in particular and the region in general. This shall be done accordingly by promoting Knowledge Triangle

Integration in terms of engaging local players and by mobilizing, interlinking and internationalizing national/regional networks.

- Raise awareness and societal acceptance of raw materials, raw materials related industrial activities in the ESEE region in order to highlight their role and economic importance, to break down mind set barriers, to motivate young generations to take part and to create social environments attracting investments and promote entrepreneurship and intrapreneurship in situ.
- Create opportunities and open environments to counteract against brain drain and ease reversed brain feed into the raw material sector of the ESEE region;
- Initiate transformative changes of raw material related or effecting education to achieve capacity building of vital skills and competences of students, professionals and faculties in the ESEE region by transform best practices and experiences from the EIT RawMaterials community into resilient transferable programmes;
- Widen access and motivate entering of potential young innovators to the EIT RawMaterials Innovation Funnel using different levels of education as carriers/tools, enhancing integration of education, research and business while activating dormant partners.

In terms of general strategic education objectives EIT RawMaterials – along with the EIT’s mission – supports a variety of education activities, aiming at training the next generation of innovators and entrepreneurs. With the EIT Label as its flagship the offered activities aim to guarantee respective quality for innovative programmes bridging universities and industry. Students shall find new curricula with innovative pedagogical models of teaching and learning, aiming at developing at the same time both their technical knowledge and their entrepreneurial mind-sets and skills. These programmes shall go beyond what is being normally offered by the university partners of EIT RawMaterials alone, in particular in terms of mobility, industry exposure, networking opportunities and learning experience.

These objectives shall be specified in view of the above listed RIS ESEE strategic objectives. This also includes right from the beginning to prove evidence for the EIT RawMaterials education and learning activities in ESEE against what is available in the countries and the region for entrepreneurship education; this shall help to demonstrate its added-value in terms of skills enhancement, cost efficiency, and, moreover, whether this education offer is the best way to educate for innovation in the KIC’s thematic areas.

In order to broaden the added value, the intention is to contribute towards a systemic transformation of the education landscape in ESEE countries and region. The long-term intention to modernise the ESEE education landscape is important and shall be reflected in every education project developed in the region.

Goals are set through a group of actions executed by EIT RawMaterials partners under the umbrella of Raw Material Academy and the resulting achievement follow on impact of innovativeness of the ESEE region. The ESEE cross-cutting domain described in the EIT Rm Education Action Plan contributes the overall development of all education domains achieving targets interpreted for ESEE region. The potential actions are organised according to the four domains of education and one cross-cutting domain, Education-Business Development Links.

In order to analyse the current situation, identify the gaps and barriers and looking for the possible drivers, a background study was carried out analysing the current situation of the higher education in the ESEE region in general, investigating any thematic gap might exist. The study was also looking for evidence if University-Business Cooperation (UBC) exist and in which level and how higher education institutions addressing the so called “third mission” of the universities. We examined our current education portfolio by ECLC partners participation and were looking for good practices within our KIC and in other KICs as well. Last but not least latest Innovation Scoreboard and its methodology were also studied to identify mechanisms possible to affect the innovativeness of the ESEE region through education activity. The key findings were as follows:

- The inventory of **raw material related education in the ESEE region showed that master and PhD level** programs are **widely available** in ESEE partner universities and also in non-partner universities from non-EU countries but suffering from **low student application and enrolment**.
- **ESEE students tend to move much more than the EU average** in mobility programs, **however they mostly move within their own region** – most flows connect countries that are already very close in terms of language and culture.

- In most of the *ESEE Universities Researcher/Lecturer* career is directly from Master – PhD, often from the same University with **a strong lack of Industrial experience and relevant skills and attitude**.
- **Recent European internal migrant flows had a major impact on the countries of ESEE region**. Regions with low levels of R&D spending as well as a narrow innovation profile, including imitative innovation areas, do not benefit from the mobility of skilled workers, because their elasticity for knowledge is not significant. In other words, **strengthening innovation capacity of a region or country can automatically counteract brain drain**.
- In order **to initiate UBC barriers need to break down** – that is a pre-requisite, but with only **with also drivers in place** – for both organization and individual level – possible to initiate successful UBC. Whilst most **HEIs include UBC in their mission and vision, this strategic commitment is often not reinforced by dedicated resources** (e.g. a responsible high-level person, budget, personnel or facilities). HEIs need to make a greater and longer-term commitment to UBC.
- Among Innovation performance Indicators, 12 were identified as indicators of innovativeness potentially possible to enhance by one form of education activity. **A set of EIT Core and EIT RawMaterial related KPI's** have been identified as target provided being able to positively effect overall innovativeness, therefore creating actions generating such KPI's **in the ESEE region in significant number has real impact on the innovativeness of the ESEE region**.
- **Very low level of activity of some partner institutions and/or weak collaboration between some of them** – there is a need to establish much closer ties with faculty and students of these universities, better understand their strengths and needs, identify motivated proactive individuals that could play a 'pivotal' role in developing new educational programs, and via closer contact (physical visits, online liaising) establish a regular dialogue with those people, with clear goals and deliverables. There is also a need to develop a better awareness of the many facets of EIT RM and wide range of benefits that partner activation can unlock, so that the organization is not principally perceived as yet another agency 'providing grants and funding';
- **Low student enrolment in some of the state-of-the-art graduate courses** organized under the EIT RM umbrella it is an important matter to understand exactly what is going on and remediate the problem;
- **Risk of low impact of some educational courses and related initiatives** (i.e., disproportionately low impact value for the money involved; insufficient outreach/attendance; low relevance of some initiatives; lack of balance between the 'quantity' and 'quality' of programs developed, i.e., high quality programs targeting a too small number of individuals, or wide-reach programs of inadequate quality);
- **Low involvement of the Industry in educational programs focused on raw materials, especially from the ESEE region**. This needs to be reversed as soon as possible, as the main recipient of graduates of RM-oriented educational programs is precisely the Industry;
- **Low visibility of the EIT Raw Materials KIC as an organization and what its role is, and poor recognition of the EIT Label;**
- **ESEE region has very low benefit from education activity so far, most program exist is mainly not executed in the region, therefore enhance brain drain;**
- There are **no mechanisms facilitating access to accelerator programmes** (incubators, internships, scholarships, or fellowship programs) **to help students launch their Ideas or funnel them into business creation;**
- There is labelled program in ESEE region in general, **however theoretically EIT RawMaterials labelled programs are available for ESEE students on a competitive basis** which means only a selected few can participate which **has very low overall impact to the ESSE region in terms of transforming mindset of graduates**.

The goals in order to break down the barriers reported in the key findings and develop drivers addressing the strategic objectives through their actions shall be the follows:

- Fewer, but robust programs developed on the basis of clustering and upgrading already existing programs focusing real impact to the innovativeness of ESEE region through education activity, in particularly toward raw material sector;
- Transfer of knowledge (best practice, summer schools, other KIC's initiatives, etc) to ESEE region using partner organizations and our HUBs in the region as gateway and mediator upgrading them first and actively involving non-partner education organization staff building on the cascading effect of information and knowledge flow;

- Create internship / fellowship programs to the RIS regions, including ESEE to further widen the innovation value chain funnel from education toward business creation and fight against brain drain keeping talented young professionals in the region;
- Establishing of active dialogue between the ESEE stakeholders and EIT RawMaterials community, just as between ESEE KIC partners and non-ESEE KIC partners, Industry and Education in order to constantly get informed about the real needs of the region, success stories referring practices worth transfer and providing feedback of the effectiveness of the knowledge transfer carried out;
- Instead of creating new programs (MSc and PhD) except missing or weakly represented fields, upgrade and consolidation of already existing programs in the region reaching “labelling ready”<sup>1</sup> quality level;
- Motivate and activate individuals of ESEE education stakeholders (teachers, students) participate in exchange programs and building strongly on the recognized patterns namely students are mobile but mainly within the region;
- Proactively outreach and invite as many industrial stakeholders in the region as possible to be in Supporting Partner role in our activities while EIT RawMaterials community clearly demonstrate its value proposition via their actions created towards these supporting partners in order to engage them become associate and core partners in the future;
- Create programs that promotes, enhance and building necessary capacity for active University-Business Cooperation and help higher education institutions to become so called ‘entrepreneur universities’ in all aspects of this concept
- Widening active public dialogue towards the society of Europe including ESEE region to reach higher awareness for the importance of raw materials and achieve social license to operate while ensure long term supply of motivated human capital for raw material sector.

To achieve these goals both EIT RawMaterials LE and its partners – because most activities within our KIC are partner driven activity - needs to align their actions. These actions are the following:

#### ***For EIT RawMaterials LE***

- EIT RawMaterials shall better and clearly integrate ESEE (RIS) related education to its RM Academy activity or any centrally steered RIS related activity in order to make real impact on innovation capacity of ESEE region
- Support pilot activities with education related thematic matchmaking events to bring together KIC partners from RIS and non-RIS regions breaking down knowledge barriers and building bridges between already existing good practices and RIS KIC partnership and beyond, while grant a foreseeable quantity of financial sources to initiate these pilot programs.
- Develop mechanisms to measure impact and transfer well performing and high impact pilots forming a healthy program ecosystem to be available to wider community even beyond our KIC via our partners and the regional RIS HUBs
- Develop KIC specific KPIs that able to measure and with the fact that they are in place initiate UBC and the development of capacity for HEIs to become Entrepreneur University

#### ***For EIT RawMaterials Partners***

Take the initiative to develop and lead complex KAVA projects addressing the findings of these document actively break down the barriers and develop drivers in the level of individuals, organisations and beyond the KIC community and even be active providing content for RIS HUB initiated activities. For designing activities, the below pool of example projects can be optionally used. The action can be organised around 4 pillars such as:

*1<sup>st</sup> pillar: Wider Society Learning Programs*

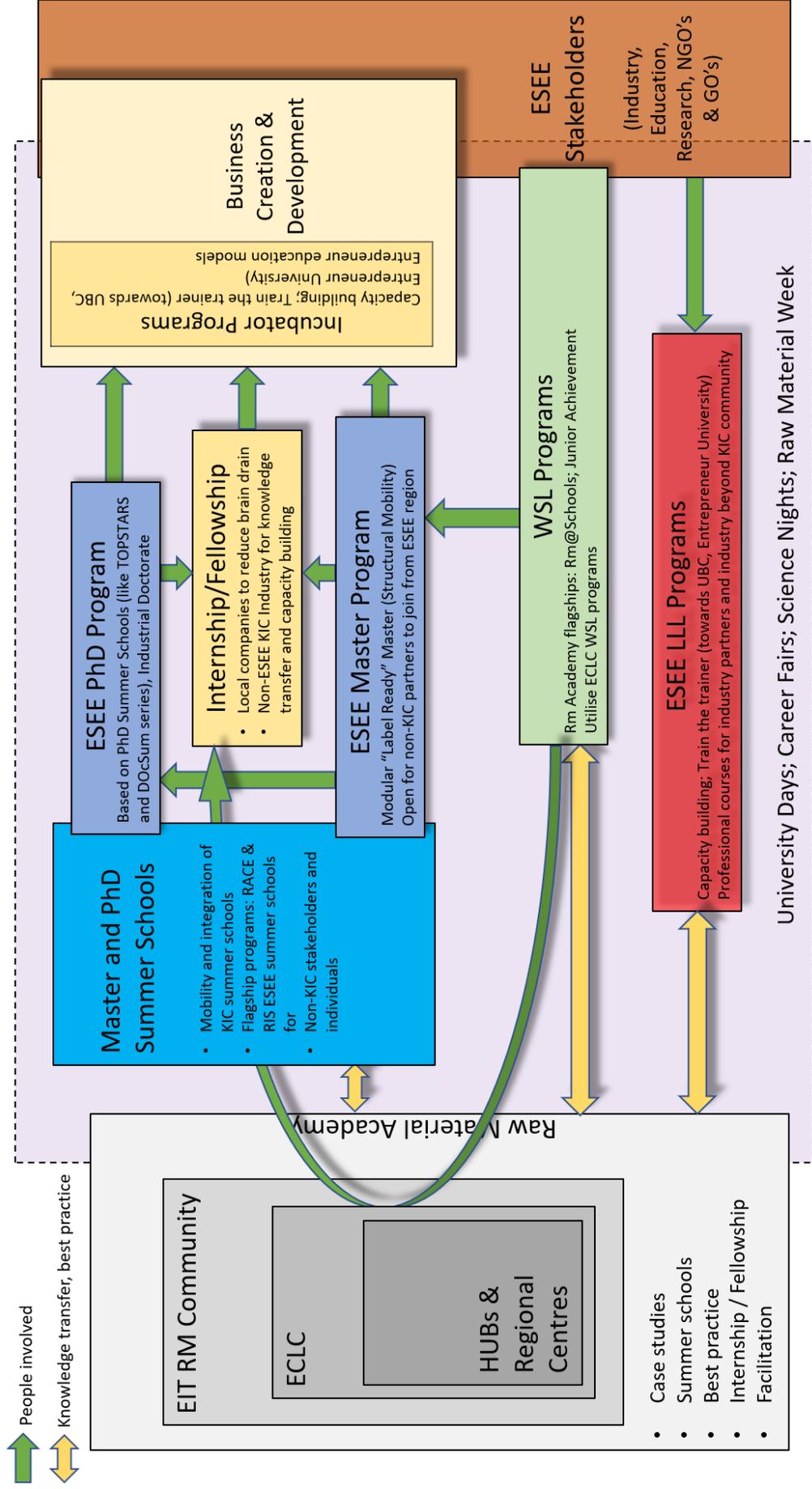
*2<sup>nd</sup> pillar: ESEE LLL programs for professionals and for Capacity Building (Train the Trainer)*

*3<sup>rd</sup> pillar: Master and PhD education programs*

*4<sup>th</sup> pillar: Business Creation and Development (Incubator and Internship/Fellowship programs)*

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<sup>1</sup> Meaning endeavour implement EIT label requirement, even if Labelling procedure not initiated or fails



## 1. Introduction

From its very start educational activities have been a major concern of the EIT. The EIT has always underlined the role of high and entrepreneurial skills as drivers of innovation. A basic assumption underpinning the educational activities of the EIT is that human capital development is at the heart of approaches to fostering growth and creating jobs.

Nevertheless, Europe is characterised by considerable disparities in terms of research and innovation performance. This has resulted in classification of the European countries as innovation leaders and strong innovators to ‘moderate and modest innovators’ in the annual European Innovation Scoreboard (EIS). One reason for lower innovation performance is missing or weak linkages among the key players—businesses and research institutions and academia, as well as between private and public sectors, including a lack of know-how of innovation schemes and a structured, systematic approach towards innovation. As a response to this challenge, the EIT Regional Innovation Scheme (EIT RIS) was introduced by the European Parliament and the Council as part of the EIT’s Strategic Innovation Agenda (SIA) 2014-2020. Consequently, in line with the SIA, the EIT RIS is designed **to share good practices and experience** emerging from the EIT Community’s activities, as well as to **widen participation in KIC activities**.

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In line with the overarching aims of EIT RIS objectives, EIT RawMaterials has designed and deployed its RIS Strategy with the aims at extending the geographical reach to those countries where it is not yet present or weakly represented by establishing fruitful partnerships and sharing of knowledge, best practice and innovative technologies with the respective ecosystems. Based on this strategy and the implications given in the initial country gap analysis, EIT RawMaterials has clustered the EIT RIS-eligible countries into five (slightly overlapping) groups with **Eastern and South-Eastern European (ESEE) region** (covering Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Hungary, Kosovo, Macedonia, Montenegro, Romania, Serbia, Slovakia and Slovenia) among them. The **ESEE region has been identified as an EIT RawMaterials priority outreach region from the very beginning**. The region has unique raw materials potential: the availability of various resources (both primary and secondary), its specific industrial history with state-owned enterprises, and its geopolitical situation and importance. As there are existing partnerships of EIT RawMaterials in the ESEE region and first EIT RawMaterials HUBs are established (so far in Croatia/Slovenia, Greece, Slovakia), conditions for both sharing good practices and experience and widening participation activities are set.

On the other hand, education and learning activities – as one of the main pillar of EIT RawMaterials activities – have a major role and strategic importance for fostering innovation and facilitating the innovativeness of a region, and as such plays an important role in all activity tracks of KIC EIT RawMaterials Innovation System (KIS) highlighted in the EIT RawMaterials Strategic Agenda. The **aim of this document** is to **define specific objectives** for the education and learning activity line under the umbrella of the EIT RawMaterial Academy within the ESEE region **aligned with strategic objectives** based on background analysis of the current education scenario: to **design activities addressing specific targets** and **list related KPI target groups to be able to measure the impact** of those activities **to the innovativeness of the ESEE region**.

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These objectives shall be specified in view of the above listed RIS ESEE strategic objectives. This also includes right from the beginning to prove evidence for the EIT RawMaterials education and learning activities in ESEE against what is available in the countries and the region for entrepreneurship education; this shall help to demonstrate its added-value in terms of skills enhancement, cost efficiency, and, more over, whether this education offer is the best way to educate for innovation in the KIC’s thematic areas.

In order to broaden the added value, the intention is to contribute towards a systemic transformation of the education landscape in ESEE countries and region. The long-term intention to modernise the ESEE education landscape is important and shall be reflected in every education project developed in the region.

## 2. Analysis of Raw Material education in ESEE region

### 2.1. Thematic analysis

EIT RawMaterials has defined six Knowledge & Innovation Themes in its Strategic Agenda. These six themes guide the interactions between the various actors of the Knowledge Triangle across the whole value chain. These themes are Exploration and Raw Material resource assessment; Mining in challenging environments; Increased resource efficiency in mineral and metallurgical processes; Recycling and material chain optimisation for End-of-Life products; Substitution of critical and toxic materials in products and for optimised performance and Design of products and services for the circular economy.

FP7 program COBALT<sup>2</sup> made an *inventory of raw material related Master education in Europe*. The mapping they made constitutes a summary of university-level educational programmes related to exploration, extraction and processing of mineral raw materials within the European Union, therefore raw material related education offers of many of the ESEE region countries (Serbia, B&H, Montenegro, Kosovo, Macedonia, Albania) are missing. Furthermore, educational programmes and courses linked to processing of secondary raw materials (recycling) and environmental engineering are considered. One of COBALT project key finding is that in terms of raw material education, master and PhD education is available for all the field examined in the Eastern European region (but not all courses in every country - for the full list, please see D3.1 report of the project). Although some countries suffer from low student intake to these education offers in comparison to domestic needs in these academic fields, the supply demand situation is in balance in Europe as a whole. It also has to be noted that most geoscience education are not focused towards mineral exploration and extractive industries. Although detailed analysis is not available, education offers toward extractive industry are also available in almost every country of the ESEE region and these education offers (eg. Materials Engineering; Chemical Engineering, Metallurgy) are part of the portfolio of EIT Raw Materials partners in the the region. Several Member States appear to be lacking in recycling-related study programmes. This is especially the case in some countries of Eastern Europe.<sup>1</sup>

In ESEE region, raw material related education is also in place, several higher education actors have already been participating in EIT Raw Materials activities, such as University of Belgrade, Faculty of Mining, Geology and Civil Engineering, University of Tuzla; University of Banja Luka, or others as Mining Faculty of Polytechnic University of Tirana; University of Mining and Geology "St. Ivan Rilski" – just to name a few.

The Society of Mining Professors (SOMP) has an annual meeting to discuss mining education. In the organisation, there are approximately 200 members representing 70 universities across 40 countries. Since 2008, each year a survey is produced on the mining programmes (focusing on mining and processing), the numbers of mining engineering students and graduates, and the staff age profile. In the 2015 survey 50 universities from 21 countries were involved the results indicate that there is a decline in the numbers of both commencing and graduating students in these institutions (and the student/staff ratio is the highest in Europe<sup>3</sup>. It is important to mention that even for regions without own mining industry competences and skills in the entire raw material value chain will be required in order to implement national mineral strategies for securing the supply in the global context that often-required innovative approaches to be effective.

Recently, *harmonisation of curricula of raw material related Bs and Ms courses* as trend are observed both in EU and global scale. The logic behind it is increasing transparency of the Earth Sciences qualifications and ultimately facilitating academic and professional mobility across Europe or the Globe. One initiative has to be mentioned is the EuroAges project, aimed at developing a qualification framework for geology based on learning outcomes rather than input factors. Similar approach is ongoing for mineral processing Bs level carried out by the International Advisory Panel of the International Mineral Processing Congress (IMPC).

Based on the related strategy documents and quick evolution of skill set required for working or not just working, but having proactive, entrepreneurial mind set, *Life Long Learning programs* for adult education is very important. According to Eurostat, an estimated 40.3 % of working age (25–64) adults across the EU-28 took part in formal or

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<sup>2</sup> <https://www.cobalt-fp7.eu/>

<sup>3</sup> Society of Mining Professors (SOMP) (2015): Survey on International Mining Engineering Programs

non-formal education or training in 2011. Training courses, seminars, conferences and guided-on-the-job training are key elements for providing job-related training; while the latter type is usually very short the other types tend to be of a slightly longer duration (typically one or two days). Guided-on-the-job training is characterised by planned periods of training, instruction or practical experience, using normal tools of work, either at the immediate place of work or in the work-situation with the presence of a tutor.

Among the EU Member States, there was a considerable variation between the shares of adult working-age populations who participated in formal and non-formal education or training. In 2011, the highest proportions were recorded in Sweden (71.8 %) and Luxembourg (70.1 %), while 50–60 % of working-age adults in Germany, France, Finland, Denmark and the Netherlands participated in some form of education and training. A small majority (14 out of 27) of the Member States recorded participation rates that were within +/-10 percentage points of the EU-28 average (of 40.3 %), while around one quarter of the adult working-age populations in Poland, Ireland, Bulgaria and Lithuania participated in education and training; Greece (11.7 %) and Romania (8.0 %) recorded much lower participation rates.

The majority of adult education and training in the EU-28 is non-formal education and training, in other words, outside of formal institutions of schools, colleges and universities. This is not surprising given that the age criterion for the AES is persons of working age (25–64 years-old), when most people have already completed their formal studies. In 2011, more than one third (36.8 %) of the EU-28's adult working-age population participated in non-formal education and training, a share that was almost six times as high as the share of those who participated in formal education or training (6.2 %).

Formal education and training was relatively common in the United Kingdom (14.8 % of working-age adults), Sweden (13.5 %), Denmark (12.6 %), the Netherlands (12.3 %), Finland (12.0 %) and Portugal (10.4 %); all of the remaining EU Member States reported single-digit shares. By contrast, fewer than 3 % of adults aged 25–64 participated in formal education and training in Italy, Greece, Bulgaria, Slovenia and Romania.

The share of non-formal instruction that was job-related but that was not sponsored by employers fell as a function of age. This suggests that younger persons (25–34) were the most likely to undertake job-related non-formal instruction without employer sponsorship, while older persons (55–64) were the least likely (perhaps due to a shorter time horizon to benefit from any job-related education and training). A similar analysis by educational attainment level displays that in 2011 a relatively high proportion (71.5 %) of the non-formal instruction undertaken in the EU-28 by those with a tertiary level of education was job-related and sponsored by employers. A similar share (71.2 %) was recorded for those with an intermediate educational attainment, whereas the share recorded among those with a low level of educational attainment was lower, at 65.5 %.

There is a large diversity between *mineral sector* in *internal policy making* for the mineral resource sector.<sup>4</sup> Some countries have well-developed and many-fold policy framework related to the sector, other countries have strategies which connect to the resources sector only by its relation to sustainable development or environmental issues.

The right policy in place is important because its capability to accommodate economic growth. Most European countries are moving to the tertiary sector of the economy. This is not a surprising economic phenomenon, since the normal pattern of economic development is from agriculture to industry and from industry to services<sup>5</sup>. However, the productivity of services affecting the performance of industry strictly depends on the framework conditions, such as the role of the internal market and regulatory systems. Investigating the EU or even the ESEE industrial development is important to predict knowledge and skills needed in the future and indicate educational directions advised to follow.

Even though primary and secondary raw material sources are widely available and have significant role in the economy of ESEE region, the future outlook of the sector is become more relevant when investigating the context

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<sup>4</sup> INTRAW Deliverable D2.1 Strategic plan for international knowledge-sharing

<sup>5</sup> The future of industry in Europe, European Union and the Committee of the Regions 2017

of the Commission Communication<sup>6</sup> in particular statement as in the EU, at least **30 million jobs depend on the availability of raw materials**. Also, **Key Enabling Technologies** playing an important role in future economy of EU which using specially processed raw materials or specially manufactured mineral commodities.

Talking about service-based economy, according to McKinsey Global Institute, **outsourcing and offshoring is already a large and fast-growing industry** in Poland, and there are opportunities to further build up centres in Romania, Bulgaria, and other CEE locations. To capture more high-value-added O&O work will require targeted investments in education and development, as well as engaging in international marketing efforts and sharing best practices in the industry. The region's O&O players have the potential to become coordinators of global outsourcing activities, including outsourced services of the raw material sector & R&D.<sup>7</sup>

Majority of the companies in the mineral sector of ESEE region are privately owned by mostly foreign ownership.<sup>8</sup> According to CMS,<sup>9</sup> in Central East European countries, as in the EU 15, both municipalities and commercial companies provide waste management services. Major EU-wide waste management contractors own or operate a number of commercial companies in CEE such as: Alba (Germany) A.S.A.; (Austria) (part of FCC); AVE (Energie AG Oberösterreich) (Austria); AVR/Van Gansewilken (Germany); Befesa (Spain); Cespa/Ferrovial (Spain); CNIM (France); Delta (Netherlands); E.On Energy From Waste (Germany); FCC (Spain); Fortum (Sweden); Jakob Becker (Germany); Lassila Tikanoja (Finland); Lobbe (Germany); Nicollin (France); Novera/Equest (UK); Plasma Leasing (US); Ragn-Sells (Sweden); Remondis/Rethmann (Germany); RWE Umwelt (Germany); Saubermacher (Austria); Saur (France); SEBA Energy (Romania); Seche (France); Servicii Salubritate București (Romania); Shanks (UK); SITA (France); Suez (France); Urbaser/ACS (Spain); Van Gansewinkel (the Netherlands); Veolia (France); Waste Management (US).

An important source for industrial development is human capital in the workforce. Human capital accumulation contributes to the development of the most advanced industries and more sustainable industrialisation across Europe. Regions vary according to the general economic situation but also in relation to their specific policies to activate new cohorts and prepare them for the labour market. The **rate of graduated in tertiary education for people aged 15-24 is particularly high at more than 20% in many southern and eastern less industrialised regions**. Many industrialised regions, on the contrary, are pushing work-based learning, vocational education and training programmes.

Labour in industry is also subject to European internal migration flows and population structure changes which may impact future economic development. Internal migration plays an important role, along with internal migrant characteristics, in terms of age, skills, education and work experience. Even if there is not enough data to encompass the **recent European internal migrant flows which had a major impact on the countries of ESEE region**. The most attractive regions for European internal migrants are in Ireland, western Spain, northern Italy and the Baltic regions. EU-citizens migrate mainly to central European regions in Germany, Belgium, the Netherlands, northern France and southern United Kingdom. A CoR study published in 2016 concludes that **EU inter-regional labour mobility is more efficiently used in regions that are more knowledge and innovation intensive**. On the other hand, **regions with low levels of R&D spending as well as a narrow innovation profile, including imitative innovation areas, do not benefit from the mobility of skilled workers, because their elasticity for knowledge is not significant**.

**Public acceptance** is a prerequisite for the development of any economic activity. It is linked to the 'social licence to operate'. This refers to the notion that companies need not only government permission to conduct their business but also society's permission based on the trust of the community in which they operate. **For the mining sector, public acceptance is a particular challenge, both for existing mines and for the development of new mining activities**. The level of acceptance of extractive activities is difficult to quantify and is determined by many different factors. These include concerns about environmental impacts, highly publicised accidents and the 'Nimby' effect (not in my backyard).<sup>10</sup>

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<sup>6</sup> European Commission (2012b), A stronger European industry for growth and economic recovery industrial policy – Communication update, COM (2012) 582

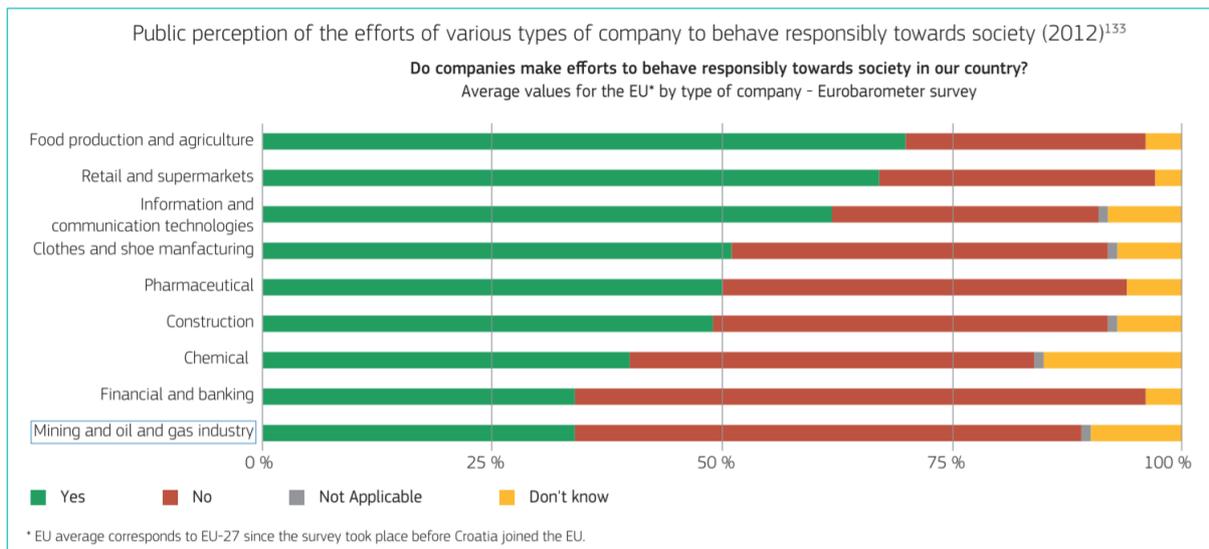
<sup>7</sup> McKinsey Global Institute: A new dawn: Reigniting growth in Central and Eastern Europe, 2013

<sup>8</sup> USGS Minerals Yearbook 2014

<sup>9</sup> Waste Management in Central and Eastern Europe, CMS CMS Cameron McKenna's free online information service, 2013

<sup>10</sup> EIP – Raw Materials Scoreboard 2017

The diagram about the ‘public perception of the efforts of various types of company to behave responsibly toward society’<sup>9</sup> shows the general public’s trust in the commitment towards society of companies from various sectors. The graph is based on a comprehensive Eurobarometer survey about public perception of companies’ behaviour, published in 2013. More than 32’000 participants were consulted in this survey covering the EU Member States, Brazil, China, India, Israel, Turkey and the United States of America. The results show that, *in comparison with other sectors, mining and oil & gas companies are perceived as making the least efforts to behave responsibly towards society*: 55 % of respondents stated that companies working in mining and oil & gas do not make sufficient efforts to behave responsibly, while 34 % said that they do.



The next figure<sup>9</sup> provides a comparison of the various public perceptions towards the mining and oil & gas industry across EU countries and for a few countries located outside the EU. For all EU countries, less than half of those surveyed responded ‘yes’ to the question whether they consider that mining and oil & gas industry companies are making efforts to behave responsibly towards society.

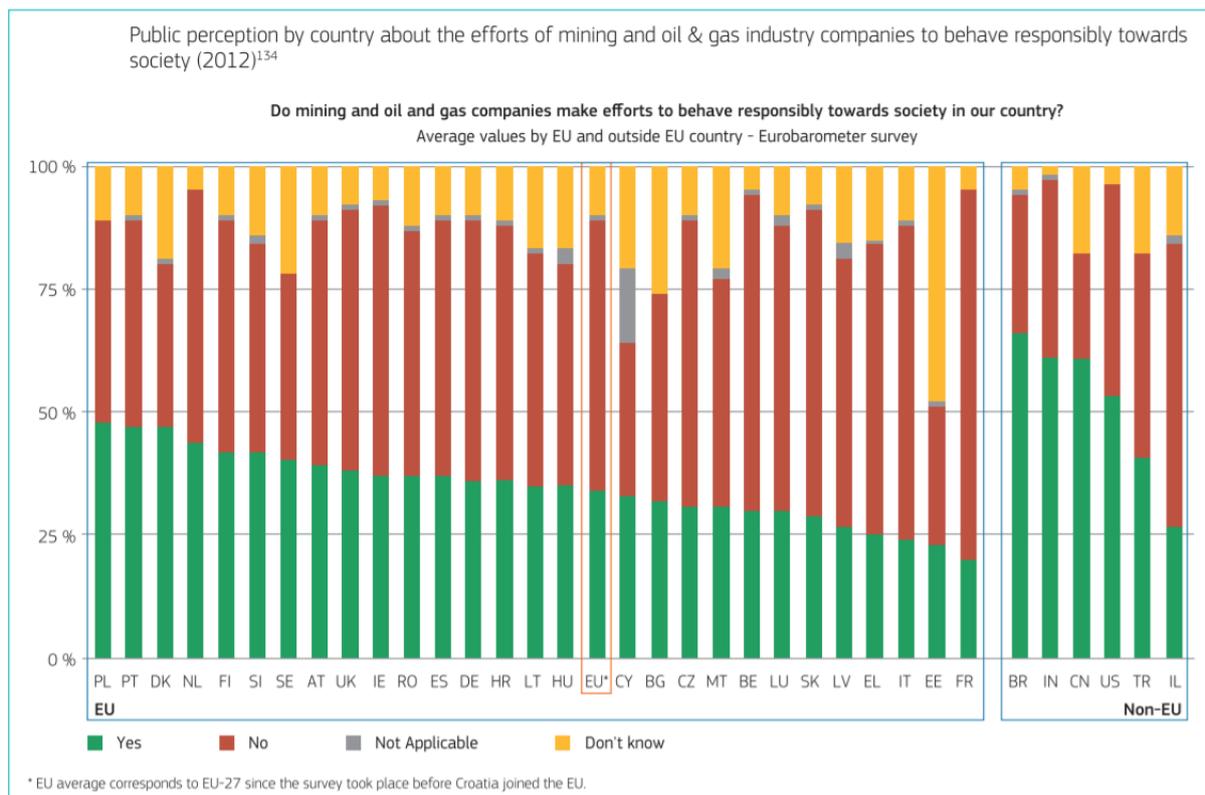
The lowest rate of ‘yes’ responses is found in France (20 %) and the highest in Poland (48 %), where mining activities are more prominent in the economy.<sup>11</sup> Similarly, in most EU countries, public perception towards the sector is low. France has the highest number of ‘no’ responses (75 %), followed by Belgium (64 %) and Italy (64 %). Estonia and Cyprus have the lowest, at 28 % and 31 %, respectively. Interestingly, this picture changes outside the EU-27. In most of the countries considered in this survey, the general public perceives a higher commitment to society from such companies. This is especially so in Brazil, India and China, but also in the US and Canada, where positive responses were significantly higher than in the EU.

Public perception is a rather complex issue, but highly important for the reputation of the sector and also for the future of the education. Data shown here again does not cover the whole scope of the EIT RMs. Perception of recycling, substitution, innovation on resource efficiency, eco-design has probably rather positive public perception.

Perception of mineral exploration and/or extraction depends on different factors:

- whether there is a clear and implemented RM policy for the country;
- are there bad legacies, e.g. accidents of tailings in the past?
- perception towards environmental policy in the country;
- contribution of the RM sector to the GDP;
- development status of synergy between resource permitting and regional / local planning.

<sup>11</sup> JRC analysis based on data from the (2013) Flash Eurobarometer



Data on the general public's perception of various economic sectors underline the low level of public acceptance of the extractive industry in the EU when compared with other economic activities. The European public perceives companies operating in the mining and oil & gas sector to be the least responsible towards society compared with other sectors (e.g. food production, construction or chemicals). The data also show that **while perceptions vary across Member States, overall trust towards the extractive industries is relatively low (below 50%)** compared with countries outside the EU. These low levels of public acceptance in the EU are probably one of the reasons why the EU raw materials sector is committed to corporate social responsibility and is an international leader on sustainability reporting. Acceptance by those communities most concerned by local developments is crucial. To this end, in addition to properly disseminating reliable and sound information, authorities concerned must ensure the full respect of EU rules on environmental impact assessments, public participation, etc.

Another aspect of the quality of higher education programs is the level and quality of cooperation between higher education institutions (HEIs) and business. The findings of the project *'The State of University-Business Cooperation in Europe'* is very interesting and relevant to our education activity within the KIC. The project has been conducted during 2016 and 2017 by a consortium led by the Science-to-Business Marketing Research Centre, Germany for the DG Education and Culture, European Commission. The aim of the project was to get a more profound, comprehensive and up to date understanding of the state of University- Business Cooperation (UBC) in Europe, from the perspective of both the higher education institutions (HEIs) and the business sector

The results – *listed below* - showed that, given the right circumstances, UBC can be a highly positive activity for all parties involved. Particularly, businesses are starting to realise the benefits of partnering or working with HEIs as a source of future-oriented innovation as well as talent development that can build a competitive advantage. Moreover, since the last study in 2010-11, there is evidence that HEIs are being increasingly seen as a source of talent, entrepreneurship and a lead player in regional development.

The majority of academics and businesses still do not engage in UBC, although the vast majority of HEIs do, to a certain extent. This limited engagement is reducing the labour market relevance of the study programmes, the employability of graduates and the impact of research. Despite significant efforts by European national governments and the European Commission to broaden the engagement in UBC, there is a lack of awareness of how HEIs and business can cooperate and how these activities (inter)relate. A total of 14 UBC activities were identified in the areas of research, education, valorisation and management but the level of cooperation is low for most of these, providing many opportunities for improvement. Cooperation in research (particularly cooperation in R&D) is the most developed activity followed by education (particularly student mobility); whilst valorisation and management activities are far less common.

UBC activities are correlated, meaning that once either *an academic (as an individual) or business (as an organisation) cooperates in one activity, they are more likely to cooperate in others*. As an example, an academic who cooperates with a business in research, is more likely to invite one of their business colleagues to give a guest lecture or supervise a thesis. Additionally, even a lack of cooperation with business does not mean that academics do not cooperate externally at all, because nearly 75% of the academics not cooperating with business, do cooperate with government or other societal actors. In order to broaden the understanding of UBC and widen its development, governments (EU and national / regional), HEIs and businesses can:

	EC	Nat/Reg Gov.	HEI Mngt.	Business
Finance project consortiums that extend their cooperation activities beyond research into education, valorisation and management cooperation.	█	█		
Provide funding for longer term cooperation initiatives, which allows the stability for expertise to develop and relationships to mature.			█	█
Promote the benefits of UBC through guides, videos, roadmaps, e-courses, forums and workshops as well as media articles.	█	█	█	█
Create more opportunities for cooperation with employers in education including more practical programmes, both within and cross-faculty.		█	█	█
Create small 'packaged' opportunities to collaborate e.g. master-thesis supervision, student 'consulting' project with business, a joint paper around a common area of expertise, etc.			█	█
Provide support to the creation of new curricula, to redesign existing curricula or undertake ongoing modernisation of curricula at HEIs.		█	█	
Develop improved employment and recruitment pathways from higher education to employers.		█	█	█
Embrace the HEIs role in providing entrepreneurship education, creating entrepreneurial ventures and facilitating a regional entrepreneurship ecosystem.		█	█	

## UBC barriers and drivers

All stakeholders are still facing barriers to UBC. Academics, HEI managers and businesses agree that lack of funding and resources is a barrier to cooperation. However, *academics specifically name bureaucracy and the lack of work time as inhibitors*, and *business identify cultural differences with respect to time management and differing motivations as specific obstacles*.

Whilst it is important to remove barriers preventing UBC, policy should focus on developing the drivers of UBC. Study results show that the removal of barriers does not necessarily trigger UBC. Instead, if there are sufficient drivers for cooperation, collaborators will find a way to cooperate. These UBC drivers consist of (i) motivators and (ii) facilitators.

Each stakeholder group has its own motivation for UBC: academics cooperate primarily to benefit their research, HEI managers have diverse reasons for wanting the university to engage including funding, graduate employability and the use of research in practice, and businesses are motivated by the outcomes for their innovation process (especially, to access future perspectives), potential access to talent, and the competitive advantage they could develop in collaboration with HEIs.

At the same time, mutual trust and commitment, common interest and goals facilitate cooperation for all stakeholder groups. People and relationships drive UBC in Europe.

Overall, a shift in thinking about UBC policies is required from a focus on barriers to drivers, and from facilitating transactions to establishing and nurturing relationships.

In order to improve personal relationships, governments, HEIs and businesses can

	EC	Nat/Reg Gov.	HEI Mngt	Business
Provide funding to develop relationships between HEIs and business at different stages of development by differentiating between shorter-term funding for 'starting up' new collaborations and longer-term funding for 'scaling up' proven collaborations.	■	■		
Develop opportunities for more frequent and extensive professional mobility which builds better cultural understanding on both sides.	■	■		
Create greater opportunities for academics and business people to develop trust and UBC experience through small funding opportunities, emphasise relationship-building exercises in projects and by drawing upon existing relationships as a source for connecting academics with business and employers.		■	■	■
Develop new mechanisms to develop contacts and relationships by:				
Creating a community or network of like-minded external collaboration-driven academics to facilitate meetings, networking events and matchmaking, to build an external collaboration culture within the HEI as well as an experience set for UBC.			■	■
Creating and promote events that encourage networking of academics with business people to help the development of relationships e.g. research pitching competitions, topic-related networking breakfasts etc.		■	■	■
European-level initiatives such as the University-Business Forums and Knowledge Alliances can serve as inspiration for similar activities on Regional or National level		■	■	■

## Mechanisms supporting UBC

For both HEIs and businesses, UBC is a discretionary activity that is not necessarily natural for the protagonists. As such, appropriate mechanisms need to be put in place to encourage and support cooperation.

These supporting mechanisms should aim to help reduce or eliminate the largest barriers (e.g. bureaucracy), offer facilitators (e.g. common aims) and provide incentives (e.g. recognition) that reward HEIs and business to undertake the activity. This can include creating new or building on old policies, strategies, structures and activities.

A number of misalignments are found between those involved in UBC and the rewards they receive.

Both cooperating academics and businesses perceived they receive some of the lowest personal benefits from UBC compared to other stakeholders. Despite HEI managers naming 'funding' as both a major barrier and driver for cooperation, national funding for HEIs is still mostly based on student numbers and research outcomes.

A brief UBC policy review across Europe showed the large variety of policies that national governments use to support each of the UBC activities, highlighting many gaps and overlapping areas. **Additionally, it shows the involvement of different ministries** (research, innovation, education, employment, etc.) **and agencies in different aspects of UBC policymaking, which could potentially create misaligned or even conflicting policies.**

**Whilst most HEIs include UBC in their mission and vision, this strategic commitment is often not reinforced by dedicated resources (e.g. a responsible high-level person, budget, personnel or facilities).** HEIs need to make a greater and longer-term commitment to UBC. Incentives for academics are the least developed UBC mechanisms, so this provides an immediate area of focus for policymakers.

Over a third of businesses commit to UBC as part of their strategy and they generally support this commitment with resources, a responsible executive and allocation of work time. Therefore, the major challenge is to get more businesses to recognise and understand the importance of UBC and how it can support their competitive advantage.

A greater commitment to UBC from government, HEIs and businesses in Europe is required to develop it, firstly ensuring that there are no barriers actually preventing UBC and put in place the fitting incentives for each stakeholder to engage in the activity.

In order to increase the strategic commitment to UBC, governments, HEIs and business should:

	EC	Nat/Reg Gov.	HEI Mngt.	Business
Ensure that both academics and business get greater benefits from their cooperation that contribute to both their short-term and long-term objectives, with focus on research / innovation outcomes.				
Reward HEIs for undertaking UBC by linking part of their funding to their UBC activities and outcomes.				
Expand the benefits from cooperation beyond research to deliver more employable graduates, support better employment pathways, more streamlined valorisation of research results and management level cooperation.				
Prior to implementing UBC mechanisms, audit the environment to have clarity about which supporting mechanisms are already in place and what is needed.				
Provide a clear UBC strategy and development policy which is aligned and included in the mission of the organisation.				
Establish an executive-level position that is responsible for UBC and a person responsible for its execution.				
Seek opportunities to remove barriers for UBC, which primarily relate to lack of funding and resources.				
Seek ways to develop improved cross-cultural understanding between the academic and business environment.				
Create external engagement offices, overseeing all external engagement activities, incl. alumni, graduate and technology transfer offices.				

## Context in which UBC occurs

UBC is still a fragmented and indistinct field, and the understanding of UBC remains inadequate because most policies focus on specific parts of the system. UBC needs to be understood as an encompassing, overarching and interconnected ecosystem instead, which comprises individuals, organisations and regions. Each of these levels affect UBC and are therefore important to understand.

At the individual level, academics who cooperate perceive their own cooperation, their HEIs' and the region's UBC capabilities as superior to those who do not cooperate. The implication is that UBC needs people with the right skills, experience and environment to engage successfully. However, all of these aspects can be improved with the right interventions and policy mechanisms.

The recognition of HEIs as a central player of a knowledge-driven regional or national innovation system is increasing. This role includes supporting regional industry and creating growth and employment, which suggests a holistic set of regional interactions. However, HEI managers state that their knowledge of UBC and business can be improved as can their amount of external contacts.

**Business are increasingly looking to a more open innovation process**, which includes other business and HEI co-operators. Cooperating businesses perceive that they have higher organisational UBC capabilities than non-cooperating business, but both cohorts perceive the UBC capabilities of their region similarly. **Most businesses cooperating with HEIs in R&D also cooperate with other businesses or have their own R&D capability.**

Building UBC experience drives cooperation. Once academics and business cooperate, they tend to cooperate in multiple ways and at increasing levels. Those academics and businesses that cooperate are mostly willing to recommend research cooperation to their colleagues and 98% predict that they will collaborate at similar or higher levels in the future.

### FACTORS AFFECTING UBC

At an individual and institutional level, a number of additional factors affect UBC positively or negatively, including:

- I. **The 'university influence'** – The greater the number of years that an academic works at an HEI the less they tend to cooperate with business.
- II. **The 'understanding effect'** – The greater the number of years that an academic works in business the more they tend to cooperate with business.
- III. **The 'experience multiplier'** – The greater the number of years that an academic cooperates with business the more cooperation they undertake.
- IV. **The 'faculty / industry' focus** – Whilst most faculties at HEIs and industries in the business world collaborate mostly in research, each has their own mix of UBC activities specific to them.
- V. **The 'size effect'** – Larger HEIs and businesses tend to cooperate more, especially in UBC areas with a longer term payoff e.g. education and management.
- VI. **The 'proximity effect'** – Most collaborating partners are in the same region (or at least country).

Considering the influence of these factors, the combined individual, institutional and regional strengths and weaknesses need to be considered to advance UBC and develop a UBC ecosystem. Policy should therefore focus on developing the UBC capabilities at an individual, organisational and regional level to develop a regional ecosystem that supports UBC.

In order to increase the UBC skills and experience of academics and business people, governments, HEIs and business can:

- Provide programmes that develop specific UBC knowledge and skills for both academics and business people. This can be done through buddy-programmes, workshops, e-courses, forums and promoting positive examples of successful UBC.
- Employ 'boundary-spanners' or 'connectors' who have a deep understanding of business and academia, to support transfer and exchange of knowledge.

In order to increase the recognition of UBC, governments, HEIs and business can:

- Seek to increase the profile and reputation of UBC including national / regional prizes for excellence in UBC, empowering UBC champions or ambassadors, publishing stories on the university website and in newsletters.
- Recognise, promote and regulate for a differentiated HEIs sector with different models of external engagement e.g. collaboration in high quality research, in education, entrepreneurship, lifelong learning, society etc.

At the same time, SMEs could:

- Join a collaborative regional and/or supply chain consortium, allowing them to exchange knowledge, skills and technology with both large companies who can support knowledge translation and HEIs.
- Include larger partners designated as 'anchor' partners committed to the life of the research and/or development project and combine this with other smaller players that have more feedback to come and go from the initiative.

The report itself determine monitoring tools also for the measurement of UBC. Among these indicators, it is possible select those that relevant to education or research activity and show a possible way to develop our KIC specific indicators as well to measure UBC within the ESEE region. . These indicators are the following:

AREA	ACTIV.	INDICATOR	MOD. 1	MOD. 2	MOD. 3
Education	Joint curriculum	Number of programmes/curricula developed in cooperation with industry			✓
		Number of courses with guest lectures from industry			✓
		Number of dual education programmes		✓	
	LLL	Number of industry professional trained			✓
		Number of training programmes for industry			✓
	Student mobility	Undergraduate internships in businesses		✓	
		Joint supervision and number of master and/or doctoral theses		✓	
		Total number of months of the stays			✓

Although the report categorizes it to be indicator for UBC in research, ***the following indicators could be very important also in joint education activities:***

- Number of teaching staff or researchers moving temporary from HEIs to businesses
- Number of researchers moving temporary from businesses to HEI
- Number of weeks that academics move from HEI to business
- Number of weeks that industry researchers move from businesses to HEI

Another current trend and approach for higher Education Institutions are the concept of *entrepreneurial and innovative higher education institution*<sup>12</sup>. According to this concept higher education institutions are required to demonstrate the ways in which they respond to the social and economic needs of society, such as enhancing graduate employability, facilitating social mobility and wider access to higher education, contributing to national economic growth and local development in short and long term, stimulating new enterprises and innovation in existing firms. In addition, higher education institutions must continuously adapt and respond to new challenges to maintain standards of excellence and be competitive on international education markets. Being, or becoming, an entrepreneurial and innovative higher education institution is a response to this. There is no "unique" approach, but a variety of ways in which higher education institutions behave in an entrepreneurial and innovative manner, for example, in how they manage resources and build organisational capacity; involve external stakeholders into their leadership and governance; embed digital technology into their activities; create and nurture synergies between teaching, research and their societal engagement, and how they promote entrepreneurship through education and business start-up support as well as knowledge exchange to enhance the innovation capacity of existing firms.

*Entrepreneurship is a concept* for which more than a hundred definitions are currently in use. The European Commission's Entrepreneurship Competence Framework defines entrepreneurship as a transversal key competence applicable by individuals and groups, including existing organisations, across all spheres of life: "Entrepreneurship is when you act upon opportunities and ideas and transform them into value for others. The value that is created can be financial, cultural, or social" In an entrepreneurial and innovative higher education institution, teaching, research, and societal engagement are intertwined. Leadership, governance and external stakeholder involvement create a continuous synergy and dynamic exchange between these. A useful working definition of the entrepreneurial and innovative higher education institution, which is broad enough to cater for institutional diversity, is provided by Gibb<sup>13</sup>:

"Entrepreneurial higher education institutions are designed to empower staff and students to demonstrate enterprise, innovation and creativity in research, teaching and pursuit and use of knowledge across boundaries. They contribute effectively to the enhancement of learning in a societal environment characterised by high levels of uncertainty and complexity and they are dedicated to creating public value via a process of open engagement, mutual learning, discovery and exchange with all stakeholders in society - local, national and international."

Being an entrepreneurial and innovative higher education institution depends, to a large extent, upon individuals and innovative ways of doing things, and a supportive organisational culture. Often these are not labelled as such. Promoting the entrepreneurial higher education institution is not about re-labelling these, it is about recognising and building – in innovative ways – on what already exists.

The challenges described above are significantly impacting upon many aspects of higher education institutions, in particular upon their governance and management. Many of the responses noted above are embraced piecemeal within the silos of established departments or professional services inside higher education institutions, yet they all impact upon each other.

This raises the potential for bringing them together into a 'holistic' approach for exploring the entrepreneurial and innovative potential of the university as the basis for change and future development. For this to happen, a certain degree of autonomy is needed both at the level of individual staff as well as for the organisation itself. Tying this back into a common vision of what being entrepreneurial and innovative means for the institution is crucial. Autonomy at faculty and individual levels needs to be grounded on shared academic values and a common vision in order for the organisation as a whole to become "biased toward adaptive change"<sup>14</sup>.

Hence, building a common and shared understanding of what being an entrepreneurial and innovative higher education institution means for a specific institution within a given socio-economic context and policy framework

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<sup>12</sup> HEInnovate: THE ENTREPRENEURIAL AND INNOVATIVE HIGHER EDUCATION INSTITUTION A REVIEW OF THE CONCEPT AND ITS RELEVANCE TODAY Updated version – June 2018

<sup>13</sup> Gibb, A.A. (2013, submitted), "Developing the Entrepreneurial University of the Future. Key Challenges, Opportunities and Responses", OECD, Paris.

<sup>14</sup> Clark, B. R. (1998), *Creating Entrepreneurial Universities: Organizational Pathways of Transformation*, Oxford: Pergamon Press.

is the main starting point. This will be a progressive and reflective process relating to the particular focus of the higher education institution in quest. Views of entrepreneurship will be considerably influenced by culture and the ways of doing things. Also, there are widely different governance and organisation structures which impact on the capacity to change. Different countries also have different imperatives, cultures, traditions, frameworks and public policy influences which will influence their view of the entrepreneurial and innovative higher education institution. There is no single model, but a magnitude of unique responses to promote "entrepreneurship as method".

In all the diversity, there is trust that there are some key characteristics that an entrepreneurial and innovative higher education institution embodies. These are presented as eight dimensions in *HEInnovate* (<https://heinnovate.eu>) and can be summarised as follows:

- **Leadership and governance** are two critical and challenging factors in developing entrepreneurial and innovative higher education institutions. Positive and responsive leadership is what maintains a dynamic and successful organisation, particularly in times of uncertainty, unpredictability and complexity. Leadership and governance can stimulate innovation of all kinds in an organisation that is held together by a shared vision and culture, not overloaded with managerial systems, constantly striving for its autonomy via the entrepreneurial management of its various interdependencies with stakeholders.
- **Organisational capacity:** funding, people, incentives. Entrepreneurial and innovative higher education institutions continuously aim at developing their organisational capacity. To this end, incentives and rewards are in place for entrepreneurship champions, staff, students and stakeholders who are promoting the entrepreneurial agenda, and removing barriers and constraints within the organisation. The aim is to empower individuals throughout the organisation to own their own initiatives, engage in innovation and build personal trust-based stakeholder relationships across external and internal boundaries in search of synergy.
- **Entrepreneurial teaching and learning** require something other than standard textbooks and ordinary classroom settings. An 'entrepreneurial' pedagogy seeks to enhance entrepreneurial capacities and capabilities amongst students by giving them more autonomy and responsibilities in the learning process through experimental, collaborative and reflexive learning.
- **Preparing and supporting entrepreneurs entails teaching strategies and learning environments** which offer targeted support for students and staff that aim at setting up a business. Higher education institutions can provide this support directly themselves or refer potential entrepreneurs to specialised start-up support services within the (local) entrepreneurship ecosystem.
- **Digital transformation and capability cut across all aspects of modern higher education institutions.** It is increasingly important that institutions make the most out of the opportunities afforded by digital technologies, which are a key enabler of innovation and entrepreneurship. Ensuring that higher education institutions are able to do so entails fostering a positive digital culture, developing and maintaining a fit-for-purpose and up-to-date digital infrastructure that serves the strategy and the missions of the higher education institution, and developing digital competences among staff and students to fully exploit the opportunities provided by digital technology and tools.
- **Knowledge exchange and collaboration** is determined by the perceptions of the respective "other". A negative attitude towards entrepreneurship, entrepreneurs and businesses within a higher education institution can limit and hinder network formation and collaboration with business partners. Communication that ensures that both sides of a knowledge exchange network have a clear understanding of respective expectations, limitations and requirements, is a major building block of the entrepreneurial and innovative higher education institution.
- **The internationalised institution.** Internationalisation is an important indicator for quality in higher education. It is not an end in itself, but rather is a vehicle for continuous change and advancement. Higher education institutions can internationalise through their activities in teaching, research and knowledge exchange, and through their staff and students. Becoming a truly internationalised institution will build on both.
- **Measuring impact** of certain practices on the entrepreneurial and innovative higher education institution is neither easy nor straight forward. To measure the impact of the entrepreneurial agenda, it is important to start by monitoring and reviewing entrepreneurship within the leadership of the higher education institution. This will help establish an understanding of how important entrepreneurship is to the governing and executive

boards – compared to other strategic objectives, such as, for example, sustainability, excellence in research, attraction of international students. Excellence is judged through the eyes of all of its stakeholders in pursuit of the creation of public value.

**HEInnovate** together with the **EU Commission made a review** of some specific countries within the EU, among them in Poland and in Hungary, the two countries are within the scope of the ESEE education activity of the EIT RawMaterials. The reports were identified gaps and formulate recommendations for both policy makers and the HEIs in Poland and Hungary. Since EIT RawMaterials can support actions made by its HEI partners, the key findings for HEIs in these two countries were:

- Develop a **common understanding of the third mission** and the entrepreneurial agenda specific to the HEI's profile and expectations.
- Appoint a senior manager in each HEI with responsibility for the **"third mission", including innovation, entrepreneurship and building relationships with government and the business community**.
- Introduce viable **resource allocation mechanisms to support entrepreneurship, innovation** and the third mission, including incentives, an innovation fund and horizontal support services.
- Incorporate a strong entrepreneurial element in advisory boards at the HEI and faculty levels.
- **Build capacity at institutional and individual levels** to understand, document and measure impact.
- **Introduce professional development and mobility programmes** for staff related to entrepreneurship, innovation and the third mission.
- Enhance the **involvement of students and young researchers** in entrepreneurship, innovation and the third mission.
- Provide basic **support for new venture creation, well-embedded** in the wider start-up ecosystem and develop more intensive business start-up support for students with high-potential ideas
- **Encourage and support** the participation of **academic staff** in international **entrepreneurship networks and conferences**.
- Use more **active methods of teaching and learning** in entrepreneurship education and training.
- Increase the **interdisciplinarity** of entrepreneurship education.

## 2.2. General situation of ESEE education

### 2.2.1. Challenges and opportunities according to EIT Raw Materials status-quo report, 2017

In 2017, an internal status-quo report has been listing opportunities and challenges of the higher education system of ESEE region in general.<sup>15</sup> This initial report aimed to discuss the strengths, but especially perceived weaknesses of the ESEE Educational ecosystem, suggest some solutions as a remediation, and to propose a roadmap for RM education in the ESEE Region. Among strengths and opportunities, the report mention

- *Easy access to higher education;*
- *Merit based scholarship system are commonly in place;*
- *Students and young generation speaks English (or other foreign languages) in general;*
- *Students are active in mobility programs, such as Erasmus/Socrates/CEEPUS-style international exchange programs.*

As it was introduced in the first chapter of this paper, **higher education is available in ESEE countries at various fields for students** at BSc, MSc and PhD level. In raw material related higher education, the capacity of the institutions is higher than the demand for the courses, therefore it is **relatively easy to access** them. The Universities are state owned in most cases, although there is legislative framework for founding private Higher Education Institutions. State owned and state funded Universities however suffer complex challenges. According to Erina and Ernis,<sup>16</sup> challenges in the field of higher education financing appeared in 1990s, when the number of students in the majority of the CEE countries grew more rapidly than the amount of financing. For example, in the period from 1995 to 2000, the amount of funding per one student in the Czech Republic reduced by 59.1%, in Hungary by 33.1%, but in Slovakia by 13.1%. Although, the number of students is falling in some ESEE countries due to demographic changes, financing of Universities is also further declining since the outbreak of 2008 financial crisis. The formula however how the **funds are calculated are differs from country to country and the cuts are more significant where funds are calculated on the basis of students enrolled**. Financing formulas are used in the majority of the CEE countries: in Lithuania the formulas are used for accredited programs, in Hungary and Romania application of the formulas is the only method to calculate state funding of higher education establishments, in Bulgaria they are used to calculate study expenses, 60% till 65% of which are covered by state budget funding. These formulas normally comprise indicators that characterize the resources of the establishment, such as the number of students enrolled, the number of employees, and total square area of the premises. They also include performance indicators, such as research efficiency or the number of students who received degrees in a definite period. In addition to the existing tendencies, there are also other trends – the part of financing connected with performance, which is allocated to higher education establishments, is gradually increasing; external sources of financing become more diversified; the states sign agreements with higher education establishments on funding of special programs; strategies to ensure sustainability of higher education financing are being developed.

Talking about **merit system**, according to the same authors are indeed in place in most countries. **However, such systems do not exist in some CEE countries – in Bulgaria, the Czech Republic, and Slovenia**. At the same time, in Poland and Slovakia state student crediting system is in place. In the Baltic States (Latvia, Lithuania and Estonia) there are state crediting systems that allow students to receive both student and study loans. Similar situation can be observed considering scholarship systems. For example, in Estonia and Latvia scholarships are granted to the students, who demonstrated excellence in the study process, but in other CEE countries state scholarships are granted when necessary. However, research and innovations are funded on competitive basis – in Estonia and Latvia the funds are allocated based on such criteria as the number of Doctoral students and/or the number of employees in a given research field, whereas in Bulgarian and Malta – considering the particular contribution made. There are also differences in higher education establishment financing policies: in some CEE countries higher education establishments have a considerable autonomy with regard to financial resource management. In Bulgaria, the Czech Republic, and Cyprus state budget funds are allocated on the basis of expense items, but in

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<sup>15</sup> Dr. Michał Młynarczyk, Raw Material education in the East and South-East European (ESEE) region: the status-quo, objectives, and a strategy for the future

<sup>16</sup> Jana Erina and Ingars Erins, Assessment of Higher Education Financing Models in the CEE Countries Procedia - Social and Behavioral Sciences 177 ( 2015 ) 186 – 189

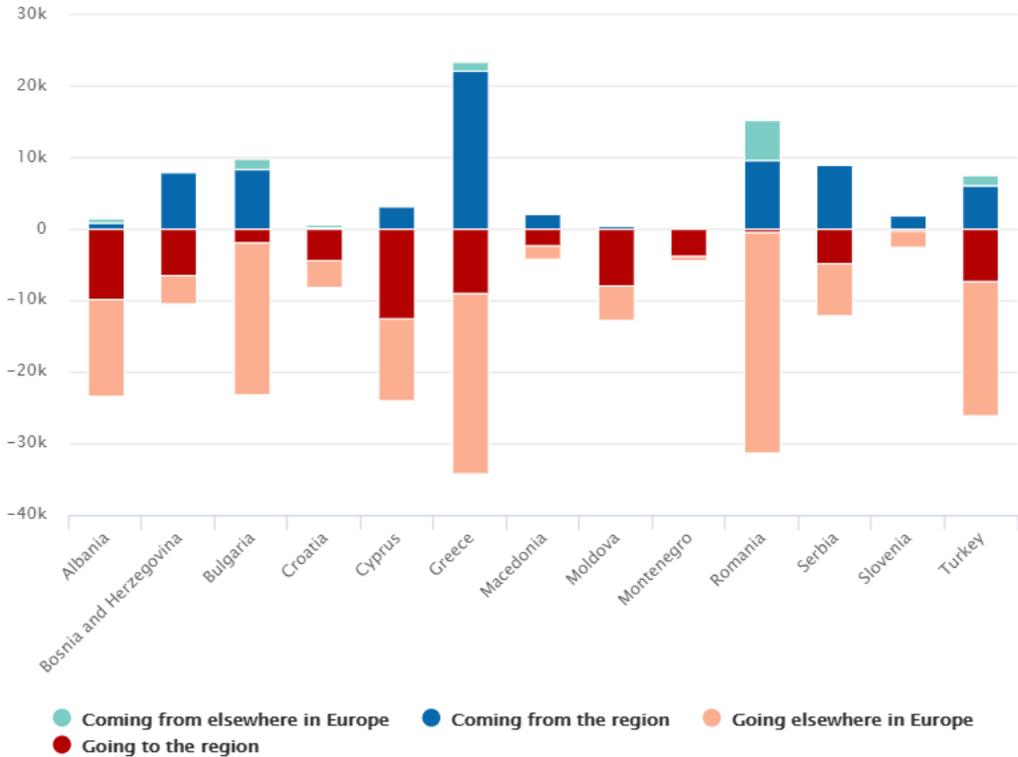
Lithuania, Poland, and Slovenia the total budget funding should be allocated in compliance with the submitted budget plan.

In the countries of the ESEE region, **language barriers are not existing according to the statistics**. Based on Eurostat data, in most ESEE countries, higher % percentage of students at the upper secondary education are studying two or more foreign languages than the EU average (59%), the only exception is Hungary. In most countries students study English (96% of students) and/or the language of one of the neighbouring country. Therefore, German, Italian and the ESEE languages are studied among ESEE students the most after English.

**Mobility habits of SEE students** were analysed by Marzia Bona and Lorenzo Ferrari based on Eurostat data.<sup>17</sup> They have found that SEE students tend to move much more than the EU average – they make up almost a third of the European students enrolling abroad. Despite the strong demand for better educational opportunities abroad, there are many obstacles.

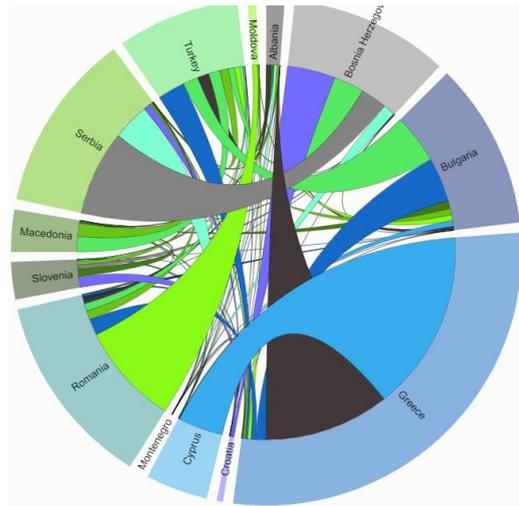
While within the EU students are free to enrol in a different country and receive the same treatment as local students, for those from outside the EU everything is more complicated: higher fees, more bureaucracy, and – unless there are bilateral agreements – limited access to scholarships and accommodation. As the data shows, EU citizenship really makes a difference for south-east European students wishing to go abroad. Among those coming from EU member states, only 23 percent stay in the region. The figure almost doubles (to 45 percent) for those who are not EU citizens.

When looking at the opposite phenomenon, i.e. students from the rest of the continent moving to south-east Europe, the main beneficiaries are EU member states such as Romania, Bulgaria, and Greece – while the other countries struggle to attract students.



<sup>17</sup> Beyond Erasmus – where and why European students travel, MARZIA BONA, LORENZO FERRARI, EUobserver 2017.11.06

However, *south-east European students* tend to get less benefits from international mobility, as they *mostly move within their own region – most flows connect countries that are already very close in terms of language and culture*. Exchanges often take place according to the state of the relationships in the area, with bilateral agreements making funds and places available for neighbouring foreigners. For instance, many Bosnian-Serb students move to Serbia. The *analysis of incoming and outgoing student flows in south-east Europe highlights some strong, often one-way bilateral relations*. It is the case of Greece, where over 85 percent of inbound students come from Cyprus (52 percent) and Albania (36 percent). For Albanian students, the key factor is the existence of established migration flows between the two countries, whereas students from Cyprus are mainly motivated by the absence of language barriers and by financial considerations.



There are naturally differences of the education system of the CEE and SEE countries stepping into the free market around the 90's and those well-established Universities of western European countries were already in the free market at that time. It is true even taking into account the fact, that most of the universities of the ESEE region existed before WWII are originally operated on the same market conditions as all over Europe. Therefore, there are differences between ESEE and Western universities by their evolution, however *these differences are not definitely weaknesses*.

Many research articles<sup>18 19 20 21</sup> dealing with mainly university system and quality of education of CEE in general. Previously discussed topic indicated that differences and the situation of funding schemes of state owned universities could lead different issues from overloaded research staff to increased number of underqualified students providing the sufficient fund, thus resulting low quality graduates, but not necessary. Seeking funds could also lead to become Entrepreneur University for local industry involving students into research and contract works resulting the implementation of learning by doing pedagogy.

What is true, that many of the *ESEE (most of them) Universities are non-represented at global rankings of universities* and this fact often translated by many as the overall quality of research and education outcome is generally low, and these universities and their graduates are not recognized in the labour market. EACEA/Eurydice, 2011 report devoted special attention to the countries of Central and Eastern Europe and found that, out of the Central and Eastern European Member States, only Poland, Hungary, the Czech Republic and Slovenia had universities in the top 500.

To understand the overall situation of higher education in Central Europe and in broader in the ESEE region Pepka Bovadijeva is cited here. According to her, "[...] there is no doubt that the development of higher education in each of the CEECs has its peculiarities and occurs in different socio-political and cultural contexts, which should be carefully analysed and taken into consideration when discussing how HEIs from each of the countries are (not) present in the global rankings. Nevertheless, there are some characteristics which, although to a different degree, outline the specific picture of higher education in CEECs. Following the radical social transformations which took place in 1989 and the early 1990s, *higher education in the countries of the former Eastern bloc appeared to be in a unique and highly complex situation*. It had to go through two deep changes simultaneously, both of which had essential impact on national higher education systems. The first change was related to the general social transformation of the countries that had been under communist regimes and the concurrent profound change in

<sup>18</sup>Grozdzanka Gojkov, Aleksandar Stojanović, Aleksandra Gojkov Rajić Critical Thinking Of Students – Indicator Of Quality In Higher Education Procedia – Social and Behavioral Sciences 191 (2015) 591-596

<sup>19</sup> Stefan George Manta, Mihaela Sarela, Viorela Ligia Vaidean Comparative analysis of University Education Systems from the Central and Eastern European Countries Procedia Economics and Finance 32 (2015) 1276-1288

<sup>20</sup> Pepka Boyadijeva Invisible higher education: Higher education institutions from Central and Eastern Europe in global rankings European Educational Research Journal 2017

<sup>21</sup> Adam Soukal The Key differences regarding HR between Western and Eastern European Companies, diploma thesis

the principles of functioning of HEIs and regulation of their relations with the state and society. In the same period, the higher education systems in almost all countries in the world underwent major and intensive innovations in response to globalization, internationalization and the increasingly wide dissemination of higher education. As a result, the following significant innovations were introduced in the higher education systems of all CEECs, which caused qualitative changes in their character: i) emergence of the private sector; ii) introduction of new structural elements, such as the three-cycle degree system (Bachelor's, Master's and PhD degrees), the credit system and university quality assurance systems; iii) restoration of university autonomy and academic freedom; iv) the encouragement of mobility of students and staff; and v) introduction of competitive research funding and tuition for students. In all CEECs, ***the expansion of higher education has led to a transformation of their higher education systems from elitist and unified to diversified systems with broad enrolment***. However, the diversification and liberalization of higher education have followed different patterns: Poland and Estonia introduced very liberal rules for establishing new HEIs; Slovakia stuck to more conservative legislation; whereas Bulgaria, Hungary and Slovenia adhered to a more balanced policy<sup>22 23 24 25</sup> (EACEA/Eurydice, 2012).

The qualitative transformation of higher education in CEECs has been accompanied by significant quantitative changes in education. In line with the worldwide trend<sup>26</sup> and driven by political and economic opening and liberalization,<sup>27</sup> higher education has been expanding in all CEECs. The expansion has taken place in a context of underfunding of the old public institutions and the emergence of new private institutions opening their doors to hundreds of thousands of new students.<sup>28</sup> Despite the general trend of expansion, the countries differ in the speed of expansion of higher education. Thus, Slovakia is the country with the highest growth of the absolute annual number of graduates per 1000 population for the period between 2000 and 2008 (14.1% per year), followed by the Czech Republic with a growth of 11.1%. In Bulgaria and Hungary, this share is the lowest – 2.0% and 0.7% respectively. For all other countries, the growth achieved for this period is higher than the EU 27 average of about 4.5% per year (EACEA/Eurydice, 2011: 66). In terms of the Europe 2020 target for tertiary educational attainment in the age group 30–34, ***Hungary and Slovenia are the countries in which the percentage of graduates in the age group 30–34 almost doubled between 2000 and 2010 while the recent trend is the decrease, especially in engineering and natural sciences***. Notwithstanding the high speed of expansion in the period between 2000 and 2008, in 2010 Slovakia had the lowest share of graduates among those aged 30–34 (22.1%). The increase of the share of higher education graduates in this age interval in Poland was almost threefold. While in 2000, the share of graduates was only by 12.5%, in 2010 it amounted to 34.8%. In Bulgaria and Croatia, the increase was relatively modest. In 2010, 27.7% of people aged 30–34 in Bulgaria had a higher education degree, as compared to 19.5% in 2000. In Croatia, this growth was respectively from 16.2% to 24.5%.<sup>29</sup>

The fundamental qualitative and quantitative changes that took place in higher education in CEECs, and the social-economic context of these changes, were connected with and, in turn, influenced the formation of some specific structural characteristics of the higher education system. We are referring to traits that are directly related to how these HEIs are present or absent in the global rankings, namely: ***i) the place of research within higher education; ii) the inherited model of specialized HEIs; iii) the existence of a large number of small and specialized HEIs; iv) the persistent underfunding of higher education; and v) the brain drain of academic staff and scientists***.

<sup>22</sup> Boyadjieva P (2007) Diversity matters: A lesson from a post-communist country. In: Krucken G, Castor Ch, Kosmutzky A, et al. (eds) *Towards a Multiversity? Universities Between Global Trends and National Traditions*. New Brunswick, NJ and London: Transaction Publishers, pp.108–131.

<sup>23</sup> Kwiek M (2013a) From system expansion to system contraction. Access to higher education in Poland. *Comparative Education Review* 57(3): 553–576.

<sup>24</sup> Simonová N and Antonowicz D (2006) Czech and Polish higher education – from bureaucracy to market competition. *Czech Sociological Review* 42(3): 517–536.

<sup>25</sup> Slantcheva S and Levy D (2007) (eds) *Private Higher Education in Post-Communist Europe: In Search of Legitimacy*. New York: Palgrave Macmillan.

<sup>26</sup> Schofer E and Meyer JW (2005) The worldwide expansion of higher education in the twentieth century. *American Sociological Review* 70(6): 898–920.

<sup>27</sup> Cerych L (1977) Educational reforms in Central and Eastern Europe: Processes and outcomes. *European Journal of Education* 32(1): 75–96.

<sup>28</sup> Kwiek M (2013b) *Knowledge Production in European Universities: States, Markets, and Academic Entrepreneurialism*. Frankfurt am Main: Peter Lang.

<sup>29</sup> Ilieva-Trichkova P and Boyadjieva P (2014) Dynamics of inequalities in access to higher education: Bulgaria in a comparative perspective. *European Journal of Higher Education* 4(2): 97–117.

The place of research within the higher education system of a given country is very important, inasmuch as in all global rankings, the indicators related to scientific production are of leading or even unique importance. However, *in many CEECs* (for example, Bulgaria, Czech Republic, Poland, Romania, Slovakia), **there is a continued reproduction of the division, inherited from the time of the communist regimes, between research institutes united in academies of sciences, and the sector of higher education.** Although to a lesser degree, the separation of teaching and research is still prominent in countries which emerged from former Yugoslavia.<sup>30</sup> Despite the evident continuing trend of integration between teaching and research in higher education noted by Peter Scott,<sup>31</sup> this trend is uneven (most pronounced in the three Baltic countries due to the radical transformation of their academies of sciences) and ‘the place of research within higher education continues to be unstable in contrast to the better-understood and accepted relationships between research and teaching characteristics of Western European and North American systems’. One of the results of this division is the concentration of researchers in research institutes and a sort of decreased scientific potential and capacity of HEIs. The effects of this division should be assessed against the background of the differences in research capacity within CEECs and between them and the other countries as shown by the evaluation report of the FP7 and Horizon 2020 Programme (European Commission, 2015). It is well-known that the network of HEIs in CEECs developed in the communist period included only state institutions and was characterized by significant institutional specialization. **The model of the specialized HEIs (also called polytechnics or professional HEIs) emerged in the beginning of the 20th century but was established as a dominating institutional model in most CEECs** after 1944 when socialist/communist parties came to power. This model was perceived as being the most appropriate one for the implementation of the political goals of the communist parties and their ideological ambitions to achieve mass industrialization. After 1989, gradual changes were introduced in the structure and status of these specialized HEIs in all CEECs. In Hungary, mergers to create larger institutions were encouraged. In Bulgaria, many of the specialized HEIs legally acquired university status. Although this process was accompanied by real changes, *in some cases, behind the displayed labels of full, multi-faculty universities, these HEIs continued to function (mainly due to the lack of qualified faculty) as specialized institutions offering specialized education in the old-fashioned disciplines and poor-quality education in the newly established ones.*<sup>16</sup> As a result, ‘the survival of many “Soviet-era” specialized HEIs and the comparative weakness of what might be called the “generalist” university tradition has influenced the form of restructuring in Central and Eastern European higher education systems.’<sup>25</sup> **The expansion of higher education in the CEECs has been realized mainly through a significant increase in the number of HEIs.** If we take into account the size of the population in these countries, the number of HEIs in each one of them is really impressive. According to the relevant ministries and national agencies for accreditation and quality assurance, there are 51 HEIs in Bulgaria, 50 in Croatia, 50 in Slovenia, 89 in Serbia, 24 in Estonia, 39 in Slovakia, 74 in Czech Republic and 460 in Poland. In the perspective of global rankings and inclusion in those rankings, an important fact is that most newly created HEIs are small in size, **narrowly specialized and offer training only in a limited number of specialties; and some of those schools have very limited scientific research activity.** Thus, although there are significant differences between countries, as a rule the average size of HEIs in CEECs is much smaller than in Western Europe or North America.<sup>25</sup>

**Consequently,** a considerable proportion of HEIs from CEECs prove to be uncompetitive; but even *by definition,* they cannot figure in the global rankings as **they do not meet,** for instance, **the criterion of the Times Higher Education World University Rankings to include at least two large academic fields and to publish at least 200 indexed articles per year.** The presence (or absence) of most HEIs from CEECs in the global rankings is also influenced by the **chronic underfunding of higher education and ‘brain drain’ of researchers and academic staff,** inasmuch as these are directly related to the quality of research and the publication activity of HEIs. The chronic underfunding of higher education in CEECs is clearly evident from statistical data, regardless of whether funding is measured as the percentage of GDP devoted to higher education, as the percentage of GDP devoted to research or as funding per student (European Commission/ EACEA/Eurydice/Eurostat). Data show that the emigration rates among tertiary-educated people tended to increase in the period between 1990 and 2010 in all CEECs, the highest increase being in Bulgaria, where it was eightfold (from 1.53% to 12.22%). As of 2010, the emigration rate among the tertiary-educated is

<sup>30</sup> Vukasovic M (2016) Contestation over integration and autonomy of universities in the former Yugoslavia: How global and European ideas are used in domestic politics. In: Chou M-H, Kamola I and Pietsch T (eds) *The Transnational Politics of Higher Education: Contesting the Global/Transforming the Local*. New York: Routledge, pp.111–129.

<sup>31</sup> Scott P (2007) Higher education in Central and Eastern Europe. In: Forest JF and Altbach PG (eds) *International Handbook of Higher Education*. Berlin: Springer, pp.423–442.

highest in Romania (20.36%) and lowest in Slovenia (9.59%).<sup>32</sup> The migration of highly skilled professionals from CEECs to the Western parts of the European Union has additionally increased after the financial crisis.<sup>33</sup> It is acknowledged that ‘all Central and Eastern European higher education systems have suffered from “brain drain” to the West, currently estimated to be 15% of teachers and researchers<sup>25</sup> and that one of the fields in which the brain drain has created specific shortages in CEECs is science and research.<sup>34</sup> While the global rankings make visible some important structural characteristics of the higher education systems in post-communist countries, they also highlight the basic problems in the development of higher education in CEECs.

That is why they are often used as an external reference point in policy debates. For instance, the debates on the quality of education in Poland present a case in which the rankings are perceived as a feature of modern higher education as opposed to the undesired communist legacy, which lends them credibility.<sup>35</sup> The generally unsatisfactory performance of Polish HEIs in the global rankings has proved to be an important motor for reforms in higher education, inasmuch as top decision-makers explicitly state that their objective is to give Polish universities a decisive push to improve their position in leading international rankings.<sup>36</sup> The use of global rankings as an external reference point is fixed in basic strategic documents that outline the policies and directions for reform of higher education in Poland.<sup>30 37</sup> The absence of Bulgarian HEIs in the global rankings was also one of the arguments adduced both by members of the academic community and by journalists in the debates surrounding the adoption of the new Strategy for the Development of Higher Education in Bulgaria.<sup>38</sup> It should also be pointed out that in CEECs ‘there is no “obsession” with rankings at any institutional level.<sup>31</sup> The *causes of this can be sought in the lack of confidence of HEIs from the CEECs that they can be competitive in the global academic area,*<sup>31</sup> and also in the perception that the global rankings are unfair with regard to HEIs from post-communist countries. The feeling of unfairness is born out of the strong connection between the position of HEIs in global rankings and their budget, while HEIs from CEECs have been underfunded for entire decades; **the feeling is also due to the fear that global rankings may contribute ‘to the brain drain and to a further marginalization of the Central and East European academic space [...]**”<sup>30</sup>

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<sup>32</sup> Brückner H, Capuano S and Marfouk A (2013) Education, gender and international migration: Insights from a panel dataset 1980–2010, mimeo: IAB, Nuremberg. Available at [www.iab.de/en/daten/iab-brain-draindata.aspx#Contents](http://www.iab.de/en/daten/iab-brain-draindata.aspx#Contents) (accessed 9 October 2016)

<sup>33</sup> Nedeljkovic V (2014) Brain drain in the European Union: Facts and figures. Rethink education working paper, no. 4. Available at: [http://www.bridgingeurope.net/uploads/8/1/7/1/8171506/wp4\\_rethink\\_edu\\_braindrain\\_nedeljkovic.pdf](http://www.bridgingeurope.net/uploads/8/1/7/1/8171506/wp4_rethink_edu_braindrain_nedeljkovic.pdf) (accessed 1 October 2016)

<sup>34</sup> Ionescu L (2014) Emigration from Eastern Europe with a focus on brain drain. Available at: [http://pure.au.dk/portal/files/75142686/Luiza\\_Ionescu\\_Emigration\\_from\\_Eastern\\_Europe\\_with\\_a\\_focus\\_on\\_Brain\\_Drain.pdf](http://pure.au.dk/portal/files/75142686/Luiza_Ionescu_Emigration_from_Eastern_Europe_with_a_focus_on_Brain_Drain.pdf) (accessed 11 October 2016).

<sup>35</sup> Erkkilä T (2014) Global university rankings, transnational policy discourse and higher education in Europe. *European Journal of Education* 49(1): 91–102.

<sup>36</sup> Dakowska D (2013) Polish higher education and the global academic competition: University rankings in the reform debates. In: Erkkilä T (ed) *Global University Rankings. Challenges for European Higher Education*. Basingstoke: Palgrave Macmillan, pp.107–126.

<sup>37</sup> Kwiek M (2016) Global university rankings in the Polish context: The University of Warsaw, a case study. In: Altbach F, Rumbley L and Yudkevich M (eds) *Global University Rankings: Impacts on Universities Worldwide*. New York: Routledge, pp.146–170.

<sup>38</sup> Boyadjieva P (2012) The ranking of the institutions of higher education in Bulgaria: Status, problems and prospects. *Bulgarian Journal Science and Education Policy* 6(1): 5–88.

## 2.2.2. Challenges and opportunities – a feedback by EIT Raw Materials ECLC partners

The ease of developing a tailored plan for serving the innovation development of ESEE region has emerged in 2017, when EIT RawMaterials RIS strategy and the Consolidation Action Plan of the EIT RawMaterial Academy has been developed. Although ESEE region is one of the primary outreach regions of EIT RawMaterials, the question was direct to ECLC partners during ECLC partner meeting has been held in Berlin, 23-24. April, 2018, if they find ESEE Education tailored plan necessary. The answer was clearly positive among the participants of the partner meeting, therefore they had been being engaged with brainstorming exercises, where they provide feedback to the ECLC management team on challenges and opportunities, possible solutions of the ESEE region related to raw material industry. Since only ~35 participants were involved this exercise, ECLC management team in agreement with the Education director of EIT RawMaterials has developed a survey in order to strengthen statistical confidence of the opinion of the partner meeting by reaching out for more individuals from ECLC partner organisations.

The survey itself contained 6 questions, among them 3 were general (name – optional; the type of organisation of the responder – Academia, Industry, research organisation and other; Country of the responder)

The other 3 questions were open, free to respond by the responder. They were as follows:

- In your opinion, what are the main challenges faced by the ESEE region in terms of raw materials education? Please name and rank 3-4 challenges.
- In your opinion, what are the opportunities offered by the raw materials education in the ESEE region?
- In your opinion, what objectives do you think are reasonable and realistically achievable within the framework of a tailored plan for ESEE RM education activities up until 2022?

The survey was responded by RTO (8%) and Education (92%) organizations of the ECLC territory from all countries where ECLC has active partnership except Slovenia, Greece and Romania.

### Q1, In your opinion, what are the main challenges faced by the ESEE region in terms of raw materials education? Please name and rank 3-4 challenges.

Survey respondents have feedback on challenges of the raw material education are very similar as our background study has already indicated. For raw material education, among EIT relevant business, entrepreneurship, marketing and communication knowledge and skills are completely missing from engineering courses, respondents mention lack of education on recycling and circular economy or cross cutting knowledge and practice of modern digital tools required to navigate in the world of industry 4.0. Education of students towards solution development capabilities is real challenge wide education for competence in many different sectors is important today therefore education enhance attitude such as self-motivation, self-organization, self-learning is missing.

Thematic connection toward environmental issues and how to handle them or corporate social responsibility was also mentioned as lacking part of ESEE Raw material education. As a consequence, as many respondents mentioned study programs are outdated (they do have neither the horizontal components for the T-shaped model nor modern thematic knowledge in a specific field). On top of that, rigid education systems are existing which are resistant to change resulting slow adaptation of the curricula to the transformations and innovations on the constantly changing and evolving job market. In some cases, strategy for curricula modernisation is completely missing. This results in difficulties in linking graduates to the world of work.

Many respondents mentioned old and outdated laboratory and research infrastructure which is a result of systematic underfunding of science and education. According to a few, underfunding results low student participation in research work. That can be a result of generally weak links and cooperation with the industry as well.

Demographic factors and the relatively low interest toward working in the raw material or extractive industries, that the number of applications is very low, therefore universities are enrolling low perform students as the financing of the university is mostly depend on it. On top of it European inner migration also hit ESEE education, both students and professionals tend to go abroad, while remaining students are not motivated for student mobility.

Lecturers are not motivated to self-improvement according to some, especially after a formal habitation or become professor that might be a reason of above mentioned outdated curricula. Also, some of the respondents are mentioning the lack of systematic lecture training options and activities.

Based on the number of each topic raised, the prioritized list of challenges is the follows according to the respondents:

1. Outdated curricula, missing raw material thematic, business and cross cutting knowledge and skills
2. Insufficient funding
3. Low level cooperation with industry
4. Outdated research and teaching infrastructure
5. Brain drain
6. Passive attitude of lecturers

### Q2, In your opinion, what are the opportunities offered by the raw materials education in the ESEE region?

Most of the answers to this question suggest more or less solutions rather than listing opportunities what education action should take advantage on. Raw material potential and the related job opportunity including processing and added value manufacturing industry was mentioned by several respondents, which we considered as number one opportunity for the education providers in the area of taking advantage on. There were responds mentioning active mining industry gives the opportunity for real life experience and practice and traditions in raw material related education. There were one responder mentioning high level of education and practical knowledge a bit controversial to the majority of answers given to 4<sup>th</sup> question. Answers on giving solution were taken into account in analysing the answers to our 6<sup>th</sup> question.

1. Raw material potential and the related job opportunity in the ESEE region
2. Active industry with a potential of real life experience and practice
3. Educational traditions

### Q3, In your opinion, what objectives do you think are reasonable and realistically achievable within the framework of a tailored plan for ESEE RM education activities up until 2022?

Most of the responds recommends upgrade and development of educational programs. There are a few thematic recommendations such as reshape learning opportunities in the light of the current EU and Global policies such as the circular economy package and the SDGs, care about sustainability and future generations or related to T-shape skills referring to a related, very fundamental difference of the 'western' educational systems, which is missing in the ESEE region is that the former put a lot of emphasis on teaching creativity, 'thinking outside of the box', actively developing solutions, and first and foremost developing independent thinking / critical thinking. In short, while the educational emphasis in the ESEE region is the 'accumulation of knowledge', what is lacking is teaching 'creativity, problem solving, and critical thinking.

Others recommend curricula upgrading by different ways. There are many recommendation matching education programs of similar European education programs and transferring knowledge and teaching methods from more industrialized European regions. Some emphasis is put in networking and mobility exchange activity with other European institutions or / and with the industry. Several respondents recommend mapping of ESEE HEI's in order to recognize universities capable to modernize study programmes and help them to do that by financing capacity building and establishing lifelong learning platforms in the ESEE region to train the teaching staff.

Among the answers there are few responders recommends a joint degree MSc and PhD programmes and even draw up a need of a strategic plan for the development of raw material education and an ongoing evaluation of progress that provides input for a past 2022 strategy.

Business development – Education linkage are strongly appearing, starting an internship/job shadowing/job placement student innovation facilitator program of which responders recommend as method creating incentives for migrated persons to come back and apply their work force and skills in their home country. For those and

graduated students setting up career centres where job seekers can get additional skills to improve their employability were recommended.

Combining up-scaling projects as case study and education was also recommended with some concrete examples, such as setting up a project that focuses on for example the recycling of material of tailings and taking that project into university courses, have students work on it. This hands-on teaching on actual cases will motivate students and the regional aspect will make them see what needs to be done/can be done in their country.

Based on the number of one topic raised, the prioritized list of recommended objectives are the follows according to the respondents:

1. Business development – Education linkage, starting an internship/job shadowing/job placement/student innovation facilitator program
2. Upgrading curricula on 'western' pattern, mind-driven pedagogy and thematic upgrade
3. Programs for industry mobilization and connection
4. Exchange and mobility programs
5. Train the trainer programs for academia staff
6. Combining up-scaling projects as case study and education

### 2.3. EIT RawMaterials portfolio in terms of education in the ESEE region

In order to analyse further objectives and actions to be taken to reach strategic education objectives of EIT RawMaterials for the ESEE region, it is necessary to create an inventory of education stakeholders and already running programs. The principal educational stakeholders in the ESEE region are the partner organizations of the EIT RawMaterials Eastern CLC, which include 15 universities – listed in Table below. Several other universities are set to join the KIC, in particular the University of Belgrade in Serbia, Charles University in Czechia, with some further universities from Ukraine (e.g., the National Mining University in Dnipro), B&H and Serbia are interested as well. It should be emphasized, however, that the educational stakeholders are not limited to universities, but also include non-academic partners of the KIC, i.e., Research & Development Institutions (e.g., KGHM Cuprum) and Industry partners (e.g., DMT), who also actively participate in educational KAVA projects and education-related events. Furthermore, the stakeholders obviously include those at the receiving end of education, i.e., school pupils, undergraduate and graduate students, alumni, independent professionals and employees, as well as wider society. Then, the non-partner organizations from all three sides of the knowledge triangle deemed relevant and interested in participating should be included, as well as the government administration of the ESEE region countries who define the rules of the educational programs (e.g., Ministries of Education / Development, etc.) as it is expected by the overarching goals of EIT. All of these should be part of the process and concerted actions should be undertaken, making good use of existing synergies, as well as other existing EU-funded parallel educational programs.

Overview of ECLC Partner universities, as of May 2018.

Name of institution	Acronym	Country	KIC partner status	# Students	Level of activation in KIC
<b>Technische Universität Bergakademie Freiberg</b>	<b>TUBAF</b>	<b>Germany</b>	<b>Core</b>	<b>4,900</b>	<b>High +</b>
Technische Hochschule Nürnberg	THN	Germany	Associate	12,200	Low
<b>Montanuniversität Leoben</b>	<b>MUL</b>	<b>Austria</b>	<b>Core</b>	<b>3,800</b>	<b>High +</b>
Graz University of Technology	TU Graz	Austria	Associate	13,200	Low
Vienna University of Technology	TU Wien	Austria	Associate	28,000	Low +
<b>AGH University of Science and Technology</b>	<b>AGH</b>	<b>Poland</b>	<b>Core</b>	<b>33,500</b>	<b>High</b>
<b>Wroclaw University of Science and Technology</b>	<b>WUST</b>	<b>Poland</b>	<b>Core</b>	<b>33,530</b>	<b>High</b>
Silesian University of Technology	SUT	Poland	Associate	23,000	Medium
Lodz University of Technology	TUL	Poland	Associate	20,000	Low
<b>University of Zagreb</b>	<b>UNIZG</b>	<b>Croatia</b>	<b>Associate</b>	<b>72,500</b>	<b>High +</b>
Ovidius University of Constanta	Ovidius	Romania	Associate	16,500	Low
National Technical University of Athens	NTUA	Greece	Associate	10,000	Medium +
Slovak University of Technology in Bratislava	STU	Slovakia	Associate	18,400	Medium +
<b>Technical University of Kosice</b>	<b>TUKE</b>	<b>Slovakia</b>	<b>Associate</b>	<b>10,000</b>	<b>High</b>
University of Miskolc	UM	Hungary	Associate	9,000	Medium

University partners are mostly expected to initiate and carry out education projects, research and industry are also likely to participate or even initiate such programs based on the assumption, they are the ones are able to draw up knowledge and skills they need. Therefore, in the following, a list of ongoing (or awarded for funding from 2019) projects listed below, the ones are lead by ECLC partner and those are lead by a partner from different CLC, but ECLC partner contributing. The detailed list of 14 ongoing or approved educational programs in the ECLC is provided in the following table below. These include a wide array of activities most of which can be grouped under the principal domains of the Raw Materials Academy, i.e., MSc Programs (6), Lifelong Learning - LLL (6), and Wider Society Learning – WSL (2). Importantly, one of these programs, SINReM has been awarded the EIT Label.

General overview of ECLC's educational project portfolio, Lead by ECLC partner including projects awarded funding in the 2018 Kava Call.

Project	Type	Lead Partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
<b>ADMIRE LAB</b> - Advanced Mineral Resources Development Labelled	MSc	MUL	M.Sc. in Mineral Resources Development in the context of a circular economy with a special focus on economic, environmental and social, as well as entrepreneurial aspects.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs KPIO2.04 - SME partners KPIO6.02 -Master Education	Low	N
<b>DIM ESEE</b> – Dubrovnik International ESEE Mining School	LLL – RIS	UNIZG-RGNF	Professional development school in the fields of zero waste management, deep intelligent mining, small mining sites, and recycling.	Y	Y	EITN03 - # Products (goods or services) or processes launched on the market EITN08 - #external participants in EIT RIS programmes IMP01.01 - Number of new primary/secondary sources of CRM up and running in the EU IMP02.02 -New KET-related breakthrough innovation accepted/in progress IMP02.03 - New RIS-related cooperative innovations accepted / in progress IMP03.02 - New environmentally friendly BAT accepted/in progress KPIO2.02 - Successful matches generated KPIO2.04 - SME partners KPIO3.01 - New demos and protos KPIO4.02 – Matches KPIO6.03 - Lifelong Education KPIO7.01 - Entrepreneurship Support Services KPIO7.04 - Funding Instruments	High	Y
<b>EC GEO SUSTAIN</b> – European MSc in Geomatics for Sustainable Mineral Resource Management	MSc	TUBAF	Innovative course in geomatics dealing with sensing technologies for mine data gathering, spatial data management/visualization/analysis/modelling	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs EITN03 - # Products (goods or services) or processes launched on the market IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.03 - Application for master programmes from outside EU	Low	Y
<b>ECLCProSchool</b> – CLC East Professional School	LLL	TUBAF	Professional development program targeted to the ECLC region technicians / engineers in the RM field in increased resource efficiency in mineral and metallurgical processes.	N	N	EITN07 – #success stories submitted to and accepted by EIT KPIO6.03 - LLL Number of professionals educated	Moderate	N
<b>LIMBRA</b> . Decreasing the negative outcomes of brain drain in the raw material sector	WSL	Uni Miskolc	This project approaches the problem of brain drain with complexity thinking and it offers multilevel solutions: with SMEs development trainings and with other events we	N	N	EITN08.1 - External participants in EIT RIS programmes – Individuals IMP04.02 – Creation of entre- and intrapreneurship-minded people KPIO1.05 – Participants awareness events KPIO6.03 – Lifelong Education KPIO7.01 - Entrepreneurship Support Services	Moderate	Y

Project	Type	Lead Partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
			improve the under and post graduate engineer students' entrepreneur knowledge with regard to the special needs of Y and Z generations and to the changing competence demand.					
<b>MINERS</b> – Mine Emergency Response and Rescue School	MSc	MUL	International mine emergency response and rescue training master module for integration into university curricula	N	Y	IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.03 - Application for master programmes from outside EU IMP04.04 - Women graduating from RM-related courses KPI06.04 - Wider Society Learning KPI07.01 - Entrepreneurship Support Services	Low	Y
<b>MiReBooks</b> . Mixed Reality Handbooks for Mining Education Mixed Reality Handbooks for Mining Education	MSc	MUL	MiReBooks produces a series of Virtual&Augmented Reality based (=Mixed Reality MR) interactive mining handbooks as a new digital standard for higher mining education across Europe. Many current challenges in mining education will be met in an innovative new way, by combining classical paper based teaching materials with MR materials and their transformation into pedagogically and didactically coherent MR handbooks for integrative classroom use.	N	Y	EITN03 - # Products (goods or services) or processes launched on the market IMP02.01 - Invest in new pilot/demo infrastructure IMP02.03 - New RIS-related cooperative innovations accepted / in progress IMP04.04 - Women graduating from RM-related courses KPI01.05 - Participants awareness events KPI03.01 - New demos and protos KPI03.06 - Projects with other KICs KPI05.02 - Network of Infrastructure KPI06.04 - Wider Society Learning	Moderate	N
<b>OpESEE</b> - Open ESEE-Region Master for Maintenance Engineering	MSc	TUBAF	Formation of specialized mechanical engineers with a specialization in maintenance engineering from the ESEE region for the ESEE region	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs, EITN02 - #start-ups created by Graduates from EIT labelled MSc and PhD programme EITN04 - # Start-ups created as a result of innovation projects EITN05 - #start-ups supported by EIT RawMaterials EITN07 - #success stories submitted to and accepted by EIT EITN08 - #external participants in EIT RIS programmes EITN08 - #external participants in EIT RIS programmes IMP04.01 - Creation of new jobs in the RM sector IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.03 - Application for master programmes from outside EU KPI04.03 - Idea Camp KPI07.01 - Entrepreneurship Support Services KPI07.02 - Start-up Booster	High	Y

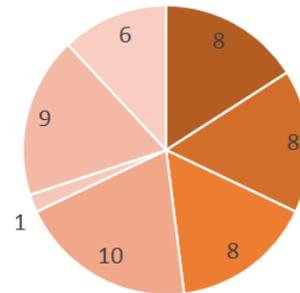
Project	Type	Lead Partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
<b>RMProSchool</b> – EIT RM High Level Professional School	LLL	TUBAF	A portfolio of professional development courses in a range of all raw material-related fields that are beyond state of the art.	N	Y	EITN07 - #success stories submitted to and accepted by EIT KPI06.03 - Lifelong Education	Moderate	Y
<b>SafeDeepMining</b> – Continued Education Program in Rock Engineering for Deep Mines	LLL	MUL	Education in state-of-the-art rock engineering addressing rock pressure problems threatening deep underground mining operations	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs EITN03 - # Products (goods or services) or processes launched on the market EITN04 - # Start-ups created as a result of innovation projects EITN07 - #success stories submitted to and accepted by EIT IMP01.04 - New SMEs created out of KIC-related activities IMP04.01 - Creation of new jobs in the RM sector IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.04 - Women graduating from RM-related courses KPI01.05 - Participants awareness events KPI06.03 - Lifelong Education	Low	Y
<b>SINReM</b> - International Master of Science in Sustainable and Innovative Natural Resource Management	MSc	TUBAF	Master degree with specializations in Resource Recovery and Sustainable Materials, Sustainable Processes, and Georesource Exploration.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.03 - Application for master programmes from outside EU KPI03.02 - Academic Quality Labels KPI06.02 - Master Education	Low	N
<b>VIRTUAL MINE</b> – A modeling tool for Wider Society Learning	WSL	KGHM Cuprum	Preparation of a 3D visualization of the copper mining process.	N	Y	IMP02.03 - New RIS-related cooperative innovations accepted / in progress IMP04.01 - Creation of new jobs in the RM sector KPI01.05 – Participants awareness events KPI02.04 - SME partners KPI06.04 - Wider Society Learning KPI03.01 - New demos and protos KPI07.01 - Entrepreneurship Support Services	Moderate	Y
<b>ESEE S</b> - ESEE Scholarships (EIT RIS activity related to action line II)	LLL	EIT RM ECLC	Train the Trainer approach for transferring modern pedagogical methods to ESEE Education practice, Pilot	N	N	EITN08 - #external participants in EIT RIS programmes KPI06.03 - LLL Number of professionals educated.	Moderate	Y
<b>TrainCall</b> . Call for Training Ideas of EIT RawMaterials High-Level Professional School	LLL	TUBAF	find the most promising training ideas that infuse the industry with new research results and encourages experts to share their knowledge with professionals. A call asks all Subject Experts to provide their solutions for the industries current challenges. The	Y	Y	EITN03 - # Products (goods or services) or processes launched on the market EITN05 - #start-ups supported by EIT RawMaterials IMP04.04 - Women graduating from RM-related courses KPI06.03 - Lifelong Education	Low-Moderate	N

Project	Type	Lead Partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
			best ideas will be selected and the Subject Experts will be assisted with a program to guarantee that topic and pedagogical implementation will fit industry needs.					

ECLC partners however involved not only projects they are leading, but projects lead by partner organization from different CLC's. The total number of not ECLC led education programs, ECLC partners are involved is 38 (in 2019). The Learning and Education projects are distributed as follows by theme, by domain and by leading CLC partner.

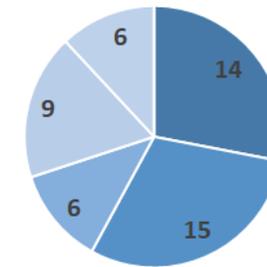
**ECLC Partners Education project involvement / Main Theme**

- Exploration and raw materials resources assessment
- Mining in challenging environments
- Increased resource efficiency in mineral and metallurgical processes
- Recycling and material chain optimization for End-of-Life products
- Substitution of critical and toxic material
- Design of products and services for the circular economy
- Non designated



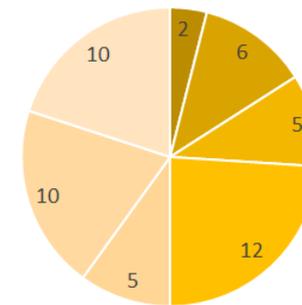
**ECLC Education as partner / Domains**

- Lifelong Learning
- Master Education
- PhD Education
- Wider Society Learning
- Academy



**ECLC partner Education projects / CLC Lead**

- HQ
- CLC Baltic Sea
- CLC Central
- CLC East
- CLC North
- CLC South
- CLC West



Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
<b>AMIR-RIS</b> - Master on Advanced Materials Innovative Recycling extended by a RIS	MSc	Uni Bordeaux/ Uni Miskolc	The consolidated AMIR Master involving 6 European universities, together with 5 RTOs and three representative industrial partners, educates T-shaped professionals for the raw materials recycling industry. They will have extensive knowledge on materials sciences specialised in recycling, and a good understanding of the related processes along the value chain, as well as the concepts and tools for achieving innovation, entrepreneurship and sustainability.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.03 - Application for master programmes from outside EU IMP04.04 - Women graduating from RM-related courses KPI04.04 - Number of Intrapreneurship Facilitator events held.	Moderate	N
<b>AWARD</b> - RM Documentary: A Series of RM Documentaries followed by Interactive Workshops	WSL	RWTH Aachen/ GeoZs	AWARD aims to boost awareness of future generations towards the importance of raw materials in our lives. To achieve that for children, documentaries will be produced to illustrate "What would happen if a raw material suddenly disappears from Earth?"	N	Y	EITN07 - #success stories submitted to and accepted by EIT KPI01.05 - Participants awareness events KPI06.04 - Wider Society Learning	None or low	N
<b>BizMet</b> - Competitive sustainable business from metal recycling	LLL	TU Lappeenranta/ MEERI	Circular economy demands new approaches along the value chain and in business models of production. SMEs often have not the capacity to keep track with developments and align their strategies for the future. BizMet bridges the gap between SMEs and universities	N	N	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.02 - Creation of entre- and intrapreneurship-minded people KPI01.05 - Participants awareness events KPI02.02 - Successful matches generated KPI04.03 - Idea Camp KPI06.03 - Lifelong Education	None or low	Y
<b>BREAKit</b> - Bringing research knowledge to exploration: a t-shape itinerary approach	LLL	Tecnalia / Monolithos	The project will implement and test an itinerary of learning events and contents, supported by a knowledge and learning platform, to create and train T-shaped innovation champions with the skills to transform new knowledge into a business value proposition through learning by doing methodology, following customer development and lean start-up approach.	Y	Y	EITN03 - # Products (goods or services) or processes launched on the market EITN07 - #success stories submitted to and accepted by EIT IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.04 - Women graduating from RM-related courses KPI02.05 - Core partners KPI02.06 - Associate partners KPI06.03 - Lifelong Education KPI07.01 - Entrepreneurship Support Services	None or low	N
<b>BRIEFCASE</b> - Learning the uses of minerals through non-conventional teaching tools	WSL	Gomez Pardo Foundation / Monolithos; MUL	The specific target audience will be primary school and 6 – 14 years old and their teachers. It will develop innovative popular science tools and content to	Y	N	KPI01.05 - Participants awareness events	Moderate	N

Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
			explain mining activities and mineral applications to society. Important considerations will be dedicated to the Not In My Backyard concept and mining in equal conditions, as well as to the problem of the so-called "blood minerals"					
<b>BusiSource</b> - Waste from companies as a secondary source	WSL	TU Delft / ZAG	The project objective is to compile different methods to improve collection of WEEE from household waste, under different circumstances in the EU and spread this information throughout the target audience; businesses, other organisations concerning (WEEE) and Electrical and Electronic Equipment (EEE) production.	N	N	KPI01.05 - Participants awareness events KPI06.04 - Wider Society Learning	None or low	N
<b>CARONTE</b> . Continuing education and scientific information literacy on raw materials for professionals	LLL	CNR / NTUA	The objective of this project is to design, pilot and disseminate within companies (that operate in the raw materials sector and that focus their activities on recycling a substitution themes) innovative approaches and strategies in retrieving, effectively organizing and properly sharing (among colleagues) scientific and technical information regarding the science and innovation frontiers, in order to speed up the time-to-market of innovative products.	N	Y	EITN03 - # Products (goods or services) or processes launched on the market EITN07 - #success stories submitted to and accepted by EIT KPI02.04 - SME partners KPI06.03 - Lifelong Education	None or low	Y
<b>CE-COSP</b> . Circular Economy and Raw Material Competence for Sustainable production	PhD	Swereña / TUBAF	Based on a need for raw material solutions for a sustainable European mobility industry, PhD students are trained in the CE COSP course. As future experts in manufacturing and material science they develop a circular perspective, innovation competence and an entrepreneurial mind set focussing on recyclability of new materials.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.04 - Women graduating from RM-related courses KPI05.02 - Network of Infrastructure KPI06.03 - Lifelong Education	None or low	Y
<b>CEDF</b> . Circular Economy Design Forum	MSc	Aalto / TU Wroclaw	Improves partner universities' Master's courses, specifically enhancing their entrepreneurial pedagogics and focus on sustainability, in order to meet the future needs of industry.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.02 - Creation of entre- and intrapreneurship-minded people	None or low	N

Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
<b>CEE-SIMP3.</b> Circular Economy Entrepreneurship in System Integrated Metals Processing	PhD	Aalto / TU Wroclaw	CEE-SIMP3 is a Doctoral-level course offered by a consortium of six prestigious European universities dealing with aspects of sustainable production of metallic raw materials, circular economy and entrepreneurship	N	Y	IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.04 - Women graduating from RM-related courses KPI06.01 - PhD Education	None or low	N
<b>CEMOOC.</b> Circular Economy MOOC: Rationales, Policies and Business Cases for Closing Material Loops in the EU	WSL	Lund University/ NTUA	The main impact and added value from CE_MOOC is to deliver experience sharing and knowledge to broad KIC RM audiences, which result in increased societal awareness of raw materials, their importance to our modern economies, and the relevance of KIC activities to broader socio-political stakeholders.	N	Y	KPI01.05 - Participants awareness events KPI06.04 - Wider Society Learning	Low	N
<b>CLLEFE-II.</b> Concept for Life Long Education for Foundry Employees II	LLL	Swerea AB/ AGH	Access to well-educated personnel is commonly seen as the biggest future challenge for the European foundry industry in order to maintain and develop its global competitiveness. The demand for individual education programs and new concepts for flexible learning preferably based on short modules, validation and e-learning therefor increases.	N	Y	EITN03 - # Products (goods or services) or processes launched on the market EITN03 - # Products (goods or services) or processes launched on the market EITN03 - # Products (goods or services) or processes launched on the market MPO2.01 - Invest in new pilot/demo infrastructure KPI01.05 - Participants awareness events KPI03.01 - New demos and protos KPI03.06 - Projects with other KICs KPI05.02 - Network of Infrastructure KPI06.03 - Lifelong Education KPI07.03 - SME Growth Booster	None or low	Y
<b>DERMAP.</b> DEsign of components in a critical Raw MAterials Perspective	LLL	University of Padova/ AGH	DERMAP is an in-field training program leading industrial designers towards a more responsible materials selection process (MSP).	N	Y	EITN03 - # Products (goods or services) or processes launched on the market EITN03 - # Products (goods or services) or processes launched on the market EITN07 - #success stories submitted to and accepted by EIT EITN08 - #external participants in EIT RIS programme MPO3.02 - New environmentally friendly BAT accepted/in progress KPI03.01 - New demos and protos KPI06.03 - Lifelong Education	None or low	Y
<b>EXplore.</b> EXplore Masters programme in exploration	MSc	Lulea / TUBAF, AGH	EXplore aims to create a MSc-programme in exploration. Exploration geoscientists will be educated in how to create exploration business and understanding the market conditions.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.04 - Women graduating from RM-related courses KPI06.02 - Master Education	None or low	Y

Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
<b>GAMES.</b> Great Adventures with Materials: Education for a Recycling Society	WSL	KU Leuven/ BASF	Dispersion of recycling knowledge and advantages into the wider society;* attract youngsters to STEM-related education programmes in general and recycling programmes in particular.	N	Y	EITN03 - # Products (goods or services) or processes launched on the market EITN07 - #success stories submitted to and accepted by EIT KPI02.04 - SME partners KPI06.04 - Wider Society Learning	None or low	Y
<b>GeoKTPro 2.0.</b> Georesources Engineers in the Knowledge Triangle 2.0	MSc	Uni Liège / HZDR, TUBAF	Georesource MSc engineering course with embedded business courses and winteschool.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.03 - Application for master programmes from outside EU IMP04.04 - Women graduating from RM-related courses KPI06.02 - Master Education	None or low	Y
<b>GeoKTPro3</b> - EMerald + ( Georesources Engineers in the Knowledge Triangle 3)	MSc	Uni Liège / HZDR, TUBAF	This project is closely linked to the EIT labelled master program - EMerald - that has now been running for five years. It aims on one hand to complement the master by financing activities integrating an important entrepreneurship component to enhance the training of T-Shape engineers and, on the other hand, to make the master more visible and attractive worldwide by financing student grants and promotional material	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.03 - Application for master programmes from outside EU IMP04.04 - Women graduating from RM-related courses	None or Low	N
<b>I-EDDA-RS</b> - Innovative Exploration Drilling and Data Acquisition Research School	PhD	Uppsala University / GFZ; TUBAF	The new research school is aimed at educating emerging scientists and engineers in on-site drilling and geoscientific investigation technology. Initial focus will be on activities around the fully cored 2.5 km deep COSC-2 borehole planned for 2020 with future sites identified in cooperation with industry. Participating students will obtain the profound methodological knowledge and entrepreneurial skills required in the exploration industry.	N	Y	IMP04.04 - Women graduating from RM-related courses IMP04.02 - Creation of entre- and intrapreneurship-minded people KPI02.01 - Partners in up-scaling projects	None or Low	N
<b>IMAGINE-II.</b> Implementation of EIT KIC Raw Materials Master Programs in Sustainable Materials	MSc	KU Leuven/ MUL, TUBAF	IMAGINE-II will deliver highly competitive SUMA (sustainable materials) Master programmes that form professionals with a deep expertise in sustainable materials and processes and with an innovation and entrepreneurial mind-set.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs IMP04.03 - Application for master programmes from outside EU IMP04.04 - Women graduating from RM-related courses	None or low	N
<b>INNOMAT.</b> Innovation Management through	LLL	Tu Delft/ ZAG	Innomat offers a course for companies with an affordable insight in LCA's and	N	N	EITN03 - # Products (goods or services) or processes launched on the market	None or low	N

Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
Integration of LCA Training Packages			CRM-risks, and methods on how to be more resource resilient.			KPI06.03 - Lifelong Education		
<b>LightRight2point0</b> - Materials for lightweight design - how to treat them right 2.0	LLL	Fraunhofer / HZDR; TUBAF	The main goal of this project is to establish a Lifelong Learning qualification system for lightweight materials by elaborating and implementing a certification process according to EN ISO/IEC 17024. Based on the analysis of customers' needs gathered in the project LightRight, LightRight 2.0 wants to bridge the gap identified between potentials of lightweight design and industrial implementation.	N	Y	EITN03 - # Products (goods or services) or processes launched on the market KPI01.05 - Participants awareness events KPI06.03 - Lifelong Education	None	N
<b>MC-CEMP.</b> Masters course in circular economy for materials processing - collaborating, training and supporting RIS countries to transfer knowledge and develop capacity	MSc	KHT / MEERI, TUKE, Poli Slaska	This project will build knowledge and capacity about state-of-the-art circular economy and resource efficiency practices - in order to ensure that future graduate engineers have the skills to develop more sustainable processes in the raw materials value chains.	N	N	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs KPI06.03 - Lifelong Education	None or low	N
<b>MineHeritage.</b> Historical Mining – tracing and learning from ancient materials and mining techn	WSL	FCT NOVA/ Pslaska, TUKE, UniZG	MineHeritage intends to reach society on the importance of RM through an historical approach. Using Europe as a common foreground, where RM have been explored and traded through times, we will show that technological developments increased the demand for certain RM linking regions to social strategies of work and progress. Through the history of mining we will show the importance of RM in the development of Europe, European Culture and Society.	N	N	EITN03 - # Products (goods or services) or processes launched on the market IMP04.02 - Creation of entre- and intrapreneurship-minded people KPI01.05 - Participants awareness events KPI03.01 - New demos and protos KPI03.06 - Projects with other KICs KPI06.04 - Wider Society Learning	Moderate - Medium	N
<b>MINETRAN.</b> Economic Study and Implementation of Pyhäsalmi Mine Open Education and Research	LLL	Uni Oulu / TUBAF	MINETRAN's objective is to develop an advanced level training program for mining industry professionals. The novelty of this education is that it provides learners with a holistic view of the whole mine lifecycle, as well as opportunities to test both skills and mining equipment in an actual deep mine site.	N	Y	EITN05 - #start-ups supported by EIT RawMaterials KPI06.03 - Lifelong Education	None or low	Y

Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
<b>MOTOPED.</b> Modular Toolbox for Professional Education	LLL	UMICORE / TUBAF; HZDR	In MOTOPED, industry and academia jointly develop training tools to meet industry's need for focused, flexible training of new and existing workforce. MOTOPED combines a modular on-demand web-based training "toolbox" and a professional blended learning methodology. It will be developed with and beta-tested by learners from industry with Umicore as test case. The toolbox and concept can also be implemented in other fields and networks later.	N	Y	EITN03 - # Products (goods or services) or processes launched on the market KPI06.03 - Lifelong Education	None	N
<b>NEAT Consolidate.</b> NEw Approaches and Technologies in Materials Production- Programme Consolidatio	PhD	TCD / UniZG-RGNF	NEAT MATERIALS is a multi-disciplinary tailor-made PhD program that tackles real current industry challenges, creates content from cutting-edge research on sustainability, circular economy and innovation on RM.	N	Y	EITN01 - #new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs EITN02 - #start-ups created by Graduates from EIT labelled MSc and PhD programme EITN03 - # Products (goods or services) or processes launched on the market EITN05 - #start-ups supported by EIT RawMaterials EITN07 - #success stories submitted to and accepted by EIT EITN08 - #external participants in EIT RIS programmes IMP01.04 - New SMEs created out of KIC-related activities IMP04.01 - Creation of new jobs in the RM sector KPI02.02 - Successful matches generated KPI03.06 - Projects with other KICs KPI06.04 - Wider Society Learning	None or low	N
<b>OpenYourMine.</b> A Master education project dedicated to mineral resources and sustainability	MSc	Université Grenoble Alpes / KGHM Cuprum, WUST	4 new teaching units of 3 ECTS each dedicated to mineral resources and sustainable development in a European perspective. Open to MSc students (about 40 every year) having backgrounds in geology, economy, sociology, and environmental protection. ECTS included and shared among already existing master curriculums dedicated to georesources, economy of sustainable development, and sociology of innovation from the 3 participating universities.	N	Y	IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.03 - Application for master programmes from outside EU IMP04.04 - Women graduating from RM-related courses KPI01.05 - Participants awareness events	Low	N
<b>PARADE.</b> Best practices for Pre-demolition Audits	LLL	VTT / TUKE	The project will develop life-long education materials on best practices for	N	Y	KPI01.05 - Participants awareness events KPI06.03 - Lifelong Education	None or low	Y

Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
ensuring high quality RAW materials			pre-demolition waste audits. The aim is to provide an harmonized approach for performing waste audits making references to legislation and benefitting existing studies, KCAs and information on best practices collected.			KPI06.04 - Wider Society Learning		
<b>PM-Life.</b> LifeLong Learning in Powder Metallurgy	LLL	INP / MUL	PM Life is a lifelong training on Powder Metallurgy organized by the European Powder Metallurgy Association (EPMA) and some of its affiliates. During five weeks,	N	Y	KPI06.03 - Lifelong Education	None or low	Y
<b>RAISE.</b> RawMaterials Students Internships	WSL	CNR / MUL	RAISE gives access to secondary schools students at internships within research laboratories/companies operating in the RM sector. RAISE tackle a carrier guidance demand originated within the schools, making youngsters aware of the career opportunities in the field, offering them tools allowing an informed university studies engagement into RM related disciplines. Motivated pupils access two/three weeks internships focused on KIC thematic pillars	N	Y	KPI01.05 - Participants awareness events KPI02.02 - Successful matches generated KPI06.04 - Wider Society Learning	Moderate	N
<b>RawMATCop.</b> RawMaterials Copernicus project - non-EIT (funded by DG GROW)	PhD	EIT Rm GmbH/ HZDR	This project utilises data from the Copernicus programme: the Earth Observation and monitoring programme of the European Union. Project funds three post-doctoral research projects at EIT RawMaterials' partner institutions as well as a Lifelong Learning course for professionals.	N	N	None	None or low	N
<b>RefresCO.</b> Professional Refresher Courses	LLL	ENEA / MEERI	The main objective is providing on-demand professional refreshment courses in the field of non-energy raw materials, in particular regarding recovery of materials from secondary resources and substitution of CRM, and related fields such as environmental evaluation, business opportunities and supply chain management.	N	Y	KPI06.03 - Lifelong Education	None or low	Y

Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
<b>RM@Schools3.0.</b> Raw Matters Ambassadors at Schools 3.0	WSL	CNR/ GeoZS/MUL	RM@Schools 3.0 promotes a wide dissemination action on RM-related themes in Schools and Society through strategic European partnerships among Research, School, and Industry. Students 10-19 years old will become RM Ambassadors to a wider community, since they will be involved in experiments with RM-related hands-on educational kits, excursions in industries, and science dissemination by using both their native and the English language.	N	N	EITN03 - # Products (goods or services) or processes launched on the market EITN07 - #success stories submitted to and accepted by EIT KPI01.05 - Participants awareness events KPI03.06 - Projects with other KICs KPI06.04 - Wider Society Learning	Low	Y
<b>RMCONFIDIF.</b> Rm metallurgy annual conferences cycle	WSL	UPM/ TUBAF, ZAG	The main activity in RMCONFIDIF is the organization of a regular seminar cycle, related to metallurgy of RM. Target groups are mainly students and professors of higher education, to attract them to RM career.	N	Y	IMP04.01 - Creation of new jobs in the RM sector KPI01.05 - Participants awareness events KPI06.04 - Wider Society Learning	None or low	N
<b>RMTechFlow.</b> RMTechFlow: Capacity Building for Advanced Raw Materials Tech Transfer Deal Flow	LLL	HIT / AGH	RMTechFlow is a two-year-long lifelong learning project aiming at coaching at least 180 amongst KIC partners' academics and staff from tech transfer offices in better scouting, analysing and boosting promising technologies towards market exploitation. Strategic goal is to improve chances for impact of KIC upscaling projects. Learning opportunities will revolve around hands-on co-located workshops, as well as operations on real IP business cases.	N	Y	KPI06.03 - Lifelong Education	Low	N
<b>SafeMine.</b> PhD-Programme Health and Safety in Mining	PhD	Clausthal University/ MUL	For a modern mining company with attractive and safe workplaces a new type of leader for tomorrow's Health and Safety at work is needed. The PhD-Programme SafeMine will create and train these officials.	N	Y	EITN07 - #success stories submitted to and accepted by EIT IMP04.01 - Creation of new jobs in the RM sector IMP04.02 - Creation of entre- and intrapreneurship-minded people IMP04.04 - Women graduating from RM-related courses KPI06.01 - PhD Education	None or low	Y
<b>SETI.</b> hands-in SummEr school on critical raw maTerials: Innovation and entrepreneurship	MSc	Trento Uni / NTUA	Summer school is intended as a complement to existing and new Master initiatives in which the EIT Raw Materials pillars are the focus, and as key tool for the achievement of the EIT labelling	N	Y	IMP02.02 - New KET-related breakthrough innovation accepted/in progress IMP04.01 - Creation of new jobs in the RM sector KPI01.06 - Kick-start funding ideas (formerly: Raw MatTERS prize ideas) KPI02.04 - SME partners	None or low	N

Project	Type	Lead Partner/ ECLC partner	Description	Industry involved		Target KPI's	Impact to ESEE	Task partners (outreach)
				In ESEE	Outside ESEE			
						KPI06.03 - Lifelong Education		
<b>TOP STARS.</b> innovaTion challenge fOr PhD STudents And ReSearchers	PhD	Trento Uni / NTUA	The summer school offers PhD students a unique hands-in opportunity to address societal challenges in the Raw Materials framework by combining the technical expertise with innovation and entrepreneurship experience. For two weeks, students will work in teams to identify a technical solution and develop it into a business proposal.	N	Y	KPI01.06 - Kick-start funding ideas (formerly: Raw MatTERS prize ideas) KPI02.04 - SME partners KPI06.03 - Lifelong Education	None or low	N
<b>VR-Lab.</b> Teaching Laboratory-Scale, Pilot Plant & Full-Scale Melting Test Evaluations	MSc	RWTH Aachen / NTUA	VR-Lab is an education program content, introducing RM & experiment procedures, including an interactive VR environment mimicking metallurgical facilities & labs. The VR-Lab allows students and professionals to gain hands-on experience on planning, performing & evaluating experiments in a test facility & operating high-temperature processes, without high costs, preparations & safety issues. VR-Lab is accessed via VR-devices, PCs & mobiles.	N	Y	EITN07 - #success stories submitted to and accepted by EIT KPI02.04 - Number of SMEs participating in projects. KPI06.02 - Number of MSc graduates generated. KPI06.04 - Number of participants in Wider Society Learning events.	None or Low	N

The projects collected above describe the education activity of ECLC partners in the context of how they affect the development of ESEE region in the innovativeness point of view. Where ESEE industrial partners (either large company or SME) were involved in the proposal writing phase, it is indicated. Also, we have analysed the project if not yet partner organisations were involved, or the target audience were broad, not only from EIT RawMaterials community therefore the project was considered one with outreach activity. The impact to ESEE region was also assessed by several criteria. These criteria were as:

- ESEE partner is involved;
- ESEE industry organisation is involved our reached out for;
- The target group is in mainly in ESEE region;
- Committed KPI's are to enhance innovative performance in a sense of education.

**Low impact value does not mean low-quality project**, only indicates its pulling effect to ESEE region as a whole is low or very insignificant in a sense of innovativeness performance indicators.

Analysing the core projects (where ECLC partner is leader; 14 running in 2018) there is no PhD related education project lead by ECLC partner, 6 MSc, 2 WSL, 6 LLL programs are running of which only two of them considered as high impact, several of them moderate and there is few with low overall impact to ESEE region.. The most active partners generating education projects are MUL and TUBAF, neither of them is from the ESEE region. MUL, TUBAF are very active in participating projects as well, and from ESEE region, NTUA, AGH, UNiZG are the most active in this regard, however many research and industrial partners are participating one or more education projects, not targeting however ESEE region.

Project distribution based on theme or the domain of education or even geographic distribution (lead CLC) shows a good balance, however there is no substitution among the education themes where ECLC partners are involved. Based on the last 2 years of activity in the ESEE region, the following points have been identified which require improvement or development.

- **Very low level of activity of some partner institutions and/or weak collaboration between some of them** – there is a need to establish much closer ties with faculty and students of these universities, better understand their strengths and needs, identify motivated proactive individuals that could play a ‘pivotal’ role in developing new educational programs, and via closer contact (physical visits, online liaising) establish a regular dialogue with those people, with clear goals and deliverables. There is also a need to develop a better awareness of the many facets of EIT RM and wide range of benefits that partner activation can unlock, so that the organization is not principally perceived as yet another agency ‘providing grants and funding’;
- **Low student enrolment in some of the state-of-the-art graduate courses organized under the EIT RM umbrella** it is an important matter to understand exactly what is going on and remediate the problem;
- **Risk of low impact of some educational courses and related initiatives** (i.e., disproportionately low impact value for the money involved; insufficient outreach/attendance; low relevance of some initiatives; lack of balance between the ‘quantity’ and ‘quality’ of programs developed, i.e., high quality programs targeting a too small number of individuals, or wide-reach programs of inadequate quality) – these need to be assessed on a case per case basis;
- **Low involvement of the Industry in educational programs focused on raw materials, especially from the ESEE region.** This needs to be reversed as soon as possible, as the main recipient of graduates of RM-oriented educational programs is precisely the Industry;
- **Low visibility of the EIT Raw Materials KIC as an organization and what its role is, and poor recognition of the EIT Label;**
- **ESEE region has very low benefit from education activity so far, most program exist is mainly not executed in the region, therefore enhance brain drain;**
- **There are no mechanisms facilitating access to accelerator programmes (incubators, internships, scholarships, or fellowship programs) to help students launch their Ideas or funnel them into business creation;**
- **There is labelled program in ESEE region in general, however theoretically EIT RawMaterials labelled programs are available for ESEE students on a competitive basis**

### 3. The Innovativeness of the ESEE region, the Innovation Scoreboard

Innovation means prosperity. It drives productivity and economic growth, creates opportunities for new and better jobs, enables social mobility and is instrumental in responding to global societal challenges. In times of profound technological and societal transformation, the competitiveness of the European economy and the well-being of European citizens depend – more than ever – on the ability of our businesses to develop and successfully commercialise innovative solutions. Innovation increases efficiency, boosts company productivity and provides huge benefits to consumers.

The overall activity of KIC's and EIT is to boost innovation to further enhance EU economy and impact to those regions are moderate or modest innovators ultimately heighten their innovativeness. The innovativeness of a region or country is measured by the European Commission its Innovation scoreboards, therefore worth a look of these scoreboards and see how EIT RawMaterials might have a positive impact to ESEE region through education activity for the raw material sector. This analysis may indicate the directions expected direct impact on the innovativeness of the target ESEE countries via education if well focused, on the other hand, it may provide glimpse of socio-demographic changes of the region.

According to the authors of EIS, following developments in policy priorities, economic theory and data availability, the previous measurement framework was in need of adjustment. Its revision for the present edition aims at better aligning the EIS innovation dimensions with evolving policy priorities, improving the quality and timeliness of the indicators, better capturing new and emerging phenomena as digitisation and entrepreneurship, and providing a toolbox with contextual data, which can be used to analyse structural differences between Member States. The new EIS measurement framework distinguishes between four main types of indicators and ten innovation dimensions, capturing in total 27 different indicators. Framework conditions capture the main drivers of innovation performance external to the firm and cover three innovation dimensions: Human resources, Attractive research systems, as well as Innovation-friendly environment. Investments capture public and private investment in research and innovation and cover two dimensions: Finance and support and Firm investments. Innovation activities capture the innovation efforts at the level of the firm, grouped in three innovation dimensions: Innovators, Linkages, and Intellectual assets. Impacts cover the effects of firms' innovation activities in two innovation dimensions: Employment impacts and Sales effects. Some indicators of the previous edition of EIS has been removed, some has been revised, and there are several new indicators as well. Among them "Life Long Learning" and Opportunity-driven entrepreneurship" has significant educational relevance.

***'Lifelong learning (percentage of population aged 25 to 64 participating in education and training)'*** captures the share of the adult population involved in training activities and measures the upgrading of skills during working life. Lifelong learning encompasses all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence. Lifelong learning makes workers involved in innovative activities more knowledgeable and efficient. The 25-64 years age group refers to the majority of the labour force outside initial formal education. The indicator was also included in earlier versions of the EIS, but was removed from the 2010 report onwards.

***'Opportunity-driven entrepreneurship'*** is measured by the motivational Index from the Global Entrepreneurship Monitor (GEM) and captures the prevalence of opportunity-driven entrepreneurship. Improvement driven opportunity entrepreneurship is the result of individuals wanting to exploit new innovative products. This type of entrepreneurship is relevant for measuring the performance of innovation systems.

Among revised indicators, the share of ***'Population having completed tertiary education'*** and ***'Foreign doctorate students'*** are relevant. The first has been revised by increasing the age group from 30-34 to 25-34. Broadening the age group will reduce the confidence interval and improve the statistical significance of changes, while still capturing a relatively narrow age group, thereby allowing the indicator to respond faster to policy changes. The second has been revised by not only capturing students with a citizenship of non-EU Member States as in the EIS 2016, but including all students with a citizenship of any foreign country (thus also including other EU Member States). The revision follows the fact that there should be no difference in the value of foreign students to a country's education system based on their country of origin.

Although, performance of the EU innovation system has improved by 2.0 percentage points between 2010 and 2016. However, not all elements of the EU innovation system have been improving at the same rate. Performance has improved most (21.0 percentage points) in Human resources, with increasing performance in ‘Doctorate graduates’ and ‘Tertiary education’<sup>15</sup>. Performance in Innovation-friendly environment has improved due to a strong improvement in ‘Broadband penetration’. Performance for all three indicators captured in Firm investments has improved, leading to a 13.6 percentage point performance increase. A 54.2 percentage point increase in International scientific co-publications has been the main driver of the performance increase for Attractive research systems.

For Sales impact, performance has improved by almost 3 percentage points, with increasing performance for all three indicators. Performance in Intellectual assets and Employment impact has almost not changed. For Employment impact, the increase in ‘Employment in knowledge intensive activities has been offset by a decline in ‘Employment of fast-growing enterprises in innovative sectors’. For Intellectual assets, performance has increased for ‘Trademark applications’ but remained stable or declined for the other two indicators. Performance has declined for three dimensions. For Finance and support, performance in both ‘Public R&D expenditures’ and ‘Venture capital investments’ has declined. For Innovators, performance has declined for all three indicators. For Linkages, performance has declined for ‘Public - private co-publications’ and remained almost the same for the other two indicators.

The overall picture for ESEE region however not as good, because if we analyse innovation performance for each performance group normalised to average scores for each performance group equal the unweighted average of the relative-to-EU scores of the Member States within that group, moderate and modest innovators - the countries of ESEE region except Slovenia show significant decrease in every performance groups.



In the following, we are listing the performance indicators relevant to education and possible to make positive changes through education activity with the emphasis of innovation and entrepreneurship / intrapreneurship in the raw material sector. ***The real importance is activities improving these indicators even in partially and sector relevant, will have real impact to ESEE region and eventually increase the innovativeness of these countries.***

For detailed explanation of the indicator, please refer to the original methodology report.<sup>39</sup>

<b>Indicator</b>	<b>1. - New doctorate graduates per 1000 population aged 25-34</b>
Description	The indicator is a measure of the supply of new second-stage tertiary graduates in all fields of training (ISCED 8). For most countries, ISCED 8 captures PhD graduates
Relevance	Increased number of doctorate graduates, especially in labelled programs for the raw material sector effects this indicator

<b>Indicator</b>	<b>2. - Percentage population aged 25-34 having completed tertiary education</b>
Description	This is a general indicator of the supply of advanced skills. It is not limited to science and technical fields, because the adoption of innovations in many areas, in particular in the service sectors, depends on a wide range of skills. The indicator focuses on a relatively young age cohort of the population, aged 25 to 34, and will therefore easily and quickly reflect changes in educational policies leading to more tertiary graduates.
Relevance	Increased number of master graduates, especially in labelled programs for the raw material sector effects this indicator

<b>Indicator</b>	<b>3. - Percentage population aged 25-64 participating in lifelong learning</b>
Description	Lifelong learning encompasses all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence. The intention or aim to learn is the critical point that distinguishes these activities from non-learning activities, such as cultural or sporting activities.
Relevance	Lifelong learning is a domain of learning and education activity that able to equip active professionals with the right set of skills and knowledge in order to better perform within the challenges of the raw material sector or/and enhance their innovation and entrepreneur mindset. EIT RawMaterials with the right programs are able to enhance this indicator

<b>Indicator</b>	<b>4. - International scientific co-publications per million population</b>
Description	International scientific co-publications are a proxy for the quality of scientific research as collaboration increases scientific productivity.
Relevance	This indicator is a clear measure of cooperation and also relevant for HEIs as being University ranking benchmark as well. Foster the right sectorial and territorial cooperation, EIT RawMaterials can enhance this indicator

<b>Indicator</b>	<b>5. - Scientific publications among the top-10% most cited publications worldwide as percentage of total scientific publications of the country</b>
Description	The indicator is a measure for the efficiency of the research system, as highly cited publications are assumed to be of higher quality. There could be a bias towards small or English-speaking countries given the coverage of Scopus' publication data.
Relevance	This indicator is a clear measure of good quality research and also relevant for HEIs as being University ranking benchmark as well. Good quality research is sometimes the matter of available infrastructure, but in the other hand it is sometimes only the matter of matching the right (industrial) partner and research topic, or just a question of training, how to write good quality research papers. EIT RawMaterials can help with these.

<b>Indicator</b>	<b>6. - Foreign doctorate students as a percentage of all doctorate students</b>
Description	The share of foreign doctorate students reflects the mobility of students as an effective way of diffusing knowledge. Attracting high-skilled foreign doctorate students will secure a continuous supply of researchers.
Relevance	Student and Teacher, as well as researcher mobility is a good way to exchange ideas and good practices, therefore fostering mobility programs within EIT RawMaterials partners are a way to improve this indicator.

<sup>39</sup> European Innovation Scoreboard 2017, Methodology Report Maastricht Economic and Social Research Institute on Innovation and Technology – MERIT

Indicator	<b>7. - Opportunity-driven entrepreneurship (Motivational index)</b>
Description	Data from GEM distinguish between two types of entrepreneurship: 1) opportunity-driven entrepreneurship and 2) necessity-driven entrepreneurship. The first includes persons involved in TEA (Total Early-Stage Entrepreneurial Activity) who (i) claim to be driven by opportunity as opposed to finding no other option for work; and (ii) who indicate the main driver for being involved in this opportunity is being independent or increasing their income, rather than just maintaining their income; the second includes persons involved in TEA who are involved in entrepreneurship because they had no other option for work. GEM has constructed the Motivational index to measure the relative degree of improvement-driven entrepreneurship.
Relevance	This indicator is relevant in EIT RawMaterials education as opportunity driven entrepreneurship is more probable outcome of educating peoples with the entrepreneur mindset and required skills. Therefore, labelled programs, short courses, relevant winter and summers schools consequently drivers of this indicator. Also, programs of TEA, beside formal education is not existing in the field of education of EIT RawMaterials

Indicator	<b>8. - Enterprises providing training to develop or upgrade ICT skills of their personnel</b>
Description	ICT skills are particularly important for innovation in an increasingly digital economy. The share of enterprises providing training in that respect is a proxy for the overall skills development of employees.
Relevance	Training is part of the learning and education action line under the EIT RawMaterials Academy. IN line with the Education Consolidation Action plan, “Digitalization’ and ‘Industry 4.0” will be major focus of overall education activity of the EIT RawMaterials Academy, because the intrusion of advanced ICT are already happening in al thematic fields of EIT RawMaterials. ICT has a relevance for the promotion of innovative teaching methods and train the trainer approach for HEI education staff.

Indicator	<b>9. - SMEs innovating in-house (percentage of SMEs)</b>
Description	This indicator measures the degree to which SMEs, that have introduced any new or significantly improved products or production processes, have innovated in-house. The indicator is limited to SMEs, because almost all large firms innovate and because countries with an industrial structure weighted towards larger firms tend to do better.
Relevance	There would be many reasons, SME’s are not innovating in-house. One of the reason is lack of knowledge or skills for a particular field of which can be remediated by education.

Indicator	<b>10. - Public-private co-publications per million population</b>
Description	This indicator captures public-private research linkages and active collaboration activities between business sector researchers and public-sector researchers resulting in academic publications.
Relevance	This indicator is a clear measure of innovation driven research and also relevant for HEIs as being University ranking benchmark as well. Good quality research is sometimes the matter of available infrastructure, but in the other hand it is sometimes only the matter of matching the right (industrial) partner and research topic, or just a question of training, how to write good quality research papers or to gain the necessary knowledge and skills. EIT RawMaterials can help with these.

Indicator	<b>11. - PCT patent applications per billion GDP (in PPS)</b>
Description	The capacity of firms to develop new products will determine their competitive advantage. One indicator of the rate of new product innovation is the number of patents. This indicator measures the number of PCT patent applications.
Relevance	There would be many reasons of low number of patent. One of the reason is lack of knowledge on IP rights, and how to put patent application in place, or the right skills and knowledge to assess research outputs worth for patenting or not. These reasons can be remediated by education.

Indicator	<b>12. - Employment in fast-growing enterprises (percentage of total employment)</b>
Description	This indicator provides an indication of the dynamism of fast-growing firms in innovative sectors as compared to all fast-growing business activities. It captures the capacity of a country to rapidly transform its economy to respond to new needs and to take advantage of emerging demand.
Relevance	Educated people with the right skills and knowledge elevate the probability they willing and finding good jobs in the region, in the sector within the most innovative industries. According to the methodology report, most innovative industries including raw material sectorial relevant industries as: Mining support service activities; Manufacture of chemicals and chemical products; Remediation activities and other waste management services; Scientific research and development and Other professional, scientific and technical activities

Above listed innovation performance indicators are showcased on ESEE country basis in the table below.

	Bulgaria		Croatia		Czech Republic		Greece		Hungary		Poland		Romania		Slovakia		Slovenia	
	A*	B**	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1.	98.4	67.6	106	44.1	114	21.3	71.2	25.0	58.5	4.6	32.9	-13.2	96.4	-3.6	158	11.4	234	134
2.	96.7	34.9	98.0	47.4	95.4	65.8	151	68.4	80.9	28.3	167	42.1	44.1	27.0	101	61.8	164	77.0
3.	10.5	6.3	18.9	0.0	80.0	-12.6	29.5	7.4	53.7	-8.4	26.3	-6.3	0.0	-2.1	17.9	-12.6	110	-50.5
4.	54.4	15.3	145	59.2	221	89.0	187	66.7	138	49.7	79.8	35.3	47.6	24.2	125	38.9	372	142
5.	27.5	-1.7	3.5	13.0	62.6	6.9	84.2	3.1	53.1	-10.5	39.2	12.6	40.1	9.0	44.5	-2.2	80.8	14.1
6.	21.1	-2.5	12.7	2.6	62.3	19.5	N/A	N/A	29.8	0.5	7.4	-2.0	9.0	-3.4	38.2	8.1	35.6	-0.1
7.	34.9	4.5	34.7	-18.1	82.3	14.1	41.7	-10.2	65.2	1.3	56.5	35.0	51.2	9.7	49.5	5.9	69.5	-64.6
8.	21.4	-42.9	121	-42.9	121	0.0	71.4	0.0	78.6	14.3	50.0	14.3	0.0	0.0	107	-35.7	157	0.0
9.	13.0	-27.0	58.4	-20.4	89.7	-7.3	105	-9.4	15.5	-3.9	0.0	-24.8	0.0	-38.0	25.6	-4.7	81.0	1.3
10.	6.6	-17.6	31.3	-47.4	46.5	-34.0	39.3	-14.6	76.5	-0.4	22.7	3.5	15.0	-24.3	45.7	-15.6	106	-38.7
11.	41.8	12.6	41.1	-1.3	53.9	2.9	38.3	5.3	59.6	-0.9	39.6	8.3	26.7	5.6	34.8	4.4	89.9	-0.2
12.	126	-0.2	51.1	31.3	98.6	-39.9	N/A	N/A	158	2.5	112	-16.7	50.0	16.4	34.6	-1.1	53.6	2.3

\* A – Performance relative to EU in 2016; \*\* B – Change 2010 - 2016

The performance indicators need to analyse in country and sector specifically. Impacting the selected indicators are possible with actions, where output generates the following KPI's.

Code	KPI name	Definition
EIT01.01	Attractiveness of Education Programmes	Number of eligible applicants for EIT labelled PhD programs
EIT01.02	Attractiveness of Education Programmes	Number of eligible applicants for EIT labelled Master programs
EIT02.01	Number of new graduates	Number of new graduates from EIT labelled PhD programs
EIT02.02	Number of new graduates	Number of new graduates from EIT labelled Masters programs
EIT03	Number of business ideas incubated	Number of formalized commitments established between the KIC and an entrepreneur
EIT05.01	Knowledge Transfer/Adoption	Number of knowledge adoptions (by KIC partners) that are direct output of a KIC Activity
EIT05.02	Knowledge Transfer/Adoption	Number of knowledge transfers (from one KIC partner to another KIC partner or to third parties) that are direct output
EITN01	#new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs	#new graduates from EIT labelled Masters programs + #new graduates from EIT labelled PhD programs

Code	KPI name	Definition
EITN02	#start-ups created by Graduates from EIT labelled MSc and PhD programme	#start-ups created by Graduates from EIT labelled MSc and PhD programme
EITN07	#success stories submitted to and accepted by EIT	#success stories submitted to and accepted by EIT
EITN08	#external participants in EIT RIS programmes	#external participants in EIT RIS programmes
IMP01.03	Investment decisions for new production units	Number of new demos and protos that led to an investment decision for a new production unit.
IMP02.02	New KET-related breakthrough innovation accepted/in progress	Number of fundamentally new innovations that are explicitly related to the Key Enabling Technologies KETs (cf. EU list).
IMP02.03	New RIS-related cooperative innovations accepted / in progress	Number of innovations done in cooperation with regional actors from regions not directly benefitting from the KIC.
IMP04.02	Creation of entre- and intrapreneurship-minded people	Aggregate number of participants in entre- and intrapreneurship related KIC Activities.
IMP04.03	Application for master programmes from outside EU	Number of internationally recruited students and teachers.
IMP04.04	Women graduating from RM-related courses	Relative number of women graduation from courses that are related to raw materials.
KPI01.05	Participants awareness events	Number of participants in Wider Society Learning events.
KPI02.02	Successful matches generated	Number of successful matches generated through matchmaking events.
KPI02.04	SME partners	Number of SMEs participating in projects.
KPI02.06	Associate partners	Number of current Associate partners within EIT Raw Materials.
KPI03.02	Academic Quality Labels	Number of EIT labelled education programs.
KPI03.04	Cross-CLC use of infrastructure	Number of infrastructure within the Network of Infrastructure KIC Activity that is used cross-CLC.
KPI03.05	Projects between CLCs	Number of projects that are cross-CLC.
KPI03.06	Projects with other KICs	Number of projects inside KIC Activities that have been jointly accomplished with at least one other KIC
KPI04.02	Matches	Number of participants in Matches events.
KPI04.04	Intrapreneurship Facilitator	Number of Intrapreneurship Facilitator events held.
KPI05.02	Network of Infrastructure	Number of users of Network of Infrastructure.
KPI06.01	PhD Education	Number of PhD graduates generated.
KPI06.02	Master Education	Number of MSc graduates generated.
KPI06.03	Lifelong Education	Number of professionals educated.
KPI06.04	Wider Society Learning	Number of participants in Wider Society Learning events.
KPI07.01	Entrepreneurship Support Services	Number of entrepreneurs assisted.

## 4. EIT interim evaluation, lessons to learn

The EIT was set up with two distinct goals. First, its aim is to be the leading European performer of innovation targeted to address specified societal challenges. Second, the EIT, uniquely within Europe's innovation efforts, has the goal to create innovation based on the close integration of education, business and research, harvesting the full potential of its universities and research institutions to drive innovation responding to the 2016 open public consultations for the Start-up and Scale-up Initiative and the EIT evaluation, who argued that Europe's innovation performance depends strongly on fostering a culture of innovation at its higher education institutions – including strengthening the link between higher education and business. ***The EIT's future activities can thus remain focused on goal-driven innovation to address societal challenges, and on its strategy to integrate education, business and research.***

A number of definitions of innovation have been put forward, with perhaps the most widely adopted being the 2005 OECD/European Communities Oslo Manual definition: ***“An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.”*** This is the definition also used by the European Court of Auditors in its 2016 performance audit on the EIT.

In contrast to this situation at the EU level, the members of the high-level group of EIT chaired by Commissioner Tibor Navracsics have found that ***the EIT and the KICs have a relatively weak presence in the national and regional innovation ecosystems.*** The KICs' activities – with notable exceptions, such as some KICs' efforts within the Regional Innovation Scheme – need to have much stronger links with national and regional innovation efforts. At the national level, the EIT and the KICs should create stronger relations with national innovation priorities, sectors and programmes, both in member states where they are strongly present such as the Netherlands or Sweden and, in those countries, where the EIT presence is still limited, such as the ESEE region. At the regional level in particular the KICs should make use of the 'proximity effect' of the Co-Location Centres (CLCs) and seek stronger integration with regional innovation schemes, particularly the Smart Specialisation Strategies. Therefore, the high-level group recommends ***at the national levels the EIT should seek stronger relationships with national innovation priorities.*** In particular the KICs should explore relationships with national innovation priorities, also in EU member states that so far do not, or only to a limited extent, participate in EIT-activities. ***At the regional level the EIT should strive for further integration in the regional innovation schemes.*** In particular the 'proximity effect' of the Co-Location Centres (CLCs) should be used to create stronger involvement in the various regional 'Smart Specialisation Strategies' and in nearby initiatives under the EIT's Regional Innovation Scheme. Consequently, ***the KICs need to sharpen their unique selling points*** for the future as the grant declines. In particular, they should promote and exploit more fully their Co-Location Centres that are a unique EIT asset and respond well to an identified core European challenge to spread innovation capacity in less-innovation intensive regions. In order to engage the different actors of innovation value chain there is a need for developing specific and targeted value propositions which clearly address the benefits for different types of business partners in KICs (e.g. in terms of access to new start-ups and newly developed solutions; experimenting with new products and business models; finding channels and partners for monetising R&D investments; accessing and recruiting new talents, etc.). For large companies and SMEs, clearly different value propositions will have to be developed.

The EIT high level group has discussed Education offers under the umbrella of EIT. Through its KICs, the EIT supports a variety of education activities, aiming at training the next generation of innovators and entrepreneurs. The offer, with the EIT Label as its flagship aims to be a guarantee of quality for innovative programmes bridging universities and industry. But, ***these new programmes should go beyond what is being normally offered by the university partners in a KIC, usually research universities, in particular in terms of mobility, industry exposure, networking opportunities and, more broadly, learning experience.***

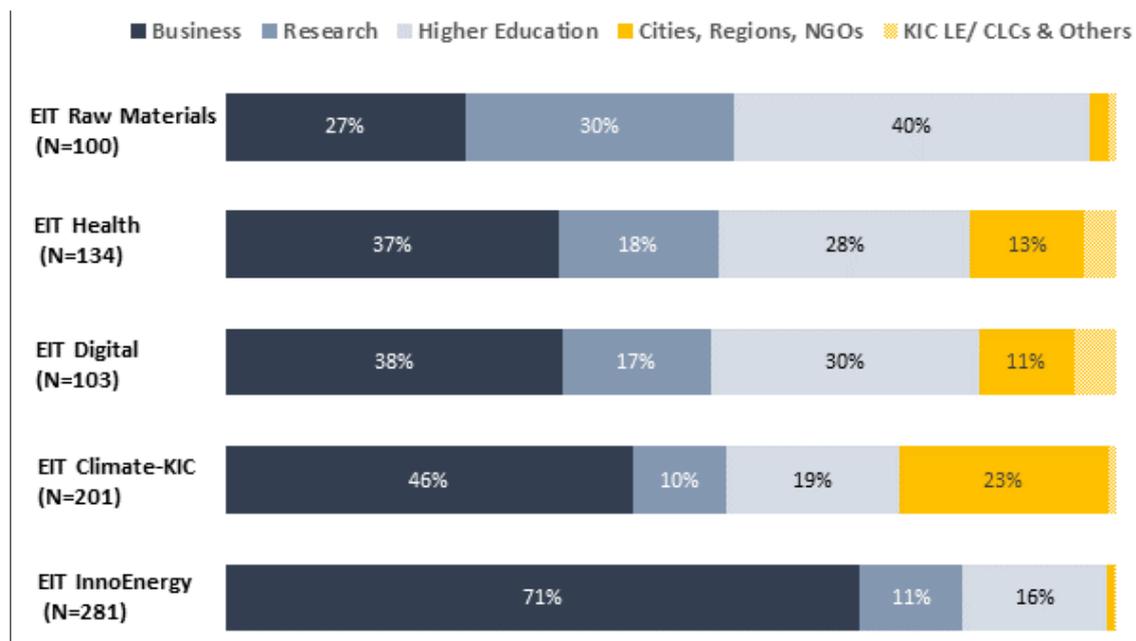
The EIT mandate was to develop 'flagship' education as a model for excellence throughout European higher education, i.e. reach out and influence higher education beyond those individuals, faculties and institutions directly involved. The EIT Label still lacks visibility and credibility and remains largely unknown to students and other stakeholders, and the main beneficiaries of the EIT/KICs education activities form a narrow circle of higher education institutions directly linked to the KICs. Visibility within a higher education institution is crucial to foster

interdisciplinary, which is at the core of the innovation process. *EIT's mission to modernise the education landscape is important and should be reflected in every education project developed by the KICs.* Therefore, the EIT should *encourage the KICs to explore and develop innovative degree* programmes (such as industrial and professional doctorates) *and innovative ways of teaching and learning* (such as the use of MOOCs and POOCs, train the trainers schemes, or more learning by doing focused on creating real new ventures).

The high-level group further recommends:

- The EIT should support the *development of new products with a strong in-built business presence in the education experience*, along the lines of industrial doctorates (e.g. MSCA EID, French Cifre, Danish Industrial PhDs, etc.), taking into account the question of scalability of the model. This would also *encourage a stronger and more active involvement of business partners in the KICs' activities, notably in supporting accelerators and other similar supports to the entrepreneurial learning of students*, such as start-up factories.
- The EIT should *focus on innovative ways of teaching and learning*, particularly with respect to the creation of innovations. This should include innovations in the delivery mechanisms, in particular through online learning. The EIT *should showcase these approaches to the wider higher education communities worldwide*, as well as within less innovative parts of Europe as part of Regional Innovation Scheme.

Based on the EIT interim evaluation, the KICs have been successful in involving all three actors of the knowledge triangle in their partnerships. All KICs and particularly EIT Climate-KIC and EIT Health have gone beyond the 'classical' actors of the knowledge triangle to also involve other actors such as public authorities representing cities and regions (EIT Climate-KIC) and civil society organisations (EIT Health). Looking at the overall partnership mix of each KIC, it can be observed that exceptionally, Higher Education Institutes are the dominant partner category within EIT Raw Materials. This is more radically true if we analyse of the territory of ECLC or ESEE region.



Within the same report, *there are many good practices and cases are mentioned in positive context, delivered by first wave of KIC's.* There are many examples of how the curriculum is being shaped by research and innovation. For example, EIT Digital is using the latest technologies and innovations as case studies in courses. EIT Health Spark courses, Innovation Days and Business Transition Fellowships aim to develop and deliver a portfolio of 'spark' activities to introduce innovation and entrepreneurship within already established academic offerings. More generally, the recently completed review of the KICs' education activities notes that all EIT labelled programmes are delivered through research-led university partners which means that teachers are often actively involved in the latest research in their disciplines and as a result, disciplinary teaching draws on the latest research.

While academic partners tend to lead the design of education programmes, industry experts are more active in supporting delivery, including through guest talks, case studies, challenges, guiding internships and supervision of

theses. There are however, examples of industry partners also being involved in the design of education programmes. For example, in several EIT Digital nodes, industry partners are being engaged in improving curriculum and in co-funding education activities. EIT Digital has developed a new Industrial Ph.D. programme which will be delivered in cooperation with the partner universities and companies – as illustrated below. The available grants and thesis topic will be aligned with the EIT Digital innovation action lines.

In EIT InnoEnergy, the industry is significantly involved in co-designing the syllabus for the Masters programme, setting the skills that the applicants should have, promoting the offering together, and setting the thesis topics. EIT InnoEnergy has developed challenge-based learning subject-specific modules, where academic educators teach alongside industry representatives around a real-world case study, thus encouraging students to apply their subject-specific domain knowledge to practical problems. There is however, still scope for improvement. For example, the 2015 business plan assessment of EIT InnoEnergy recommends that the participation of industry in education should be further increased in the KIC's Masters and Executive programs. It also flags timing issues (duration of the innovation projects vs. program duration), as well as content issues (low TRL for PhD, higher TRL for innovation projects and business creation) with the KIC's PhD programmes as barriers to greater industry involvement in the Doctoral programmes.

There are good examples how to ***facilitating access to accelerator programmes to help students launch their ideas.*** There are several examples of graduates from EIT Climate-KIC education courses that have progressed with their ideas to other stages of EIT Climate-KIC. For example, winners from the Climathon are directed to the Greenhouse or the Accelerator. The Journey provides the opportunity for students to develop their business and entrepreneurial skills, meet a range of industry contacts and extend their peer networks across Europe. It further facilitates students in developing their business ideas into market ready concepts which can then be supported by the KIC Accelerator. Berlin based start-up, Coolar, featured under Forbes, was first ideated under the EIT label education programme (2012) and subsequently, went through the Journey (2012), Greenhouse (2014), and Accelerator (2015, 2016).

A similar concept (the Sidewalk) was launched by some KICs in their Master's programme. This initiative supports students in developing ideas they have initiated during their studies into fundable propositions, although there is no guarantee that these will be taken up by the KIC Accelerator. Following initial successes, the Sidewalk is now expected to be scaled-up in the coming years. EIT Health has developed innovation fellowships and Innovation Days which support students' idea generation and application of scientific knowledge to industry challenges. The "Incubate Package", developed under the Accelerator Programme is run as a joint activity between Accelerator and Campus, with coordinators from both pillars organising the Bootcamp and Local Training Networks.

Apart from the specific examples mentioned above, the available evidence suggests that facilitation of student involvement in business creation and innovation projects is in the main limited to occasional short-term internship, guest visits and business case education opportunities. Although students are encouraged to take part in other KIC related activities, a relatively small share of the respondents (at most 35 per cent) to the graduate survey actually reported participating in at least one other KIC activity (e.g. innovation project, accelerator etc.).

The KIC's education programmes are an important, if somewhat under-exploited, source of talent and ideas for their entrepreneurship and innovation activities. EIT InnoEnergy appears to have made the most progress in facilitating the flow of talent from its education programmes to other activities. Between 2011 and 2016:

- 223 students participated in start-up ventures supported by EIT InnoEnergy;
- 12 start-ups were co-led by KIC graduates; and
- 143 students participated in innovation projects.

According to the education review, businesses benefit from access to motivated and enthusiastic students through the network and their involvement in programmes had an impact on industry, including potential to adopt ideas from master's theses into industry and access to graduates from the programmes to support talent scouting and new business creation. It was noted that while students may not all end up creating their own businesses, they were becoming highly employable into the associated industries and sectors. In the example of EIT Raw Materials, the integration of the knowledge triangle helps build trust and address the fragmentation of

the raw materials supply chain and the lack of cross-country cooperation in the sector (especially regarding the link between education and the private sector). For example, university curricula are being reviewed with inputs from the research and business communities to incorporate the latest techniques and technologies, and new innovative approaches and delivery methods for education are being proposed in a topic that has usually been seen as a traditional area of study (especially for the first stages of the materials cycle). This will help contribute to generating technical and managerial profiles that can have a higher-level view of the whole sector and are better equipped to incorporate the notions of circular economy and materials substitution. The expectation is that this more sophisticated way of thinking about the sector and its supply chain can contribute to tackling the issues affecting the sector and its future development, it can in turn help address the negative press that the sector often has, which is impacting supply and demand for adequately skilled graduates.

As described above, the EIT / KICs are advancing KTI through several channels and these efforts are starting to bear fruit in the form of:

- Increased opportunities for networking, collaborating and idea sharing between university, research institutions, industry and public stakeholders;
- Improved employability and entrepreneurialism among students via greater exposure to industry in the EIT education courses;
- Greater interaction between industry and universities. The EIT education review notes that KIC activity had created a catalyst for universities and industry to work more closely together around education provision and that this was beginning to have a positive impact on all partners to take advantage of the new opportunities this created.

Yet the education review also notes that these *positive opportunities and impacts were limited to the partners themselves and there was little evidence to suggest that these benefits were spreading to universities or businesses outside of the KIC partnerships* (a comment also echoed by the HLG in its report, see above) except where specific effort was being put by KICs to reach out beyond partners. Some isolated examples can be found:

- EIT Health's Innovation Fairs provide a meeting point in cities for public, private and education stakeholders along with citizens to raise awareness of key health issues.
- EIT Climate-KICs Climathon programme focuses on city-based challenges and brings together public, private and education stakeholders (beyond partners) to support an open call for teams to work on a city-led challenge over a 24-hour period.

There is some evidence that the KIC process is leading to changes in the practices of HEIs that are involved in the KICs. As more HEIs become involved in KIC level activities so the effects ripple out further. However, as previously noted there is very limited evidence of the EIT achieving wider changes in HEI practices, beyond those involved in the KICs. One reason for this is that the focus of the activities of the EIT and its KICs has not been fully directed towards such ambitions. A second is the highly conservative nature of the European HE sector. Across the EU a myriad of institutional settings governs the operation of HEIs and effectively constrain the rapid development of new practices. The sclerotic nature of the HE system within the EU is widely acknowledged and so the more limited ability of the EIT to promote wider changes in HE practices is not unexpected.

If it is desired that the EIT should deliver systemic change in this area it will need to engage more strongly with the policy community in this field. There is a growing pool of talent and experience within the EIT on this topic, but a more concerted effort may be required to mobilise this in the future.

## 5. Conclusion

A background analysis of raw material sector, sector related education, its effect on the innovativeness of the ESEE region and portfolio analysis of currently running education projects were carried out. The mapping was required because for the preparation phase of the ESEE Education Concept Note, partners are indicated, that there is a knowledge gap on current situation on ESEE region, because the lack of extensive, mainly industrial partnership within EIT RawMaterial from the region, not(yet) established information feedback and distribution mechanisms. Therefore, during the ECLC partner meeting was held in Berlin 23-24 April, 2018 partners are indicated as number 1 priority to carry out a background analysis on ESEE region.

The background analysis has been carried out based on desktop research and surveying partners and results the following key founding's:

- The inventory of **raw material related education in the ESEE region showed that master and PhD level** programs are **widely available** in ESEE partner universities and also in non-partner universities from non-EU countries throughout the entire raw material value chain;
- Raw Material related education programs are suffering **low student application and enrolment** in the region;
- **The majority of European adult training programs (LLL)** just as in ESEE region **is non-formal education and training**, in other words, outside of formal institutions of schools, colleges and universities. The **share of non-formal instruction that was job-related** but that **was** not sponsored by employers fell as **a function of age**. This suggests that **younger persons (25–34) were the most likely to undertake job-related non-formal instruction without employer sponsorship**, while older persons (55–64) were the least likely (perhaps due to a shorter time horizon to benefit from any job-related education and training).
- A similar analysis by educational attainment level displays **a relatively high proportion (71.5 %) of the non-formal instruction undertaken by those with a tertiary level of education was job-related and sponsored by employers**
- The **rate of graduated in tertiary education for people** aged 15-24 is particularly high at **more than 20% in many southern and eastern less industrialised regions**, that create the **opportunity applying fast track courses** re-educate people with different engineering knowledge according the industrial needs.
- **SEE students tend to move much more than the EU average** in mobility programs, **however they mostly move within their own region** – most flows connect countries that are already very close in terms of language and culture. Exchanges often take place according to the state of the relationships in the area, with bilateral agreements making funds and places available for neighbouring foreigners.
- Many of the **ESEE** (most of them) **Universities are non-represented at global rankings of universities** and this fact often translated by many as the overall quality of research and education outcome is generally low, and these universities and their graduates are not recognized in the labour market. The traits that are directly related to how these HEIs are present or absent in the global rankings are: i) **the place of research within higher education**; ii) the inherited model of specialized HEIs; iii) the existence of a large number of small and specialized HEIs; **the persistent underfunding of higher education; and the brain drain of academic staff and scientists.**
- In most of the **ESEE Universities Researcher/ Lecturer** career is directly from Master – PhD, often from the same University with **a strong lack of Industrial experience and relevant skills and attitude.**
- A **considerable proportion of HEIs from ESEE** prove to be uncompetitive; but even **by definition**, they **cannot figure in the global rankings** as they do not meet, for instance, the criterion of the Times Higher Education World University Rankings to include at least two large academic fields and to publish at least 200 indexed articles per year **because of the size and capacity of the University**. This fact however **does not automatically mean low quality of research or education** but lacking critical mass.
- The presence (or absence) of most HEIs from ESEE in the global rankings is also influenced by the chronic underfunding of higher education and ‘brain drain’ of researchers and academic staff which is a back-kicking effect because **global rankings may contribute ‘to the brain drain and to a further marginalization of the Eastern and South-Eastern European academic space.**
- Missing capacity to carry out education both in English and national languages in all fields of education programs

- There is a large diversity between mineral sector in internal policy making for the mineral resource sector. **Some countries have well-developed and many-fold policy framework** related to the sector, other countries have strategies which connect to the resources sector only by its relation to sustainable development or environmental issues.
- In the EU, **at least 30 million jobs depend on the availability of raw materials**. Also, **Key Enabling Technologies seems to play an important role in EU future economy** of which partially using specially processed raw materials or specially manufactured mineral commodities. Raw material supply for these commodities are available in ESEE countries.
- **Outsourcing and offshoring is already a large and fast-growing industry** in Poland, and there are opportunities to further build up centres in Romania, Bulgaria, and other CEE locations. To capture more high-value-added O&O work will require targeted investments in education and development, as well as engaging in international marketing efforts and sharing best practices in the industry. **This is relevant, because among fast growing industries** measured by the Innovation Scoreboard **there are several raw materials related as: mining support service activities; Manufacture of chemicals and chemical products; Remediation activities and other waste management services; Scientific research and development and Other professional, scientific and technical activities**
- **Recent European internal migrant flows had a major impact on the countries of ESEE region**. Regions with low levels of R&D spending as well as a narrow innovation profile, including imitative innovation areas, do not benefit from the mobility of skilled workers, because their elasticity for knowledge is not significant. In other words, **strengthening innovation capacity of a region or country can automatically counteract brain drain**.
- **Toward the raw material sector, public acceptance is a particular challenge**, both for existing mines and for the development of new mining activities. In comparison with other sectors, mining and oil & gas companies are perceived as making the least efforts to behave responsibly towards society. **Although the highest acceptance rate was measured in Poland, in general this rate is way below 40% in ESEE countries**.
- All **stakeholders** are still facing barriers to University Business Cooperation (UBC), however **once** either an academic (as an individual) or business (as an organisation) **cooperates in one activity, they are more likely to cooperate in others**.
- In order **to initiate UBC barriers need to break down** – that is a pre-requisite, but with only **with also drivers in place** – for both organization and individual level – possible to initiate successful UBC.
- Whilst most **HEIs include UBC in their mission and vision, this strategic commitment is often not reinforced by dedicated resources** (e.g. a responsible high-level person, budget, personnel or facilities). HEIs need to make a greater and longer-term commitment to UBC. Incentives for academics are the least developed UBC mechanisms, so this provides an immediate area of focus for policymakers.
- **Most businesses cooperating with HEIs in R&D also cooperate with other businesses** or have their own R&D capability.
- For successfully **become and entrepreneurial university, a HEI need to strategically address the eight dimensions** (Leadership and governance; Organisational capacity; Entrepreneurial teaching and learning; Preparing and supporting entrepreneurs entails teaching strategies and learning environments; Digital transformation and capability cut across all aspects of modern higher education institutions; Knowledge exchange and collaboration; The internationalised institution; Measuring impact) **of being innovative** and building the capacity to implement them.

Analysing the innovation scoreboard, the following outcomes have to mention:

Among Innovation performance Indicators, 12 were selected and analysed as indicators of innovativeness potentially possible to enhance by one form of education activity. These indicators are:

1. New doctorate graduates per 1000 population aged 25-34
2. Percentage population aged 25-34 having completed tertiary education
3. Percentage population aged 25-64 participating in lifelong learning
4. International scientific co-publications per million population
5. Scientific publications among the top-10% most cited publications worldwide as percentage of total scientific publications of the country
6. Foreign doctorate students as a percentage of all doctorate students

7. Opportunity-driven entrepreneurship (Motivational index)
  8. Enterprises providing training to develop or upgrade ICT skills of their personnel
  9. SMEs innovating in-house (percentage of SMEs)
  10. Public-private co-publications per million population
  11. PCT patent applications per billion GDP (in PPS)
  12. Employment in fast-growing enterprises (percentage of total employment)
- ***There were increasing number of new doctorate graduates between 2010 – 2016 in almost all country analysed*** except Poland and Romania. Croatia, Czech Republic, Slovakia and Slovenia are above EU average, others are below with Poland in the back with 32.9% of EU average.
  - Population aged 25-34 having ***completed tertiary education shows similar increasing tendency*** with the lowest value of 44.1% in Romania.
  - ***Lifelong learning*** (percentage of population aged 25 to 64 participating in education and training)' captures the share of the adult population involved in training activities and measures the upgrading of skills during working life. Lifelong learning encompasses all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence. ***Lifelong learning makes workers involved in innovative activities more knowledgeable and efficient.*** Most country has shown decreasing value except Greece with the lowest values in Romania and Bulgaria. Highest value is in Slovenia relative to the EU average (110) however the value is decreased more than 50% between 2010 – 2016.
  - ***International publication*** is indication of quality research also relevant for being indexed in global university ranking systems. All measured country increased its rate relative to the EU average, some countries are show very high values (Slovenia 372%, Czech Republic 221%). ***Most country however perform worse in regard of publication among the top-10% most cited publications worldwide.***
  - ***Opportunity-driven entrepreneurship*** is measured by the motivational Index from the Global Entrepreneurship Monitor (GEM) and captures the prevalence of opportunity-driven entrepreneurship. ***Improvement driven opportunity entrepreneurship is the result of individuals wanting to exploit new innovative products.*** This indicator ***is very low in most of the countries (7.4 – 62%) and mostly decreasing or increasing at a low rate.***
  - ***SME's are poorly innovating in-house***, except Greece (105% of EU average), however most country ***shows decreasing intensity of between 4-40%***, except Slovenia with a slow increasing (1.3%) tendency.
  - Employment in fast-growing enterprises (percentage of total employment) has various cases, best performance is presented by Hungary (158% with 2.5% growth).
  - Public-private co-publications per million population is very low in almost all analysed country (except Slovenia). This could be the result of innovation, because patented results of cooperation are not published in general. However, PCT patent applications per billion GDP (in PPS) values are also very low ***which means a very low cooperation between public and private organizations, research and industry.***

***A set of EIT Core and EIT RawMaterial related KPI's*** have been identified as target provided being able to positively effect overall innovativeness, therefore creating actions generating such KPI's ***in the ESEE region in significant number has real impact on the innovativeness of the ESEE region.***

Analysing our current ECLC education portfolio based on the last 2 years of activity in the ESEE region, the following points have been identified which require improvement or development.

- ***Very low level of activity of some partner institutions and/or weak collaboration between some of them*** – there is a need to establish much closer ties with faculty and students of these universities, better understand their strengths and needs, identify motivated proactive individuals that could play a 'pivotal' role in developing new educational programs, and via closer contact (physical visits, online liaising) establish a regular dialogue with those people, with clear goals and deliverables. There is also a need to develop a better awareness of the many facets of EIT RM and wide range of benefits that partner activation can unlock, so that the organization is not principally perceived as yet another agency 'providing grants and funding';
- ***Low student enrolment in some of the state-of-the-art graduate courses*** organized under the EIT RM umbrella it is an important matter to understand exactly what is going on and remediate the problem;

- **Risk of low impact of some educational courses and related initiatives** (i.e., disproportionately low impact value for the money involved; insufficient outreach/attendance; low relevance of some initiatives; lack of balance between the 'quantity' and 'quality' of programs developed, i.e., high quality programs targeting a too small number of individuals, or wide-reach programs of inadequate quality);
- **Low involvement of the Industry in educational programs focused on raw materials, especially from the ESEE region.** This needs to be reversed as soon as possible, as the main recipient of graduates of RM-oriented educational programs is precisely the Industry;
- **Low visibility of the EIT Raw Materials KIC as an organization and what its role is, and poor recognition of the EIT Label;**
- **ESEE region has very low benefit from education activity so far, most program exist is mainly not executed in the region, therefore enhance brain drain;**
- There are **no mechanisms facilitating access to accelerator programmes** (incubators, internships, scholarships, or fellowship programs) **to help students launch their Ideas or funnel them into business creation;**
- There is labelled program in ESEE region in general, **however theoretically EIT RawMaterials labelled programs are available for ESEE students on a competitive basis** which means only a selected few can participate which **has very low overall impact to the ESSE region in terms of transforming mindset of graduates.**

ECLC partners are indicating priorities on challenges, opportunities and actions doing our survey as follows:

Based on the number of each topic raised, the prioritized list of challenges is the follows according to the respondents:

1. Outdated curricula, missing raw material thematic, business and cross cutting knowledge and skills
2. Insufficient funding
3. Low level cooperation with industry
4. Outdated research and teaching infrastructure
5. Brain drain
6. Passive attitude of lecturers

Based on the number of each topic raised, the prioritized list of opportunities is the follows according to the respondents:

1. Raw material potential and the related job opportunity in the ESEE region
2. Active industry with a potential of real life experience and practice
3. Educational traditions

Based on the number of each topic raised, the prioritized list of recommended objectives is the follows according to the respondents:

1. Business development – Education linkage, starting an internship/job shadowing/job placement/student innovation facilitator program
2. Upgrading curricula on 'western' pattern, mind-driven pedagogy and thematic upgrade
3. Programs for industry mobilization and connection
4. Exchange and mobility programs
5. Train the trainer programs for academia staff
6. Combining up-scaling projects as case study and education

## 6. ESEE Education Concept Note

Based on the outcome of the background analysis and partner feedback, in line with the EIT RawMaterials RIS Strategy and the overall Education Strategy (The RawMaterial Education Roadmap; The RawMaterial Education Action Plan and the Academy Implementation Plan) addressing the following strategic objectives:

- Generate impact in the ESEE region by contributing to enhancing the innovation capacity of the countries in particular and the region in general. This shall be done accordingly by promoting Knowledge Triangle Integration in terms of engaging local players and by mobilizing, interlinking and internationalizing national/regional networks.
- Raise awareness and societal acceptance of raw materials, raw materials related industrial activities in the ESEE region in order to highlight their role and economic importance, to break down mind set barriers, to motivate young generations to take part and to create social environments attracting investments and promote entrepreneurship and intrapreneurship in situ.
- Create opportunities and open environments to counteract against brain drain and ease reversed brain feed into the raw material sector of the ESEE region;
- Initiate transformative changes of raw material related or effecting education to achieve capacity building of vital skills and competences of students, professionals and faculties in the ESEE region by transform best practices and experiences from the EIT RawMaterials community into resilient transferable programmes;
- Widen access and motivate entering of potential young innovators to the EIT RawMaterials Innovation Funnel using different levels of education as carriers/tools, enhancing integration of education, research and business while activating dormant partners.

Goals are set through a group of actions executed by EIT RawMaterials partners under the umbrella of Raw Material Academy and the resulting achievement follow on impact of innovativeness of the ESEE region. The ESEE cross-cutting domain described in the EIT Rm Education Action Plan contributes the overall development of all education domains achieving targets interpreted for ESEE region. The potential actions are organised according to the four domains of education and one cross-cutting domain, Education-Business Development Links.

The goals addressing the strategic objectives through their actions shall be the follows:

- Fewer, but robust programs developed on the basis of clustering and upgrading already existing programs focusing real impact to the innovativeness of ESEE region through education activity, in particularly toward raw material sector;
- Transfer of knowledge (best practice, summer schools, other KIC's initiatives, etc) to ESEE region using partner organizations and our HUBs in the region as gateway and mediator upgrading them first and actively involving non partner education organization staff building on the cascading effect of information and knowledge flow;
- Create internship / fellowship programs to the RIS regions, including ESEE to further widen the innovation value chain funnel from education toward business creation and fight against brain drain keeping talented young professionals in the region;
- Establishing of active dialogue between the ESEE stakeholders and EIT RawMaterials community, just as between ESEE KIC partners and non-ESEE KIC partners, Industry and Education in order to constantly get informed about the real needs of the region, success stories referring practices worth transfer and providing feedback of the effectiveness of the knowledge transfer carried out;
- Instead of creating new programs (MSc and PhD) except missing or weakly represented fields, upgrade and consolidation of already existing programs in the region reaching "labelling ready"<sup>40</sup> quality level;
- Motivate and activate individuals of ESEE education stakeholders (teachers, students) participate in exchange programs and building strongly on the recognized patterns namely students are mobile but mainly within the region;
- Proactively outreach and invite as many industrial stakeholders in the region as possible to be in Supporting Partner role in our activities while EIT RawMaterials community clearly demonstrate its value proposition via

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<sup>40</sup> Meaning endeavour implement EIT label requirement, even if Labelling procedure not initiated or fails

their actions created towards these supporting partners in order to engage them become associate and core partners in the future;

- Create programs that promotes, enhance and building necessary capacity for active University-Business Cooperation and help higher education institutions to become so called entrepreneur universities in all aspects of this concept
- Widening active public dialogue towards the society of Europe including ESEE region to reach higher awareness for the importance of raw materials and achieve social license to operate while ensure long term supply of motivated human capital for raw material sector.

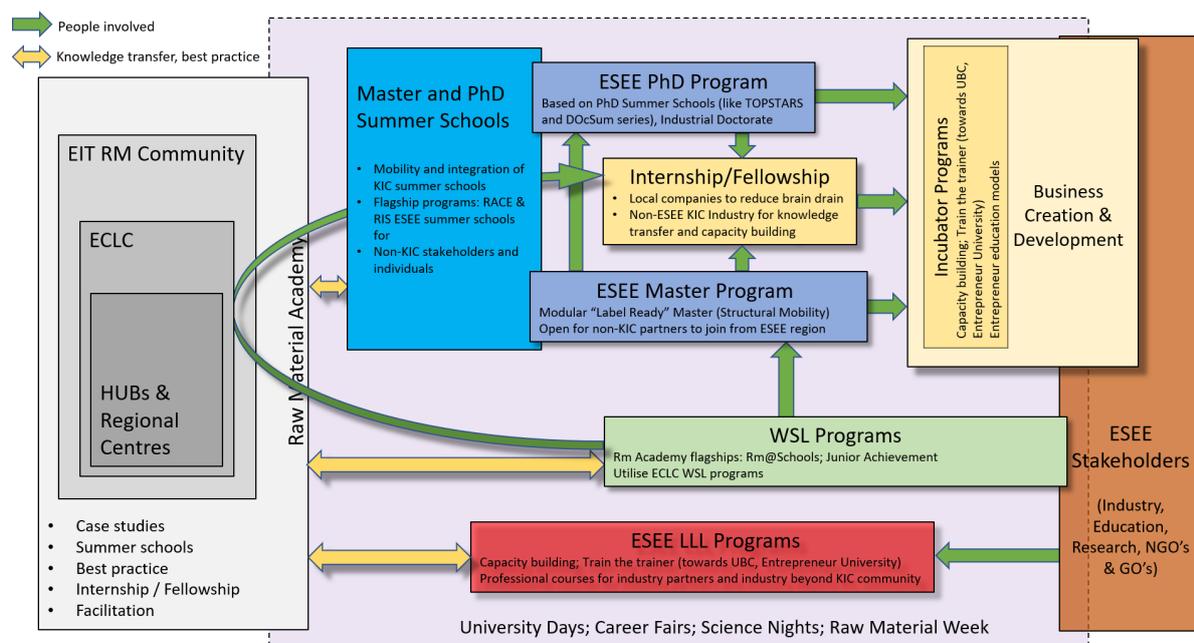
To achieve these goals both EIT RawMaterials LE and its partners – because most activities within our KIC are partner driven activity - needs to align their actions. These actions are the following:

#### For EIT RawMaterials LE

- EIT RawMaterials shall better and clearly integrate ESEE (RIS) related education to its RM Academy activity or any centrally steered RIS related activity in order to make real impact on innovation capacity of ESEE region
- Support pilot activities with education related thematic matchmaking events to bring together KIC partners from RIS and non-RIS regions breaking down knowledge barriers and building bridges between already existing good practices and RIS KIC partnership and beyond, while grant a foreseeable quantity of financial sources to initiate these pilot programs.
- Develop mechanisms to measure impact and transfer well performing and high impact pilots forming a healthy program ecosystem to be available to wider community even beyond our KIC via our partners and the regional HUBs
- Develop KIC specific KPIs that able to measure and with the fact that they are in place initiate UBC and the development of capacity for HEIs to become Entrepreneur University

#### For EIT RawMaterials Partners

Take the initiative to develop and lead complex KAVA projects addressing the findings of these document actively break down the barriers and develop drivers in the level of individuals, organisations and beyond the KIC community and even be active providing content for RIS HUB initiated activities. For designing activities, the below pool of example projects can be optionally used.



The actions can be organised around 4 pillars, such as:

### *1<sup>st</sup> pillar: Wider Society Learning Programs*

Despite of the ESEE region has been identified as an EIT RawMaterials priority outreach region from the very beginning based on the region unique raw materials potential, its specific industrial history with state-owned enterprises, and its geopolitical situation and importance, outreach success in terms of geographical outreach and activating extended number of industrial actors in the field has failed so far but definitely under the perform to reach the necessary critical mass. Based on our background analysis and interim evaluation of EIT the EIT and the KICs have a relatively weak presence in the national and regional innovation ecosystems, especially in ESEE region. As result positive opportunities and impacts were limited to the partners themselves and there was little evidence to suggest that these benefits were spreading to universities or businesses outside of the KIC partnerships. Although mineral and recycling industry is active in the ESEE region and it is known outsourcing and offshoring services connected to fast grooving industries using Key Enabling Technologies in order to produce partially using specially processed raw materials or specially manufactured mineral commodities are have important role in the economy and innovativeness of the ESEE region. Furthermore, most ESEE country has deployed regional innovation schemes, particularly the Smart Specialisation Strategies (S3) at national levels EIT and KIC's has not strong relationships with national innovation priorities.

In addition, public acceptance is a particular challenge toward the raw material sector which shows also a wide diversity in policy level I the ESEE countries. Some countries have well-developed and many-fold policy framework related to the sector, other countries have strategies which connect to the resources sector only by its relation to sustainable development or environmental issues. All Wider Society Learning programs in the region shall address wide target groups of society in order to facilitate and promote:

- Social acceptance of mineral industry and its activity to get the social licence to operate;
- Raw material sector being a potential good career opportunity;
- The role of Industry 4.0 and digitalization in the raw materials innovation chain
- Entrepreneur and intrapreneurship

Joining to the RM Academy initiatives such as University days, Career fairs, Science Nights, Raw Material Days and the Raw Materials Week is a good opportunity to all stakeholders and transfer the RM Academy WSL flagships: RM@Schools and Junior Achievement program to ESEE region has high potential.

RM@School is a Wider Society Learning project, focused on an innovative program to make science education and careers in RM attractive for youngster. An active learning will be proposed to schools by RM Ambassadors (experts in some RM-related issues and trained teachers) by involving students in experiments with RM-related hands-on educational kits, in excursions in industries, and in science dissemination activities. The students will be asked to become Young RM Ambassadors themselves (science communicators) and to create dissemination products focused on issues related to RM (i.e. videos, cards, comics, etc), by using their native language (student age: 10-13 yrs) or both their native and the English language (student age: 14-19 yrs.). Local Competitions for awarding the best communication products as well as an annual European Conference with delegates from European schools (students and teachers) will be annually organized. In addition, teachers will be trained to become RM Ambassadors themselves in the future at school, and selected groups of students will be trained on digital competence and video making and/or on activities suitable to be proposed during Public Events in order to work together with RM Ambassadors. All the produced materials and the best communication materials realised by pupils will be accessible online at the website (<http://rmschools.isof.cnr.it>) of the project to be shared with a wider public. The overall goal is to extend the program for ESEE region intensively and strengthen awareness by accessing young generation ad their teachers engaging them by interesting activates and events while they T-shaped skills are also elevated, enhancing creativity and ICT knowledge and skills both for students and teachers.

Junior Achievement program (JA Europe) is the largest non-profit in Europe dedicated to preparing young people for employment and entrepreneurship. JA Europe is a member of JA Worldwide® which for 100 years has delivered hands on, experiential learning in entrepreneurship, work readiness and financial literacy. JA creates

pathways for employability, job creation and financial success. Last school year, the JA network in Europe reached more than 4 million young people across 40 countries with the support of 140,000 business volunteers and 130,000 teachers/educators. Official cooperation between JA Europe and EIT RawMaterials officially started in 2018 in Bulgaria and Romania and planned to expand to Slovenia in 2019.

### **2<sup>nd</sup> pillar: ESEE LLL programs for professionals and for Capacity Building (Train the Trainer)**

The goal of these activities is twofold. As one of the main target group of these programs being professionals either working in the raw material sector or coming to the raw material sector or entrepreneurs would like to enter raw material sector meaning need specific sector related knowledge. The offers are designed targeting local industrial needs based on active dialogue with local stakeholders. It is important outline that in program design, the majority of European adult training programs (LLL) just as in ESEE region is non-formal education and training, in other words, outside of formal institutions of schools, colleges and universities. The share of non-formal instruction that was job-related but that was not sponsored by employers fell as a function of age. This suggests that younger persons (25–34) were the most likely to undertake job-related non-formal instruction without employer sponsorship, while older persons (55–64) were the least likely (perhaps due to a shorter time horizon to benefit from any job-related education and training). A similar analysis by educational attainment level displays a relatively high proportion (71.5 %) of the non-formal instruction undertaken by those with a tertiary level of education was job-related and sponsored by employers The LLL program target audience is mostly non-partner industry (since only very limited industry partners are in the ESEE region).

The other goal of these potential programs is the capacity building of either universities or business in order to successfully adapt and implement innovation and enhance and enable effective UBC and help local universities to become 'Entrepreneur University'. Training programs are not only regular, conventional trainings but strongly built on staff exchange programs between universities or between universities and business or even larger scale 'Twinning-like' programs can be developed. Specific approach to build on already existing summer schools (e.g.: DocSumCube series) – or develop new ones – for students that either utilize Train the Trainer approach as well.

### **3<sup>rd</sup> pillar: Master and PhD education programs, including**

#### **Master programs for ESEE region**

EIT's mission to modernise the education landscape is important and should be reflected in every education project developed by the KICs. Therefore, the EIT encourage the KICs to explore and develop innovative degree programmes. These new programmes should go beyond what is being normally offered by the university partners in a KIC, usually research universities, in particular in terms of mobility, industry exposure, networking opportunities and, more broadly, learning experience. Yet the education review notes that these positive opportunities and impacts were limited to the partners themselves and there was little evidence to suggest that these benefits were spreading to universities or businesses outside of the KIC partnerships.

The development of education portfolio of EIT RawMaterials are around the design principles of Balance, Integration, Consolidation and Intersection. It is outmost underlined that EIT RawMaterials need to consolidate our portfolio in each domain of learning by concentrating on a few pan-European flagship programmes and enhancing their reach and impact by providing the corresponding financial resources. Therefore, **consolidating and enhancing existing programs are priority against creating new programs with the exception of recognised gaps in terms of thematic fields like advanced recycling or circular economy**. It is also outlined in our overall strategy that programs need to intersect Innovation & Entrepreneurship and Digitalization (including digital technologies in industry 4.0 relevant in raw material sector and digital pedagogy).

The inventory of **raw material related education in the ESEE region showed that master and PhD level** programs are **widely available** in ESEE partner universities and also in non-partner universities from non-EU countries throughout the entire primary raw material value chain, however these education programs are suffering **low student application and enrolment**. Many of the Universities offering these courses are non-represented at global rankings **by definition, they cannot figure in the global rankings as they** do not meet, for instance, the criterion of the Times Higher Education World University Rankings to include at least two large academic fields and to publish at least 200 indexed articles per year because of the size and capacity of the University. This fact however does

not automatically mean low quality of research or education but *lacking critical mass*. Although collaboration between organisations would definitely help to solve this issue our portfolio analysis indicated a very low level of activity of some partner institutions and/or weak collaboration between some of them. One of the reason could be that ESEE Universities are expected to run programs in their national language and being relatively small organisations (at least most of them) they have missing capacity to carry out education both in English and national languages in all fields of education programs.

Further identified issues are the low involvement of the Industry in educational programs focused on raw materials, especially from the ESEE region; low visibility of the EIT Raw Materials KIC as an organization and what its role is, and poor recognition of the EIT Label. There is labelled program in ESEE region in general, however theoretically EIT RawMaterials labelled programs are available for ESEE students on a competitive basis which means only a selected few can participate which has very low overall impact to the ESSE region in terms of transforming mindset of graduates, therefore ESEE region has very low benefit from education activity so far, most program exist is mainly not executed in the region, therefore enhance brain drain.

Despite of the active industry with a potential of real-life experience and practice and historical educational traditions ESEE region, EIT RawMaterials partners are also recognized the issue of outdated curricula with missing raw material thematic (referring to recycling and circular economy) and the lack of business and cross cutting knowledge and skills such as low-level cooperation with industry combined with old and outdated research and teaching infrastructure.

Therefore, the aim of the related master programs is to bring together ESEE higher education providers to upgrade their education offers in the field of raw material without creating new courses, but modernising the existing ones to be “Label Ready – meaning endeavour labelling criteria even without carrying out the official labelling process” programs by 2022.

The basic concept is that an alliance of providers can compare their education portfolio and consolidate the in a matter that which education offer is important in each country more, therefore those courses need to be organised in national language while mapping competences and excellence education offers in English can be distributed by the alliance partners in a cooperative way than none of the interest of organisations are hurt enable required critical mass in capacity for upgraded research interlinked education for upgrading their scores in global ranking. Program upgrade is carried out implementing best practises of EIT RawMaterials partner institutions applying both stand alone and embedded approach for cross cutting knowledge and skills and using critical strategic feedback of ESEE Dialogue program, while capacity building is implemented by Train the Trainer approach. The developed master programs are ideally modular structured or based on structural mobility enable non KIC partner HEIs to join and also allow synergies with other mobility programs like ERASMUS or CEEPUS. The relevant Master programs are looking for the way implementing existing summer schools to the curricula or develop new ones for upgrading existing master program curricula.

The curricula, programmes, modules and courses build on five groups of quality criteria, such as the EIT Overarching Learning Outcomes (EIT OLOs), robust entrepreneurship education, highly integrated, innovative ‘learning-by-doing’ curricula, mobility, the European dimension and openness to the world and has its own outreach strategy and access policy. The program delivery utilizes innovative framework of pedagogical concepts and novel hybrid training environments (face-to-face combined with online learning and Massive Open Online Courses, MOOC) through innovative, blended types of pedagogical approaches containing combined lecture cycles (simultaneously broadcasted at several universities), MOOC platform, technical training, summer schools, entrepreneurial- and project management training.

Also, the developed master programs utilising the potential synergies with the Business Creation and Support activities of the EIT RawMaterials, such as Business Idea Competition or the existing Network of Infrastructures.

### ***PhD program for ESEE region***

There is no existing PhD program lead by ESEE HEI and most of the PhD activity within the KIC is summer school related. Developing a PhD summer school or transfer and extend one among the existing ones making them available for individuals (students, young researchers or even lecturers furthermore industrial professionals

channelling them into industrial doctorate programs) are expected such as a potential beneficial program for network of doctoral school, Twinning like activities between doctoral schools and industrial doctorate programs.

### ***Summer and Winter schools***

Summer and Winter Scholl's are complementary activities of Master and PhD courses. Already existing summer schools are potentially able to upgrade already existing curricula and good bridges between RIS and non-RIS regions of the KIC while summer schools are possible to organise that way to be accessible for individuals coming from non-partner organizations. Transfer and extend of already existing summer schools are priority within the KIC, especially the flagship programs like RACE. RACE is a learning journey for industrial R&D professionals organised by EIT RawMaterials and hosted by its industrial partners. The RACE curriculum will comprise a mix of lectures from leading experts on the rapid developments in digitalisation and circular economy business model development. Participants will see first-hand the study tours at hosts and essential to the programme, group work on circular economy challenges. During the RACE participants will explore circular business models and work together in teams to solve industrial challenges.

### ***4<sup>th</sup> pillar: Business Creation and Development (Incubator and Internship/Fellowship programs)***

According to its strategic goals, EIT supports the development of new products with a strong in-built business presence in the education experience, along the lines of encourage a stronger and more active involvement of business partners in the KICs' activities, notably in supporting accelerators and other similar supports to the entrepreneurial learning of students, such as start-up factories or hackathon exercises. It is also underlined that EIT should focus on innovative ways of teaching and learning, particularly with respect to the creation of innovations. Despite of partners indicated as number one priority of delivering business development – education linkage such as starting an internship/job shadowing/job placement/ student innovation facilitator program and there are recorded good examples how to facilitating access to accelerator programmes to help students launch their Ideas there are no such mechanisms funnel them into business creation in the ESEE are or among RIS programs.

Recent European internal migrant flows had a major impact on the countries of ESEE region. Even tough strengthening innovation capacity of a region or country can automatically counteract brain drain opportunity-driven entrepreneurship is measured being very low in most of the ESEE countries.

Such programs would be a RIS project creating incubator / fellowship program for ESEE MSc and PhD students with direct link to boot camps and idea competition and internship programs for teachers and lecturers, researchers in ESEE since in most of the ESEE Universities Researcher/ Lecturer career is directly from Master – PhD, often from the same University with a strong lack of Industrial experience and relevant skills and attitude. Internship and fellowship programs would involve mostly local industry identified by active dialogue in the ESEE region or companies within the EIT RawMaterials partnership. Incubator programs would allow students to carry out proof of concept research and development while they are free to get mentoring service on business or IP rights.

As an integral part of such programme's capacity building train the trainer approach for the related organisations on how to develop such business supporting programs effectively also could be one example of these type of activities integrating business creation and support activities to the other 3 pillars enhancing UBC and Knowledge Triangle Integration.

In order to maximise the KTI effect and outreach in the RIS regions all non-education programs in the RIS regions or targeting RIS region stakeholders are invite to include and commit at least two types of the below mentioned core and/or EIT RM KPI's, one by one from each group:

- EITN08 #external participants in EIT RIS programmes;
  - KPI01.05 Participants awareness events;
  - KPI02.04 SME partners (possibly new SME from ESEE)
- and
- KPI06.01 PhD Education
  - KPI06.02 Master Education
  - KPI06.03 Lifelong Education
  - KPI06.04 Wider Society Learning

## 7. Disclaimer and Acknowledgement

Any and all errors, omissions, and possible bias are the author's only, and the views presented herein do not necessarily reflect the opinions of the contributors, listed below of this page, to whom the author is very much grateful for sharing their thoughts and giving feedbacks.

- Dr Markus **KLEIN** – Business developer of ECLC
- Krzysztof **KUBACKI** – General Manager of ECLC
- Antonis **POLITIS** - Business developer of ECLC
- Sylwia **WASILEWICZ CROZIER** - Administration and Finance Officer of ECLC

The whole **Education Team** with special thanks to Dr Rima **DAPOUS** Director Education and Wesley **CROCK** head of Academy and Michał **MŁYNARCZYK** former educational officer of ECLC.

- Prof Peter **MOSER** – chair of ECLC Steering Committee

Members of the ESEE Education Working Group

- Dr Katerina **ADAM** - NTUA
- Dr Norbert **BENECKE** - DMT
- Dr Sibila **BOROJEVIĆ ŠOŠTARIĆ** - UNIZG
- Ulrike **HASLINGER** - MUL
- Dr Pawel **MALINOWSKI** - AGH
- Dr Ferenc **MÁDAI** – Uni Miskolc
- Dr Ildiko **MERTA** - TU Vienna
- Anna **MEYER** – MUL
- Dr Radosław **POMYKAŁA** - AGH
- Jana **SMIHULOVA** - TUKE
- Willem **ZANK** - TUBAF

And those who sent feedback based on our survey on the topic.



Contact @ EIT RawMaterials CLC East:

*Dr. Imre Gombkötő*  
*Education Manager*  
*Imre.gombkoto@eitrawmaterials.eu*  
*+36 20 436-2313*

[www.eitrawmaterials.eu](http://www.eitrawmaterials.eu)