cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Impact assessment study

Final report

Erdyn
Engaging Innovation

ZSI

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1. EXECUTIVE SUMMARY

The Impact Assessment Study commissioned by the COST Association to ERDYN and ZSI in January 2019 aimed to **evaluate whether participation in COST Actions has positively impacted the careers of researchers and innovators**.

Two main methodological tools have been used in this study to assess the impact of COST Actions:

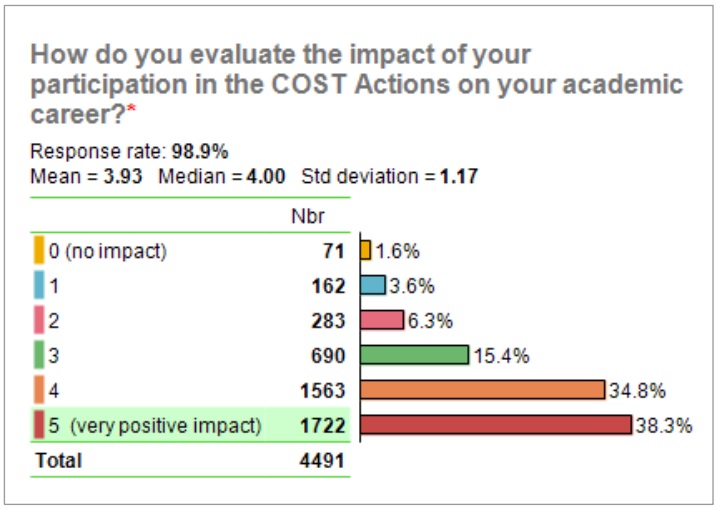
- An **online survey** disseminated to a sample of 10,000 researchers and innovators who participated in COST Actions between 2015 and 2017
- **Semi-structured phone interviews** with a sample of 30 researchers and innovators, who participated in COST Actions between 2015 and 2017.

High interest in and positive opinion on COST

The **survey generated a high response rate of 45.4%.** Out of a sample of 10,000 colleagues involved in COST Actions and contacted, 4,543 answered our survey. This impressive response and the positive attitude to our interview requests indicate **a high interest in the COST programme** among beneficiaries. Qualitative information from interviews shows that **interviewees are quite positive in their opinion of the COST programme**, and that they appreciate that this form of support is available for networking and short-term scientific missions (STSMs).

Career impact

Overall, a **large majority of researchers estimated** that their participation in COST Actions had **a positive impact on their career**. When considering researchers who rated the impact from 3 to 5 (on a scale from 0 to 5), it was observed that **88.5% of respondents** declared that they see a positive impact. This is in line with the 85% objective set for the COST Strategic KPI "share of young researchers and innovators stating that COST has boosted their career".



Key message 1

88.5% of respondents to the online survey declared that they see a positive impact of their participation in the COST Actions on their career

This has been confirmed by interviewees, who all said that participation in the **COST Action enhanced their personal standing, and that it had an influence on their career track. Mostly it was one factor among others.** Some exceptional success cases were pointed out, for example one researcher got a permanent position thanks to a role as Chair in a COST Action, and another participant went from being the only expert in her scientific field in her country, to founding and becoming director of a research institute with about 50 collaborators.

From interviews we have also learned that **finding a new research position** thanks to COST Action involvement has overall been rare for the interviewees. They have, however, mentioned that they are aware of other colleagues who found a new position thanks to the Action, or, in other cases, that the Actions are used as a **pool for recruiting of younger researchers**, for example those who have been doing PhDs in the frame of the Action.

Key message 2

COST Actions have a positive impact on researchers' career more in an indirect way (by helping them establish new connections, start new collaborations and enhancing their reputation in the scientific community) than in a direct way (by helping them finding new professional opportunities).

Empowering and retaining younger researchers and innovators

The survey results also indicate that **some groups of researchers clearly benefit more than their colleagues** do from their participation in COST Actions. This is notably the case for:

- **younger researchers**
- **researchers having a leadership position**
- **female researchers**
- **researchers who intensively participate in COST Actions**
- **researchers from Inclusiveness Target Countries (ITC)**
- **researchers from non-COST countries**

Younger researchers benefitted more from their participation in COST Actions than their more experienced colleagues in all of the aspects examined, except for the joint preparation of new research proposals.

Key message 3

COST Actions have a stronger positive impact on the career of **younger** researchers, **female** researchers and academics from **Inclusiveness Target Countries**.

In the interviews carried out, the positive impact on the careers of younger researchers found in the survey was also widely confirmed. COST Actions **help younger researchers (**doctoral students and post-doctoral researchers) **considerably with networking, and are very useful in that they lead to new projects, new ideas, and new collaborations**. **Some Action Chairs are very supportive of younger researchers, and motivate the younger colleagues to share their ideas.** There were **also, however, reports about different attitudes present in COST Actions**, and some cases where younger researchers are left with a minor role only or few younger researchers are involved.

Promoting and spreading excellence

The support of COST has the highest impact on **network expansion, meeting people from different disciplines, and starting new research collaborations**. Effects more directly linked to career advancement (such as finding new opportunities or advancing in home institution) obtain less positive evaluations, while still being important from the researchers' perspective.

The **three features that researchers appreciate most** in COST Actions include **networking with other colleagues, the meetings/conferences and the Short-term Scientific Missions**.

Please select and rank the three most important features of the COST Actions:

Response rate: **97.6%**

	Nbr	Imp.	
Networking with other colleagues	2630	1.23	59.3%
The meetings/conferences	2564	1.29	57.9%
The STSMs (Short-term scientific missions)	2190	1.08	49.4%
New research collaborations	1609	0.64	36.3%
The Training Schools	1326	0.54	29.9%
The funding	1018	0.50	23.0%
General knowledge and know-how sharing	865	0.32	19.5%
The interdisciplinarity of the networks	658	0.24	14.8%
Management skills through organising networks/activities	201	0.07	4.5%
Establish research collaboration with non-COST countries	108	0.04	2.4%
Total	**4432**		

Data from the interviews are in line with these findings. All researchers interviewed managed to expand their network thanks to COST Action involvement. **They confirmed that the purpose of COST, to develop and expand a network of research colleagues in Europe is definitely fulfilled.** COST Actions also **lead to publications and new projects (e.g. in Horizon 2020, EUROSTARS, national programmes), but their number differs from Action to Action,** and it depends on how long an Action has already been running or whether it has ended. In some cases, COST Actions have even helped **establish a research field in a country**, for example in Portugal, Serbia or Slovenia.

When it comes to the impact of COST Actions on researchers from less research-intensive countries, the results of this survey definitely indicate a positive impact on accessing networks and connecting to poles of excellent research. For example, researchers from **ITC countries graded** the following features better than those from non-ITC countries: the **global impact of COST Actions**, as well as **the expansion of their network, finding professional opportunities for their next career step and increasing their motivation to stay in Europe**. Looking into detail at the network expansion for researchers from **ITC countries**, **a stronger network building effect is identified** than for colleagues who are not from ITC countries. It is **more frequently the case that colleagues from ITC countries become involved in a COST Action without knowing any of the other participants beforehand**: 41.2% of respondents from ITC countries as compared to 27.9% of respondents from non-ITC countries.

Key message 4

Researchers from **Inclusiveness Target Countries** are more likely to become involved in COST Actions **without having any previous connections** to any of the other participants beforehand.

Fostering interdisciplinary research

Regarding interdisciplinarity, a contrast emerges between the findings of the online survey and the findings of the qualitative interviews (more focused on a leadership perspective). In fact, the survey results show that researchers give a positive assessment of COST Actions and their effects on interdisciplinarity (phrased as "meeting people from different disciplines than yours"), but they do not estimate that interdisciplinary is important for the impact on their career. From qualitative interviews we can deduce that, **in several COST Actions, interdisciplinarity is a key feature.** Interviewees stated for example that, if compared to H2020 or national projects, then the expertise of the researchers involved in the COST Action is much wider, while in H2020 and national projects it is narrower.
When asking in interviews about innovation activities and interaction among researchers and innovators, it was discovered that **contacts to business take place more frequently than would have been expected**. Again, this depends on the Action topic.

Points for improvement

While the assessment of the COST programme by the beneficiaries is overall very positive, some weaknesses have also been pointed out, especially in the qualitative interviews. Main points of concern among interviewees were the **relatively high administrative effort for managing COST actions**, and **weaknesses in the selection of Management Committee members**.

2. INTRODUCTION

The Impact Assessment Study commissioned by the COST Association to ERDYN and ZSI in January 2019 **evaluated whether participation in COST Actions has positively impacted the careers of researchers and innovators**. More specifically, the study assessed whether COST activities are in line with the corresponding Strategic Plan KPI: "Share of young researchers and innovators stating that COST has boosted their career." The target for such KPI is set to 85%, plus 'anecdotal evidence'.

This general objective can be broken down along the **three strategic priorities** of the COST mission:

– **Empowering and retaining younger researchers and innovators**: has the participation in a COST Actions helped researchers find a new lab for the next career step and increased their motivation to stay in Europe?

– **Promoting and spreading excellence**: have researchers expanded their network, acquired knowledge from their peers, got access to cutting-edge tools and advanced faster in their research thanks to the COST Actions? Have the COST actions given researchers from less research-intensive countries the opportunity to enter into networks and to connect to poles of excellent research?

– **Fostering interdisciplinary research** for breakthrough science: did researchers meet people from different specialisations and start new interdisciplinary research collaborations thanks to the COST Actions?

Two main methodological tools have been used in this study to answer the questions above:

- An **online survey** disseminated to a sample of 10,000 researchers/innovators who participated in COST Actions between 2015 and 2017
- **Semi-structured phone interviews** with a sample of 30 researchers.

This final report illustrates the findings of the analysis. Section 3 presents the quantitative results of the online survey. The following chapters provide an analysis from the perspective of COST strategic priorities: sections 4 and 5 deal with "themes linked to outputs and results" and "policy-driven themes" respectively. Section 7 contains our conclusions and recommendations.

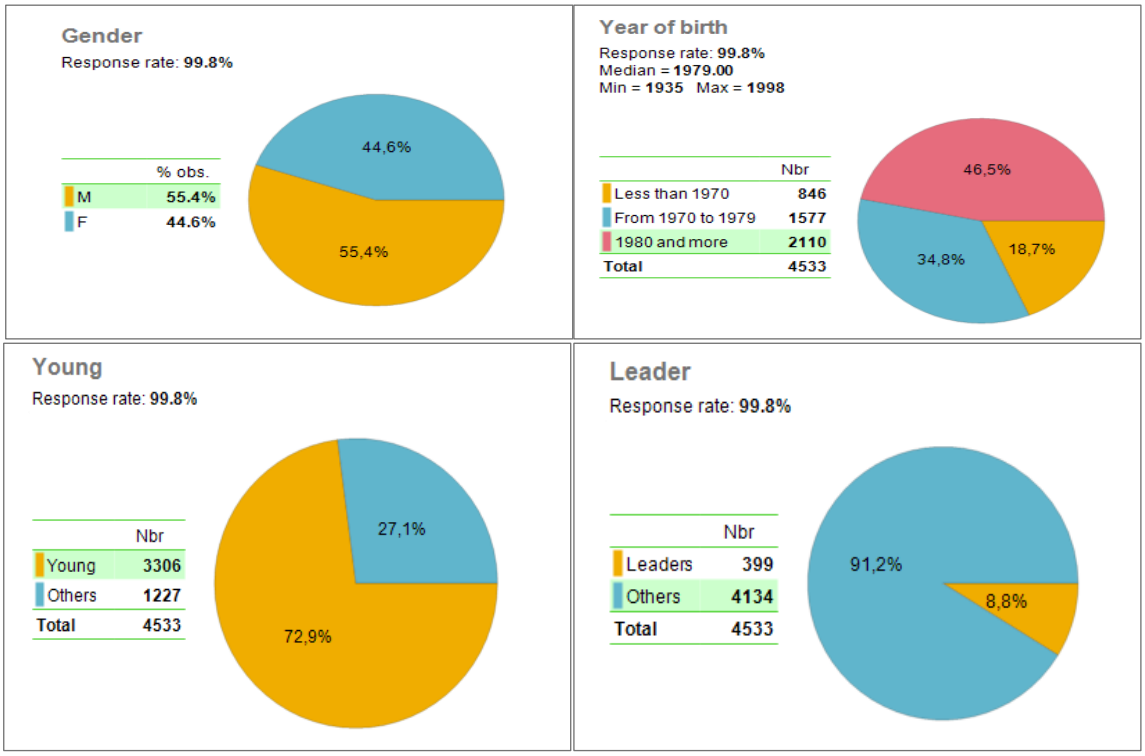
3. DESCRIPTIVE STATISTICS

This chapter illustrates the findings from the online survey, from simple descriptive statistics concerning the respondents to more sophisticated multivariate analysis.

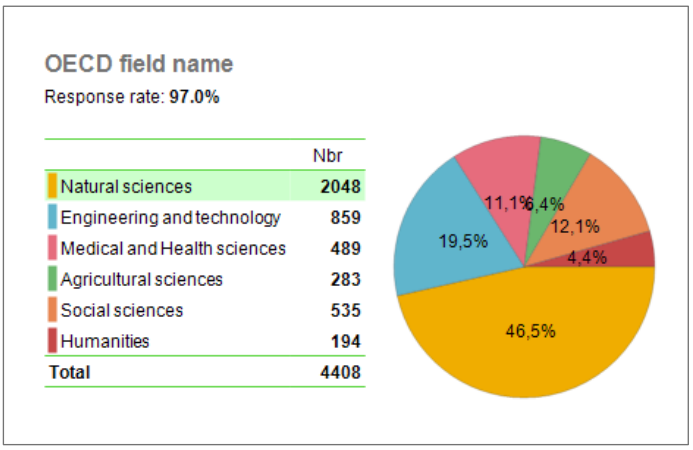
3.1 Respondents' profile

The charts below illustrate the composition of the sample of 4,543 respondents. For all of the variables, the composition of the respondents' set is coherent with the composition of the sample (the percentage difference is never higher than + or – 4%). The respondents are therefore representative of the initial sample to which the survey was disseminated.

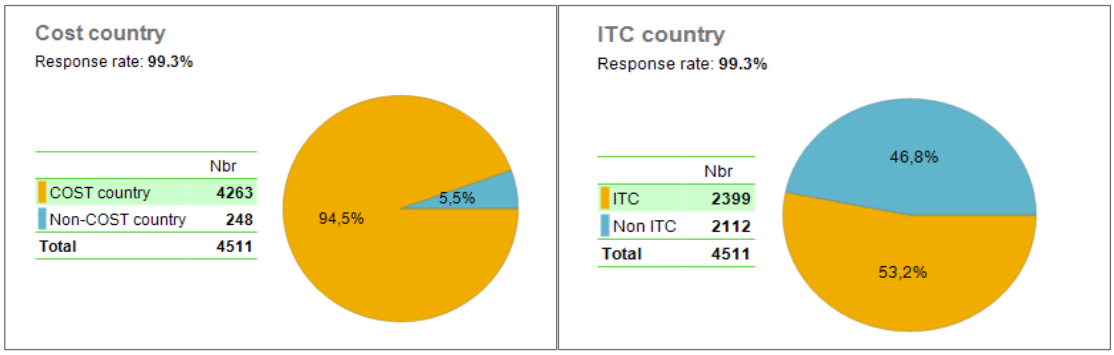
The researchers who answered the survey are mostly younger researchers (born after 1975). A majority of 55.4% is male, while 44.6% is female. 8.8% of the respondents hold leadership positions.

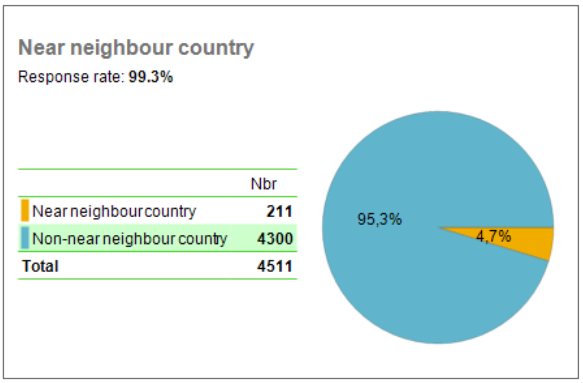


"Natural Sciences" is the most represented scientific discipline, followed by "Engineering and technology" and "Social Sciences".

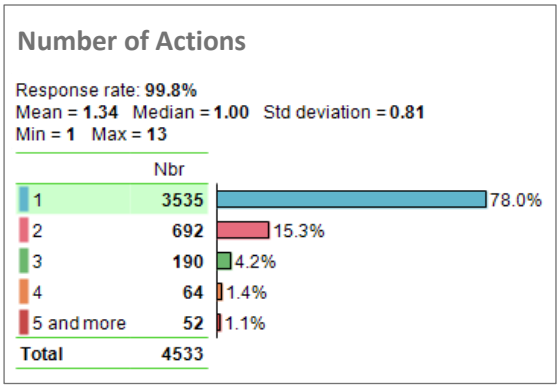


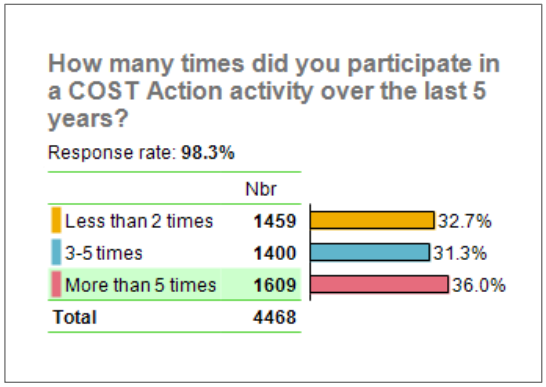
5.5% of respondents come from non-COST countries. Even a smaller share (4.7%) comes from Near Neighbour Countries. However, almost half of respondents work in ITC countries.

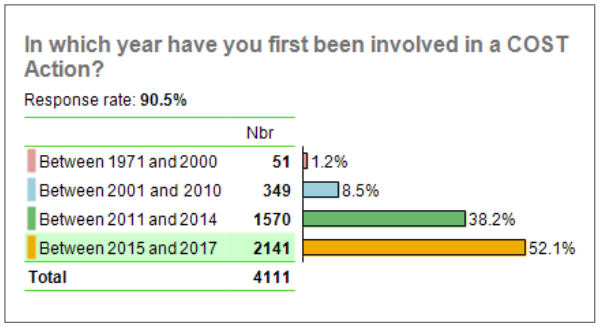




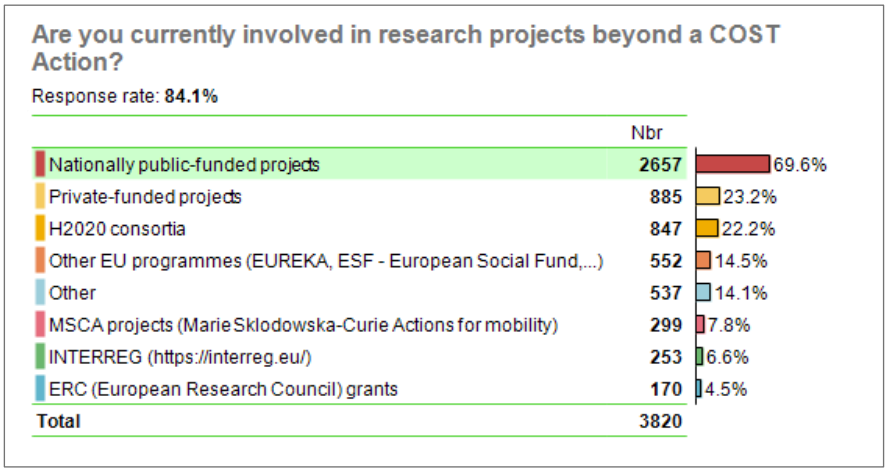
The great majority of researchers have only participated in one COST Action, and they were first involved between 2015 and 2017.







Since COST only funds networking activities, it is not surprising to observe that 70% of researchers are currently involved in other research projects, mainly publicly funded national projects.

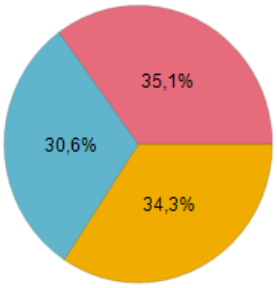


It is very interesting to observe that for one third of researchers COST had a directly additional tangible effect, since they had no previous connections with any of the participants before being involved in the COST Action.

Did you already have connections to any of the participants in the COST Action before becoming involved in the project?

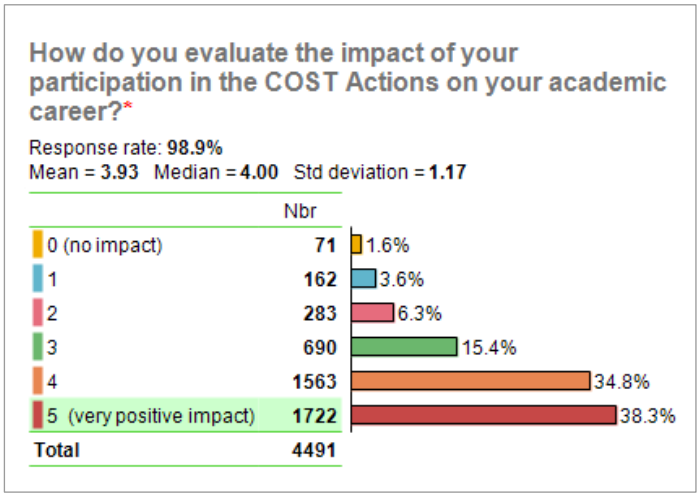
Response rate: **98.6%**

	Nbr
Yes, and we had already worked together	**1538**
Yes, but we had never worked together before	**1371**
No	**1571**
Total	**4480**

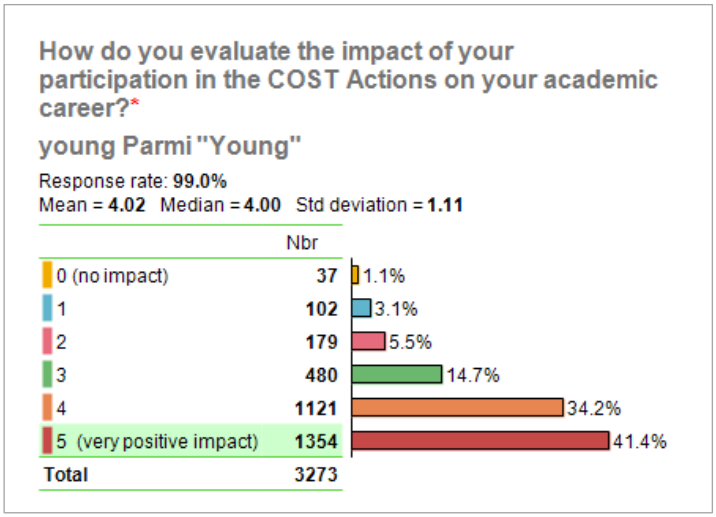


3.2 The impact of COST Actions

Overall, researchers estimate that their participation in COST Actions had a positive impact on their career. Considering researchers who rated the impact from 3 to 5 (on a scale from 0 to 5), it can be observed that 88.5% of respondents declare seeing a positive impact. However, if only the scores 4 and 5 are considered, the total percentage goes down to 73.1%.



When considering only younger researchers[1], the results of the survey show that 90.3% of respondents see a positive impact of COST Actions on their career (scores from 3 to 5). This is in line with the 85% objective set for the COST Strategic KPI “share of young researchers and innovators stating that COST has boosted their career”. If only the scores 4 and 5 are taken into consideration, the total percentage goes down to 75.61%, below the COST target.



The aspects for which COST had the highest impact are, according to researchers:

- Network expansion
- Meeting people from different disciplines

[1] Researchers born after 1975.

- Starting new research collaborations.

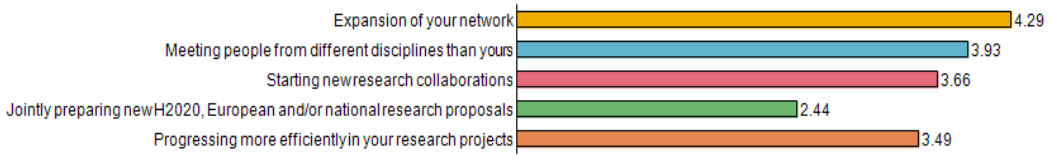
On the contrary, the impact on finding new professional opportunities, jointly preparing new research proposals or enabling career advancements in their home institutions is less marked.

ASPECTS_ASSESSMENT1

	Mean	Std deviation
Expansion of your network	4.29	1.01
Meeting people from different disciplines than yours	3.93	1.16
Starting new research collaborations	3.66	1.35
Jointly preparing new H2020, European and/or national research proposals	2.44	1.74
Progressing more efficiently in your research projects	3.49	1.37

Cronbach's Alpha = **0.79**

Evaluation of scales: from 0 (0) to 5 (5)

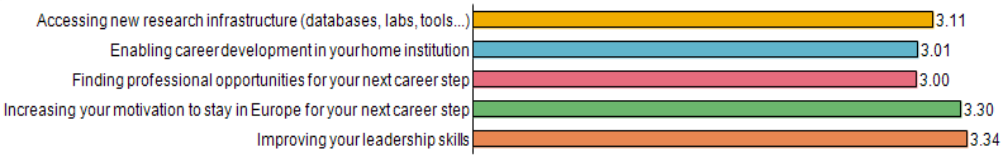


ASPECTS_ASSESSMENT2

	Mean	Std deviation
Accessing new research infrastructure (databases, labs, tools...)	3.11	1.52
Enabling career development in your home institution	3.01	1.53
Finding professional opportunities for your next career step	3.00	1.57
Increasing your motivation to stay in Europe for your next career step	3.30	1.68
Improving your leadership skills	3.34	1.49

Cronbach's Alpha = **0.84**

Evaluation of scales: from 0 (0) to 5 (5)



The three features that researchers appreciate most in COST Actions are networking with other colleagues, the meetings/conferences and the Short-term Scientific Missions.

Please select and rank the three most important features of the COST Actions:

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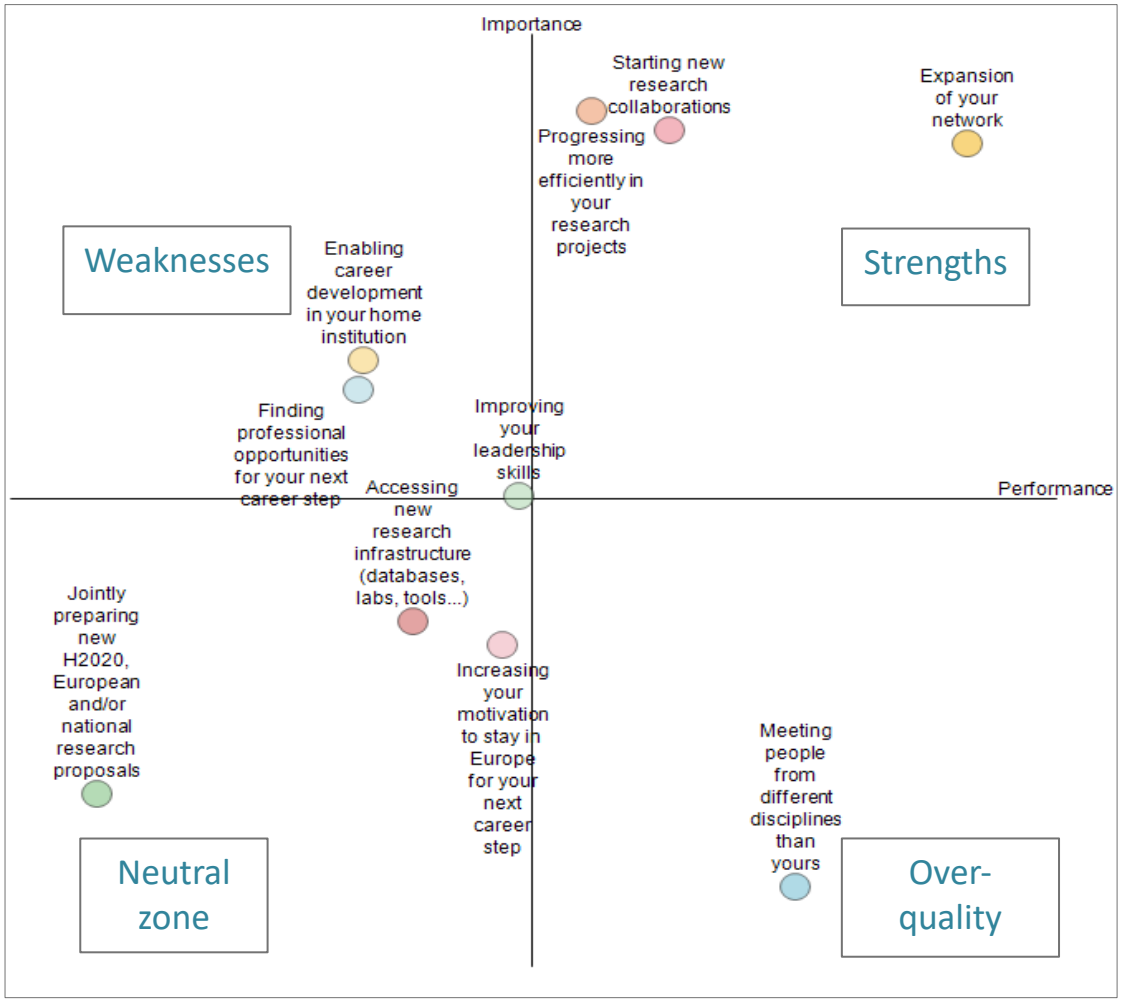
Establish research collaboration with non-COST countries	108	0.04	2.4%
Total	**4432**		

3.2.1 Importance-performance matrix

The **importance - performance matrix** is a specific application of the multiple regression analysis aimed at understanding the satisfaction of the survey participants and the importance they give to the different criteria assessed. This analysis leads to the design of a chart, where each criterion is placed along two dimensions:

- Horizontally, **performance**: it is measured by the criterion's average score for all the respondents.
- Vertically, **importance**: it is assessed based on the correlation coefficient between each criterion and global satisfaction. Thus, the stronger the correlation between a criterion's performance and the score of global satisfaction (the closer to 1), the more the criterion is important. Although correlation to general satisfaction is a good indicator, it should be taken into account that this measure is only a proxy for importance. Global satisfaction is measured by a specific question in the online survey: "How do you evaluate the impact of your participation in the COST Actions on your career, on a scale from 0 to 5?"



With the **importance / performance matrix**, the Sphinx software can estimate which factors explain the **satisfaction** of the survey participants. As shown in the image above, researchers were asked to evaluate COST Actions overall and to assess their satisfaction on different aspects of COST Actions. We can therefore very easily identify the **strengths** of COST Actions – factors that are considered highly important and evaluated positively – at the top-right of

the matrix (for instance “Expansion of your network”, “Starting new research collaborations” and “Progressing more efficiently in your research projects”) and its **weaknesses** – factors that are considered highly important but negatively evaluated (for instance “Enabling career development in your home institution”, “Finding professional opportunities for your next career step” and “Improving your leadership skills”).

It is also interesting to notice the position of “Meeting people from different disciplines than yours”: COST Actions receive a very high score on this aspect, but interdisciplinarity does not seem to be a priority for researchers. This criterion appears in the “over-quality” zone.

3.3 Cross-tabulated analyses

This section explores the bivariate relationships between variables measuring the impact of COST Actions and variables that characterise the respondents, in order to identify which groups of researchers benefit the most from the participation in COST Actions.

In the following tables, statistically significant relationships are highlighted in bold, by category of researchers concerned. These tables highlight the mean scores obtained in each category. Numbers in blue mean that the score for that category is significantly higher than the global average; numbers in pink mean that the score for that category is significantly lower than the global average. When means are written in black and in bold, the relationship is significant but without over/under representation of a category in the impact observed. For all the other cases (numbers written in grey with a smaller font), no significant relationship has been found with respect to the categories observed.

3.3.1 Impact of COST Actions

i. By country of affiliation

As we can see in the table below, the relationship between the assessment of COST Actions by researchers and their country of affiliation is significant. For instance, researchers from **non-ITC countries** saw a significantly lower impact of COST Actions on their career both overall and with respect to the following aspects: expansion of their network, access to new research infrastructure, career development in their home institution, finding new professional opportunities, motivation to stay in Europe for their next career step and improvement of leadership skills.

It also seems that COST Actions impacted more significantly researchers from **COST countries** than researchers from non-COST countries in expanding their networks and increasing their motivation to stay in Europe for their next career step.

Researchers from **Near-Neighbour Countries** are significantly more impacted regarding network expansions, but less affected on progressing more efficiently in their research projects and increasing their motivation to stay in Europe. More detailed analysis on NNCs is presented in part 5.3.

	COST country	Non-COST country	ITC	Non-ITC	Near-Neighbour Country	Non Near-Neighbour Country
Global impact	3,93	3,96	**4,01**	**3,84**	3,96	3 ,93
Expansion of your network	**4,30**	**4,10**	**4,25**	**4,34**	**4,06**	**4,30**
Meeting people from different disciplines than yours	3,92	3,96	**4,09**	**3,73**	3,97	3 ,92
Starting new research collaborations	**3,67**	**3,46**	3,67	3,65	3,49	3,67
Jointly preparing new H2020, European and/or national research proposals	2,46	2,22	2,48	2,41	2,28	2,45
Progressing more efficiently in your research projects	**3,48**	**3,76**	**3,65**	**3,33**	**3,82**	**3,48**
Accessing new research infrastructure (databases, labs, tools etc.)	3,12	3,03	**3,29**	**2,91**	3,17	3,11
Enabling career development in your home institution	3,01	3,06	**3,23**	**2,77**	3,07	3,01
Finding professional opportunities for your next career step	3,00	3,00	**3,18**	**2,80**	2,98	3 ,00
Increasing your motivation to stay in Europe for your next career step	**3,34**	**2,79**	**3,51**	**3,08**	**2,88**	**3,33**
Improving your leadership skills	3,33	3,48	**3,41**	**3,26**	3,51	3,33

ii. By respondents' profile

Interestingly, an important difference of assessment is observed between intense participants[2] and more occasional participants in COST Actions: on average, intense participants give significantly higher scores on all aspects on which they were interrogated. Therefore, the impact of COST Actions increases with stronger involvement.

[2] At least 5 participations in one Action

It also seems that the effects of COST Actions are more pronounced for younger researchers: on average, they gave a lower rate than younger researchers to various aspects assessed (global impact, expansion of their network, starting new research collaborations, accessing new research infrastructure etc.). Younger researchers benefited more than experienced researchers concerning expanding their network, finding new professional opportunities and increasing their motivation to stay in Europe.

Finally, leaders experienced increased improvement of their leadership skills compared to other researchers thanks to their participation in COST Actions. The same holds for network expansion, starting new research collaborations and jointly preparing new proposals.

	Younger researchers	Experienced researchers	Leaders	Others	Intense participants	Others
Global Impact	**4,02**	**3,69**	4,04	3,92	**4,19**	**3,63**
Expansion of your network	**4,37**	**4,09**	**4,58**	**4,26**	**4,60**	**3,93**
Meeting people from different disciplines than yours	3,91	3,93	3,86	3,93	**4,02**	**3,82**
Starting new research collaborations	**3,71**	**3,51**	**3,95**	**3,63**	**4,02**	**3,24**
Jointly preparing new H2020, European and/or national research proposals	2,43	2,48	**3,12**	**2,38**	**2,77**	**2,05**
Progressing more efficiently in your research projects	3,52	3,42	**3,29**	**3,51**	**3,65**	**3,30**
Accessing new research infrastructure (databases, labs, tools etc.)	**3,16**	**2,97**	2,98	3,12	**3,23**	**2,97**
Enabling career development in your home institution	**3,06**	**2,87**	3,05	3,01	**3,17**	**2,83**
Finding professional opportunities for your next career step	**3,14**	**2,62**	**2,76**	**3,02**	**3,18**	**2,79**
Increasing your motivation to stay in Europe for your next career step	**3,44**	**2,93**	**3,05**	**3,33**	**3,44**	**3,14**
Improving your leadership skills	**3,38**	**3,23**	**4,04**	**3,27**	**3,58**	**3,06**

c. Respondents' gender

The table below shows that women seem to benefit less than men from their participation in COST Actions on almost all aspects. However, this result is overturned in the multivariate analysis (see par. 3.4.3).

	Men	Women
Meeting people from different disciplines than yours	3,80	4,08
Progressing more efficiently in your research projects	3,43	3,57
Accessing new research infrastructure (databases, labs, tools etc.)	3,02	3,23
Enabling career development in your home institution	2,94	3,09
Finding professional opportunities for your next career step	2,88	3,15
Improving your leadership skills	3,28	3,41

c. Researchers' OECD field

The table below illustrates the assessment given by researchers in different scientific fields. The most striking result is that researchers in Humanities and Social Sciences give lower scores than the average on all aspects. On the contrary, it seems that, on average, researchers in medicine, engineering and agricultural sciences are significantly more satisfied than the average about the impact of COST Actions.

	Natural sciences	Engineering and technology	Medical and Health Sciences	Agricultural Sciences	Social Sciences	Humanities
Meeting people from different disciplines than yours	3,82	4,07	4,13	4,09	3,95	3,76
Jointly preparing new H2020, European and/or national research proposals	2,38	2,64	2,68	2,38	2,31	2,13
Progressing more efficiently in your research projects	3,55	3,54	3,56	3,53	3,27	3,23

	Natural sciences	Engineering and technology	Medical and Health Sciences	Agricultural Sciences	Social Sciences	Humanities
Accessing new research infrastructure (databases, labs, tools etc.)	**3,15**	**3,26**	**3,26**	**3,24**	**2,65**	**2,88**
Enabling career development in your home institution	**2,98**	**3,11**	**3,19**	**3,22**	**2,77**	**2,73**
Finding professional opportunities for your next career step	**2,98**	**3,09**	**3,09**	**2,96**	**2,99**	**2,72**
Increasing your motivation to stay in Europe for your next career step	**3,31**	**3,47**	**3,39**	**3,29**	**3,16**	**2,93**
Improving your leadership skills	**3,32**	**3,48**	**3,60**	**3,37**	**3,16**	**2,94**

3.3.2 Creating new connections

In par.3.1 it was mentioned that a third of respondents had no previous connections to any of the participants in the COST Action before becoming involved in the project. The tables below show that this is especially true for some groups of researchers.

For example, it is more frequent for researchers from ITC countries to become involved in a COST Action without knowing any of the participants before. On the contrary, researchers from non-ITC countries have often already worked with at least one of the participants.

	ITC	Non ITC
Yes, and we had already worked together	29.5%	40.1%
Yes, but we had never worked together before	29.3%	31.9%
No	41.2%	27.9%
Total	**100.0%**	**100.0%**

p = **0.00** ; Chi2 = **94.98** ; dof = **2** (**VS**)

The relation is very significant.
elements over (under)represented are coloured.

It is also interesting to observe that researchers from Near-Neighbour Countries are more likely to become involved in COST Countries if they have already worked with one or more participants. This may indicate that previous personal relationships are a factor which encourages researchers from NNCs to engage in COST Actions.

	Near neighbour country	Non-near neighbour country
Yes, and we had already worked together	42.9%	34.1%
Yes, but we had never worked together before	30.2%	30.6%
No	26.8%	35.4%
Total	**100.0%**	**100.0%**

p = **0.01** ; Chi2 = **8.53** ; dof = **2** (**S**)

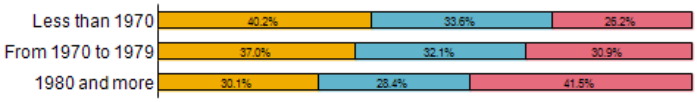
The relation is significant.
elements over (under) represented are coloured.

Unsurprisingly, younger researchers often do not have previous connections with other participants in the COST Actions. This is not the case for their more experienced colleagues.

	Yes, and we had already worked together	Yes, but we had never worked together before	No	Total
Less than 1970	40.2%	33.6%	26.2%	100.0%
From 1970 to 1979	37.0%	32.1%	30.9%	100.0%
1980 and more	30.1%	28.4%	41.5%	100.0%

p = **<0.01** ; Chi2 = **80.47** ; dof = **4** (**VS**)

The relation is very significant.
elements over (under) represented are coloured.



3.4 Multivariate analyses

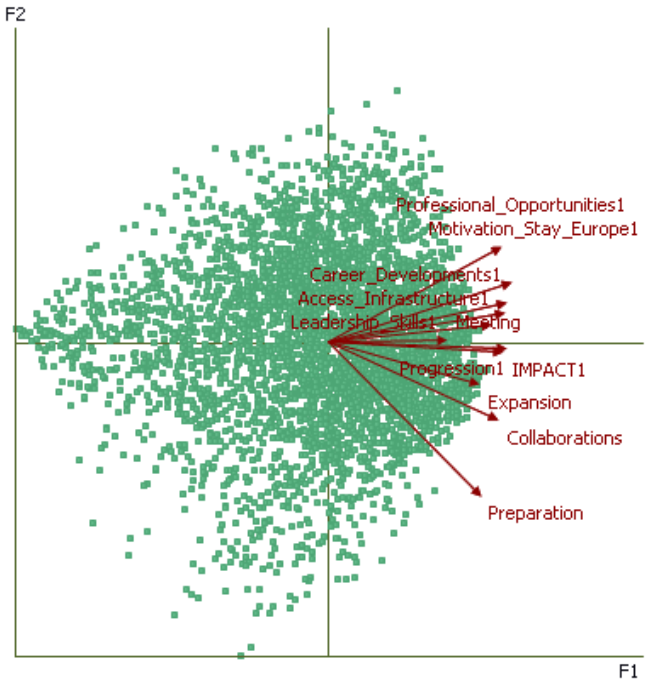
Multivariate analyses allow to clear up spurious results driven by hidden interactions between variables. Below the results of a Principal Component Analysis, a Cluster Analysis and a Multiple Regression Analysis are presented.

3.4.1 Principal Component Analysis

Principal Component Analysis (PCA) is a statistical method aimed at simplifying and summarising a large amount of information. More specifically, PCA transforms a set of possibly correlated variables into a set of values of new linearly uncorrelated variables called principal components. This transformation is defined in such a way that the first principal component has the largest possible variance (that is, accounts for as much of the variability in the data as possible), and each succeeding component in turn has the highest variance possible under the constraint that it is orthogonal to the preceding components.

For this analysis, the researchers' assessment of the impact of COST Actions on all the aspects of their career cited in the online survey[3] (12 variables in total) is summarised.

The figure below shows the geographical representation of the selected variables (the red arrows) along the first two principal components: the horizontal axis (F1) and the vertical axis (F2). The orthogonality of the two axes represents their independence.



It is clear that the first principal component (the horizontal axis) is positively correlated to all the variables (all arrows on the right side). This axis can therefore be interpreted as representing the overall satisfaction of researchers.

As for the second axis, it opposes mainly:

[3] Overall satisfaction, Expanding your network, Meeting people from different disciplines, Starting new research collaborations, Jointly preparing new H2020, European and/or national research proposals, Progressing more efficiently in your research projects, Accessing new research infrastructure (databases, labs, tools…), Enabling career developments in your home institution, Finding professional opportunities for your next career step, Increasing your motivation to stay in Europe for your next career step, Improving your leadership skills

- "Increasing your motivation to stay in Europe for your next career step", "Finding professional opportunities for your next career step" and "Enabling career developments in your home institution" on the upper portion of the graph;
- "Jointly preparing new H2020, European and/or national research proposals" and "Starting new research collaborations" on the lower portion of the graph.

All the other variables only provide a minor contribution to the second axis. This second principal component can therefore be interpreted as opposing:

- researchers who are more satisfied than the average of the impact of COST Actions on their career developments, on one side;
- researchers who are more satisfied than the average of the impact of COST Actions on their scientific advancement (proposals and research collaborations), on the other side.

The following section (cluster analysis) will illustrate how this helps in identifying different types of researchers.

The figure below shows the contribution of each variable to the two axes.

	F1	F2
Positive contributions	Motivation_Stay_Europe1 (13.16)	Motivation_Stay_Europe1 (20.33)
	Professional_Opportunities1 (12.97)	Professional_Opportunities1 (6.97)
	Career_Developments1 (11.70)	Career_Developments1 (2.75)
	Preparation (11.22)	Leadership_Skills1 (1.54)
	Leadership_Skills1 (10.75)	Access_Infrastructure1 (0.52)
	Access_Infrastructure1 (9.58)	Meeting (<0.01)
	Progression1 (9.34)	
	Collaborations (8.24)	
	IMPACT1 (6.39)	
	Expansion (3.64)	
	Meeting (3.01)	
Negative contributions		Preparation (-57.39)
		Collaborations (-8.79)
		Expansion (-1.50)
		IMPACT1 (-0.13)
		Progression1 (-0.07)

In order to check whether the representation along the first two principal components is good enough or whether its entail a great loss of information, the variance explained by the two axes had to be checked. The figure below shows that F1 and F2 account together for 61.23% of the variability in the data. As more information is explained by the two axes than it is lost, it can be concluded that the image of reality reflected in this analysis is not distorted.

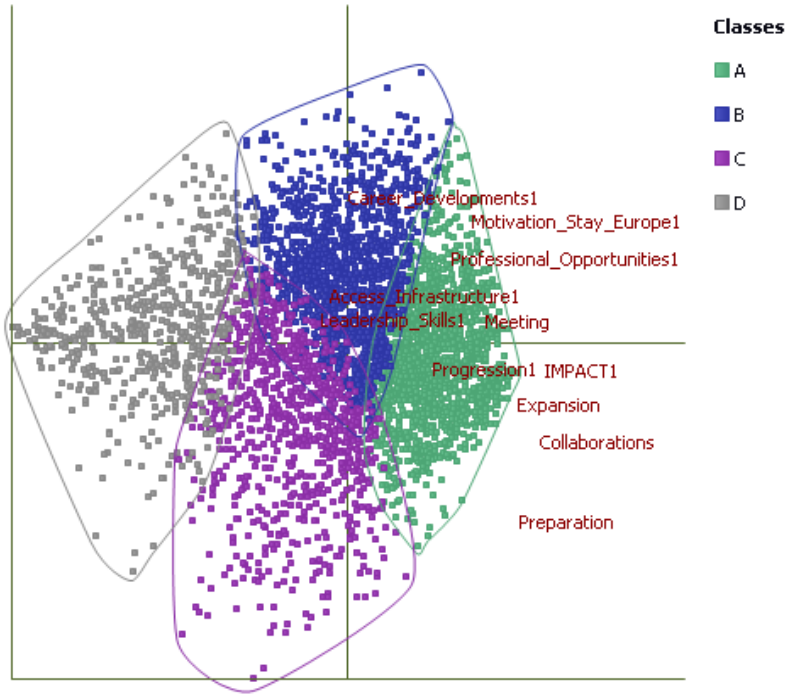
	F1	F2	F3	F4	F5	F6
Eigenvalue	11.56	2.27	1.62	1.31	1.17	1.13
variance explained	51.18%	10.04%	7.15%	5.79%	5.18%	4.99%
cumulated variance	51.18%	61.23%	68.38%	74.17%	79.34%	84.33%

The value of the "Alpha of Cronbach", a standard test of internal consistency, is very high in this analysis (0.9). Although values higher than 0.7 are generally considered as good, values as high as 0.9 indicate that the explanatory variables are not independent but strongly correlated between them, which can create some redundancy.

3.4.2 Cluster Analysis

After carrying out a Principal Component Analysis in order to represent data from 12 variables along two orthogonal axes, a **k-means clustering** was applied to the observations. K-means clustering aims to partition *n* observations into *k* clusters in which each observation belongs to one cluster, in a way that minimises the within-cluster variance.

The figure below shows the results of the k-means clustering applied to the observations. Four groups (also called classes or clusters) of respondents are identified by four different colours. It can be observed that the position of the variables on the graph is the same as in the Principal Component Analysis, meaning that the interpretation of the two axes is the same too.



In order to interpret these findings, it was necessary to determine what characterises each group with respect to the 12 variables considered. The table below shows such a characterisation of the groups: variables coloured red or green have a mean value significantly higher or lower than the set for the group considered.

	Higher than average	Lower than average
Group A (1646 researchers)	- Overall impact - Preparation of new proposals - Professional opportunities - Career Developments - Motivation to stay in Europe - Leadership skills - New collaborations - More efficient progression of research projects - Access to new infrastructure - Network expansion - Meeting people from different disciplines	
Group B (1210 researchers)	- Professional opportunities - Career Developments - Motivation to stay in Europe - Leadership skills	- Preparation of new proposals - New collaborations
Group C (854 researchers)	- New collaborations - Network expansion	- Overall impact - Professional opportunities - Career Developments - Motivation to stay in Europe - Leadership skills - More efficient progression of research projects - Access to new infrastructure - Meeting people from different disciplines
Group D (567 researchers)		- Overall impact - Preparation of new proposals - Professional opportunities - Career Developments - Motivation to stay in Europe - Leadership skills - New collaborations - More efficient progression of research projects - Access to new infrastructure - Network expansion - Meeting people from different disciplines

A cross-tabulated analysis allows us to identify which types of researchers belong to each group: the table below shows significantly overrepresented modalities for each group and each characterising variable.

	Group A	Group B	Group C	Group D
Gender			M (**558**)	
OECD field name	Engineering and technology (**349**)			Social sciences (**91**)
	Medical and Health Sciences (**193**)			Humanities (**40**)
Cost country				Non-COST country (**46**)
Near neighbour country				Near neighbour country (**37**)
ITC country	ITC (**953**)	ITC (**629**)	Non-ITC (**544**)	Non-ITC (**321**)
Young	Young (**1211**)	Young (**889**)	Advanced (**294**)	Advanced (**214**)
Leader	Leaders (**166**)	Non-leaders (**1065**)	Leaders (**123**)	Non-leaders (**563**)
Intense participation	Intense participants (**1030**)	Non-intense participants (**558**)	Intense participants (**554**)	Non-intense participants (**432**)

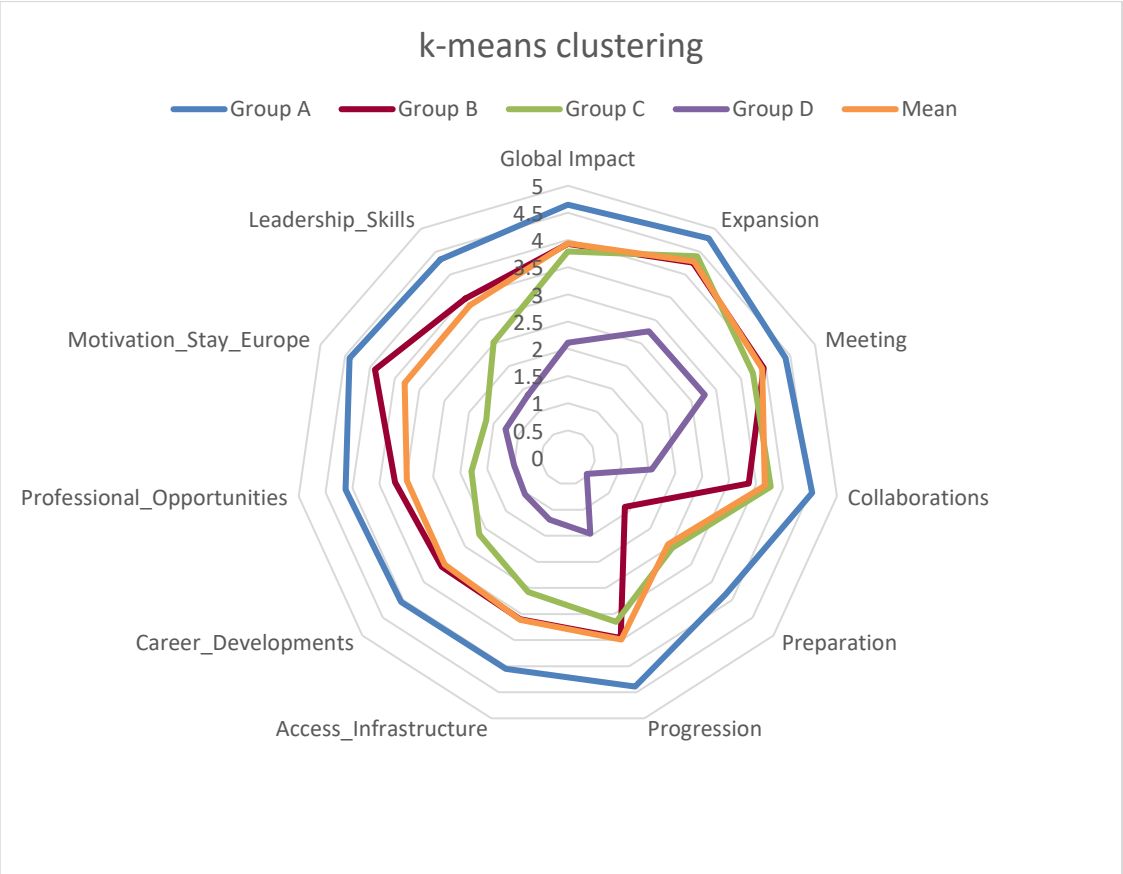
The table shows the significantly overrepresented modalities.

This helps us understand the meaning of the four groups and to describe which researchers belong to them:

- **Group A**: group A counts most researchers (1646 individuals). Respondents in this group see a **stronger impact** of their participation in COST Actions than the average **for all the aspects considered**. Group A typically includes young researchers having leadership positions and participating intensively in COST Actions, who come from ITC and work in Engineering and Technology or Medical and Health Sciences.
- **Group B**: researchers in group B see a higher impact than the average on four aspects (motivation to stay in Europe, finding new professional opportunities, improving their leadership skills, enabling career developments in their home institution), but lower than the average for starting new research collaborations and jointly prepare new research proposals. It could therefore be said that respondents in this group are those who see an **important effect of COST Actions on the aspects directly linked to their career-advancement**. Group B typically includes young researchers from ITC who do not have leadership positions and do not participate intensively in COST Actions.
- **Group C**: this cluster is almost the mirror image of group B. Researchers see a higher impact than the average on the expansion of their network and the start of new research collaborations, but a lower impact than the average for the other aspects. In summary, respondents in this group are those who see an **important effect of COST Actions on the aspects more indirectly linked to their career-advancement**. Group C typically includes male advanced researchers from non-ITC who have leadership positions and participate intensively in COST Actions.
- **Group D**: it only includes 567 individuals. Researchers in this group see **a lower impact of COST Actions than the average** for almost all the aspects considered. Group D typically includes advanced researchers from near-neighbour countries, who do not have leadership positions, do not participate intensively in COST Actions and work in Social Sciences or Humanities.

The radar chart below represents the mean values for each group and for each variable, as compared to the overall mean.

As for the Principal Component Analysis, the value of the “Alpha of Cronbach” of our k-means clustering is very high (0.9), thus indicating that the explanatory variables are not independent but strongly correlated between them, which can create some redundancy. However, this is not surprising: researchers who see the impact on one dimension also see the impact on other dimensions, since these dimensions are interconnected.


k-means clustering
Group A
Group B
Group C
Group D
Mean
Global Impact
Expansion
Meeting
Collaborations
Preparation
Progression
Access_Infrastructure
Career_Developments
Professional_Opportunities
Motivation_Stay_Europe
Leadership_Skills
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

3.4.3 Regression Analysis

In order to try to explain which factors influence the researchers' assessment of the COST Actions' impact on different aspects of their career, a **multiple regression analysis** was carried out.

The **explanatory variables** included in the model include:

- The scientific discipline (OECD field)
- A dummy variable for COST countries
- A dummy variable for NNC countries
- A dummy variable for ITCs
- A dummy variable for younger researchers (under 40)
- A dummy variable for leader researchers (Researchers are considered to have a leadership position if they are MC Chair, MC Vice-Chair, Working Group Leader, STSM coordinator or Science Communication Manager)
- A dummy variable for intense participation (at least 5 participations in one Action)
- A dummy variable for female researchers
- The frequency of participation in COST Actions over the last 5 years (which correlates with the dummy variable for intense participation)

We adopt a linear regression model with heteroskedasticity-robust estimators of the variance-covariance matrix.

We test **three different specifications** for our model:

- The first specification includes all the variables listed above
- The second specification, on top of the explanatory variables, accounts for the interaction between gender and discipline (since there are more female researchers in social sciences and humanities)
- The third specification adds to the second one the interaction between gender and the dummy variable for ITC countries (since there are more female researchers in ITC countries).

For all the specifications, the coefficients are jointly statistically significant. However, the R^2-value is not very high, meaning that much of the variance remains unexplained.

The tables presenting all the results of the regression analysis can be found in "Annex 1: Regression analysis output". **The table below summarises the findings**: the first line indicates the dependent variable, while the first columns list the explanatory variables. The colours represent the sign of the relationship: green if the coefficient is positive and significant, orange is the coefficient is negative and significant. The intensity of the colour indicates whether the relationship is significant in one, two or all the three specifications:

	Positive coefficient	**Negative coefficient**
Significant in 3 specifications		
Significant in 2 specifications		
Significant in 1 specification		

Summary of regression results

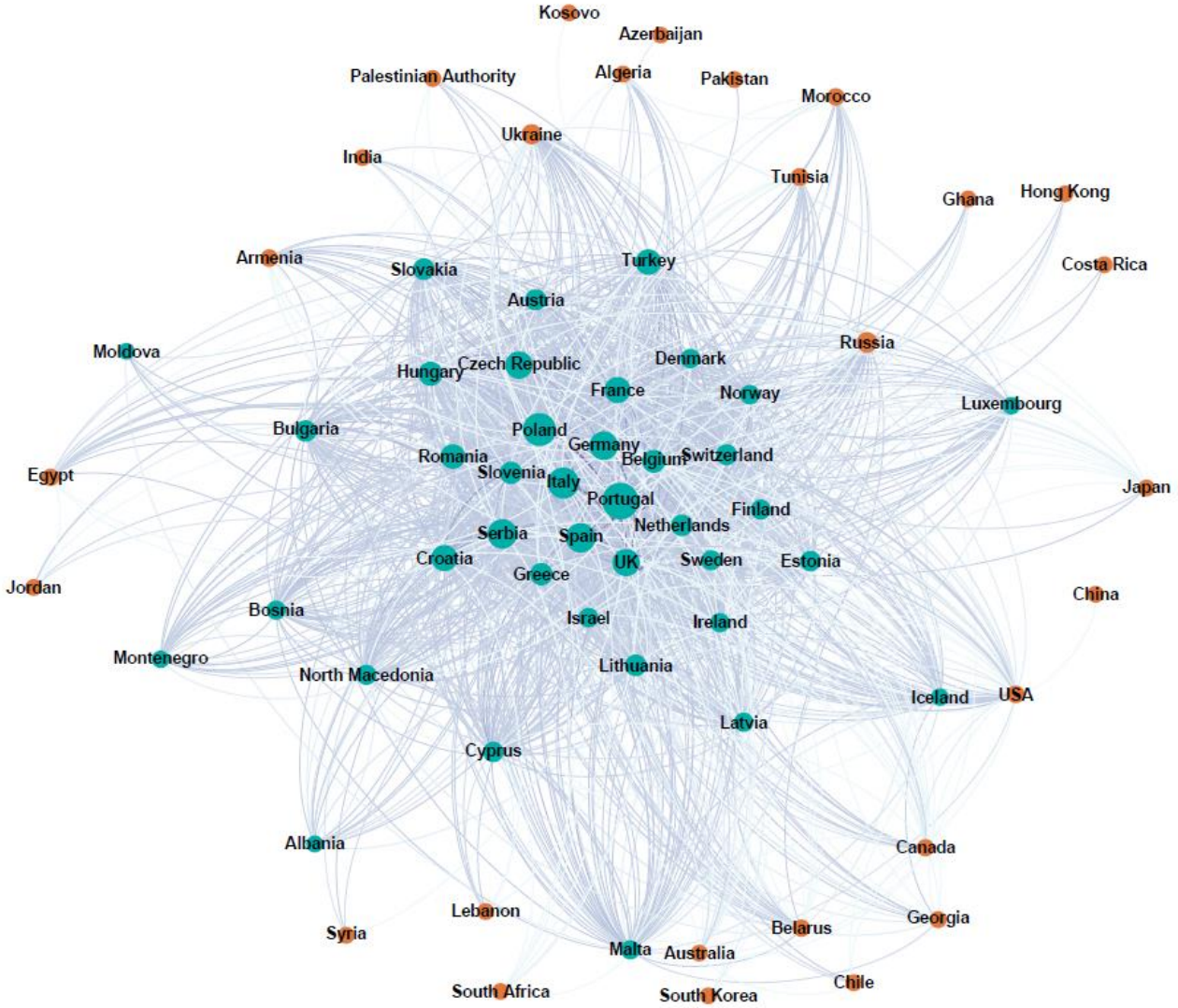
	Overall impact	Expanding your network	Meeting people from different disciplines	Starting new research collaborations	Jointly preparing new H2020, European and/or national research proposals	Progressing more efficiently in your research projects
Scientific Discipline						
Natural Sciences (reference level)						
Engineering and technology						
Medical and Health Sciences						
Agricultural Sciences						
Social Sciences						
Humanities						
Country of affiliation						
COST country (vs non-COST country)						
NNC (vs non-NNC)						
ITC (vs non-ITC)						
Researchers characteristics						
Young (vs experienced)						
Leader (vs non-leader)						
Intense participation (vs non-intense)						
Female (vs male)						
Participation in COST Actions over the last 5 years						
Less than twice (base level)						
3-5 times						
more than 5 times						

	Accessing new research infrastructure (databases, labs, tools…)	Enabling career developments in your home institution	Finding professional opportunities for your next career step	Increasing your motivation to stay in Europe for your next career step	Improving your leadership skills
Scientific Discipline					
Natural Sciences (base level)					
Engineering and technology					
Medical and Health Sciences					
Agricultural Sciences					
Social Sciences					
Humanities					
Country of affiliation					
COST country (vs non-COST country)					
NNC (vs non-NNC)					
ITC (vs non-ITC)					
Researchers characteristics					
Young (vs experienced)					
Leader (vs non-leader)					
Intense participation (vs non-intense)					
Female (vs male)					
Participation in COST Actions over the last 5 years					
Less than twice (base level)					
3-5 times					
more than 5 times					

Some **general conclusions** can be drawn:

- The impact of COST Actions is, in general, more pronounced for **non-COST countries** than for COST countries
- Researchers from **ITC countries** benefit more than researchers from non-ITC countries from participation in COST Actions
- Researchers from **Near Neighbour Countries** do not significantly differ in reported impact from researchers coming from COST countries, except for expanding their network (negative coefficient) and accessing new research infrastructure (positive coefficient)
- **Intense participation** leads to a more positive impact on all aspects, independently from the chosen specification
- **Younger researchers** benefit more from COST Actions than more experienced researchers on almost all aspects. An exception can be observed for "Jointly preparing new research proposals", for which experienced researchers show a higher satisfaction.
- Researchers in **leadership positions** show a mixed pattern on impact: holding a leadership position appears to have a negative effect on progressing more efficiently in their own research projects, finding new professional opportunities and increasing motivation to say in Europe
- **Female** researchers benefit more from COST Actions than their male colleagues, although the effect sometimes disappears when the interaction between gender and ITC country is added to the model
- Researchers from **Social Sciences and Humanities** are often less satisfied than those in other disciplines. This effect is often attenuated when controlling for the interaction between scientific field and gender.

3.5 Network analysis



Network analysis with non-COST countries included

In addition to statistical analyses, an analysis of the country network created by the project was conducted (see the graph in Annex 3 for the non-curved graph showing the arrows). In the network, each country is a node, and each tie established thanks to COST Actions is a link. The purpose of this analysis is to evaluate the impact of the project on the construction of a network.

The network generated by the COST Actions consists of 67 countries (nodes) and 1677 links between the countries. The links are based on the responses to the survey questions presented in the tables below. Whenever a participant mentions having established a strong tie with a specific country thanks to COST Actions, a link between this specific country and the participant's country of origin is created. The respondents have been asked to rank these created ties (from 1 to 5) in the online survey (in the question "Please select and rank the countries with which you have established the strongest ties thanks to COST Actions"). In the graph above, the stronger the link created between two countries, the darker its colour.

Please select and rank the countries with which you have established the strongest ties thanks to the COST Actions (max 5 choices)

Response rate: **96.2%**

	Nbr	Imp.	
Germany	**1508**	**1.25**	34.5%
Italy	**1395**	**1.12**	31.9%
United Kingdom	**1316**	**1.01**	30.1%
Spain	**1226**	**0.95**	28.1%
France	**1076**	**0.87**	24.6%
Portugal	**872**	**0.65**	20.0%
Netherlands	**733**	**0.55**	16.8%
Belgium	**611**	**0.52**	14.0%
Poland	**578**	**0.43**	13.2%
Greece	**533**	**0.39**	12.2%
...	**6965**	**0.13**	159.4%
Total	**4370**		

In the last screen, you chose other countries. With which of the following countries have you established these links? (maximum 5 countries)

Response rate: **91.0%**

	Nbr	
USA	**88**	46.1%
Russia	**41**	21.5%
Canada	**34**	17.8%
Australia	**26**	13.6%
Ukraine	**24**	12.6%
Japan	**17**	8.9%
South Africa	**10**	5.2%
...	**55**	28.8%
Total	**191**	

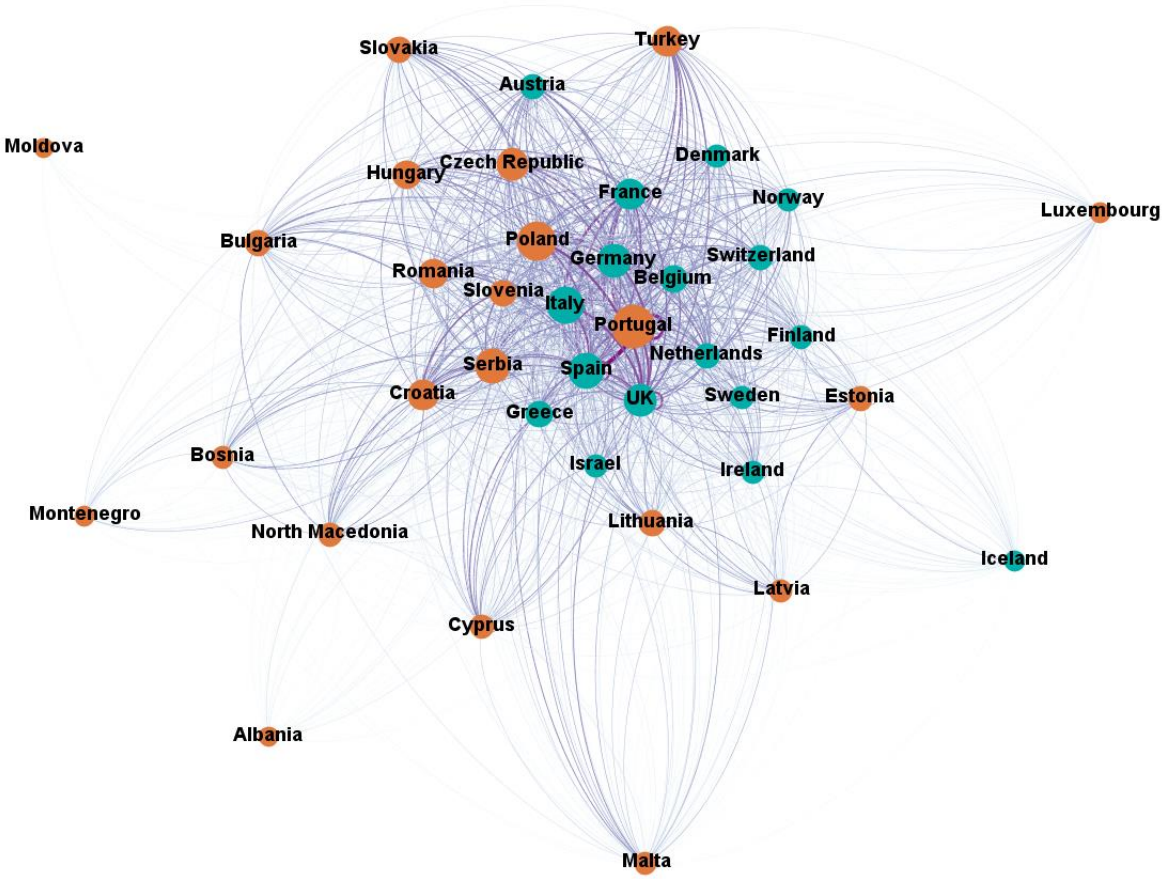
To what extent has participation in COST Actions fostered contacts with researchers from non-COST countries (see map below)?

Response rate: **79.5%**

Mean = **2.65** Median = **3.00** Std deviation = **1.36**

	Nbr	
1	**1024**	28.4%
2	**708**	19.6%
3	**833**	23.1%
4	**612**	17.0%
5	**433**	12.0%
Total	**3610**	

In the graphical representation, the thickness of the links is proportional to the number of ties created between the two countries, and the arrows show the direction of the exchange (see Annex 3 for the graphs showing the arrows).



Network analysis with COST countries only

The graphical representation above shows the network created between COST countries only. It consists of 39 nodes (countries) and 1254 links. Again, the thickness of the links is proportional to the number of ties created between the two countries, and the arrows show the direction of the exchange (see Annex 3 for the graph showing the arrows). As for the colour of the nodes, the ones in green show the non-ITC countries while the ones in orange show the ITC countries.

In addition to the graphical representations, the following metrics were calculated to describe and characterise the network:

- **The clustering coefficient**: it is the existence of communities within the network to be identified. It answers the following question: do the members of the network collaborate? A high cluster coefficient reflects a strong propensity of actors to form connected subsets and to collaborate closely with each other. In the network with non-COST countries, the clustering coefficient is 0.741, which indicates a relatively strong presence of communities within the network. In practical terms, this implies that researchers tend to meet researchers from most other countries in the Action networks. In the network analysis which includes the COST countries only, the clustering coefficient is 0.894, which indicates an even stronger presence of communities within the network.
- **The average distance**: this is the average number of links needed by a country to reach any other country in the network. A small distance reflects an assumed speed in the transmission of knowledge and information, which would be favourable to research and innovation. In COST Actions, the average distance between countries is 1.57. In

the network including COST countries only, the average distance between countries is 1.157. This can be considered as an excellent score, as in French or European analyses (these based on H2020 co-operation or previous FP) an average distance of 3 has been found and considered as a very good result[4].

- **Diameter**: This shows the maximal distance between all pairs of countries. In COST Actions, the diameter between countries is 4. In the analysis of the COST Actions with COST countries only, the diameter between countries is 2.
- **Density**: This translates the total number of existing links to the total number of possible links. In COST Actions, the density of the network is 37.9%. In COST Actions with COST countries only, the density of the network is 84.6%, which equals to a strong density.
- **A hub** is a country that holds an essential position within the network. For example, it can have a large number of partner countries and/or it can hold an intermediate position in such a way that without it the distance between two other countries would be lengthened. Their presence makes easy connections between other countries possible. Having a plurality of hubs prevents networks from being too dependent on a few players. In the network of COST Actions, the main hubs are Portugal, Italy, Serbia, Poland, Germany, France, Spain and the UK. In the network of COST Actions with COST countries only, the main hubs are Serbia, Bulgaria, Portugal, Poland, Croatia, Italy. For comparison, in H2020 collaborations the main hubs are Germany, Spain, Italy and France[5]. Even though Portugal and Croatia have improved their position between the FP7 and H2020, the impact of COST on the collaborations of researchers in this country seems significantly higher. The hub position of Serbia and Poland in the COST Actions' collaborations (and also Bulgaria if we consider only the COST countries in the analyses) is a specific added value compared to the EU Framework Programmes.

Considering these different results, we can say that this network presents an effective structure for the dissemination of knowledge.

[4] Pierre-Alexandre Balland, Ron Boschma, Julien Ravet; *Network dynamics in collaborative research in the EU, 2003-2017;* Papers in Evolutionary Economic Geographic; #19.11, Utrecht University.

[5] Pierre-Alexandre Balland, Ron Boschma, Julien Ravet; *Network dynamics in collaborative research in the EU, 2003-2017;* Papers in Evolutionary Economic Geographic; #19.11, Utrecht University.

4. ANALYSIS OF OUTPUTS AND RESULTS

This section illustrates the results of the analysis with respect to different themes which are relevant for the COST Association, especially regarding outputs and results.

4.1 Networking with other researchers

The results of the online survey show that the biggest impact of the participation in COST Actions on researchers' career is the expansion of their network. This is not surprising, given that helping researchers expand their network is one of the main strategic priorities of the COST Association.

It is interesting to notice that network expansion is one of the most important criteria determining the overall satisfaction of researchers with the impact of COST Actions on their career (see the importance-performance matrix at par.3.2.1).

According to the multivariate analysis, the impact of COST Actions on network expansion is higher for:

- younger researchers
- researchers having a leadership position
- female researchers
- researchers who intensively participate in COST Actions

Based on the content analysis of COST Actions' points of success, networking is the most quoted point of success (1/3rd of the sample mentioned it); for instance, many researchers described a successful network building, composed of fellow researchers, experts, professionals, etc. Below is a verbatim illustrating the importance of networking:

"I definitely benefited from my participation in the COST Action. I made new contacts, expanded my pool of collaborators, and had many opportunities to present my work together with colleagues, and also, I published together with colleagues thanks to COST and STSMs that we benefitted from. Many collaborations live beyond the end of the COST action, and I am very grateful to COST to have the vision and ambition to support such networking initiatives."

Data from the interviews are in line with these findings. All interviewed researchers managed to expand their network thanks to the COST Action involvement. They confirmed that the purpose of COST, to develop and expand a network of research colleagues in Europe, is definitely fulfilled.

"Being involved in the COST Actions made it possible for me to do research on the topic I was interested into even though I was the only one in my country, because I was part of a European network and I could exchange with other researchers."

One interviewee pointed out that COST reinforces existing networks.

"COST Actions are not only about expanding networks and about getting to know new people. But importantly, it reinforces existing contacts and networks. Some people you know from conferences, you meet them once per year. But in the frame of the COST Action you can work regularly for a longer time with them, and get to know them better. COST Actions are about joining communities. COST reinforces links that have happened previously."

Short Term Scientific Missions (STSMs) were highlighted as a particularly useful tool, which allows collaborating for a short period among colleagues.

"Especially the STSMs were instrumental for strengthening my collaborations and my network. It makes a difference, if you visit the people in their home institution. You become part of the collective at that institution for some time. I was involved in several STSMs, as a visiting researcher and as a host – I hosted more colleagues than I myself visited other institutions. All the STSM missions resulted in really strong publications, starting first with conference papers, which were developed then into journal articles."

4.2 Sharing knowledge

Helping researchers progress more efficiently in their research projects is one of the strengths of COST Actions. In fact, as the importance-performance matrix shows (par.3.2.1), such impact is positively evaluated by researchers, and it is considered as an important effect of such projects.

According to the multivariate analysis, the impact is stronger for:

- younger researchers
- female researchers
- researchers who intensively participate in COST Actions
- researchers from ITCs
- researchers from non-COST countries.

Researchers leading COST Actions benefit less of this effect, maybe because of the effort they need to put into administrative tasks. The impact is also less pronounced for Social Sciences and Humanities.

Results are less positive for the impact of COST Actions on "Accessing new research infrastructure". In the importance-performance matrix (par.3.2.1), such criterion falls in the *neutral zone*: this means that researchers give to this aspect a lower score than the average of all criteria, but this does not negatively influence their overall satisfaction with COST Actions.

Based on the multivariate analysis, the categories of researchers for which the impact on accessing new infrastructure is stronger can be identified:

- younger researchers
- female researchers
- researchers who intensively participate in COST Actions
- researchers from ITCs
- researchers from NNCs
- researchers in Medical and Health Sciences

Based on the content analysis of COST Actions' points of success, sharing knowledge is pinpointed as a point of success by 11.1% of the sample used for the content analysis: researchers that developed this point often mentioned that COST Actions gave them access to knowledge, data, methods and results they could work on with other researchers. Moreover,

they underlined that this had a positive impact on their research activities. Below is a verbatim illustrating the importance of sharing knowledge:

"Thanks to collaboration I can gain access to technologies and know-how not available in my country. It helps in getting national funding."

Sharing knowledge among research and business

When asked in interviews about innovation activities and interaction among researchers and innovators, it was discovered that contacts to business take place more frequently than would have expected. This involvement of companies is mostly indirect, through participation of company representatives in workshops and conferences, and not as direct members in the Action membership. Some commented that business involvement should be better facilitated and that a better selection process at the national level would be needed for this. In addition, the instrument portfolio is designed for researchers and not so much for the purpose of business/industry involvement.

"I must say that we have a problem with COST to link with companies, and to show them that it can be interesting for them. We would like to see their contribution higher. In my opinion, COST is good to bridge gaps between universities, institutes, so the public sector; I guess this is the way COST works."

"The problem with the national research councils is that most of them do not know what is happening in their country (in the economic field). There is a huge frustration: when a COST action is being formed by the management committee, bureaucratic people from these national committees sit around the table and choose the projects; but they do not have the means to really know what is happening in their country."

"Our COST Action targets industry. Among the MC members we have about 10% industry, 5-10 companies. Overall, 32 countries are involved in the Action. Our target was to reach 30% of total participants in our Action and its events coming from industry, and I think we reached it. From the COST office we got the information that COST values the co-operation with industry. But the COST instruments are focused on researchers, not so much on industry. For example, we are dealing with communication of the research knowledge to industry, but that does not contribute to the usual goals of COST Actions."

4.3 New collaborations

One point is that helping researchers start new research collaborations is one of the strengths of COST Actions. In fact, as the importance-performance matrix shows (par.3.2.1), such impact is positively evaluated by researchers, and it is considered as an important effect of such projects.

According to our multivariate analysis, the impact is stronger for:

- researchers having a leadership position
- female researchers
- researchers who intensively participate in COST Actions
- researchers from ITCs

The effect is less pronounced for Social Sciences and Humanities.

Results are less positive for the impact of COST Actions on "Jointly preparing new H2020, European and/or national research proposals". In the importance-performance matrix

(par.3.2.1), such criterion falls in the *neutral zone*: this means that researchers give to this aspect a lower score than the average of all criteria, but this does not negatively influence their overall satisfaction with COST Actions.

However, the categories of researchers for which the impact on jointly preparing new research proposals is stronger can be identified based on the multivariate analysis that:

- researchers having a leadership position
- younger researchers
- researchers who intensively participate in COST Actions
- researchers from ITCs
- researchers in Medical and Health Sciences and Engineering and Technology.

Based on the content analysis of COST Actions' points of success, new collaborations are mentioned by 53.4% of the random sample. The notion encompasses different features identified for the content analysis: "finding partners for collaborations", "joint publications and proposals", "long-lasting collaborations with researchers". Below is a verbatim illustrating the importance of new collaborations:

"During my COST participation experience, I have met and collaborated with active academics and strong research groups. Throughout our collaboration we have developed new research ideas for future proposals (some of them have already been accepted and running) and combinations of work has led to novel publications in scientific journals."

In the interviews, there was a specific focus on joint publications and proposals that have emerged from the COST Actions. Publications and follow-up projects have been generated in almost all cases, but numbers differ between the Actions. This depends on how far the Action is advanced in the implementation; the closer to the end of the Action, or the longer beyond the end of the Action, the more publications and projects usually appear. Furthermore, there are differences in publication patterns among disciplines, some publishing more papers than others, and, of course, there are Actions which are more successful than others due to good leadership, a timely research topic or other factors.

"I managed to get some publications in high impact journals. These are about 7-8 papers thanks to the COST involvement, which I got over the last two years. They were mostly prepared thanks to the secondments, which I did or initiated."

While project proposals have been generated in the Actions, it is only a limited number that receives financing. The Action leadership (chairs, vice-chairs, working group leaders, etc.) has stronger prospects of initiating or becoming involved in follow-up projects, as they know and are in touch with all Management Committee members. Project proposals have been generated at the national level, in bilateral funding schemes, in Horizon 2020 (MSCA ITN, FET, Twinning and Teaming in Widening call), in Joint Programming Initiatives (JPI), EUROSTARS, and several new Actions in COST.

One success case managed to generate a H2020 Innovative Training Network and a EUROSTARS project out of the Action; in addition a proposal for H2020 Future and Emerging Technologies (FET) was submitted (without results yet). In some cases COST Actions have even helped to establish a certain research field in a country, e.g. in Portugal, Serbia or Slovenia.

"I have a very close collaboration with several partners. Partners from Spain and Hungary, both have mentioned me as a partner in their national projects. I am also involved in a H2020

Teaming proposal as a co-Principal Investigator; the evaluation results should come very soon, in the next weeks."

"It is a huge difference, being a chair or participant of an Action. As a chair you have much bigger opportunities. We got much more offers for participating in project proposals than as we got as simple participants. So from this point of view, the higher workload with managing the Action was worth it. We were involved in a lot of proposals thanks to the COST contacts. In 2017 it was 4 H2020 proposals, whereby 1 got funded. In 2018 again, we were involved in 4-5 proposals, but none funded."

"Based on the COST Action network, we have submitted an ITN network proposal. First time it did not go through, second time we submitted it with nearly no changes and it was selected for funding. Many partners from the COST Action are involved in this ITN. Other people in the Action did also write a proposal, but I don't know, whether they were successful. A FET proposal we have also written. Then we got a EUROSTARS project together with a COST Action partner from Turkey, a company from Switzerland, and a start-up from Switzerland where I am involved as an advisor. On another occasion I was invited to a workshop of a different COST Action (not the one I'm chairing), and also got the offer to participate in a proposal."

4.4 New leadership/science administration skill

The evaluation given by researchers to the impact of COST Actions on "improving their leadership skills" is neither very positive, nor very negative, being very similar to the average satisfaction for all the other criteria (importance-performance matrix - par.3.2.1). However, some groups of researchers benefit more than the others of such an effect:

- younger researchers
- researchers having a leadership position
- female researchers
- researchers who intensively participate in COST Actions
- researchers from ITCs
- researchers in Medical and Health Sciences and Engineering and Technology (in comparison with Natural Sciences).

The content analysis of COST Actions' points of success reveals that a part of the researchers interrogated benefited from COST Actions in terms of skills (14.8% of the sample) and more precisely for leadership and administrative skills (2,5%); for instance, they learned to manage projects, to organise meetings and conferences, to coordinate with researchers, universities, laboratories, etc. Below is a verbatim illustrating this notion:

"I have gained insight into the management of an interdisciplinary research project at international level, and this experienced has boosted my carrier and perspectives in the country where I currently live."

In qualitative interviews improvement of science administration skills was not focused on, but interviewees have come forward with remarks on positive effects.

"The COST Action has helped me to develop my science management skills. I have been STSM coordinator; it has been some work, but it was in a field where I have previously not yet

gathered experience. Based on this experience, I am now also ERASMUS+ programme coordinator."

4.5 Career advancement

Helping researchers advancing in their career is not one of the most prominent features of COST Actions, according to researchers. In fact, as the importance-performance matrix shows (par.3.2.1), "Enabling career developments in your home institution" and "Finding professional opportunities for your next career step" are among the weaknesses of COST Actions, while "Increasing your motivation to stay in Europe for your next career step" is found in the neutral zone.

However, some groups of researchers benefit more than the others from the career advancement effect induced by COST Actions. According to our multivariate analysis, they are:

- younger researchers
- female researchers
- researchers who intensively participate in COST Actions
- researchers from ITCs
- researchers from non-COST countries
- researchers in Medical and Health Sciences and Engineering and technology (with respect to Natural Sciences).

The effect is less pronounced for researchers having a leadership position in COST Actions, maybe because these roles are often assumed by experienced researchers at an advanced phase of their career. Researchers in Social Sciences and Humanities also seem to benefit less from this effect.

Based on the content analysis of COST Actions' points of success, it can be seen that even though the impact of COST Actions on researchers' career advancement is not as tangible as the increase in research opportunities, some respondents stated that COST helped them to get a better position (6.4%), to have new professional opportunities (8.9%) but also to boost the achievement of a PhD (6.4%). Below is a verbatim illustrating this notion:

"At the beginning (in 2015) I was junior researchers as a Ph.D. student. Today, I'm employed at the University of Ljubljana as a Teaching Assistant and I believe that STSM and other COST activities also contributed to that, because they helped me grow as a researcher. All the people I met through COST were very nice, open for collaborations and willing to accept new researchers in their laboratories. Additionally, many professors and researchers visited our laboratories and we performed some research together."

The survey findings have been confirmed by interviewees, who all said that participation in the COST Action enhanced their personal standing, and that it had an influence on their career track. But in most cases it was a factor among others. Some exceptional success cases were pointed out, for example one researcher got a permanent position thanks to the COST Action chair role, or another colleague expanded from being a single expert in her scientific field in her country, to founding and becoming director of a research institute with about 50 collaborators nowadays.

"When I submitted the proposal for the action, I was doing a post-doc (2014). Afterwards, I obtained a position as Associate Professor. My role in the action certainly played a role to a

certain extent, because it showed that I had the trust and the approval of the scientific community. Afterwards, I obtained an ERC grant and other national grants."

"I was first working as group leader and took after one year over the chair of the Action. This has influenced my career importantly. I have got a fixed position thanks to my role and work in the Action; it seems I did a good job in chairing the Action."

The interviews also showed that finding a new research position thanks to the COST Action involvement has overall been rare for the interviewees. But the interviewed colleagues normally had already a research position. They mentioned, however, that they were aware of other colleagues who found a new position thanks to the Action, or that the Actions were used as a pool for recruiting younger researchers, for example among those, who have been doing PhDs in the frame of the Action.

"I had my position already when we started the COST Action. There was no motivation to find another one, as I was and am still pretty satisfied with the current one. Short term scientific missions were there and helpful. There were opportunities in the action to move between partners or change positions. This has to be seen in a positive sense. It was an opportunity to start a research position or enter this career path, e.g. post-doc positions, or Praktika were offered over borders /between partners and I am aware of 2 such cases."

Similarly, there were only a few cases in the interviews who mentioned that COST contributed to keeping them in Europe. An important effect was, however, the integration in European research networks, which was mentioned on this question (due to the ambiguity of the question).

"I never considered leaving Europe, but thanks to the COST Actions I had some good opportunities that convinced me it was the right choice."

"It helped me establish myself among European colleagues. Currently I have my Fulbright grant in the US, which will last one more year. But I think of getting back to Europe afterwards, as I have my tenure track position in Serbia. I continue to participate in COST meetings in spite of the longer travel from the US."

5. ANALYSIS OF POLICY-DRIVEN THEMES

This section illustrates the results of the analysis with respect to different themes which are relevant for COST, especially regarding the association's strategic priorities.

5.1 Younger researchers (in comparison to more advanced researchers)

The analysis shows that younger researchers clearly benefit more from their participation in COST Actions than their more experienced colleagues (par. 3.4.3). This holds for all of the aspects examined, except for the joint preparation of new research proposals.

The content analysis[6] shows that younger researchers cite as the main added-value of COST actions (compared to other funding sources) the following: Networking, STSMs, Clear and easy rules, More knowledge exchange than other funds, More collaboration than other funds.

Networking appears as a top added-value for younger researchers while more experienced researchers see the "clear and easy rules" of COST as its main added value compared to other funds. Moreover, while the fact that COST Actions "allow more knowledge exchange than the other funds" appears among the most cited added-values of COST by younger researchers, more experienced researchers prioritise the bigger consortium and the more international collaboration allowed by COST. It is worth mentioning that the STSMs are cited as one of the best added-values of COST compared to other programs by both younger and experienced researchers.

Top 5 Added values of COST actions according to younger researchers	
	% citation
Networking	13%
STSMs	9%
Clear and easy rules	7%
More knowledge exchange	6%
More collaboration	6%

Top 5 Added values of COST actions according to more experienced researchers	
	% citation
Clear and easy rules	10%
Networking	9%
STSMs	8%
Bigger consortium	8%
More international collaboration	6%

The content analysis of COST Actions' points of success provided complementary comments, which vary with the researcher's age. There is a difference of feedback concerning career successes, personal development and research opportunities. First, many younger researchers consider that COST Actions allowed for greater career successes. It increased their professional opportunities (e.g., being invited as a speaker to conferences) and helped their career development (e.g., getting a better position or a job). COST also boosted or helped them achieving academic work (e.g., finishing a PhD). Nevertheless, among advanced researchers, 41.7% mentioned increased professional opportunities as the top point of success in the category of career successes.

[6] The content analysis of the two open questions related to the added-value and points of success of the COST actions is based on a sample of approximately 400 responses.

	Young	Others
Increased professional opportunities	26.2%	41.7%
Career development	23.0%	8.3%
Academic achievements	23.0%	8.3%
Reinforcement of researchers' status	8.2%	8.3%
Project management and leadership	6.6%	16.7%
Improving research in the home institution / country	6.6%	0.0%
Boosting research portfolio	4.9%	0.0%
Independance	1.6%	8.3%
No impact	0.0%	8.3%

Second, it is interesting to note that COST Actions had an impact on the personal development of younger researchers, but the results are pretty similar to the ones of the more advanced researchers. A larger number of younger researchers mentioned that COST Actions helped them to acquire new skills, such as research methodology, writing, organisation, but also to expand their knowledge, in their discipline or in others. COST Actions, thanks to STSMs and training schools, have been useful to widen their view and provide new research perspectives (which is linked to meeting researchers from other disciplines). Becoming more self-confident and gaining experience are also two features pointed out by younger researchers.

	Young	Others
New skills	34.1%	31.6%
Knowledge expansion	22.4%	31.6%
New research perspectives	23.5%	26.3%
Long-lasting collaborations with researchers	8.2%	5.3%
Increased self-confidence	5.9%	5.3%
Meeting researchers from other disciplines	3.5%	0.0%
Gaining experience	2.4%	0.0%

Last, the content analysis underlines the greater impact of COST Actions on research opportunities for younger researchers. Networking, finding partners for collaborations, and writing joint publications and proposals but also the great contribution of STSMs and training schools for developing their research activities are the most cited points of success. These results are pretty similar for advanced researchers.

	Young	Others
Networking	21.1%	24.4%
Finding partners for collaborations	15.8%	19.5%
Joint publications and proposals	16.5%	12.2%
STSMs and training schools	11.6%	1.2%
Sharing knowledge, data, methods, results etc.	4.9%	8.5%
Accessing tools and infrastructure	4.6%	6.1%
Interdisciplinarity	4.2%	7.3%
Participating in events and workshops	4.9%	3.7%
Becoming more visible as a researcher	4.9%	1.2%
Discussing research topics and experiences	4.2%	2.4%
Connecting with the EU	2.5%	4.9%
Getting complementary funds	2.5%	2.4%
Expanding research activities	0.7%	2.4%
Overall quality	0.4%	2.4%
Presenting research achievements	0.7%	0.0%
Limited collaborations	0.0%	1.2%
Giving more visibility to a field of research	0.4%	0.0%
Connecting with ITC/marginal countries	0.4%	0.0%

To conclude, responses indicate that COST Actions have substantial and positive effects on younger researchers' career. Assuming that it is harder for younger researchers to build a network, to gain experience or to progress in their research track, these results support COST objectives towards younger researchers.

In interviews the positive impact for younger researchers identified in the survey results was widely confirmed. The COST Actions help the younger researchers (doctoral students and post-doctoral researchers) importantly with networking, and are very useful in that they lead to new projects, new ideas, and new collaborations. It was stated that some Action Chairs are very supportive of younger researchers, and motivate the younger colleagues to show their ideas. There were, however, also reports about different attitudes in COST Actions, where younger researchers are left only with a minor role or only a few younger researchers are involved.

"It is a very good programme for early career researchers. In our Action, the Action chairs are very supportive of young researchers, and motivate the young colleagues to show their ideas. The already well established and older colleagues in the Action are really interested to see the ideas and learn about what the young and early stage researchers are doing."

"There is a certain limiting effect within COST, in that older professors limit access to the COST to the meetings and the excellence network. You may get sidelined to training and measures for early stage researchers. It is therefore important also for the young researchers to become MC member of their country and to get access to the core activities of the Action."

"A general feeling that sometimes we had during the Action was that the funding was a bit limited and only specific activities were eligible for funding. However, those eligible activities, as STSMs or training schools, were excellent tools for the professional development of young researchers, to bring them the possibility to visit other institutions and moving around Europe."

"The COST Actions are interesting, but not easy because the budget cannot be used to pay people for the research. This is why the Actions rely mostly on early-career researchers, whose work is less expensive. It also makes COST Actions more useful for young scholars from ITC."

5.2 Researchers from Inclusiveness Target Countries

The results of the online survey demonstrated that researchers from Inclusiveness Target Countries are among those who benefit the most from their participation in COST Actions. In fact, they appear to be more impacted by all of the different effects of COST Actions on their career with respect to their colleagues from non-Inclusiveness Target Countries, except for network expansion (for which there is no significant difference - par. 3.4.3).

The content analysis of the question related to the added value of COST Actions compared to other programs shows that respondents from non-ITCs tend to quote significantly more the following aspects as the main added values of COST: the fact that COST Actions usually have a bigger consortium than other programs and that COST meetings are held more regularly (see table below).

Cost added value according to ITC and non-ITC

	ITC	Non ITC
Networking	12.9%	10.4%
STSMs	6.7%	11.0%
Clear and easy rules	9.6%	5.8%
Easy access to mobility	6.2%	6.5%
Bigger consortium	2.9%	9.1%
More international collaboration	5.3%	5.8%
More knowledge exchange	5.7%	4.5%
Young researchers	4.8%	5.8%
More collaboration	4.8%	4.5%
Financial advantage	4.3%	1.9%
More expertise	2.4%	3.9%
Flexibility	3.3%	2.6%
Long-term partnerships	3.3%	2.6%
Continuity of partnerships after Cost	2.9%	3.2%
More interdisciplinarity	3.3%	1.9%
Easy participation	3.8%	1.3%
No strict research agenda	1.9%	3.2%
New research insights	1.9%	3.2%
Regular meetings	0.5%	3.9%
Training schools	2.4%	0.0%

The financial advantage of COST is quoted more by researchers from ITCs than researchers from non-ITCs (4.3% compared to 1.9%). Smooth reimbursements and the advantage of having a fund for "mobility only" has been mentioned a few times by ITC respondents like a real added value of COST, as shown below:

"You cannot travel unless you have your own funding or funding within projects but then you can go for specific purposes on a visit, with COST if a new idea or technique is of your interest, you just need to make a plan and arrange it with the trainer or host."

However, some respondents complained about the long time needed to obtain a reimboursement:

"The advance payment expenses and long term waiting reimbursement procedure is the only weak side of the whole concept (sometimes it takes 3 months)".

Similarly, STSMs are quoted more often as a significant real added value of COST by ITC researchers (11% of citations by ITC compared to 6.7% for non-ITC countries).

In the random sample used for the content analysis of COST Actions' points of success, researchers from ITC countries stressed points of success with regard to career successes, personal development and research opportunities. Although percentages are close, researchers from ITC countries mentioned increased professional opportunities and academic achievements more often than other researchers, while researchers from non-ITC countries insisted more on career development (e.g. getting a new position or a job). In addition, ITC researchers seem to have experienced the advantages of COST at a more individual level, with regard to getting new skills and knowledge expansion (see verbatim below). Last, while more researchers from non-ITC countries referred to networking, researchers from ITC countries highlighted the opportunities COST Actions offered them for finding partners for collaborations, writing joint publications and proposals, learning during STSMs and training schools, accessing tools in infrastructure.

"By being a part of a COST action, I greatly improved my interpersonal and leadership skills, as well as broadening my horizons and learning a lot of new information usually not easily accessible to ITCs."

Interviewees from ITC countries were more positive than those from non-ITC countries on the effects of COST overall, and there were several hints that COST fulfils the purpose of integrating colleagues from ITC countries in European research networks well. Most remarks on weaknesses in the COST programme (see section Conclusions below) were coming from interviewees from non-ITC countries, especially from Western and Northern EU member states. This might have to do with the available COST budget per Action; it can have more effects in ITC countries, with lower income and price levels, than in other countries.

"I see a lot of effect from the COST Action. As a young researcher in a widening country, it is not so easy to get established in Europe as a researcher. Thanks to the COST Action involvement, and the network, I became a player at the European level in my field."

"I would like to say that COST has a very good impact for doctoral students and post-doctoral researchers. It helps a lot for networking. In Turkey, and in ITC countries in general, there might not be enough budget for networking (in universities' internal budget). Cost Actions are extremely useful in that sense. These networking activities lead to new projects, new ideas, new collaborations."

"The Action helped me to be recognised at the EU level among researchers from other European countries. We could show that also ITC countries have really good ideas, and the Action helped me to share my ideas. My suggestion would be to introduce a new support instrument for ITC countries, for establishing a new research field in an ITC country. This support should help starting-up a research field in an ITC country, for coordinating suitable research groups around this field. That is based on our experience in Serbia, where we have pioneered the field of our COST Action."

"Keep up the good work at COST, it is important that funding will stay in place. Especially for widening countries it is very beneficial. It enables collaboration in Europe and contributes to achieving a united European Research Area, with true inclusion of the widening countries. It helps that the talent pool of the widening countries can really be used in Europe. The COST Actions need to be carefully communicated, it contributes to achieving one Europe, bringing everyone in."

COST disposes of a specific support tool with the ITC conference grants, for facilitating the integration of colleagues from ITC countries in research networks. Those colleagues that have used it are satisfied with it and suggest continuation.

"STSMs and ITC grants are all great tools. Especially for early career investigators these are very good tools. Our chair is pushing very much participation from ITC countries and young researchers."

"Besides the STSMs, I was also coordinating the ITC grants in our Action. I think the ITC conference grants are quite a good initiative. But as it is a more recent tool of COST, it will need more time to assess it. My group got one grant, and overall several grants were allocated; in fact all who asked for the grant got it, as there were not so many requests. The young, students benefitted most from this ITC conference grant."

5.3 Researchers from Near Neighbour Countries

From the quantitative analysis, it seems that researchers from Near Neighbour Countries (NNC) do not significantly benefit more nor less than their colleagues from the participation in COST Actions. However, some differences exist between certain groups of NNC and the rest of the sample. In fact, COST classifies NNC in different groups[7]:

- *Mediterranean*: Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, the Palestinian Authority, Syria, Tunisia
- *Eastern Partnership*: Armenia, Azerbaijan, Belarus, Georgia, Moldova, Ukraine

In the table below, we compare the perceived impact on their career by researchers from Mediterranean countries, Eastern Partnership countries and the rest of the sample. Statistically significant relationships are highlighted in bold. The table below shows the mean scores obtained in each category: numbers in blue mean that the score for that category is significantly higher than the global average; numbers in pink mean that the score for that category is significantly lower than the global average. When means are written in black and in bold, the relationship is significant but without over/under-representation of a category in the impact observed. For all the other cases (numbers written in grey with a smaller font), no significant relationship has been found with respect to the categories observed.

	Mediterranean countries	Eastern partnership	Other countries
Impact	**3,73**	**4,30**	**3,93**
Expansion of your network	**3,67**	**4,42**	**4,30**
Meeting people from different disciplines than yours	**3,88**	**4,38**	**3,92**
Starting new research collaborations	**2,98**	**3,91**	**3,66**
Jointly preparing new H2020,	**1,78**	**2,75**	**2,45**

[7] A third group called '*Western Balkan*' (which only includes Kosovo) is also part of the COST classification. There is also one country without any classification, which is Russia. In the present section, we exclude Kosovo and Russia from our analysis since the number of respondents from these countries is too low.

	Mediterranean countries	Eastern partnership	Other countries
European and/or national research proposals			
Progressing more efficiently in your research projects	**3,50**	**4,23**	**3,48**
Accessing new research infrastructure (databases, labs, tools etc.)	**2,85**	**3,69**	**3,11**
Enabling career development in your home institution	3,08	3,40	3,00
Finding professional opportunities for your next career step	**2,54**	**3,65**	**3,00**
Increasing your motivation to stay in Europe for your next career step	**2,69**	**3,68**	**3,31**
Improving your leadership skills	**3,75**	**3,97**	**3,33**

The relationship between being from a Near Neighbour Country and the different measures of impact is almost always very significant, except for career development in the home institution (for which the relationship is only "slightly significant").

Researchers from **Eastern partnership** give a significantly higher assessment of the global impact of COST Actions on their career, but also of almost all of the other aspects. In addition, the means obtained are always higher than those observed for researchers from all the other countries. Therefore, they seem **highly impacted by COST Actions**, although less affected by the aspects regarding new projects with other researchers (networking, collaborations, and new proposals).

On the contrary, researchers from **Mediterranean countries** expressed a lower assessment of COST Actions' impact on the expansion of their network, starting new research collaborations, jointly preparing new H2020, European and/or national research proposals, finding professional opportunities for their next career step and increasing their motivation to stay in Europe. The means obtained are almost always lower than those observed for researchers from all the other countries. Therefore, they seem **overall less impacted** by COST Actions that researchers from Eastern partnership countries and from the rest of the sample.

Concerning the content analysis of the questions related to the added value and points of success of COST Actions does not show any significant result for near-neighbour countries, because of their non-significant number in the random sample. However, it is worth mentioning that several respondents from near-neighbour countries emphasised the opening of COST to non-COST countries as one of the programme's main added values, as illustrated in the response below:

"Opportunity to see invited experts from national and international level (not only from COST countries) on each COST seminar and conference."

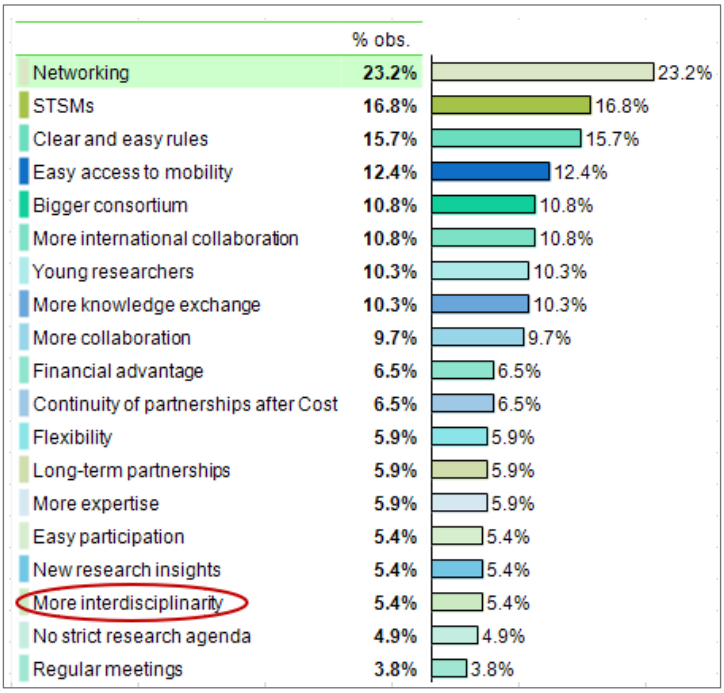
"It is more open for non-COST (non-European) countries."

5.4 Interdisciplinarity

In our importance-performance matrix (par.3.2.1), interdisciplinarity (phrased as "meeting people from different disciplines than yours") is the only effect of COST Actions to appear in the *over-quality* zone. This indicates that researchers give a positive assessment of such effect of COST Actions, but they do not estimate that it is very important with respect to the impacts[8].

According to our multivariate analysis (par.3.4.3), some categories of researchers see a stronger impact of COST Actions on meeting people from different disciplines: they are typically female researchers from ITC who participate intensively in COST Actions and work either in Engineering and Technology, Medical and Health Sciences or Agricultural Sciences.

The content analysis shows that the more interdisciplinary aspect of COST compared to other programs is among the most cited added-values of COST (cited in 5.4% of the sample's responses). However, it is quoted at a much lower rate than the other added values such as the networking or the programme's clear and easy rules, as illustrated in the table below.



[8] It should be noted however that researchers might appreciate interdisciplinarity (or profit from it) without actually recognising it as such, as "Interdisciplinarity" is still somewhat of a technical term.

Interdisciplinarity has been more often quoted as an added-value of COST actions by female participants (3,1% against 2,1%) as well as ITC countries (3,7% against 1%), as shown in the graphs below:

Added value of COST actions according to ITC/Non-ITC

	ITC	Non ITC
Networking	20.0%	15.7%
STSMs	10.4%	16.7%
Clear and easy rules	14.8%	8.8%
Bigger consortium	4.4%	13.7%
More international collaboration	8.1%	8.8%
More knowledge exchange	8.9%	6.9%
Mobility	7.4%	7.8%
Flexibility	5.2%	3.9%
Financial advantage	4.4%	2.9%
New research insights	3.0%	4.9%
More interdisciplinarity	3.7%	1.0%
Freeness of deciding on research directions	0.7%	2.9%
Easy access to mobility	1.5%	2.0%
Time	2.2%	0.0%
Training	1.5%	0.0%
Easiness of reimbursement	1.5%	0.0%
Attractiveness	0.0%	2.0%

Added value of COST actions according to the gender

	M	F
Networking	18.6%	17.3%
STSMs	14.3%	11.2%
Clear and easy rules	15.0%	8.2%
Bigger consortium	6.4%	11.2%
More international collaboration	6.4%	11.2%
More knowledge exchange	7.9%	8.2%
Mobility	7.9%	7.1%
Flexibility	5.7%	3.1%
New research insights	2.9%	6.1%
Financial advantage	3.6%	4.1%
More interdisciplinarity	2.1%	3.1%
Freeness of deciding on research directions	2.1%	1.0%
Easy access to mobility	1.4%	2.0%
Time	2.1%	0.0%
Training	0.7%	1.0%
Easiness of reimbursement	0.7%	1.0%
Attractiveness	0.7%	1.0%

Given the low number of quotations, this conclusion taken on its own cannot be considered robust, but it is coherent with the findings of the multivariate analysis.

The content analysis of COST Actions' points of success shows that interdisciplinarity can be seen from two perspectives: it has been experienced by some researchers as a factor of personal development, allowing them to enlarge their research views ("meeting researchers from other disciplines" as shown in the first table below), while other researchers depicted it as a direct contribution to their research activities ("interdisciplinarity" in the second table below).

The first figure illustrates personal development successes, where "meeting researchers from other disciplines" is ranked 6th. The second figure illustrates research activities successes, where "interdisciplinarity" is also ranked 6th.

	% obs.
New skills	41.2%
New research perspectives	29.4%
Knowledge expansion	29.4%
Long-lasting collaborations with researchers	9.4%
Increased self-confidence	7.1%
Meeting researchers from other disciplines	3.5%
Gaining experience	2.4%
Total	

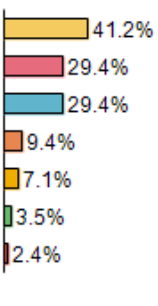


Figure 1. Personal development successes

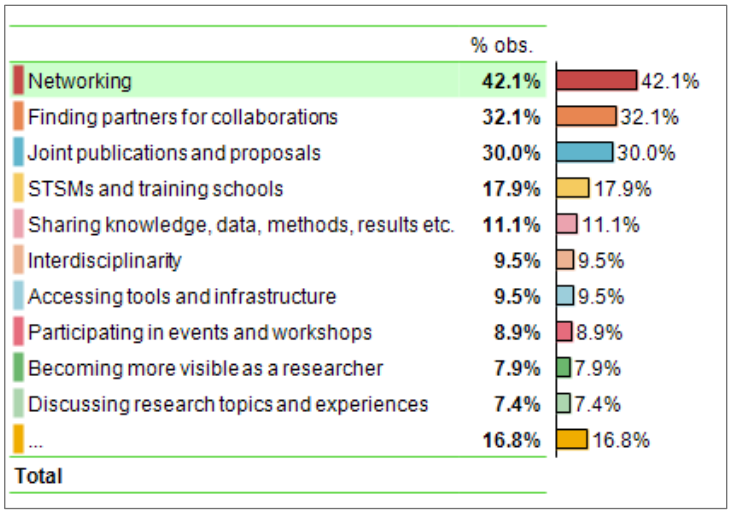


Figure 2. Research activities successes

Here is a verbatim illustrating interdisciplinarity success:

"My participation in multidisciplinary teams of Cost Action resulted with new insights for my profession. STSM was very valuable in sense of starting co-operation with other institutions/university. That experience opened for me some new research topics."

From qualitative interviews it can be deducted that interdisciplinarity is a key feature in several COST Actions. For example, interviewees stated that if compared to H2020 or national projects, then the expertise of the researchers involved in the COST Action is much wider, while in H2020 and national projects it is more restrained/focused. In certain topics of COST Actions interdisciplinarity is, however, quite limited.

"With the help of the Action we started thinking of joint research including other thematic fields. For me it was very interesting to see, how the research in my field and my results can be used in other fields. The Action has helped to work with the other participants, with their different backgrounds, and to bring that all together for a joint research purpose and goals – and to get new results out of that."

"I am myself a pharmacologist. But we have different disciplines involved, such as biologists, medical doctors, biophysicists, and also basic and applied sciences. So interdisciplinarity is an important feature of the Action."

Integration of user requirements and of user groups has been reported. This indicates that in COST Actions also transdisciplinary co-operation through the involvement of practitioners and non-scientific stakeholders is happening.

"Interdisciplinarity is present inside the COST Action as well as in our national platform in Serbia. We have basic researchers, clinicians, and also patient organisations involved in the Action. They will join the network. The patient organisations are organised mostly on a national level, so through the Action we want to coordinate and bring them together as well. This is innovative in the sense of integration of user requirements in the research."

5.5 Gender

The analysis shows that female researchers clearly benefit more from their participation in COST Actions than their male colleagues (par. 3.4.3). This holds for all of the aspects we examined, except for the joint preparation of new research proposals and the motivation to stay in Europe for their next career step.

The content analysis shows that female researchers cite as main added-value of COST Actions compared to other funding sources) the following:

Top 10 Added values of COST actions according to female researchers	
	% of citation by F
Networking	10%
STSMs	7%
Bigger consortium	7%
More international collaboration	7%
Younger researchers	7%
Clear and easy rules	5%
More knowledge exchange	5%
More collaboration	5%
Easy access to mobility	4%
Continuity of partnerships after COST	4%
New research insights	4%

Compared to female researchers, male researchers rather emphasise the added value of COST on "organisational" aspects: "clear and easy rules" is the 2nd most cited added value of COST for male researchers (see table below) while it only comes at the 6th place for female researchers. Similarly, "flexibility" is among male researchers' top 10 most cited added value of COST, while it doesn't appear among the 10 most cited added values by female researchers.

Top 10 Added values of COST actions according to male researchers	
	% of citation by M
Networking	13%
Clear and easy rules	10%
STSMs	10%
More knowledge exchange	5%
Easy access to mobility	5%

Top 10 Added values of COST actions according to male researchers	
	% of citation by M
More collaboration	5%
Bigger consortium	4%
More international collaboration	4%
Young researchers	4%
Flexibility	4%
Long-term partnerships	3%

However, female researchers tend to quote the "continuity of partnerships after COST" and the fact that it gave them "new research insights" among the best added values of COST, while these aspects don't appear in the most cited added values mentioned by male researchers.

As for the content analysis of COST Actions' points of success, results are pretty similar for men and women. Nevertheless, it reveals that male respondents insisted more on career-related features, such as career successes and research opportunities (professional opportunities, networking, collaborations), while female respondents underlined more often personal development features (new skills, knowledge expansion, and increased self-confidence) and academic achievements.

	M	F
Increased professional opportunities	31.1%	25.0%
Career development	20.0%	21.4%
Academic achievements	17.8%	25.0%
Reinforcement of researchers' status	8.9%	7.1%
Project management and leadership	6.7%	10.7%
Improving research in the home institution / country	6.7%	3.6%
Boosting research portfolio	4.4%	3.6%
Independance	2.2%	3.6%
No impact	2.2%	0.0%

	M	F
New skills	28.0%	38.9%
Knowledge expansion	22.0%	25.9%
New research perspectives	28.0%	20.4%
Long-lasting collaborations with researchers	14.0%	1.9%
Increased self-confidence	4.0%	7.4%
Meeting researchers from other disciplines	4.0%	1.9%
Gaining experience	0.0%	3.7%

6. POINTS FOR IMPROVEMENT AND SUGGESTIONS OF INTERVIEWEES

While the assessment of the COST programme by the beneficiaries is overall very positive, some weaknesses have also been pointed out, especially in the qualitative interviews. These might be considered by the COST Association.

The **administrative effort required for Chairs to manage a COST Action is relatively high**. This is combined with the of 15% limitation which can be spent on management overhead from the budget of an Action. This leads in some instances to hesitation or refusal among researchers from Western European countries to chair a COST Action.

"The 15% Overhead is not covering the effort required for managing the Action, especially if the Action is managed from Germany with our income and price levels. These are many hours that are invested in the Action to run it. So this overhead share should be reconsidered."

"One problem with COST is that personnel costs are not funded and that a lot is expected by the COST secretariat from an Action in terms of outputs, including publications, activities, and deliverables. It seems that requirements from COST side towards the Actions have increased. The COST Actions how they are done currently are outdated and revision of the approach is required. All colleagues contributing in the Action were at maximum workload. They contribute, because of the group and social interaction, and because we have become friends inside the Action."

"Thanks to the first COST action, I could have a great network, but I don't think I would engage in another COST action soon. There is a high administrative burden (it takes too much time and there are too many deliverables which were sometimes very specific) and there is no research funding (we couldn't make some tests with our budget e.g.). This was frustrating."

The **current management approach to COST Actions contributes to this high administrative effort**. The budget of an Action is planned and negotiated every year, and there is very little flexibility to shift resources from one year to another. This drives up administrative work and some Actions could not spend relevant shares of their budget or organise events due to these limitations. Elaborate rules by the COST Association for individual events and travel costs have been raised as a disadvantage in this context. Furthermore, local organiser costs for events in countries with high price levels are low, and some planned meetings could not take place due to this fact.

"The administrative work in COST Actions is very time-consuming for Chairs. The budget is planned and negotiated every year, while for ERC grants or H2020 you prepare a 3 or 4-year planning. From a practical perspective, this makes things very complicated: the planning has to be very precise, if 50 people show up at a conference instead of 40, there's very little flexibility to adapt the budget or shift money from one year to another. Also, for any small change, COST has to re-approve everything (e.g. change of location)."

"More flexibility with the budgeting periods is recommended. We have about €100,000 per period available and we have to see to spend the whole sum during this period. If not everything is spent, the remaining budget is lost for the Action."

"One important issue is the use of budget and the limitations imposed here on usage for Local Organiser Support. In fact we could not use up the available budget, we spent less than 50% of the budget we had available. The rules for usage of budget were interpreted very strictly, overly strictly. The key problem is the budget for Local Organiser Support. It's quite low what can be spent here."

A few measures could be taken to reduce the administrative effort for managing a COST Action. A budget planning over the whole duration of an Action could be established, instead of the annual budget negotiations. The 15% limitation spent on management overhead of the

budget of an Action may be reconsidered and adapted to price levels of COST countries. Less elaborate rules and more flexibility with workshop organisation and travel costs could be applied, and the differentiation of local organiser costs in relation to where an event is taking place could also help alleviating problems.

From a more general perspective on participants in COST Actions, some of the interviewed chairs/vice chairs complained that **not all Management Committee members were qualified or actively contributing to the Action**. They stated that the selection of members by national coordinators was not sufficiently transparent and clear, and Action chairs claimed that they should have a say in selecting the members.

Additional support measures to be implemented by COST were suggested. Financial support should be provided for establishing a new research field in an ITC country, and for implementing new ideas generated in STSMs by younger researchers. At the start of the COST Action, more **facilitation measures** could be taken to allow for a smooth start of the Action.

"New COST Action coordinators should be able to learn from experienced ones, e.g. organise a meeting for new coordinators, where experienced colleagues of Actions which are about to finish present their experience and knowledge in management procedures. That would speed up the process for the new coordinators in learning how the Actions work."

The fact that such an **impact evaluation** has been commissioned by COST and its focus on longer-term effects of COST Actions have been underlined as very positive by an interviewee.

"I think it is really a great initiative to do this kind of impact evaluation of COST Actions. I am not aware that other funding agencies are doing this. In H2020 you have to do the regular reporting and provide KPIs, but that's it. The longer-term impact of the action/of a project or impact on research careers is not checked, at least I am not aware of it."

7. CONCLUSIONS

Firstly, the high response rate, as well as the welcoming attitude to the interview requests, shows a real interest of the researchers for COST and its impacts, which is a positive finding.

The results of this study show that, overall, researchers estimate that their participation in COST Actions had a positive impact on their career. Adding up researchers who rated the impact from 3 to 5 (on a scale from 0 to 5), we observe that 88.5% of respondents declared that they see a positive impact. This is in line with the 85% objective set for the COST Strategic KPI "share of younger researchers and innovators stating that COST has boosted their career".

Key message 1

88.5% of respondents to the online survey declared that they see a positive impact of their participation in the COST Actions on their career.

Among the different effects of COST Actions on career advancement, researchers appreciate the most network expansion, starting new research collaborations and progressing more efficiently in their research project. The effects more directly linked to career advancement (such as finding new opportunities or advancing in home institution) obtain less positive evaluations, while being very important from the researchers' perspective.

Key message 2

COST Actions have a positive impact on researchers' career more in an indirect way (by helping them establish new connections, start new collaborations and enhancing their reputation in the scientific community) **than in a direct way** (by helping them finding new professional opportunities).

Some groups of researchers clearly benefit more than their colleagues from their participation in COST Actions. This is notably the case for:

- younger researchers
- researchers having a leadership position
- female researchers
- researchers who intensively participate in COST Actions
- researchers from ITCs
- researchers from non-COST countries

Key message 3

COST Actions have a stronger positive impact on the career of **younger** researchers, **female** researchers and academics from **Inclusiveness Target Countries**.

Key message 4

Researchers from **Inclusiveness Target Countries** are more likely to become involved in COST Actions **without having any previous connections** to any of the other participants beforehand.

Drawing a conclusion from the content analysis, researchers seem very satisfied globally by COST Actions, whether it concerns their career advancement, their research activities, or their personal development.

First, the detailed answers provide a strong and positive evaluation of networking, no matter gender, age or origin of the respondent. COST Actions are described as a great instrument to be introduced to research networks across Europe, connecting researchers, laboratories, methods, knowledge, etc., and significantly increasing collaborations. They often boost researchers' personal and professional evolution. As an added value, COST Actions also increased awareness on project management, leadership and organisational skills.

Second, the content analysis seems to confirm the evaluation of interdisciplinarity obtained in the importance/performance table presented above: often cited as a positive feature of COST Actions, this dimension hardly appears to be the top added-value or point of success, regardless the respondent's profile.

Third, the sample illustrates different considerations and different priorities according to gender, age and country of origin. The data indicates that male respondents valued more the impact of COST Actions on their research advancement, while female respondents stressed personal development and connection with their peers. Younger researchers benefited more from networking. ITC researchers positively assess new opportunities thanks to networking, exchanges and collaborations, as it is often harder to get contacts, knowledge and infrastructure in their home country. Similarly, younger researchers also highly appreciated networking and STSMs, as new opportunities could emerge for them as new entrants of research systems.

Fourth, some points for improvement were suggested in open questions and interviews, especially for reducing the administrative effort for managing COST Actions (e.g. budgeting over the whole duration of an action instead of annual budgeting), and for more transparency and a co-decision right for chairs in the selection of Management Committee members.

Therefore, despite some points of attention on more practical aspects, it can be concluded that COST Actions have a significant positive impact on researchers, and they are particularly effective with regard to younger researchers from Inclusiveness Target Countries.

ANNEX 1: REGRESSION ANALYSIS OUTPUT

The present annex shows the results of the **multiple regression analysis** aimed at explaining which factors influence the researchers' assessment of the COST Actions' impact on different aspects of their career (section 3.4.3).

The **explanatory variables** included in the model include:

- The scientific discipline (OECD field)
- A dummy variable for COST countries
- A dummy variable for NNC countries
- A dummy variable for ITC
- A dummy variable for younger researchers (under 40)
- A dummy variable for leader researchers (Researchers are considered to have a leadership position if they are MC Chair, MC Vice-Chair, Working Group Leader, STSM coordinator or Science Communication Manager)
- A dummy variable for intense participation (at least 5 participations in one Action)
- A dummy variable for female researchers
- The frequency of participation in COST Actions over the last 5 years (which correlates with the dummy variable for intense participation)

We adopt a linear regression model with heteroskedasticity-robust estimators of the variance-covariance matrix.

We test **three different specifications** for our model:

- REG1: The first specification includes all the variables listed above
- REG2: The second specification, on top of the explanatory variables, accounts for the interaction between gender and discipline (since there are more female researchers in social sciences and humanities)
- REG3: The third specification adds to the second one the interaction between gender and the dummy variable for ITC countries (since there are more female researchers in ITC countries).

Model comparison for global impact

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	0.0261	0.0759	0.0772
	(0.0434)	(0.0554)	(0.0555)
Medical and Health sciences	-0.0059	0.0140	0.0178
	(0.0562)	(0.0784)	(0.0785)
Agricultural sciences	-0.0107	0.0150	0.0170
	(0.0649)	(0.0952)	(0.0953)
Social sciences	-0.1845**	-0.1207	-0.1197
	(0.0563)	(0.0818)	(0.0817)
Humanities	-0.3047**	-0.1230	-0.1204
	(0.0930)	(0.1716)	(0.1710)
is_cost_country	-0.6926***	-0.6907***	-0.6827***
	(0.1765)	(0.1747)	(0.1748)
is_near_neighbour	-0.1251	-0.1252	-0.1148
	(0.1909)	(0.1894)	(0.1895)
is_itc	0.3469***	0.3448***	0.3959***
	(0.0363)	(0.0363)	(0.0518)
young	0.2782***	0.2783***	0.2782***
	(0.0408)	(0.0408)	(0.0408)
leader	0.0461	0.0422	0.0402
	(0.0592)	(0.0594)	(0.0595)
intense_part	0.4119***	0.4123***	0.4126***
	(0.0404)	(0.0405)	(0.0405)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.3414***	0.3416***	0.3429***
	(0.0449)	(0.0449)	(0.0449)
More than 5 times	0.5641***	0.5638***	0.5656***
	(0.0458)	(0.0458)	(0.0458)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.1030**	0.1667***	0.1182
	(0.0338)	(0.0490)	(0.0612)
Observations	4339	4339	4339
r2	0.1263	0.1272	0.1276
F	42.5733	31.6536	30.2098

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for network expansion

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	-0.0107	0.0798	0.0808
	(0.0383)	(0.0480)	(0.0480)
Medical and Health sciences	0.0216	0.1067	0.1095
	(0.0461)	(0.0613)	(0.0616)
Agricultural sciences	-0.0859	0.0084	0.0099
	(0.0611)	(0.0841)	(0.0842)
Social sciences	-0.0417	-0.0428	-0.0422
	(0.0458)	(0.0710)	(0.0710)
Humanities	-0.0677	-0.0675	-0.0655
	(0.0745)	(0.1425)	(0.1424)
is_cost_country	-0.5041**	-0.5119***	-0.5058**
	(0.1540)	(0.1552)	(0.1550)
is_near_neighbour	-0.3752*	-0.3899*	-0.3821*
	(0.1688)	(0.1701)	(0.1702)
is_itc	0.0372	0.0347	0.0738
	(0.0300)	(0.0300)	(0.0436)
young	0.1604***	0.1609***	0.1609***
	(0.0356)	(0.0355)	(0.0355)
leader	0.1533***	0.1527***	0.1511***
	(0.0434)	(0.0436)	(0.0436)
intense_part	0.4835***	0.4806***	0.4808***
	(0.0338)	(0.0338)	(0.0338)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.3370***	0.3372***	0.3381***
	(0.0405)	(0.0404)	(0.0404)
More than 5 times	0.5029***	0.5038***	0.5052***
	(0.0382)	(0.0382)	(0.0382)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.0771**	0.1639***	0.1269*
	(0.0294)	(0.0436)	(0.0506)
Observations	4313	4313	4313
r2	0.1550	0.1575	0.1578
F	53.8632	40.4571	38.5226

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for meeting people from different disciplines

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	0.2445***	0.2940***	0.2932***
	(0.0442)	(0.0580)	(0.0580)
Medical and Health sciences	0.2228***	0.2903***	0.2881***
	(0.0554)	(0.0795)	(0.0794)
Agricultural sciences	0.2175***	0.3092***	0.3080**
	(0.0640)	(0.0939)	(0.0938)
Social sciences	0.0341	0.0645	0.0640
	(0.0577)	(0.0891)	(0.0892)
Humanities	-0.1557	-0.1102	-0.1118
	(0.0881)	(0.1668)	(0.1671)
is_cost_country	-0.4784*	-0.4800*	-0.4846*
	(0.2239)	(0.2244)	(0.2252)
is_near_neighbour	-0.0840	-0.0901	-0.0962
	(0.2366)	(0.2372)	(0.2381)
is_itc	0.4250***	0.4229***	0.3929***
	(0.0369)	(0.0369)	(0.0517)
young	-0.0207	-0.0210	-0.0209
	(0.0398)	(0.0398)	(0.0398)
leader	-0.0340	-0.0353	-0.0341
	(0.0634)	(0.0636)	(0.0637)
intense_part	0.2103***	0.2089***	0.2087***
	(0.0400)	(0.0400)	(0.0400)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.1644***	0.1647***	0.1639***
	(0.0451)	(0.0451)	(0.0451)
More than 5 times	0.2595***	0.2605***	0.2594***
	(0.0459)	(0.0459)	(0.0459)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.2504***	0.3188***	0.3472***
	(0.0348)	(0.0533)	(0.0669)
Observations	4312	4312	4312
r2	0.0712	0.0721	0.0722
F	22.8463	16.8841	16.0946

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for starting new research collaborations

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	-0.0536	0.0507	0.0515
	(0.0523)	(0.0620)	(0.0620)
Medical and Health sciences	-0.0127	-0.0050	-0.0029
	(0.0666)	(0.0910)	(0.0913)
Agricultural sciences	-0.1081	-0.0996	-0.0985
	(0.0786)	(0.1165)	(0.1165)
Social sciences	-0.2780***	-0.4300***	-0.4296***
	(0.0638)	(0.0948)	(0.0948)
Humanities	-0.2090*	-0.3137	-0.3123
	(0.0981)	(0.2034)	(0.2035)
is_cost_country	-0.2561	-0.2766	-0.2722
	(0.2554)	(0.2567)	(0.2568)
is_near_neighbour	0.0796	0.0532	0.0590
	(0.2718)	(0.2732)	(0.2735)
is_itc	0.1688***	0.1676***	0.1963**
	(0.0411)	(0.0411)	(0.0611)
young	0.0720	0.0754	0.0754
	(0.0467)	(0.0466)	(0.0466)
leader	0.1670**	0.1674**	0.1662**
	(0.0633)	(0.0637)	(0.0637)
intense_part	0.5860***	0.5820***	0.5822***
	(0.0464)	(0.0464)	(0.0464)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.4277***	0.4267***	0.4275***
	(0.0529)	(0.0528)	(0.0528)
More than 5 times	0.6424***	0.6404***	0.6415***
	(0.0523)	(0.0522)	(0.0523)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.0999*	0.1210*	0.0939
	(0.0404)	(0.0577)	(0.0697)
Observations	4299	4299	4299
r2	0.1246	0.1277	0.1278
F	42.4570	31.9870	30.3984

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for jointly preparing new research proposals

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	0.2113**	0.3868***	0.3855***
	(0.0684)	(0.0833)	(0.0834)
Medical and Health sciences	0.2116*	0.2275	0.2239
	(0.0866)	(0.1210)	(0.1212)
Agricultural sciences	-0.0430	-0.0255	-0.0276
	(0.1072)	(0.1561)	(0.1564)
Social sciences	-0.1843*	-0.3401**	-0.3408**
	(0.0853)	(0.1216)	(0.1217)
Humanities	-0.3166*	-0.1213	-0.1239
	(0.1280)	(0.2307)	(0.2309)
is_cost_country	0.0552	0.0371	0.0301
	(0.3461)	(0.3487)	(0.3488)
is_near_neighbour	0.3831	0.3566	0.3468
	(0.3642)	(0.3667)	(0.3671)
is_itc	0.2219***	0.2189***	0.1680*
	(0.0545)	(0.0545)	(0.0816)
young	-0.1610**	-0.1569**	-0.1569**
	(0.0589)	(0.0588)	(0.0588)
leader	0.5493***	0.5434***	0.5455***
	(0.0879)	(0.0880)	(0.0881)
intense_part	0.5219***	0.5194***	0.5190***
	(0.0614)	(0.0613)	(0.0614)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.2490***	0.2472***	0.2458***
	(0.0649)	(0.0648)	(0.0648)
More than 5 times	0.6241***	0.6195***	0.6176***
	(0.0706)	(0.0706)	(0.0707)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.0467	0.1312	0.1792
	(0.0530)	(0.0776)	(0.0953)
Observations	4264	4264	4264
r2	0.0835	0.0873	0.0875
F	30.1181	23.3493	22.2562

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for progressing more efficiently in research projects

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	-0.0273	0.0194	0.0213
	(0.0522)	(0.0658)	(0.0658)
Medical and Health sciences	-0.0540	0.0117	0.0170
	(0.0678)	(0.0924)	(0.0925)
Agricultural sciences	-0.0494	0.0145	0.0173
	(0.0801)	(0.1187)	(0.1187)
Social sciences	-0.3891***	-0.4836***	-0.4825***
	(0.0706)	(0.1062)	(0.1061)
Humanities	-0.3958***	-0.4841*	-0.4804*
	(0.1073)	(0.2103)	(0.2100)
is_cost_country	-0.6539**	-0.6632**	-0.6521**
	(0.2399)	(0.2417)	(0.2414)
is_near_neighbour	0.1595	0.1451	0.1599
	(0.2522)	(0.2541)	(0.2541)
is_itc	0.4528***	0.4514***	0.5237***
	(0.0438)	(0.0438)	(0.0639)
young	0.1083*	0.1087*	0.1086*
	(0.0466)	(0.0466)	(0.0466)
leader	-0.2218**	-0.2204**	-0.2233**
	(0.0683)	(0.0686)	(0.0685)
intense_part	0.3320***	0.3289***	0.3294***
	(0.0472)	(0.0473)	(0.0473)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.3544***	0.3537***	0.3556***
	(0.0525)	(0.0525)	(0.0525)
More than 5 times	0.5125***	0.5124***	0.5149***
	(0.0541)	(0.0542)	(0.0542)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.1837***	0.2081***	0.1398
	(0.0414)	(0.0597)	(0.0749)
Observations	4299	4299	4299
r2	0.0845	0.0857	0.0862
F	27.4415	20.4809	19.6255

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for accessing new research infrastructure

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	0.0925	0.1983**	0.2014**
	(0.0596)	(0.0737)	(0.0736)
Medical and Health sciences	0.0514	0.0133	0.0217
	(0.0724)	(0.1017)	(0.1017)
Agricultural sciences	0.0432	0.0782	0.0828
	(0.0896)	(0.1396)	(0.1387)
Social sciences	-0.6002***	-0.5412***	-0.5399***
	(0.0774)	(0.1124)	(0.1124)
Humanities	-0.3585**	-0.4300*	-0.4241*
	(0.1135)	(0.2072)	(0.2066)
is_cost_country	0.3414	0.3292	0.3488
	(0.3180)	(0.3219)	(0.3222)
is_near_neighbour	0.8724**	0.8543*	0.8798**
	(0.3350)	(0.3390)	(0.3393)
is_itc	0.4535***	0.4531***	0.5707***
	(0.0484)	(0.0485)	(0.0713)
young	0.2193***	0.2229***	0.2225***
	(0.0521)	(0.0522)	(0.0521)
leader	-0.1069	-0.1086	-0.1139
	(0.0770)	(0.0770)	(0.0769)
intense_part	0.2232***	0.2210***	0.2217***
	(0.0542)	(0.0542)	(0.0542)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.3433***	0.3441***	0.3473***
	(0.0586)	(0.0586)	(0.0585)
More than 5 times	0.4533***	0.4547***	0.4586***
	(0.0615)	(0.0615)	(0.0615)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.2377***	0.3052***	0.1940*
	(0.0464)	(0.0688)	(0.0858)
Observations	4229	4229	4229
r2	0.0726	0.0741	0.0753
F	23.5222	17.6848	17.0865

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for career developments in home institution

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	0.1055	0.1671*	0.1675*
	(0.0600)	(0.0758)	(0.0758)
Medical and Health sciences	0.1232	0.1715	0.1723
	(0.0741)	(0.1081)	(0.1081)
Agricultural sciences	0.2023*	0.3026*	0.3030*
	(0.0879)	(0.1316)	(0.1316)
Social sciences	-0.3231***	-0.3352**	-0.3351**
	(0.0779)	(0.1144)	(0.1144)
Humanities	-0.3113**	-0.1948	-0.1942
	(0.1168)	(0.1889)	(0.1888)
is_cost_country	-0.7885**	-0.7930**	-0.7910**
	(0.3014)	(0.3006)	(0.3007)
is_near_neighbour	-0.0758	-0.0862	-0.0836
	(0.3179)	(0.3172)	(0.3175)
is_itc	0.6109***	0.6083***	0.6205***
	(0.0483)	(0.0483)	(0.0710)
young	0.2290***	0.2299***	0.2299***
	(0.0519)	(0.0520)	(0.0520)
leader	0.0781	0.0743	0.0738
	(0.0770)	(0.0771)	(0.0771)
intense_part	0.2519***	0.2507***	0.2508***
	(0.0536)	(0.0537)	(0.0537)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.4186***	0.4184***	0.4188***
	(0.0585)	(0.0585)	(0.0585)
More than 5 times	0.6035***	0.6030***	0.6034***
	(0.0623)	(0.0623)	(0.0623)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.1464**	0.2129**	0.2015*
	(0.0462)	(0.0680)	(0.0853)
Observations	4232	4232	4232
r2	0.0852	0.0859	0.0859
F	29.2624	21.6724	20.5848

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for finding new professional opportunities

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	0.0869	0.1956**	0.1966**
	(0.0612)	(0.0753)	(0.0753)
Medical and Health sciences	0.0646	0.1492	0.1520
	(0.0770)	(0.1075)	(0.1075)
Agricultural sciences	-0.0445	-0.0320	-0.0305
	(0.0929)	(0.1429)	(0.1429)
Social sciences	-0.1291	-0.1055	-0.1050
	(0.0763)	(0.1118)	(0.1117)
Humanities	-0.3473**	-0.3452	-0.3432
	(0.1252)	(0.2104)	(0.2098)
is_cost_country	-0.9641**	-0.9701**	-0.9639**
	(0.2950)	(0.2949)	(0.2949)
is_near_neighbour	-0.3705	-0.3827	-0.3744
	(0.3127)	(0.3126)	(0.3127)
is_itc	0.5273***	0.5256***	0.5647***
	(0.0497)	(0.0497)	(0.0730)
young	0.5338***	0.5336***	0.5335***
	(0.0551)	(0.0551)	(0.0551)
leader	-0.2280**	-0.2280**	-0.2298**
	(0.0825)	(0.0827)	(0.0828)
intense_part	0.2884***	0.2856***	0.2858***
	(0.0556)	(0.0557)	(0.0557)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.4297***	0.4298***	0.4307***
	(0.0596)	(0.0597)	(0.0597)
More than 5 times	0.5374***	0.5390***	0.5404***
	(0.0640)	(0.0640)	(0.0641)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.2584***	0.3515***	0.3146***
	(0.0473)	(0.0691)	(0.0864)
Observations	4225	4225	4225
r2	0.0927	0.0940	0.0941
F	32.1956	24.1602	22.9912

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for increasing motivation to stay in Europe

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	0.1059	0.1119	0.1106
	(0.0645)	(0.0810)	(0.0811)
Medical and Health sciences	0.0644	0.0707	0.0670
	(0.0836)	(0.1137)	(0.1137)
Agricultural sciences	-0.0188	-0.0898	-0.0919
	(0.1044)	(0.1557)	(0.1558)
Social sciences	-0.2492**	-0.2677*	-0.2683*
	(0.0869)	(0.1271)	(0.1271)
Humanities	-0.4115**	-0.4523	-0.4547
	(0.1354)	(0.2486)	(0.2494)
is_cost_country	0.4841	0.4827	0.4747
	(0.3631)	(0.3637)	(0.3635)
is_near_neighbour	0.5674	0.5674	0.5569
	(0.3812)	(0.3818)	(0.3818)
is_itc	0.5074***	0.5082***	0.4555***
	(0.0534)	(0.0535)	(0.0795)
young	0.5279***	0.5273***	0.5275***
	(0.0602)	(0.0602)	(0.0602)
leader	-0.2949**	-0.2930**	-0.2905**
	(0.0926)	(0.0930)	(0.0931)
intense_part	0.1454*	0.1450*	0.1447*
	(0.0591)	(0.0592)	(0.0592)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.3878***	0.3877***	0.3863***
	(0.0639)	(0.0639)	(0.0639)
More than 5 times	0.5680***	0.5682***	0.5665***
	(0.0688)	(0.0689)	(0.0690)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.0174	0.0061	0.0558
	(0.0511)	(0.0741)	(0.0934)
Observations	4224	4224	4224
r2	0.0753	0.0754	0.0756
F	24.4497	18.0014	17.1537

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Model comparison for improving leadership skills

	(1) REG1	(2) REG2	(3) REG3
Natural sciences	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Engineering and technology	0.1443*	0.2190**	0.2194**
	(0.0562)	(0.0696)	(0.0696)
Medical and Health sciences	0.1891**	0.3051**	0.3060**
	(0.0693)	(0.0948)	(0.0949)
Agricultural sciences	0.0147	0.0288	0.0293
	(0.0890)	(0.1305)	(0.1304)
Social sciences	-0.2807***	-0.3950***	-0.3948***
	(0.0769)	(0.1141)	(0.1141)
Humanities	-0.4440***	-0.3788	-0.3782
	(0.1186)	(0.2085)	(0.2084)
is_cost_country	-0.5943	-0.6074	-0.6053
	(0.3248)	(0.3227)	(0.3229)
is_near_neighbour	0.1280	0.1094	0.1121
	(0.3390)	(0.3372)	(0.3375)
is_itc	0.3458***	0.3434***	0.3564***
	(0.0470)	(0.0470)	(0.0701)
young	0.1226*	0.1216*	0.1215*
	(0.0513)	(0.0513)	(0.0513)
leader	0.6940***	0.6937***	0.6931***
	(0.0651)	(0.0654)	(0.0655)
intense_part	0.3656***	0.3629***	0.3630***
	(0.0514)	(0.0515)	(0.0515)
Less than 2 times	0.0000	0.0000	0.0000
	(.)	(.)	(.)
3-5 times	0.2798***	0.2787***	0.2791***
	(0.0568)	(0.0568)	(0.0568)
More than 5 times	0.5869***	0.5861***	0.5865***
	(0.0585)	(0.0586)	(0.0587)
Male	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Female	0.1678***	0.2197***	0.2074*
	(0.0447)	(0.0660)	(0.0821)
Observations	4235	4235	4235
r2	0.1002	0.1020	0.1020
F	37.3541	27.7333	26.3547

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

ANNEX 2: QUESTIONS OF THE ONLINE SURVEY

First page: introduction message

The impact of COST Actions on your career

Dear Sir or Madam,

The present study aims at **evaluating whether participation in COST Actions has impacted the careers** of researchers.

The survey will take approximately 10 minutes to complete. The deadline for completing the survey is Monday 4th of March 2019 (at 6pm Brussels time).

If needed, you can fill the survey in several times: your answers will be saved and you will not need to enter them again.

Many thanks in advance for your contribution,

The Team

Questions

Part 1: Your involvement in COST Actions

1. In which year were you first been involved in a COST Action? *Drop down menu: from 1971 to 2017*

2. How many times did you participate in a COST Action activity over the last 5 years? *Multiple choice: less than 2 times, 3-5 times, more than 5 times*

3. Did you already have connections to any of the participants in the COST Action before becoming involved in the project? *Multiple choice: Yes, and we had already worked together; Yes, but we had never worked together before; No.*

4. Are you currently involved in research projects beyond a COST Action? *Multiple choice: H2020 consortia, ERC grants, MSCA projects, INTERREG, other EU programmes (ESF, EUREKA…), nationally public-funded projects, private funded projects, other → If "other", please specify*

Part 2: The impact on your career

5. How do you evaluate the impact of your participation in the COST Actions on your career?* (*score/5*)

6. How do you evaluate the impact of your participation in the COST Actions on the following aspects? *Scale from 0 (no impact) to 5 (very positive impact):*

- *Expanding your network*
- *Meeting people from different disciplines*
- *Starting new research collaborations*

- *Jointly preparing new H2020, European and/or national research proposals*
- *Progressing more efficiently in your research projects*
- *Accessing new research infrastructure (databases, labs, tools…)*
- *Enabling career developments in your home institution*
- *Finding professional opportunities for your next career step*
- *Increasing your motivation to stay in Europe for your next career step*
- *Improving your leadership skills*

7. Please select and rank the countries with which you have established the strongest links thanks to the COST Actions (max 5 choices)

List of COST countries + "other countries (non-COST members)"

8. (Only if "other" is selected in question 7) With which of the following countries have you established strong links?

Near Neighbour countries:

Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Jordan, Kosovo (under UNSCR 1244/1999), Lebanon, Libya, Morocco, the Palestinian Authority, Russia, Syria, Tunisia and Ukraine

International Partner Countries:

Australia, Canada, Japan, South Africa, USA, South Korea

9. To what extent has participation in COST Actions fostered contacts with researchers from non-COST countries outside Europe?

Scale 1 to 5, use stars.

Part 3: Your feedback on COST Actions

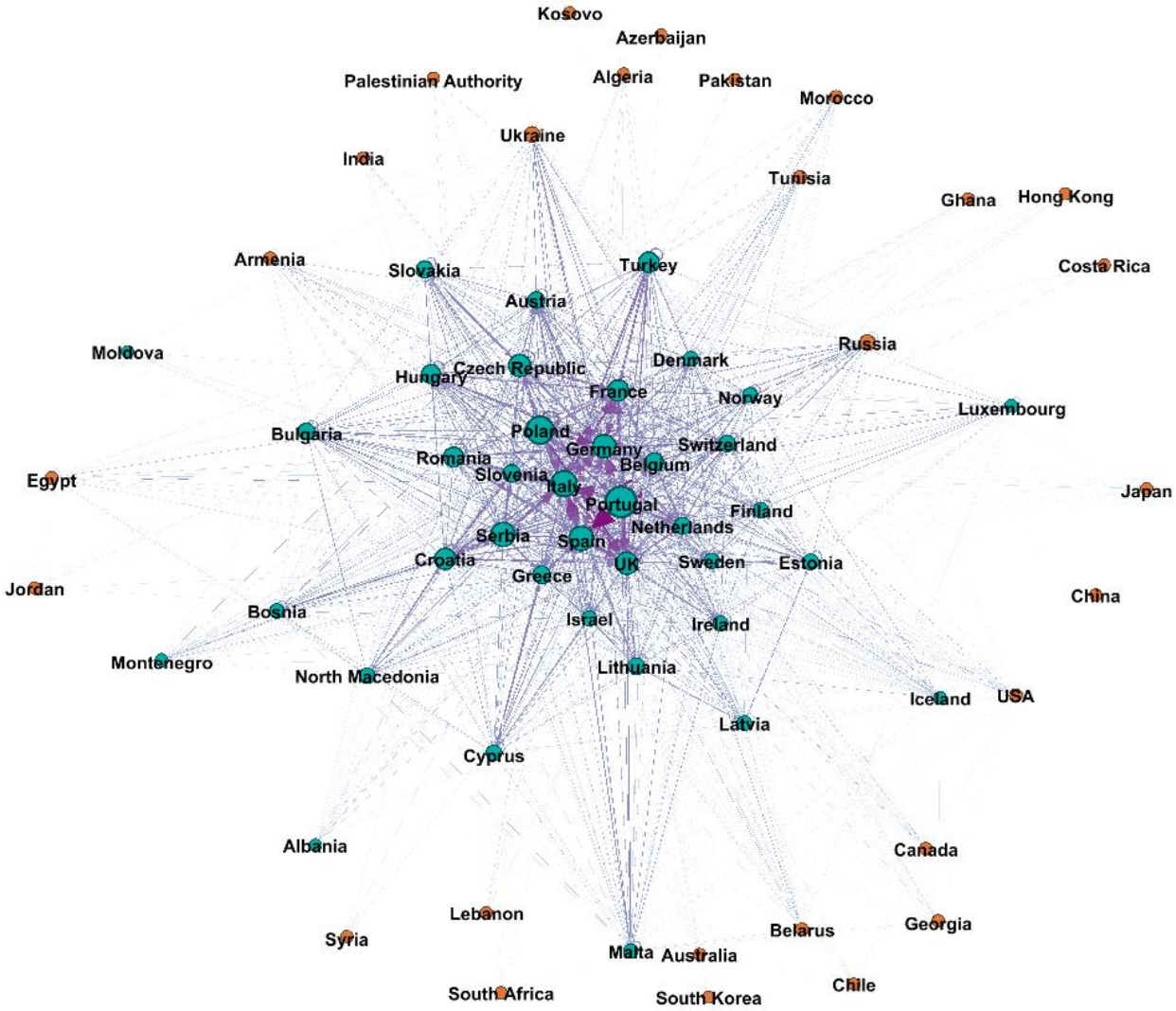
10. Please select and rank the three most important features of the COST Actions:

   a. *the funding*
   b. *the meetings/conferences*
   c. *networking with other colleagues*
   d. *establish research collaboration with non-COST countries*
   e. *new research collaborations*
   f. *the STSMs*
   g. *the Training Schools*
   h. *general knowledge and know-how sharing*
   i. *management skills through organising networks/activities*
   j. *the interdisciplinarity of the networks*

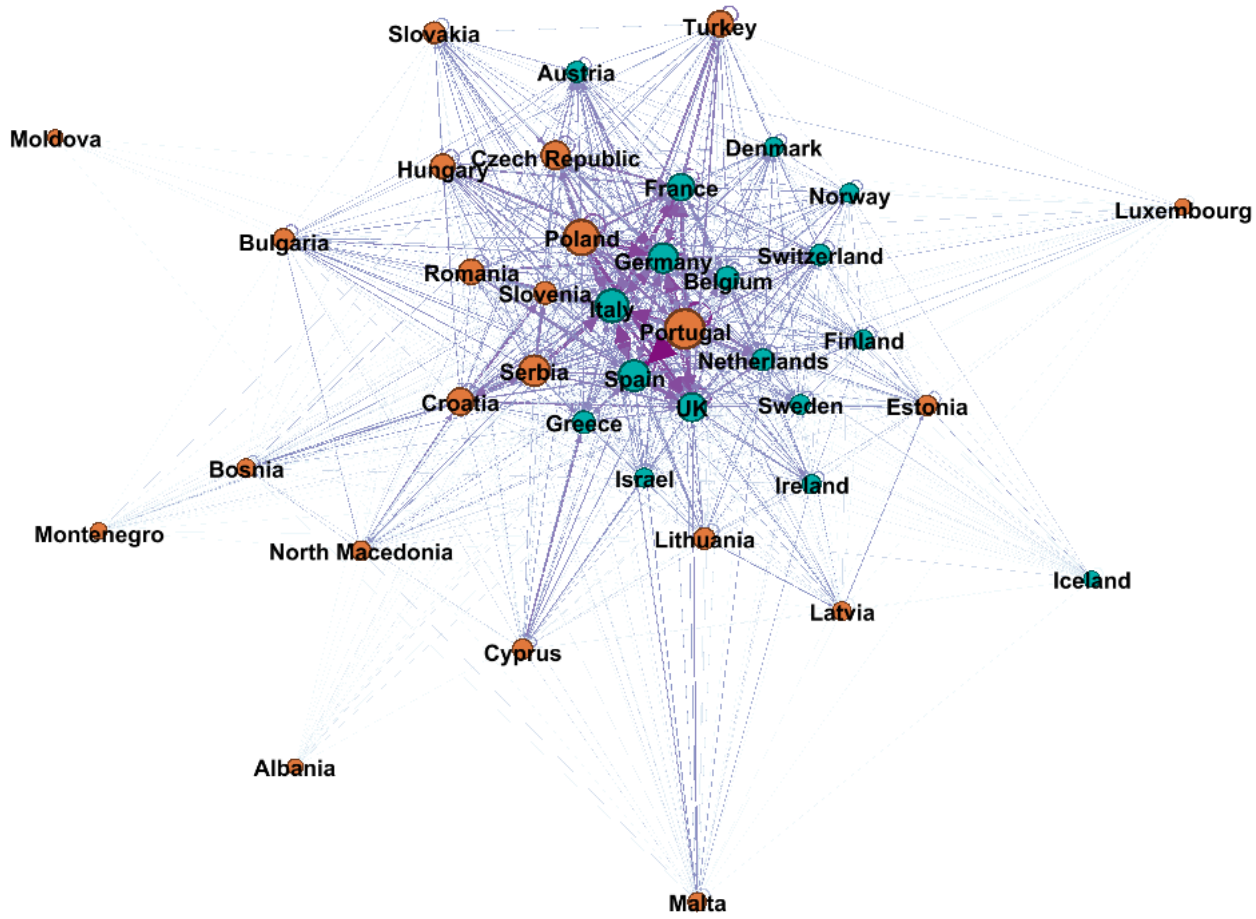
11. Please detail how the experience of collaboration has contributed to your professional development (open question, 15-line box).

12. What is the added value of the COST Actions with respect to other funding programmes for mobility and networking between researchers? (open question, 15-line box).

ANNEX 3: NETWORK ANALYSIS WITH NON-COST COUNTRIES – GRAPH WITH ARROWS



COST Actions network



COST Actions network with COST countries only