Set of 6 target value chains profiles in digitalisation

Deliverable D.T1.3.2

Lead Contractor of the Deliverable: PP7 CLUSTERO

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Content

Introduction

Challenges caused by digital transformation in the industry and related changes in business models and value chains have tremendous impact on the Danube region countries, particularly on the regional labour markets and the development of human resource qualifications. While in the advanced Danube countries a lack of digital competences threatens innovative SMEs and start-ups by limiting their chances for scale-up and internationalisation, in less developed countries the need for catching up in digital qualification of work force and their employing companies is urgent and crucial for economic development.

In Romania with a Digital Economy and Society Index (DESI) score of 40 in 2020 (compared to 52.6 of EU) the transformation of traditional "Low skilled – Low tech" sectors such as textiles, agri-food, is crucial, as GDP contributors and exporting sectors are being faced with the critical decision of becoming smart sectors or dying out.

Bosnia and Herzegovina are affected with a "Brain Drain" and the most negative effects are in the industrial sector, especially metal industry. With a rate of more than 64% youth unemployment in Bosnia and Herzegovina is the highest in Europe. Workforce needs new technology qualifications and practical education to keep up with the region and Europe as well.

Research done by PP University of Belgrade shows an evident lack of digitally skilled labour in Serbia. Although there is evident need for additional skills in companies, only one-fourth of them organize training programs for employee skills improvement, while about 15% of all surveyed companies have embarked on the process of recruiting individuals with the digital skills.

Creating value - particularly in smaller Danube countries such as Slovenia with limited resources, capacities and capabilities – is largely dependent on intensive investments, high risks, high responsiveness and originality, which can only be achieved through collaboration and deploy their full impact through transnational value-chain integration.

The mapping of Transnational Value Chains provides a visionary goal for the whole project regions that will guide all following project activities, particularly the development and piloting of a value-chain oriented capacity building and training programme and development of action plans for establishing labour-market relevant cooperation links.

Analysis and Selection

The methodology takes into consideration United Nations Industrial Development Organization (UNIDO)'s approach on value chain analysis, based on industrial cluster development, which assume that spatial organization, strategic firm alliances, and networking are sources of systemic competitiveness. Their analytical focus is often on a) how actors network to exchange goods, services, and information; b) institutional and political frameworks that promote building industrial clusters and the inclusion of small-to medium-sized firms; and c) the level of knowledge and technology used.

As described in D T.1.3.1, the methodology considers a 4-step analysis approach:

Step 1: The labelled clusters by the European Secretariat for Cluster Analysis

The European Secretariat for Cluster Analysis (ESCA) is the one-stop shop for promoting Cluster Management Excellence through benchmarking and quality labelling of cluster management organisations worldwide.

Clusters assessed by ESCA are distributed along following sectors:

- Aviation and space.
- Biotechnology.
- Construction/building sector („Construction").
- Creative industries and businesses, media, design, financial services ("Creative industries").
- Energy and environment.
- Food Industry (non-biotech) and Agro Tech ("Food").
- Health and medical technologies ("Health").
- Information and Communication; Hard/Software ("ICT").
- Logistics: Packaging, Delivery, Logistical Systems and Services ("Logistics/Packaging").
- Maritime technologies, water resources, water transport ("Maritime").
- Micro, nano and optical technologies ("micro/nano/opto »).
- Mobility: Vehicles, rail, traffic systems. ("mobility").
- New Materials and chemistry ("new materials").
- Production and engineering.
- Textile industries ("textiles").
- Tourism, Leisure, Sports ("tourism").

As to „Production and engineering", the sector has been further broken down into:

- Mechatronics, electronics and automation.
- Wood & Furniture.
- Mechanical Engineering.
- Trade.
- Plastics.

The indicators to be assessed are:

- The number of labelled clusters in a specific sector in the Danube Region, i.e., the higher the number, the better the chances to be selected as a targeted value chain in DanubePeerChains.
- The geographical distribution of labelled clusters in a specific sector in the Danube Region; the more there are more countries having labelled clusters in a specific sector, the better the chances to be selected as a targeted value chain in DanubePeerChains.

The countries/regions taken into consideration are Austria, Bulgaria, Croatia, Czechia, Baden Wuerttemberg, Bavaria, Hungary, Romania, Slovakia, Slovenia, Bosnia and Herzegovina, Montenegro, Serbia, Odessa, Ivano Frankivsk, Chernivtsi, Zakarpatija, Moldova.

There are 3 ESCA labelled **"Aviation and space"** clusters in the Danube Region, located in Czechia (1), Baden Wuerttemberg (1) and Bavaria (1).

There are 15 ESCA labelled **"Biotechnology"** clusters in the Danube Region, located in Austria (1), Baden Wuerttemberg (3), Bavaria (2), Hungary (3), Romania (1), Slovakia (2), Slovenia (1) and Serbia (2).

There are 12 ESCA labelled **"Construction"** clusters in the Danube Region, located in Austria (1), Bulgaria (1), Czechia (3), Baden Wuerttemberg (2), Bavaria (1), Hungary (2), Romania (1) and Serbia (1).

There are 14 ESCA labelled **"Creative Industries"** clusters in the Danube Region, located in Austria (1), Croatia (1), Baden Wuerttemberg (4), Bavaria (3), Romania (3) and Slovakia (2).

There are 37 ESCA labelled **"Energy and environment"** clusters in the Danube Region, located in Austria (3), Croatia (1), Czechia (4), Baden Wuerttemberg (4), Bavaria (4), Hungary (7), Romania (3), Slovakia (7), Slovenia (2) and Serbia (2).

There are 11 ESCA labelled **"Food"** clusters in the Danube Region, located in Austria (1), Croatia (3), Bavaria (1), Hungary (1) and Romania (5).

There are 19 ESCA labelled **"Health"** clusters in the Danube Region, located in Austria (1), Czechia (2), Baden Wuerttemberg (6), Bavaria (2), Hungary (2) and Romania (6).

There are 47 ESCA labelled **"ICT"** clusters in the Danube Region, located in Austria (1), Bulgaria (3), Croatia (2), Czechia (3), Baden Wuerttemberg (4), Bavaria (4), Hungary (9), Romania (11), Slovakia (6), Slovenia (2) and Serbia (2).

There are 3 ESCA labelled **"Logistics/Packaging"** clusters in the Danube Region, located in Baden Wuerttemberg (1), Bavaria (1) and Hungary (1).

There is 1 ESCA labelled **"Maritime"** cluster in the Danube Region, located in Bulgaria.

There are 13 ESCA labelled **"Micro/Nano/Opto"** clusters in the Danube Region, located in Bulgaria (1), Baden Wuerttemberg (6), Bavaria (3) and Romania (3).

There are 21 ESCA labelled **"Mobility"** clusters in the Danube Region, located in Austria (1), Bulgaria (2), Croatia (2), Czechia (1), Baden Wuerttemberg (5), Bavaria (1), Hungary (2), Romania (5), Slovakia (1) and Slovenia (1).

There are 13 ESCA labelled **"New materials"** clusters in the Danube Region, located in Austria (1), Czechia (2), Baden Wuerttemberg (3), Bavaria (3), Romania (1), Slovakia (1) and Slovenia (2).

There are 14 ESCA labelled **"Mechatronics, electronics and automation"** clusters in the Danube Region, located in Austria (2), Bulgaria (1), Baden Wuerttemberg (4), Bavaria (2), Hungary (1), Romania (3) and Slovakia (1).

There are 8 ESCA labelled **"Wood and furniture"** clusters in the Danube Region, located in Bulgaria (1), Croatia (1), Czechia (1), Hungary (1), Romania (3) and Slovenia (1).

There are 19 ESCA labelled **"Mechanical engineering"** clusters in the Danube Region, located in Austria (1), Bulgaria (4), Czechia (2), Baden Wuerttemberg (1), Hungary (1), Romania (5), Slovakia (2), Slovenia (1) and Serbia (2).

There is 1 ESCA labelled **"Trade"** cluster in the Danube Region, located in Bulgaria.

There are 5 ESCA labelled **"Plastics"** clusters in the Danube Region, located in Czechia (1), Baden Wuerttemberg (2), Hungary (1), and Bosnia and Herzegovina (1).

There are 6 ESCA labelled **"Textiles"** clusters in the Danube Region, located in Bulgaria (1), Romania (4) and Slovakia (1).

There are 13 ESCA labelled **"Tourism"** clusters in the Danube Region, located in Croatia (1), Czechia (1), Hungary (2), Romania (3) and Slovakia (6).

An overview of the situation can be seen in Annex 1 ESCA labelled clusters in the Danube Region (January 2021)
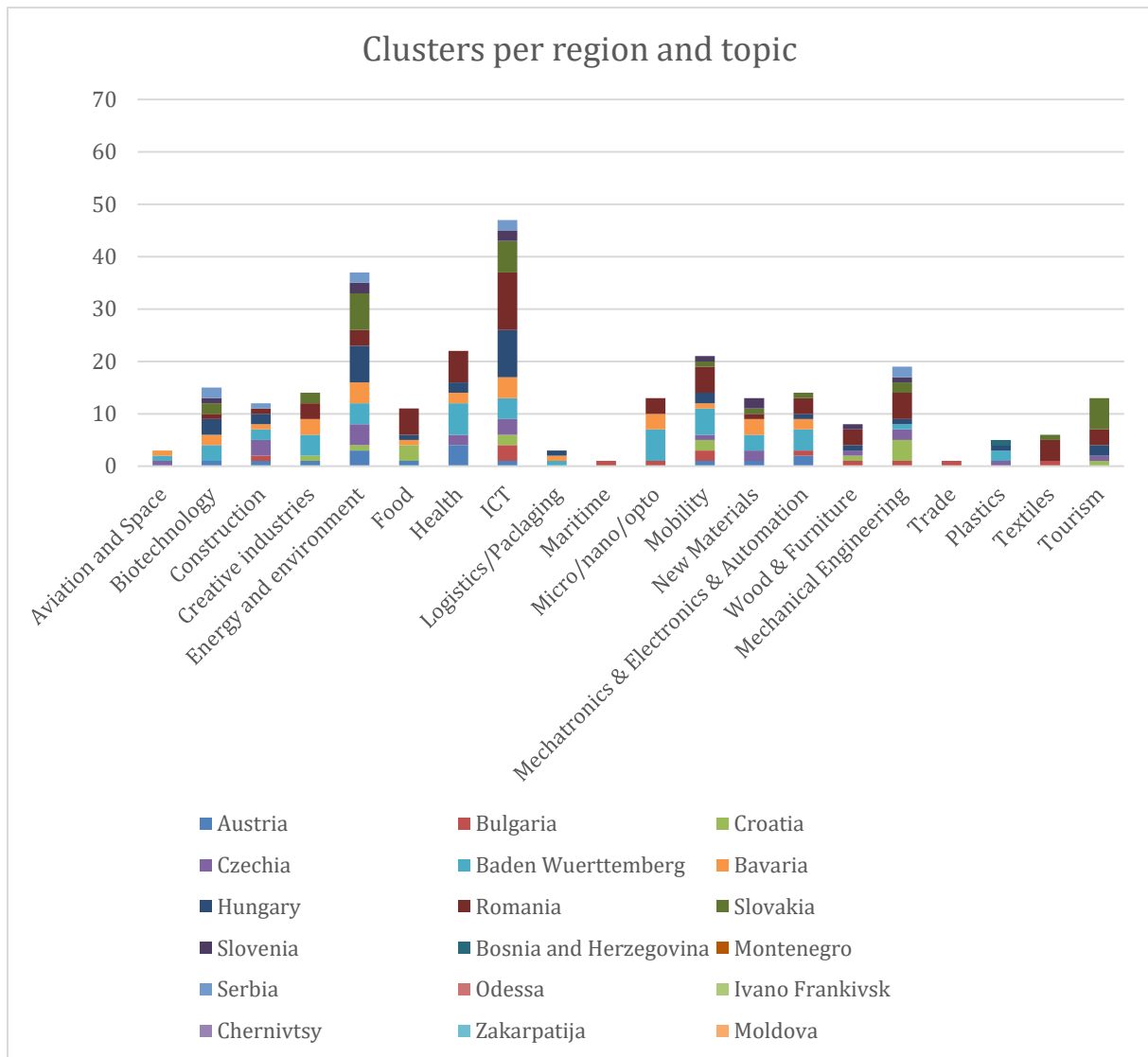
Figure 1: Distribution of clusters per region and topic, Source: see Annex 1 ESCA labelled clusters in the Danube Region (January 2021)

According to the topic, most ESCA labelled clusters are found in the "ICT" sector (47), followed by "Energy and environment"(37), "mobility" (21), "health" (19), "mechanical engineering"(19), "biotechnology" (15), "creative industries"(14), "mechatronics, electronics and automation" (14), "micro/nano/opto" (13), "new materials"(13), "tourism"(13), "construction" (12), "food" (11), "wood and furniture" (8), "textiles" (6), "plastics" (5), "aviation and space" (3), "logistics/packaging" (3), "maritime" (1) and "trade" (1).

According to the country/region, most ESCA labelled clusters are found in Romania (57), followed by Baden Wuerttemberg (46), Hungary (33), Slovakia (29), Bavaria (28), Czechia (21), Croatia (15), Austria (13), Bulgaria (13), Slovenia (10), Serbia (9) and Bosnia and Herzegovina (1). Unfortunately, no ESCA labelled clusters exist in the 3 Danubian Regions of Ukraine and the Republic of Moldova.

Step 2: The 14 industrial ecosystems

As part of the EU Industrial Strategy, clusters are seen as pillars of the 14 industrial eco-systems for a green, digital and resilient economic recovery, as identified by the European Commission:

- Tourism.
- Creative & Cultural Industries.
- Aerospace & Defence.
- Textiles.
- Electronics.
- Mobility-Automotive.
- Low carbon energy intensive industries.
- Renewable energy.
- Agri Food.
- Healt.;
- Digital.
- Construction.
- Retail.
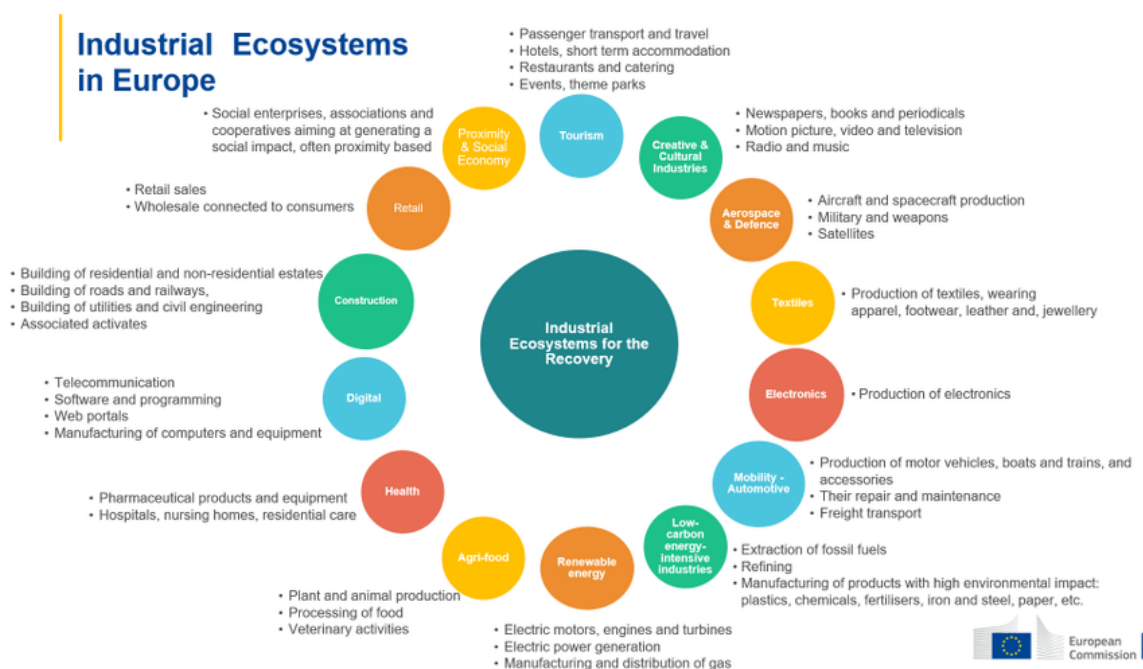- Proximity & Social Economy.

Figure 2: The EU industrial eco-systems, Source: https://twitter.com/socialecoeu/status/1362349859244752900

Checking the correspondence between ESCA and the 14 industrial ecosystems leads to the following result:

Table 1: Correspondence between ESCA labelled clusters and the 14 EU industrial eco-systems

ESCA	Industrial Ecosystems
Aviation and space	Aerospace & Defence
Biotechnology	
Construction	Construction
Creative Industries	Creative & Cultural Industries
Energy and environment	Renewable energy
Food	Agri-Food
Health	Health
ICT	Digital
Logistics/Packaging	
Maritime	
Micro/nano/opto	
Mobility	Mobility-Automotive
New Materials	
Mechatronics & Electronics & Automation	Electronics
Wood & Furniture	Low carbon energy intensive industries
Mechanical Engineering	
Trade	Retail
Plastics	
Textiles	Textiles
Tourism	Tourism
	Proximity and social economy

Step 3: DanubePeerChains

DanubePeerChains has already pre-identified several sectors: metal industry, machine building, engineering, electro industry, electronics/robotics, ICT, which have already been analysed in terms of labour market (A.T1.1 Capitalisation and upgrade of labour market analysis and identification of regional development demand) and digitalisation (A.T1.2 Transnational mapping of competences in key knowledge fields of digitalisation).

Checking the ESCA labelled clusters identified clusters against the correspondence to the results of the DanubePeerChains previous analyses leads to following results:

Table 2: Correspondence between ESCA labelled clusters and DanubePeerChains pre-identified sectors

ESCA	Pre identified DanubePeerChains Sectors
Aviation and space	
Biotechnology	
Construction	
Creative Industries	
Energy and environment	
Food	
Health	

ICT	ICT
Logistics/Packaging	
Maritime	
Micro/nano/opto	
Mobility	
New Materials	
Mechatronics & Electronics & Automation	Electronics & robotics, electro industry
Wood & Furniture	Engineering)
Mechanical Engineering	Machine Building, metal industry
Trade	Engineering
Plastics	Engineering
Textiles	
Tourism	

Step 4: Selection

The selection follows both a quantitative and qualitative approach.

As to the quantitative assessment, a composite index is being calculated, having the following vectors:

$$V_i = c_i + r_i + s_i + d_i,$$

- where V_i represents the value of the indicator for the sector (i),
- c_i represents the number of clusters acting in the sector (i), calculated as percentage of the total number of ESCA labelled clusters in the Danube Region,
- r_i represents the number of regions/countries where the clusters acting in the sector (i) are to be found, calculated as a percentage of the total number of countries/regions in the Danube Region,
- s_i represents the correspondence value between ESCA labelled clusters and the 14 industrial ecosystems. It takes the value (1) in case of correspondence and (0) in its absence,
- and d_i represents the correspondence value between ESCA labelled clusters and the preidentified DanubePeerChains sectors. It takes the value (1) in case of correspondence and (0) in its absence.

Example	Number of clusters in the specific sector (i), c_i (%)	Number of regions/countries where clusters in the sector (i) are located. r_1 (%)	Correspondence Industrial Ecosystems s_i Yes = 1 No = 0	Correspondence DanubePeer Chains d_i Yes = 1 No = 0	Result V_i $= c_i + r_i + s_i + d_i$
ICT	0,17 (47/278)	0,61 (11/18)	1	1	2,78

The "ICT" sector has the highest value (2,78), followed by "mechatronics & electronics & automation" (2,43), "wood & furniture" (2,32), "food" (1,68), "mobility"(1,63), "mechanical engineering" (1,56), "construction" (1,48), "health" (1,40), "creative industries"(1,38), "tourism" (1,32), "food" (1,31), "plastics" (1,24), "textiles" (1,18), "aviation and space" (1,17), "trade" (1,05), "biotechnology" (0,49), "new materials" (0,43), "micro/nano/opto" (0,26), "logistics/packaging" (0,17) and "maritime" (0,05).

A detailed calculation is given in Annex 2.
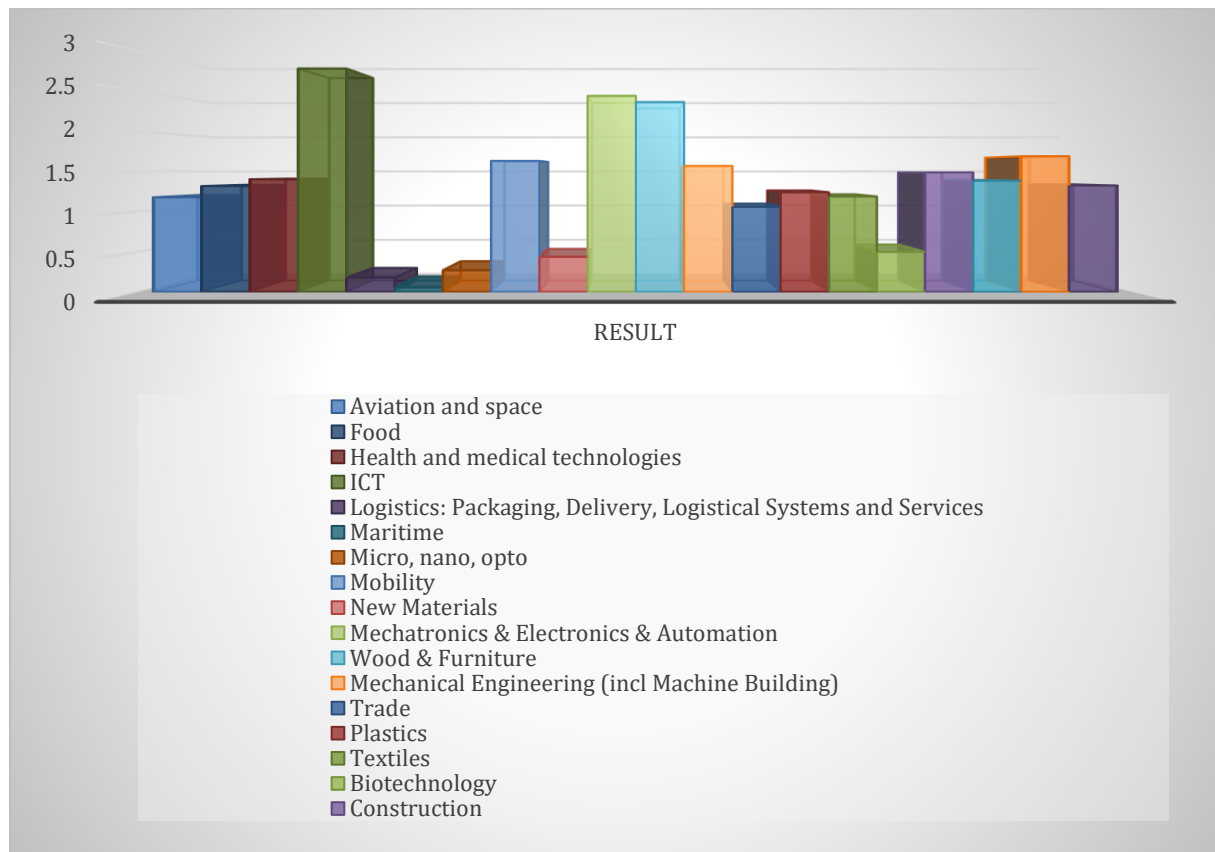
Figure 3: Quantitative assessment of the sectors

The quantitative results have been validated in a dedicated peer review workshop among the project partners, leading to the final selection of the 6 target value chains:

- ICT.
- Mobility.
- Mechanical engineering.
- Mechatronics & electronics & automation.
- Plastics.
- Wood & furniture.

The selection criteria took into consideration:

- Those industrial sectors being able to absorb digital solutions in terms of Industry 4.0 approaches.
- The balance between innovative and more traditional sectors.

- The geographic distribution.

Results

ICT

At the level of the analysed clusters in the Danube Region, 1383 companies and 154 RDI organisations are active in the Danube Region and the ICT sector.

In terms of companies acting in the "ICT" ESCA labelled clusters, there is an equilibrated East West geographical distribution: Baden Wuerttemberg, Bavaria and Austria make together 51% of the total number of companies in the sector.

Nevertheless, in terms of Research-Development-Innovation (RDI) capacities, the Western part scores 66%.

The absolute leader is Baden Wuerttemberg with 40% of the companies and 45% of the RDI capacities.

This situation reflects the ICT "subcontracting" problem of the Eastern part of the Danube region, which, on medium to long term can be regarded as a threat for the Eastern part.

Figure 4: The situation of the ICT sector in the Danube Region. Source: see Annex 3

Mobility

At the level of the analysed clusters in the Danube Region, 844 companies and 92 RDI organisations are active in the Danube Region and the mobility sector.

As a rule, companies tend to find themselves in regions with OEM producers. There is an outstanding presence of Austria in terms of companies (36%) – mainly automotive supplying SMEs and of Romania in terms of RDI organisations (58%). The explanation consists in the Renault delocalising some of the RDI activities to Romania.

Figure 5: The situation of the mobility sector in the Danube Region. Source: see Annex 3

Mechanical Engineering

At the level of the analysed clusters in the Danube Region, 522 companies and 44 RDI organisations are active in the Danube Region and the mechanical engineering sector.

The sector is heavily represented in the Eastern part of the region, i.e., Romania, Slovakia, Slovenia, Serbia, Croatia, Czechia and Hungary make together 83% of the companies and 100% of the RDI organisations which act in ESCA labelled clusters.

The sector was a main industrial field in the socialist period of the Eastern side and is characterised by a low level of innovation and digitalisation.

Figure 6: Situation of the mechanical engineering sector in the Danube Region. Source: see Annex 3

Mechatronics

At the level of the analysed clusters in the Danube Region, 668 companies and 147 RDI organisations are active in the Danube Region and the mechatronics sector.

Austria heavily dominates the sector with 44% of the companies and 73% of the RDI organisations acting in ESCA labelled clusters across the Danube Region. The explanation consists in the structural economic changes undertaken by Austrian regions (in particular Lower Austria) which enabled an industrial transition based on supporting brand new industrial sectors.

A relatively new sector, it is represented in only 7 out of the 18 countries/regions of the Danube Region.
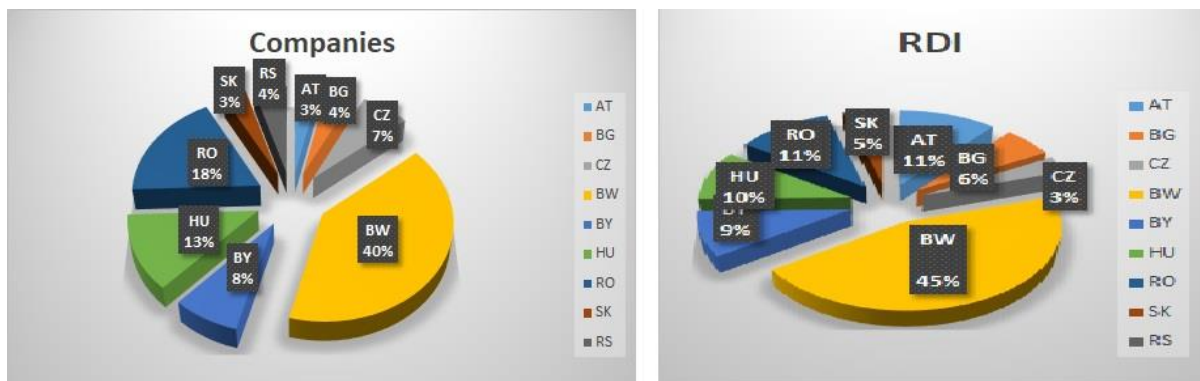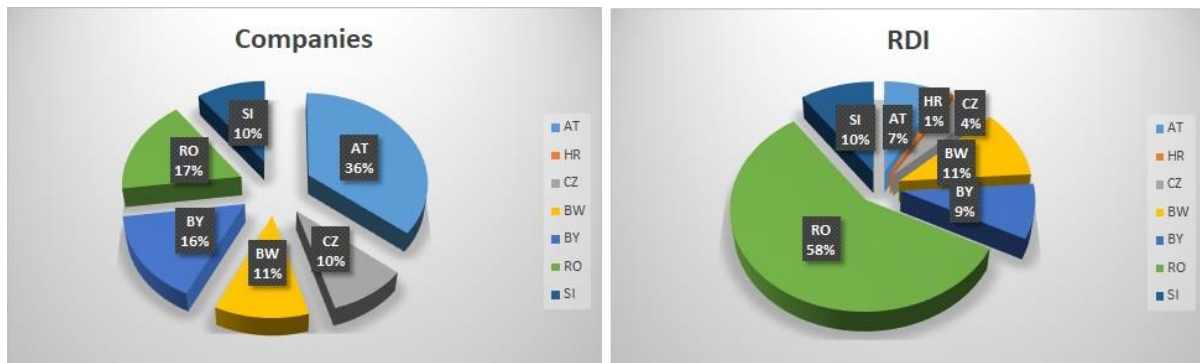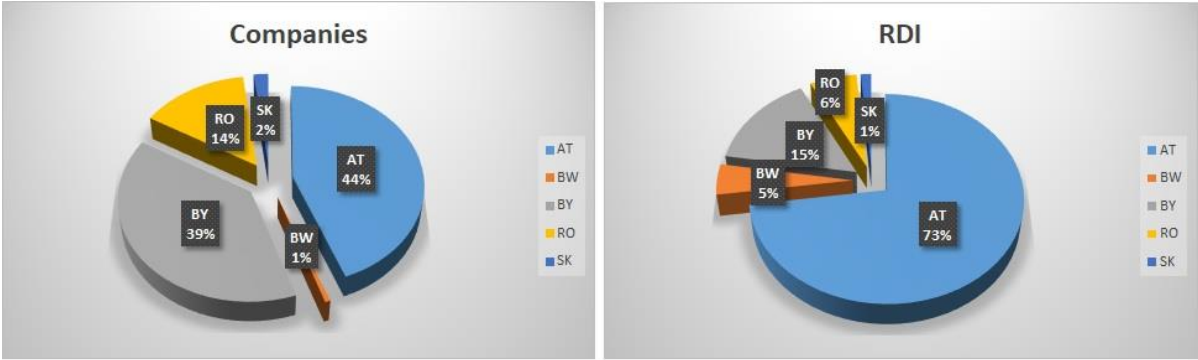

Figure 7: The situation of the mechatronics sector in the Danube Region. Source: see Annex 3

Plastics

At the level of the analysed clusters in the Danube Region, 165 companies and 8 RDI organisations are active in the Danube Region and the plastics sector.

The sector is relatively poorly represented in the region, i.e., only 4 out of the 18 countries/regions of the Danube Region have ESCA labelled clusters acting in the plastics field.

Baden Wurttemberg is the uncontested leader with 65% of the companies and 75% of the RDI organisations.

To be noted that the metal & plastics cluster in Mostar is the only ESCA labelled cluster in Bosnia and Herzegovina.
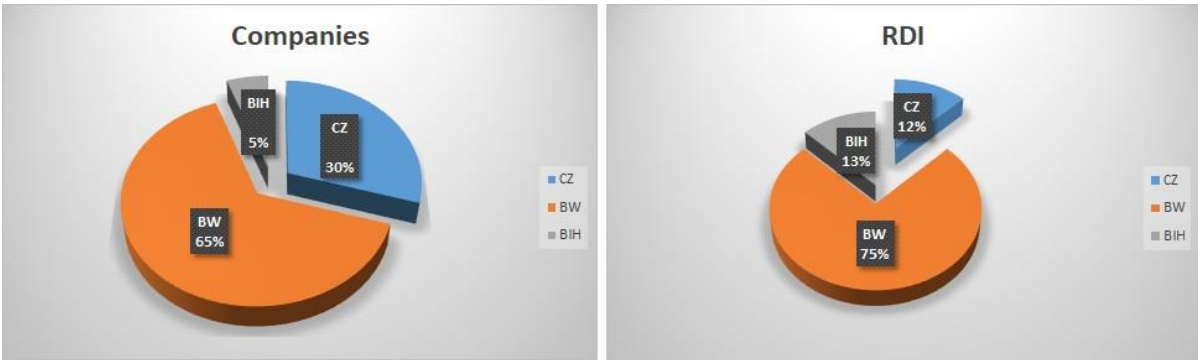
Figure 8: The situation of the plastics sector in the Danube Region

Wood and furniture

At the level of the analysed clusters in the Danube Region, 290 companies and 11 RDI organisations are active in the Danube Region and the wood and furniture sector.

The sector is represented only in the Eastern part of the Danube Region, as the ESCA labelled clusters are concerned. As in the case of mechanical engineering, it is a traditional sector characterised by low level of innovation and internationalisation. There is a very poor representation of the RDI organisations overall.
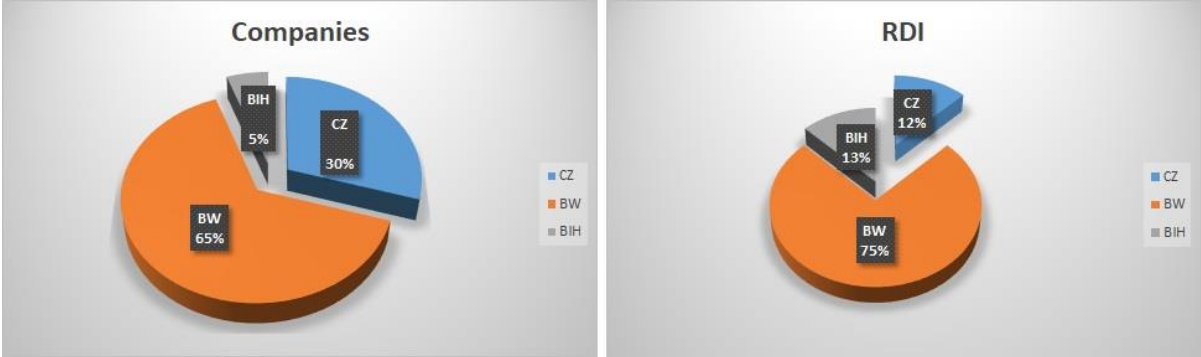
Figure 9: The situation of the Wood & Furniture Cluster in the Danube Region. Source: see Annex 3

Conclusions

The Danube Region sees a diversity of clusters in various fields, drivers of industrial eco-systems and generators of international value chains.

278 clusters have reached the management excellence recognised by the European Secretariat for Cluster Analysis by means of the bronze, silver and gold labels.

The ICT sector is leading both in terms of labelled clusters (47), member companies (1383) and RDI providers (154).

The non - IT sectors are divided into traditional clusters (mechanical engineering, wood and furniture, textiles etc.) and smarter ones (mechatronics, plastics, mobility etc.).

There is an East-West divide both in terms of innovative/non-innovative companies as well as with regard to traditional vs. smart sectors.

66% of the ICT RDI providers, members of ESCA labelled clusters are present in Austria, Bavaria and Baden Wuerttemberg, while all 290 cluster companies acting in the wood & furniture sector are to be found in the Eastern part of the Danube Region.

With 44% of the 668 companies and 73% of the 147 RDI providers acting in the field of mechatronics, Austria is the absolute leader; on the other side, 83% of the 552 mechanical engineering cluster member companies are to be found in the Eastern part of the region.

Mobility clusters follow the localisation of Original Equipment Manufacturers (OEMs) (with an outstanding 58% of RDI providers due to Renault's delocalisation of research) while plastics is heavily represented in the Western part of the region, Baden Wuerttemberg leading with 65% of the companies and 75% of the RDI organisations.

As a consequence, the Western part of the Danube Region (Baden Wuerttemberg, Bavaria, Austria) are more specialised in R&D and product development while the Eastern regions focus on production.

At a first glance, the identified complementarities in the value chains represent a solid base for enhanced cooperation. However, from a medium-term perspective, the "low-skilled low tech" sectors as well as the low added value associated with the "production" link of the value chain represent a competitive disadvantage which put an additional stress on Eastern Danubian industrial sectors which face the challenge of getting smarter or dying out. In this context, the digitalisation processes in companies, against the broader Industry 4.0 approach represent a forthcoming solution. This must be accompanied by reskilling and upskilling measures leading to individual and institutional learning processes at the level of staff and companies.

	AT	BG	HR	CZ	BW	BY	HU	RO	SK	SI	BH	MN	RS	Odessa	Ivano Frankivsk	Chernivtsi	Zakarpatija	MD	
Aviation and Space				1	1	1													3
Biotechnology	1				3	2	3	1	2	1			2						15
Construction	1	1		3	2	1	2	1					1						12
Creative industries	1		1		4	3		3	2										14
Energy and environment	3		1	4	4	4	7	3	7	2			2						37
Food	1		3			1	1	5											11
Health	4			2	6	2	2	6											22
ICT	1	3	2	3	4	4	9	11	6	2			2						47
Logistics/Packaging					1	1	1												3
Maritime		1																	1
Micro/nano/opto		1			6	3		3											13
Mobility	1	2	2	1	5	1	2	5	1	1									21
New Materials	1			2	3	3		1	1	2									13
Mechatronics & Electronics & Automation	2	1			4	2	1	3	1										14
Wood & Furniture		1	1	1			1	3		1									8
Mechanical Engineering		1	4	2	1		1	5	2	1			2						19
Trade		1																	1
Plastics				1	2		1				1								5
Textiles		1						4	1										6

Tourism			1	1			2	3	6				9						13
	16	13	15	21	46	28	33	57	29	10	1		9						278

Source: https://www.cluster-analysis.org/

Annex 2 The Value Chain Index Calculation

No	Sector according to ESCA	Number in the Danube Region (c)	Countries in the Danube Region (r)	14 industrial ecosystems (s)	DanubePeerChains (d)	Result (V)
1	Aviation and space	0.010791367	0.166666667	1	0	1.177458
2	Biotechnology	0.053956835	0.444444444	0	0	0.498401
3	Construction	0.043165468	0.444444444	1	0	1.48761
4	Creative industries	0.050359712	0.333333333	1	0	1.383693
5	Energy and environment	0.133093525	0.555555556	1	0	1.688649
6	Food	0.039568345	0.277777778	1	0	1.317346
7	Health and medical technologies	0.068345324	0.333333333	1	0	1.401679
8	ICT	0.169064748	0.611111111	1	1	2.780176
9	Logistics: Packaging, Delivery, Logistical Systems and Services	0.010791367	0.166666667	0	0	0.177458
10	Maritime	0.003597122	0.055555556	0	0	0.059153
11	Micro, nano, opto	0.04676259	0.222222222	0	0	0.268985
12	Mobility	0.075539568	0.555555556	1	0	1.631095
13	New Materials	0.04887218	0.388888889	0	0	0.437761

14 a	Mechatronics & Electronics & Automation	0.050359712	0.388888889	1	1
					2.439249
14 b	Wood & Furniture	0.028776978	0.333333333	1	1
					2.36211
14 c	Mechanical Engineering (incl. Machine Building)	0.068345324	0.5	0	1
					1.568345
14 d	Trade	0.003597122	0.055555556	1	0
					1.059153
14 d	Plastics	0.017985612	0.222222222	0	1
					1.240208
15	Textiles	0.021582734	0.166666667	1	0	1.188249
16	Tourism	0.04676259	0.277777778	1	0	1.32454

Annex 3 Number of companies and RDI providers in the ESCA labelled clusters

ICT	AT	BG	CZ	BW	BY	HU	RO	SK	RS	Total
Companies	47	53	92	556	107	174	247	44	63	1383
RDI	17	9	5	70	14	15	17	7		154

Mobility	AT	HR	CZ	BW	BY	RO	SI	Total
Companies	302		82	98	133	143	86	844
RDI	7	1	4	10	8	53	9	92

Mechanical Engineering	BG	HR	CZ	BW	HU	RO	SK	SI	RS	Total
Companies	21	22	40	97	28	133	9	70	132	552
RDI	5		1		1	23	3	2	9	44

Mechatronics	BG	HR	CZ	BW	HU	RO	SK	SI	RS	Total
Companies	21	22	40	97	28	133	9	70	132	552
RDI	5		1		1	23	3	2	9	44

Plastics	CZ	BW	BH	Total
Companies	49	107	9	165
RDI	1	6	1	8

Wood & furniture	BG	CZ	HU	RO	SI	Total
Companies	15	28	44	107	96	290

RDI		1		10	11

Source: ESCA Website and the websites of the labelled clusters