



CYBERSECURITY LEADERS AND FOLLOWERS IN THE EU

WITH A FOCUS ON THE 3 SEAS REGION

Dominique Lepore – Ph.D. Candidate in Global Studies. Justice, Rights and Politics UNIMC (Italy)

Robert Siudak – International Mobility Supervisor, The Kosciuszko Institute

INTRODUCTION: OBJECTIVES AND METHODOLOGY

The present analysis aims to describe cybersecurity perspectives among European countries with a focus on the 3 SEAS countries by considering the digital aspects of civil society and of the digital business environment through digital-related indicators.¹

The indicators are listed in Table 1. They were selected to provide a general overview of the digital trends in business and civil society. As for the business area, the following indicators were considered: the % of enterprises employing ICT specialists, training to develop or upgrade ICT skills,

ICT functions performed internally, and the buying of high level cloud computing (CC) services. On the other hand, for civil society, the analysis focused on factors such as the % of individuals with above basic digital skills and using cloud services. For both categories, an indicator was selected to describe security-related aspects, such as the % of firms with a formalized ICT security policy and the % of those concerned about security, calculated as a mean of different scores. Overall, the indicators used for clustering are presented in Appendix 1, and were first applied to all EU countries and then only to the countries of the 3 SEAS region. Further, since most indicators encompass interesting sub-categories that were not included in defining clusters to avoid duplication of results, they are analyzed in Chapter 3. Chapter 2 describes the averages and standard deviations registered among the European countries.

BUSINESSES RELATED:	CIVIL SOCIETY RELATED:	SECURITY RELATED:
% enterprises that employ ICT specialists (2017)	% of individuals with above basic digital skills (2017)	% of enterprises with formalized ICT security policy (2015)
% of enterprises in which ICT functions are performed mainly by own employees (2017)	% of individuals using internet storage space to save document, pictures, music, video or other files (2017)	% of individuals with security concerns (2015)
% of enterprises buying high level CC services (accounting, software, CRM software and computing power) (2017)		
% of enterprises providing training to develop or upgrade ICT skills (2017)		

Table 1- Indicators selected

¹ Eurostat, Eurostat Databases, <http://ec.europa.eu/eurostat/data/database>.

CLUSTER ANALYSIS

The outcomes of the cluster analysis performed with R software using the Ward’s method and the Euclidean distance are presented first for all EU countries and then only for 3 SEAS countries. For each cluster, the average levels for each group are included. A correlation matrix was developed based on the indicators to highlight emerging relationships.

Clusters within the EU (all countries)

The first macro cluster that was identified based on the eight indicators for all EU countries (Table 1) indicated the presence of three main groupings (from left to right): A, B, and C,

This group performed slightly better than cluster B (35.8%) that outperformed other countries (the United Kingdom, Finland, Sweden, Denmark, the Netherlands, and Luxemburg) in respect of all the other indicators. Conversely, cluster A included the lowest performing countries with regard to business security policies, with only 17.3% firms with a formalized security policy.

Moreover, the highest security concerns were registered in the best performing group (20.9% of individuals respect to 14.8% in cluster C and 13.7% in cluster A)

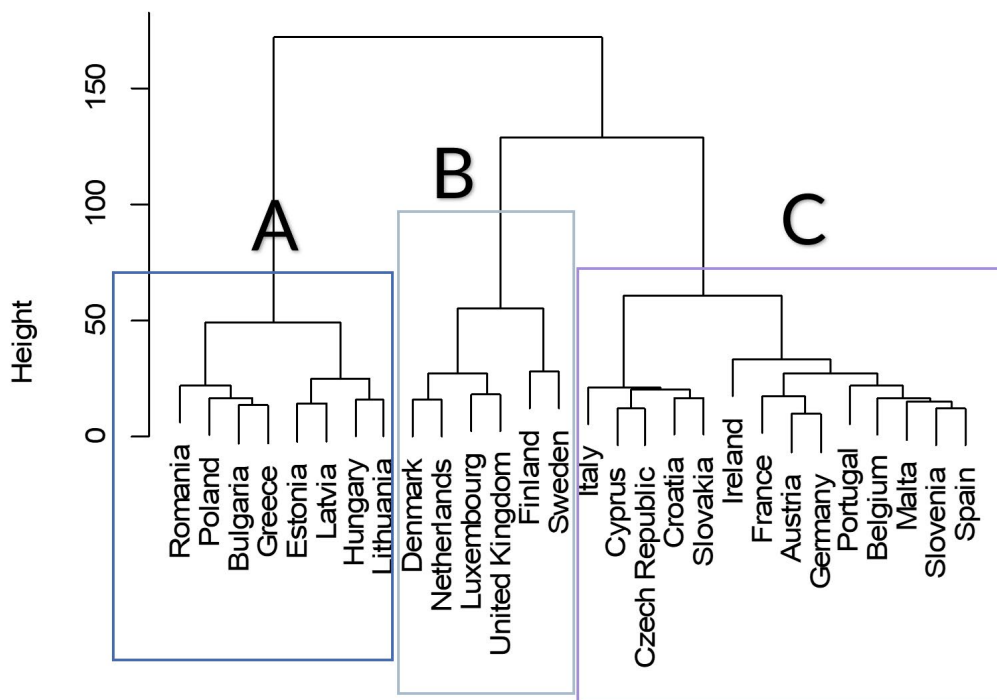


Figure 1 - Cluster Analysis within the EU (all countries)

with Poland, Romania, Bulgaria, Greece, Hungary, Lithuania, Estonia and Latvia included in cluster A. The table below shows the average values for the three groupings with respect to each indicator.

In relation to business security policies, the highest values were found in group C, including most of the EU countries: Italy, Portugal, Cyprus, the Czech Republic, Croatia, Slovakia, Austria, Germany, France, Slovenia, Ireland, Belgium, Malta and Spain, with an average of 36.8%.

These percentages should be considered together with the average level of digital skills which was much higher in cluster B than in the two other clusters (47.3% with respect to 23% in cluster A and 29.1% in cluster C). and with cloud services used by individuals with 46.9% in cluster B. Instead, group A scored the lowest on the % of enterprises offering training to develop or upgrade ICT skills (11% compared to 28.2% in cluster B), and on basic digital skills (23% against 47.3% in group B).

INDICATOR	A	B	C
% of enterprises that employ ICT specialists (2017)	16.9	28.6	22.1
% of enterprises providing training to develop or upgrade ICT skills of staff (2017)	11	28.5	24.6
% of firms performing ICT functions internally (2017)	18.3	23.2	16.9
% of enterprises with a formalized ICT security policy (2015)	17.3	35.8	36.8
% of enterprises buying high level cloud computing services (2017)	7.9	25.6	11.7
% of individuals with basic overall digital skills (2017)	23	47.3	29.1
% of individuals with concerns over Internet security (2015)	13.7	20.9	14.8
% of individuals using cloud services (2017)	22.6	42.6	28.3

Figure 1 – Cluster Analysis within the EU (all countries)

Correlation between indicators

The correlation (Figure 2) allows us to understand the relationships among indicators, considering all eight indicators reported for the 28 EU countries.

The correlation matrix showed that there were mostly positive relationships among indicators, except for security policies and ICT functions performed internally where the relation was zero; similarly, no relation occurred between security concerns by society, expressed by the % of individuals with concerns over Internet security and ICT specialists employed.

Considering the strongest positive relationships, it should be noted that there was a close relationship between individuals with a high level of digital skills and individuals using cloud services, and between ICT functions performed internally and high digital skills for ICT training and ICT specialists employed (absolute positive value of 0.7).

Another interesting relationship, even if less relevant in intensity, was found in companies offering training and companies purchasing cloud services, with an absolute value of 0.6.



Figure 2. Correlation matrix

Clusters within the 3 SEAS countries

A similar analysis was performed to include only the 12 countries of the 3 SEAS initiative. The analysis showed two leading clusters: A and B (from the left to right), with Poland in cluster B along with Estonia, Latvia, Bulgaria, Hungary and Lithuania. It is interesting to note that the first grouping includes all the countries previously in cluster C: Italy, Portugal, Cyprus, the Czech Republic, Croatia, Slovakia, Austria, Germany, France, Slovenia, Ireland, Belgium, Malta and Spain (the second best performing cluster at the EU level). Indeed, these are the countries performing better than cluster B of 3 SEAS countries. Table 3, based on the average values, shows the greatest differences between the clusters regarding the % of enterprises providing training to develop or upgrade ICT skills, with the highest percentage recorded in cluster A (24.2%) compared to 10.9% in cluster B. Similar differences between the clusters were observed in relation to the % of enterprises with a formalized ICT security policy (35.8% in cluster A compared to only 16.4% in cluster B). In general, the % of individuals with security concerns was higher in cluster B (nearly 14%) than in cluster A (11.5%). Conversely, the former performed slightly better in terms of the % of internal staff working in ICT functions (19.3% compared to 17.6% respectively). As for the % of individuals using cloud services, the values were similar between the two clusters.

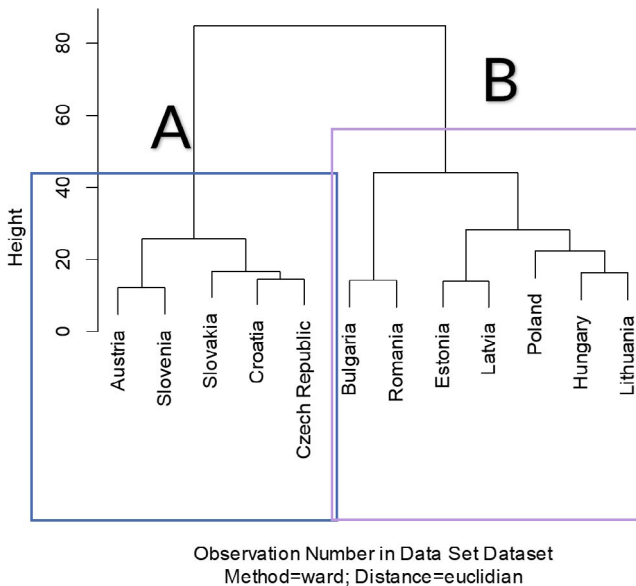


Figure 2. Correlation matrix

*missing value for Lithuania regarding the % of business with a formalized ICT security policy was calculated based on the average value recorded by the country.

INDICATOR	A	B
% of enterprises that employ ICT specialists (2017)	20.6	16.4
% of enterprises providing training to develop or upgrade ICT skills of staff (2017)	24.2	10.9
% of firms performing ICT functions internally (2017)	17.6	19.3
% of enterprises with a formalized ICT security policy (2015)	35.8	16.4
% of enterprises buying all high cloud computing services (2017)	12.4	8.4
% of individuals with basic overall digital skills (2017)	28.8	23.1
% of individuals with concerns over Internet security (2015)	11.5	13.9
% of individuals using cloud services (2017)	23.6	23

Table 3. Average values for indicators in the 3 SEAS clusters

OVERVIEW OF INDICATORS IN THE EU

Minimum and Maximum Values at the EU level

Maximum scores were observed mainly for the countries in the best performing group (B), as seen in the first cluster analysis, with Ireland as a top scorer for ICT specialists, and Sweden for security policies, ICT functions performed internally, and security concerns among individuals. Conversely, the United Kingdom scored the highest for ICT internal staff, followed by Finland for both the % of businesses using cloud services and ICT training, confirming the positive relationship noted in the correlation matrix.

On the other hand, Luxemburg led in the category of high-level digital skills whereas Denmark scored the highest when it comes to the % of individuals using cloud services. However, it must be noted that no country from cluster A (all EU countries) scored the highest in any of the eight categories; on the contrary, they recorded minimum values, with Romania scoring the lowest in the % of ICT specialists, ICT training, ICT skills recruitment, and general digital skills. Poland, on the other hand, scored the lowest in the % of individuals using cloud services, together with Hungary and Croatia. The Czech Republic noted the lowest % of individuals with concerns over Internet security while Hungary was the lowest performing country in the category of a formalized ICT security policy among enterprises.

	ICT specialists	ICT internally	Security policy	Cloud services	ICT training	Sec concerns	Use of cloud services	Digital skills
MIN	ROMANIA	GREECE	HUNGARY	HUNGARY, POLAND, CROATIA	ROMANIA	CZECH REPUBLIC	POLAND	ROMANIA
MAX	IRELAND	SWEDEN	SWEDEN	FINLAND	FINLAND	SWEDEN	DENMARK	LUXEMBURG

Table 4. Best and worst performing countries

Average and standard deviation levels in the EU and 3 SEAS

	ICT specialists	ICT internally	Security policy	Cloud services	ICT training	Sec concerns	Use of cloud services	Digital skills
EU Average	21	19	31	14	22	16	30	31
EU Standard Deviation	5	4	11	9	8	7	10	11
3 SEAS Average	18	19	25	10	16	13	23	26
3 SEAS Standard Deviation	5	4	11	4	8	6	4	8

Table 5. The EU average and standard deviation compared to 3 SEAS

The highest average percentage among the indicators selected at the EU level was recorded for ICT security policy and digital skills areas; there were also the largest variations among the EU countries, with deviations of 11 noted in the areas mentioned above; a similar emerging trend was also observed in the 3 SEAS countries.

Conversely, low percentages on average were related mainly to security concerns in society and the use of cloud services among businesses. The same trend was also observed in the 3 SEAS countries.

European overview

To give a better general picture, an average of all indicators was computed (average: 23) and compared with the average recorded in each country to identify those above and below the EU average. These groupings are highlighted on the map below (Figure 4) with different colours: countries within and above the EU average are in green, countries below the EU average – in red, and countries close to but not equal to the EU average² – in blue. The map largely reflects the results from the cluster analysis with a slight difference regarding Austria, Belgium, Germany, Luxemburg, Malta, Portugal, and Spain which are marked green as the leading countries, with Austria being the leading country in the 3 SEAS.

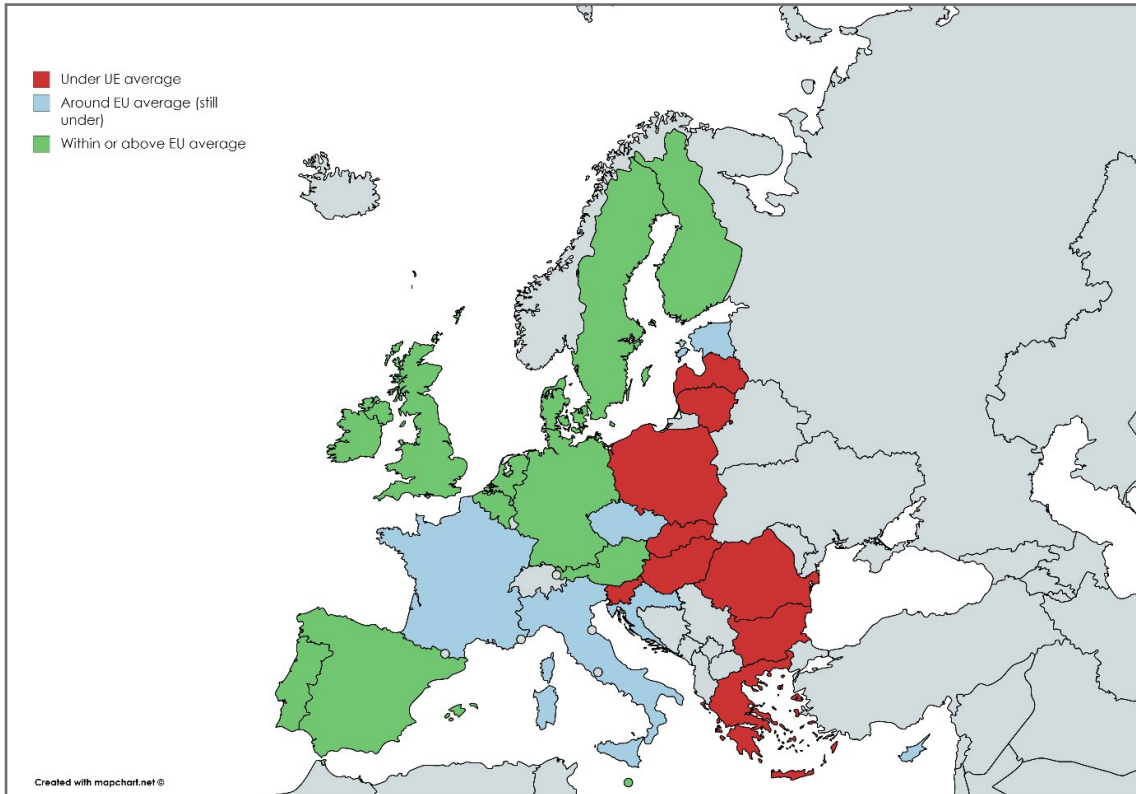


Figure 4. Mapping the EU according to average levels of ICT ecosystem maturity indicators

EXPLORING EACH INDICATOR

ICT specialists

For this indicator, the variations among the EU countries show that between 2012 and 2017 there was a decrease with respect to 2012, especially in Greece (-15%), Latvia and Portugal (-9%), whereas an increase was recorded for Bulgaria and Romania (+6%), showing the willingness of these 3 SEAS countries to catch up with the European level. It can be noted that from 2012, differences among European countries have been decreasing.

In the case of SMEs employing ICT specialists, a decrease was observed for Greece, Latvia and Portugal. However, considering the size of these firms, further aspects should be captured in order to analyse the trend more accurately. In general, the average was higher in 2012, and so were differences among the countries. The same trend could be observed in the 3 SEAS countries.

For ICT specialists employed, other aspects may need to be considered, for example the number of enterprises experiencing difficulties to fill vacancies requiring ICT skills, noting a general increase in all countries, except for Poland. In Estonia and the Netherlands, it appears more difficult to fill vacant positions for ICT specialists.

Enterprises that employ ICT specialists											
All enterprises, without financial sector (10 employees or more)						VAR	SMEs (10-249 employees)				
GEO/TIME	2012	2014	2015	2016	2017		2012	2014	2015	2016	2017
Austria	31	24	24	25	23	-8.00	30	22	22	23	21
Belgium	28	26	28	26	29	1.00	26	24	27	24	28
Bulgaria	13	21	20	20	19	6.00	13	20	19	19	18
Croatia	21	20	22	17	20	-1.00	19	17	19	15	18
Cyprus	24	25	26	25	25	1.00	23	24	25	23	24
Czech Republic	29	21	19	19	21	-8.00	27	18	17	17	18
Denmark	27	27	24	25	24	-3.00	25	25	23	24	23
Estonia	18	15	15	15	15	-3.00	16	14	13	13	14
Finland	33	28	25	24	26	-7.00	31	26	23	23	24
France	15	15	16	16	17	2.00	13	13	15	14	16
Germany	21	22	21	22	19	-2.00	19	20	19	20	17
Greece	35	24	26	30	20	-15.00	34	24	25	29	19
Hungary	30	27	26	26	27	-3.00	29	25	24	24	26
Ireland	32	28	30	35	33	1.00	31	26	29	34	32
Italy	14	15	17	17	16	2.00	13	14	16	16	15
Latvia	23	21	19	17	14	-9.00	22	19	17	16	12
Lithuania	22	16	15	15	18	-4.00	21	14	13	14	16
Luxembourg	32	20	25	24	24	-8.00	30	19	23	22	23
Malta	26	26	26	26	26	0.00	24	24	24	24	24
Netherlands	26	27	28	26	27	1.00	24	25	26	24	25
Poland	14	10	12	12	12	-2.00	12	8	10	10	10
Portugal	29	19	20	19	20	-9.00	28	18	18	18	18
Romania	4	12	13	11	10	6.00	4	11	12	10	9
Slovakia	25	18	19	20	20	-5.00	23	16	17	18	17
Slovenia	21	20	20	20	19	-2.00	19	17	18	18	17
Spain	22	25	25	25	21	-1.00	21	23	24	24	20
Sweden	22	20	19	18	20	-2.00	17	14	13	12	14
United Kingdom	30	24	22	23	22	-8.00	29	23	21	22	20
EU Average	24	21	22	21	21	EU AVERAGE	22	19	20	20	19
EU Standard Deviation	7	5	5	5	5	EU SD	7	5	5	6	5
3 SEAS Average	21	19	19	18	18	3 SEAS AVERAGE	20	17	17	16	16
3 SEAS Standard Deviation	8	5	4	4	5	3 SEAS SD	7	4	4	4	4

	Enterprise with hard-to-fill vacancies for jobs requiring ICT specialist skills					VAR
GEO/TIME	2012	2014	2015	2016	2017	
Austria	5	4	5	6	7	2.00
Belgium	3	3	3	3	4	1.00
Bulgaria	3	3	3	4	5	2.00
Croatia	4	5	5	6	7	3.00
Cyprus	-	4	-	4	5	1.00
Czech Republic	2	3	3	5	8	6.00
Denmark	4	4	5	6	6	2.00
Estonia	2	2	2	2	3	1.00
Finland	2	1	2	2	2	0.00
France	3	3	3	3	4	1.00
Germany	2	1	2	3	5	3.00
Greece	1	1	1	2	2	1.00
Hungary	2	2	3	2	4	2.00
Ireland	2	2	2	2	2	0.00
Italy	4	4	3	4	4	0.00
Latvia	7	6	6	8	9	2.00
Lithuania	3	4	4	5	6	3.00
Luxembourg	5	6	7	7	8	300
Malta	4	4	4	5	8	4.00
Netherlands	4	5	5	5	6	2.00
Poland	3	1	2	2	2	-1.00
Portugal	-	1	1	2	2	1.00
Romania	1	1	1	1	1	0.00
Slovakia	2	3	3	4	4	2.00
Slovenia	3	2	3	4	3	0.00
Spain	5	4	3	5	6	1.00
Sweden	6	4	4	4	5	-1.00
United Kingdom	5	5	4	4	5	0.00

ICT security policy

This indicator can be further explored considering the types of risks that ICT security policies address and the differences emerging with respect to 2010.

In this sense, as it is outlined in the tables below, Sweden is the leading country (50% of enterprises with a formalized ICT security policy), followed by Portugal (49%).

Considering the number of security policies that were updated within a period of 12 months, the highest value was recorded in Ireland (30%) and not in the leading countries like Sweden (26%) and Portugal (29%).

The security risks considered by the policies are that of destruction or corruption of data due to an attack or by unexpected

incident, disclosure of confidential data due to intrusion, pharming, phishing attacks or by accident, unavailability of ICT services due to an attack from outside (e.g. Denial-of-Service attack), destruction or corruption of data, disclosure of confidential data and unavailability of ICT services due to an attack or an accident

The security risks addressed relate especially to the destruction or corruption of data due to an attack or an unexpected accident. Given the variation values from 2010, a significant increase in ICT policies per risk was noted for Croatia for all types of risks included in the security policies in general, whereas a decrease was observed for Greece in security policies for destruction or corruption of data due to an attack or unexpected incident.

	Formalized ICT security policy	ICT security policy was defined or most recently reviewed within the last 12 months	ICT security policy was defined or most recently reviewed within the last 24 months
GEO/TIME	2015	2015	2015
Austria	5	4	5
Belgium	3	3	3
Bulgaria	3	3	3
Croatia	4	5	5
Cyprus	-	4	-
Czech Republic	2	3	3
Denmark	4	4	5
Estonia	2	2	2
Finland	2	1	2
France	3	3	3
Germany	2	1	2
Greece	1	1	1
Hungary	2	2	3
Ireland	2	2	2
Italy	4	4	3
Latvia	7	6	6
Lithuania	3	4	4
Luxembourg	5	6	7
Malta	4	4	4
Netherlands	4	5	5
Poland	3	1	2
Portugal	-	1	1
Romania	1	1	1
Slovakia	2	3	3
Slovenia	3	2	3
Spain	5	4	3
Sweden	6	4	4
United Kingdom	5	5	4

GEO/TIME	Destruction or corruption of data due to an attack or an unexpected incident		VARIATIONS	Disclosure of confidential data due to intrusion, pharming, phishing attacks or by accident		VARIATIONS	Unavailability of ICT services due to an attack from outside (e.g. Denial-of-Service attack)		VARIATIONS	Destruction or corruption of data, disclosure of confidential data and unavailability of ICT services due to an attack or an accident		VARIATIONS
	2010	2015		2010	2015		2010	2015		2010	2015	
Austria	22	26	4	21	24	3	19	21	2	18	20	2
Belgium	23	30	7	20	26	6	19	25	6	17	23	6
Bulgaria	5	17	12	4	15	11	4	13	9	3	12	9
Croatia	14	38	24	12	34	22	10	33	23	9	31	22
Cyprus	36	37	1	28	25	-3	25	24	-1	24	20	-4
Czech Republic	19	30	11	14	27	13	12	22	10	10	20	10
Denmark	38	33	-5	31	29	-2	34	29	-5	29	26	-3
Estonia	9	15	6	8	14	6	6	12	6	6	11	5
Finland	35	34	-1	30	30	0	28	28	0	26	26	0
France	20	24	4	17	22	5	15	20	5	14	19	5
Germany	25	26	1	22	24	2	19	21	2	18	20	2
Greece	38	21	-17	31	16	-15	31	15	-16	27	13	-14
Hungary	9	9	0	7	9	2	7	8	1	6	8	2
Ireland	26	40	14	24	39	15	22	36	14	21	35	14
Italy	26	37	11	22	32	10	17	26	9	15	22	7
Latvia	14	15	1	11	14	3	10	12	2	10	11	1
Lithuania	21	-		17	-		17	-		16	-	
Luxembourg	26	24	-2	25	22	-3	24	21	-3	22	19	-3
Malta	27	38	11	25	38	13	21	32	11	20	31	11
Netherlands	23	24	1	21	23	2	22	23	1	17	20	3
Poland	10	12	2	8	9	1	7	9	2	7	8	1
Portugal	17	44	27	13	37	24	12	35	23	10	29	19
Romania	8	24	16	6	21	15	5	19	14	5	18	13
Slovakia	35	38	3	34	35	1	35	29	-6	34	26	-8
Slovenia	15	32	17	12	28	16	12	26	14	11	23	12
Spain	30	32	2	27	29	3	28	24	3	24	23	3
Sweden	38	39	1	35	38	2	30	33	-4	27	30	-1
United Kingdom	27	32	5	25	32	7	23	27	4	21	26	5

Cloud services used by businesses

The indicator considered in the cluster analysis for cloud services in the business area can be further explored by looking at different factors as accounting, CRM, or computing power. The greatest usage was noted for buying mail as a cloud service in Finland (55%) in 2017. As for cloud computing

services over the Internet, the highest value was once again reported for Finland (66%). All EU countries noted the lowest variation values in relation to CRM in general and buying computing power to run the enterprise's own software, even though an upward trend could be observed compared to 2014, with Finland once again in the lead.

GEO/TIME	Buy high CC services (accounting software applications, CRM software, computing power)			
	2014	2015	2016	2017
Austria	12	14	16	-
Belgium	5	3	3	4
Bulgaria	8	-	9	12
Croatia	25	23	26	33
Cyprus	5	-	7	-
Czech Republic	8	-	15	-
Denmark	12	17	20	-
Estonia	4	5	4	4
Finland	6	7	9	12
France	5	-	8	-
Germany	14	12	13	17
Greece	16	-	7	-
Hungary	4	6	7	10
Ireland	3	4	4	7
Italy	9	10	10	15
Latvia	4	-	9	-
Lithuania	4	5	6	9
Luxembourg	6	-	11	-
Malta	17	-	23	-
Netherlands	5	-	8	9
Poland	3	3	4	4
Portugal	7	-	10	11
Romania	2	5	4	5
Slovakia	9	10	12	11
Slovenia	12	12	10	13
Spain	27	30	34	42
Sweden	22	-	28	-
United Kingdom	11	-	19	-

GEO/TIME	Buying computing power to run the enterprise's own software (as a CC service)				Buying CC services used over the Internet				Buying e-mail (as a CC service)			
	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
Austria	5	8	8	-	21	25	28	40	11	15	16	-
Belgium	1	1	1	2	8	5	7	8	6	4	4	6
Bulgaria	3	-	4	4	15	-	18	22	12	-	14	17
Croatia	13	12	14	17	38	37	42	51	24	24	28	36
Cyprus	2	-	3	-	11	-	16	-	5	-	8	-
Czech Republic	1	-	6	-	15	-	23	-	9	-	15	-
Denmark	5	6	8	-	28	35	36	-	16	23	25	-
Estonia	2	3	2	2	8	9	9	11	5	6	6	8
Finland	4	4	5	7	14	15	18	24	9	10	13	18
France	2	-	3	-	12	-	17	-	7	-	11	-
Germany	6	5	5	6	22	22	23	31	19	18	17	25
Greece	3	-	2	-	40	-	22	-	35	-	18	-
Hungary	2	3	3	5	10	13	15	22	7	9	11	16
Ireland	1	2	2	2	6	8	8	12	3	6	6	8
Italy	5	6	6	9	13	16	17	23	9	12	12	18
Latvia	2	-	5	-	13	-	19	-	6	-	12	-
Lithuania	2	2	3	5	8	11	12	16	5	7	8	11
Luxembourg	3	-	6	-	17	25	28	-	10	-	21	-
Malta	5	-	7	-	28	-	35	-	15	-	20	-
Netherlands	2	-	4	4	12	-	17	21	6	-	9	12
Poland	1	1	2	2	6	7	8	10	4	5	6	7
Portugal	4	-	6	6	13	-	18	23	10	-	14	18
Romania	1	3	2	2	5	8	7	11	4	5	5	8
Slovakia	4	4	5	4	15	17	22	22	10	10	13	14
Slovenia	4	4	4	6	19	20	18	22	16	17	15	18
Spain	7	7	8	10	51	53	57	66	33	37	42	50
Sweden	10	-	12	-	39	-	48	-	22	-	32	-
United Kingdom	5	-	8	-	24	-	35	-	12	-	22	-

GEO/TIME	Buying office software (e.g. word processors, spreadsheets, etc.) (as a CC service)				Buying Customer Relationship Management software (as a CC service)			
	2014	2015	2016	2017	2014	2015	2016	2017
Austria	4	3	3	4	6	8	9	-
Belgium	6	-	7	11	2	1	1	2
Bulgaria	16	17	20	27	3	-	4	5
Croatia	2	-	5	-	13	12	14	18
Cyprus	6	-	10	-	2	-	3	-
Czech Republic	10	15	17	-	2	-	4	-
Denmark	2	4	5	5	6	9	11	-
Estonia	4	4	7	10	2	2	2	2
Finland	4	-	6	-	3	4	5	7
France	12	10	11	16	3	-	5	-
Germany	16	-	8	-	3	4	3	5
Greece	4	6	8	13	6	-	4	-
Hungary	2	3	3	5	3	4	4	7
Ireland	5	5	6	10	1	1	2	3
Italy	4	-	9	-	5	4	4	6
Latvia	3	4	6	8	2	-	5	-
Lithuania	5	-	14	-	2	3	3	4
Luxembourg	11	-	17	-	3	-	6	-
Malta	4	-	6	8	10	-	14	-
Netherlands	2	2	3	4	3	-	4	5
Poland	5	-	8	11	1	2	2	2
Portugal	2	3	3	4	2	-	5	6
Romania	5	6	11	11	0	0	1	0
Slovakia	9	10	9	12	3	4	5	5
Slovenia	20	24	29	37	3	4	3	5
Spain	12	-	21	-	15	16	20	22
Sweden	7	-	17	-	10	-	14	-
United Kingdom	19	-	-	-	6	-	11	-

ICT training

Variation levels in the area of training to develop or upgrade ICT skills showed a growing trend in the Netherlands (8%), Luxemburg and Spain (7%). Poland kept its percentage stable at 12, increasing only by 2 percentage points compared to 2012,

which is still below the EU average. A major decrease was noted especially in Slovenia (with a decrease of 8 percentage points). In the case of SMEs, the results were consistent with general trends except for France and Romania, where no variation occurred for SMEs and other enterprises.

GEO/TIME	Enterprise provided training to their personnel to develop/upgrade their ICT skills						SMEs (10–249 employees), without financial sector					
	2012	2014	2015	2016	2017	VAR	2012	2014	2015	2016	2017	VAR
Austria	29	34	33	37	31	2	28	33	32	35	29	1
Belgium	30	33	32	34	35	5	29	31	31	32	33	4
Bulgaria	14	15	8	8	9	-5	13	15	7	7	8	-5
Croatia	28	23	25	22	23	-5	27	22	23	20	22	-5
Cyprus	28	22	23	22	26	-2	27	21	22	21	25	-2
Czech Republic	22	22	22	22	23	1	20	20	20	19	21	1
Denmark	28	30	29	28	27	-1	26	28	28	27	25	-1
Estonia	12	14	14	13	13	1	11	12	12	12	12	1
Finland	40	40	37	34	38	-2	38	38	36	33	36	-2
France	20	21	21	20	19	-1	18	19	20	19	18	0
Germany	24	31	30	29	28	4	22	29	28	27	26	4
Greece	15	11	15	15	12	-3	14	11	14	14	11	-3
Hungary	14	16	16	16	17	3	13	14	14	14	16	3
Ireland	28	25	30	30	30	2	26	24	29	29	29	3
Italy	11	10	12	12	13	2	10	9	12	11	12	2
Latvia	10	11	12	12	10	0	9	10	11	11	9	0
Lithuania	10	9	11	10	11	1	9	8	10	9	10	1
Luxembourg	21	22	25	29	28	7	19	21	24	27	26	7
Malta	24	21	25	23	28	4	22	19	23	21	26	4
Netherlands	16	18	18	22	24	8	15	16	16	21	22	7
Poland	10	10	12	12	12	2	9	8	10	10	10	1
Portugal	23	26	22	23	21	-2	22	25	21	22	20	-2
Romania	5	5	5	5	4	-1	4	4	5	4	4	0
Slovakia	25	17	19	20	17	-8	23	15	17	18	15	-8
Slovenia	27	20	28	27	27	0	25	18	27	26	25	0
Spain	23	27	26	25	28	5	22	26	25	23	27	5
Sweden	16	22	22	23	23	7	15	21	21	22	21	6
United Kingdom	28	24	27	28	26	-2	27	23	26	27	25	-2

Society concerns

The indicator related to society concerns used in the cluster analysis was an average of different aspects, such as security concerns regarding buying or ordering goods via the Internet for private usage, online banking activities, sharing personal information with online communities for social and professional purposes, communicating with public services, and downloading applications. All these results were compared to 2010.

Greater variation levels showing increasing concerns were recorded in Romania (16.4%), followed by Malta (12.8%) and

Sweden (+9%), a country that was leading in security policies among businesses; on the other hand, negative levels were observed in Italy where concerns seemed lower compared to 2010 (-9%).

As for the categories where major concerns are present at the EU level, sharing information with online communities, social and professional networking (24.7%) scored the highest, same as in the 3 SEAS region (18.8%). Minor concerns were noted instead in the category of communicating with public services and administration.

GEO/TIME	Security concerns prevented individuals from ordering or buying goods or services for private use		Carrying out banking activities such as account management		Sharing personal information with online communities for social and professional networking		Communicating public services - administration		Downloading software, music, video files, games or other data files		AVERAGE SCORE 2010	AVERAGE SCORE 2015	VAR
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015			
Austria	17	19	7	15	18	18	3	8	11	17	11.2	15.4	4.20
Belgium	28	20	15	15	33	32	9	11	23	19	21.6	19.4	-2.20
Bulgaria	29	19	28	18	31	22	11	9	13	9	22.4	15.4	-7.00
Croatia	13	14	7	6	10	17	3	4	6	7	7.8	9.6	1.80
Cyprus	18	9	12	9	18	14	3	2	5	4	11.2	7.6	-3.60
Czech Republic	4	5	5	9	2	8	1	1	3	3	3	5.2	2.20
Denmark	21	22	13	12	33	32	6	7	23	25	19.2	19.6	0.40
Estonia	12	18	4	5	14	34	3	3	11	25	8.8	17	8.20
Finland	27	26	5	7	47	42	6	5	41	41	25.2	24.2	-1.00
France	30	29	19	15	36	35	9	8	24	17	23.6	20.8	-2.80
Germany	11	10	25	27	35	38	13	17	23	24	21.4	23.2	1.80
Greece	23	15	20	22	9	18	4	3	5	3	12.2	12.2	0.00
Hungary	12	11	14	12	16	-	6	5	8	9	11.2	9.25	-1.95

Ireland	13	13	11	10	13	16	3	4	4	5	8.8	9.6	0.80
Italy	44	25	39	24	35	32	20	13	27	25	33	23.8	-9.20
Latvia	22	28	15	17	25	24	11	16	17	25	18	22	4.00
Lithuania	9	6	6	4	10	8	5	1	5	4	7	4.6	-2.40
Luxembourg	23	16	18	14	29	21	10	10	19	19	19.8	16	-3.80
Malta	11	25	5	16	8	31	2	9	8	17	6.8	19.6	12.8
Netherlands	17	21	9	18	34	43	5	10	21	26	17.2	23.6	6.40
Poland	11	7	11	8	12	13	3	3	7	5	8.8	7.2	-1.60
Portugal	24	30	21	26	27	35	13	12	17	20	20.4	24.6	4.20
Romania	9	35	9	10	1	21	5	5	0	35	4.8	21.2	16.4
Slovakia	7	9	9	13	18	17	3	6	7	10	8.8	11	2.20
Slovenia	19	24	13	18	25	25	5	7	12	10	14.8	16.8	2.00
Spain	40	28	32	23	40	30	12	14	21	24	29	23.8	-5.20
Sweden	25	34	14	15	35	54	11	16	24	35	21.8	30.8	9.00
United Kingdom	16	11	19	13	21	17	4	4	14	11	14.8	11.2	-3.60
EU Average	19.11	18.89	14.46	14.32	22.68	25.81	6.75	7.61	14.25	16.93	15.45	16.59	
3 SEAS Average	13.67	16.25	10.67	11.25	15.17	18.82	4.92	5.67	8.33	13.25	10.55	12.89	
Standard Dev	9.42	8.51	8.49	6.10	11.99	11.14	4.39	4.59	9.25	10.45	7.55	6.79	
3 SEAS Standard Dev	6.70	8.99	6.24	4.82	8.66	7.30	3.01	3.94	4.50	9.65	5.28	5.66	

Digital skills

In the cluster analysis, only individuals with overall above basic digital skills were considered. For this category, variation was computed, showing an increase in Poland (6%), Cyprus (4%), and Austria (3%) compared to 2015. Conversely, in the same period of time, a decrease was observed in Croatia (-9%) and Estonia (-2%).

GEO/TIME	2015	2016	2017	VAR
Austria	33	35	36	3%
Belgium	31	32	31	0%
Bulgaria	13	10	11	-2%
Croatia	30	33	21	-9%
Cyprus	15	20	19	4%
Czech Republic	23	20	24	1%
Denmark	48	53	47	-1%
Estonia	37	35	35	-2%
Finland	41	44	45	4%
France	27	28	29	2%
Germany	35	33	37	2%
Greece	16	19	22	6%
Hungary	22	24	26	4%
Ireland	25	25	28	3%
Italy	19		-	
Latvia	26	27	27	1%
Lithuania	30	29	32	2%
Luxembourg	56	54	55	-1%
Malta	34	31	38	4%
Netherlands	43	45	48	5%
Poland	15	19	21	6%
Portugal	28	28	31	3%
Romania	9	9	10	1%
Slovakia	26	29	33	7%
Spain	30	31	32	2%
Sweden	17	24	18	1%
United Kingdom	24	25	23	-1%

CONCLUSIONS

The analysis showed that the set of best performing countries was represented by the United Kingdom, Finland, Denmark, Sweden and Ireland, followed – in terms of the second-best performing cluster – by most of the EU countries: Portugal, Cyprus, the Czech Republic, Croatia, Slovakia, Austria, Germany, France, Slovenia, Ireland, Belgium, Malta and Spain. By contrast, the cluster composed mainly of the 3 SEAS countries, i.e. Poland, Romania, Bulgaria, Hungary, Lithuania, Estonia Latvia, and Greece; they recorded the lowest scores on average.

The results also highlighted the presence of a set of leading countries among the 3 SEAS, with scores closer to the EU average like Austria which, on average, achieved results nearly as good as the best performing countries in the EU. However, considering the average of indicators in 3 SEAS in greater detail, this group differed less in terms of cloud services among businesses, reporting on average low levels on business using high CC.

Exploring averages and standard deviation among the EU countries, stark differences among the best and worst performing countries emerged mainly when it comes to two

indicators: high level of digital skills and a formalized ICT security policy, which was also reflected at the 3 SEAS level. Taking a closer look at the formalized security policy indicator, it is interesting to note a growing positive trend in Croatia and Malta in addressing most types of the risks. Then, for cloud services among businesses, the leading countries were represented by Finland creating the greatest variance in the EU.

Differences were less evident in terms of ICT functions performed internally as the averages for this indicator were one of the lowest in the EU, together with the use of cloud services and security concerns among individuals.

Security concerns among individuals are not equally spread among the European countries since there is an increasing trend both in the best performing countries (Sweden) and in those in need of improving their digital development (Romania). Concerns appear to be much higher when it comes to sharing information with social and professional networks than communicating with public services and administration.

Last, interesting relations were found between individuals with high level digital skills and individuals using cloud services, and between ICT performed internally and high-level digital skills, and for ICT training and ICT specialists employed (absolute value of 0.7).

APPENDIX 1	ICT specialist employed	ICT functions internally	Security policies	Business Cloud services	ICT training	Security concerns (Individuals)	Cloud services (Individuals)	Digital skills
Austria	23	21	28	9	31	15.4	27	36
Belgium	29	17	32	16	35	19.4	33	31
Bulgaria	19	15	19	4	9	15.4	18	11
Croatia	20	18	42	17	23	9.6	16	21
Cyprus	25	15	38	10	26	7.6	32	19
Czech Republic	21	14	33	12	23	5.2	24	24
Denmark	24	18	38	33	27	19.6	55	47
Estonia	15	27	17	15	13	17	30	35
Finland	26	26	37	42	38	24.2	37	45
France	17	17	27	8	19	20.8	23	29

Germany	19	21	29	7	28	23.2	27	37
Greece	20	11	23	4	12	12.2	20	22
Hungary	27	17	10	9	17	9.25	25	26
Ireland	33	17	42	20	30	9.6	42	28
Italy	16	12	43	7	13	1	23	19
Latvia	14	24	17	7	10	22	25	27
Lithuania	18	23	14	15	11	4.6	25	32
Luxembourg	24	23	25	9	28	16	47	55
Malta	26	16	41	11	28	19.6	36	38
Netherlands	27	18	29	23	24	23.6	49	48
Poland	12	15	13	4	12	7.2	15	21
Portugal	20	15	49	11	21	24.6	28	31
Romania	10	14	25	5	4	21.2	23	10
Slovakia	20	19	41	13	17	11	25	33
Slovenia	19	16	35	11	27	16.8	26	30
Spain	21	19	35	12	23	23.8	34	32
Sweden	20	27	51	28	28	31	22	46
United Kingdom	22	27	35	19	26	11.2	46	46

Data from 2016 instead of 2017 is highlighted in orange.
For Lithuania, the value in red was missing and was therefore replaced by an average of scores at a business level.



The Kosciuszko Institute is a non-profit, independent, non-governmental research and development institute (think tank), founded in 2000.

The Kosciuszko Institute's aim is to influence the socio-economic development and the security of Poland as a new member of the EU and a partner in the Euro-Atlantic alliance. Studies conducted by the Institutes have been the foundation for both important legislative reforms as well as a content-related support for those responsible for making strategic decisions.

The Kosciuszko Institute organizes the European Cybersecurity Forum – CYBERSEC – the first conference of its kind in Poland and one of just a few regular public policy conferences devoted to the strategic issues of cyberspace and cybersecurity in Europe, and also publishes the European Cybersecurity Journal – a new specialised quarterly publication devoted to cybersecurity.

More on the European Cybersecurity Forum: <http://cybersecforum.eu/>

More on the European Cybersecurity Journal: <https://cybersecforum.eu/en/about-ecj/>.

Office: Wilhelma Feldmana 4/9-10, 31-130 Kraków, Polska, tel.: +48 12 632 97 24,

www.ik.org.pl, e-mail: instytut@ik.org.pl