Final Report

on

COST Targeted Impact Assessment 2016

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1 Executive summary

Introduction

A consortium of researchers from Fraunhofer ISI and AIT Austrian Institute of Technology carried out a targeted impact assessment for the COST Association between late April and August 2016. The aim was to investigate the participation of non-academic partners and partners from non-COST countries in COST Actions. In order to increase both the frequency and effectiveness of their participation in COST Actions, there were two concrete goals in this study: firstly, to gain a thorough understanding of the nature and impact of their participation in COST Actions, and secondly, to identify crucial factors which influence the participation of these two groups.

Empirical basis

In order to achieve these goals, the evaluation team first conducted 7 preparatory interviews with relevant stakeholders and experts to gain detailed insights into the overall position of COST within the European Research Area, its goals, strategy and internal governance. Furthermore, an online survey was conducted, which targeted the participants of COST Actions that are either still ongoing (with a starting date in 2016) or have recently finished (with a starting date in 2010). In total, 4563 participants of COST Actions were reached by email and 2000 responded positively to this request (response rate: 44%). 43% of the survey participants stem from non-COST countries, and 88% of them are academics. 57% of survey respondents come from COST countries, 60% of them have an industrial background and 26% are academics. The public sector (2%) and non-profit organisations (8%) have a minimal share among the survey respondents. As a result, more than 70% of the survey respondents have either non-academic or non-COST backgrounds. Finally, 12 case studies were carried out between May and August 2016. These cases were identified by the COST Association staff according to their perceived success. Document analyses and 4-6 semi-structured interviews were conducted for each case, which provide in-depth insights into highly diverse COST Actions.

The following report presents first of all the results of the online survey in chapter 2. Chapter 3 demonstrates the main findings of the 12 case studies with a focus on impacts and contributions of non-academic and non-COST participation. Chapter 4 concludes this study with the synthesised findings of the online survey and case studies. In addition, the strengths and weaknesses of non-academic and non-COST participation will be analysed. Finally, recommendations on how to strengthen the non-academic and non-COST participation in COST Actions are formulated at the end of the report.

Main findings

COST Actions are highly diverse with respect to topic, aim, research environment as well as motivation of initiators and members. We found that these factors strongly influence the organisational set-up, formats and group dynamics in each Action and render the nature and impact of non-academic and international participation very specific to individual Actions. All of these differences have an impact on motivations, possibilities and activities of Action participants, including non-academic and non-COST members.

A general finding is that COST is truly a **networking** instrument. In our case studies we found that especially chairs and vice-chairs played an essential role in building up and enlarging their networks. However, they extended the network mainly by using their **personal contacts**. This finding is consistent with the results of the online survey: half the survey respondents learned about COST through invitations from already existing members of COST Actions, who serve as a bridge to the COST Actions for the newcomers. Other channels seem to play a moderate role in raising awareness of COST.

The **motivation for industrial partners** to become a member of a COST Action is manifold and depends heavily on the research field. A major motivation is that COST helps to find partners for research projects and proposals (as a "contact exchange"), stay up-to-date with research, exploit new technologies, retrieve first-hand information, and be aware of the key researchers in this field. These results correspond to the results of the online survey: the main motivations are **network-driven (66%) and knowledge and information-driven (65%)**. However, the case study analysis showed that the differentiated interests between **large companies and** small or medium enterprises **(SMEs)** could be identified in some cases: the participation of large companies aims rather at keeping informed about the latest discussion in their business area, while SMEs tend to use this platform actively to demonstrate their abilities and ideas, in the hope that they can find potential collaboration partners for their business or career. The main **motivation of non-COST** partners is **network-driven**. Major benefits for them are network building, paving the way for joint research projects as well as exchange possibilities for their PhD students. COST is today often the first collaborative European scheme for New Neighbour Countries **(NNC)** and for some International Partner Countries **(IPC)** partners, as the case of the young EU member states 10-15 years ago. It is an "**entry point**" to European collaborative research.

COST generates a very high degree of **added value** through its bottom-up, flexible and open approach, particularly in **networking effects, capacity building** and **addressing societal challenges**.

The contributions to addressing societal challenges are especially highlighted in this study. Compared to the impact assessment in 2014 "COST Impact Study and Cus-

tomer Satisfaction Survey 2014", where the majority of stakeholders stated that their Actions contribute to these areas to a rather moderate extent (p. 61), this study demonstrates that the majority of the survey participants agree with the COST's contribution in this regard to a high or very high extent. Furthermore, the case studies also showed the **potential** and **possibilities** for this kind of contribution. This confirms also the experts' opinion: the major comparative advantage of COST is that (societal-related) topics can be developed at a relatively early stage, when a real community does not really exist. Besides, the **importance of including non-academic partners**, especially from the area of industry, regulatory agencies etc., lies in that **pre-standard setting** occurs in the COST network. **This is a real unique added value which the COST scheme can provide**.

The major **contribution of non-academic members** to COST Actions is being a partner for research projects and bringing in new perspectives and data for testing research hypotheses and models. It is noteworthy in this respect that especially SMEs provide innovative momentum, whereas large companies have sometimes been perceived as taking more information than they have provided. Industry also offers insights into real-life application, gives validation and feedback on the work of academia and redefines the research. **Contributions of non-COST** partners are diverse: IPC partners are usually invited as individual experts in order to discuss their advanced research results or good practices with the European scientific community. Although NNC partners' direct scientific contribution is comparatively smaller, many COST members regard their integration as a worthy cause as it bears great potential with respect to Early Career Investigators with excellent scientific capacities.

Some **barriers** make non-COST participation (both from IPC and NNC) complicated. Rather tedious budgeting procedures were mentioned by a number of interview partners, including non-academic and non-COST participants. Examples mentioned by interviewees are difficulties for international participants to receive reimbursement for their travel expenses, but also the limitation of invitation of international partners (e.g. only once per Action), of becoming an MC member for international partners, of time-consuming application procedures for membership and finally, of all of the COST Actions' events having to be held in COST countries. Regarding non-academic participation, the attitudes among industrial partners are very heterogeneous due to different motivations. Large firms behaved rather more passively than SMEs, in some cases also due to Intellectual Property Rights **(IPR)** issues. Some non-academic partners viewed the **dominance of academic partners** as a barrier to their participation. The **low awareness of COST** in the international communities was also viewed as a barrier to non-COST participation, especially for NNCs. The same problem can be identified among many non-academic partners, too.

Recommendations

In order to tackle the above mentioned barriers, the COST Association may reconsider the following issues: **raising the awareness of COST in non-academic areas and non-COST countries, simplifying the rule of non-academic as well as non-COST participation and enhancing the sustainability of networks.** Several measures were suggested by interview partners to raise the awareness of COST: strengthening COST's communication efforts with international professional communities including industrial umbrella organisations and chambers of commerce, raising the visibility of COST at international conferences with the focus on applied research or magazines with high professional profile, and improving communication with national scientific authorities or institutions in non-COST, in particular NNC countries. In addition, COST National Coordinators (CNC) should play an active role in disseminating the information about COST. In order to enhance the sustainability of networks, additional funding for a future- and planning-oriented review meeting after the end of an Action was requested. Moreover, the importance of the linkage between the COST Association and the Framework Programmes was put forward, which was demonstrated by the fact that almost all of the 12 analysed Actions had produced Framework Programme proposals.

For a better **integration of non-academic partners**, it is recommended to **clarify the role** of academic and non-academic partners in each COST Action. Action proposers must communicate clearly and in detail what the expectations towards non-academics and their contributions are. When the topic of an Action is of high societal relevance, the **inclusion of practice-partners** might be obligatory for the application. Finally, measures were mentioned by some chairs in case knowledge generation touches also upon industrial applications, in order to address **the problem of knowledge owned by firms**.

Despite various suggestions for how to improve the non-academic and non-COST participation, more than 60% of survey respondents consider COST to be attractive to a high or very high degree. In the case studies, most interviewees appreciated very much that COST provides this kind of platform and pointed to the excellent cost/benefit ratio of the scheme: Well-organised Actions develop a high level of activities and lasting impacts with the small budget at hand. Most importantly, not a single interviewee criticised the general objectives and concept of COST, which is a clear indication of the success of the COST scheme. However, in the opinion of the interviewees, the success of COST Actions was **endangered by recent budget cuts**. On this condition, the risk of losing the attractiveness of COST Actions will arise - **especially since COST is already heavily oversubscribed** and the likelihood of receiving funding from COST has diminished over the last few years.

2 Findings of the online survey

2.1 Description of the survey

On 17 May 2016, 4668 participants of present and previous COST Actions were invited to participate in an online survey to evaluate the possible impacts of COST Actions. After two reminders were sent (on 30 May and 7 June), the online survey was closed on 14 June. The results were exported then to the statistical analysis program SPSS. Of 4668 contacts, 105 persons could not be reached (either because the e-mail addresses were incorrect, people had switched jobs or were absent for a longer period of time). The net sample of persons reached was therefore 4563. In total, 2356 persons participated in the survey, resulting in a gross participation rate of 51.6%. Of these 2358 persons, exactly 2000 (84.8%) finished the online survey completely, with a net participation rate of 43.8%. 1570 respondents are male (66.6%), 786 female (33.4%).

2.2 Occupational status and regional background of the sample

Among the respondents, 12% are employed in a large company, 19% in a small or medium-sized company and 6% percent are self-employed. 35 (2%) are employed in the public sector in ministries or hospitals. 480 (22%) work at research organisations, 645 (29%) at higher education institutions. Moreover, 162 (7%) are employed in non-profit organisations such as foundations or NGOs. 82 respondents (4%) indicated an alternative occupational status.

In a second step, the occupational status of respondents was merged into four groups to facilitate further data analysis. The **four occupational groups** are (1) **Industry** (38%), (2) **Public sector** (2%), (3) **Research and higher education** (53%), and (4) **Non-profit organisations** (8%).

Figure 1: Occupational status (all respondents)

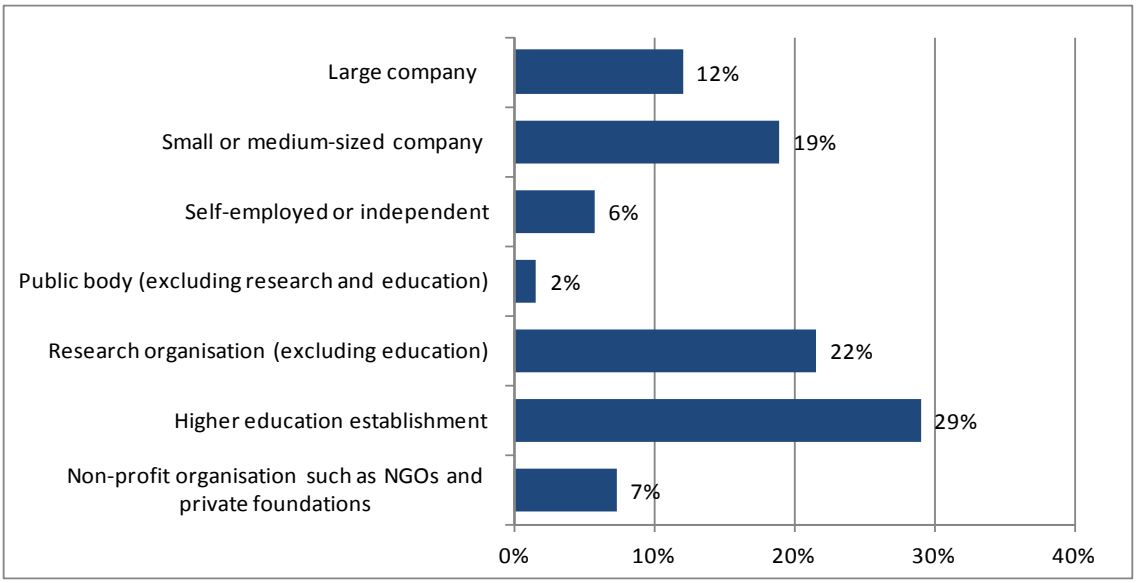
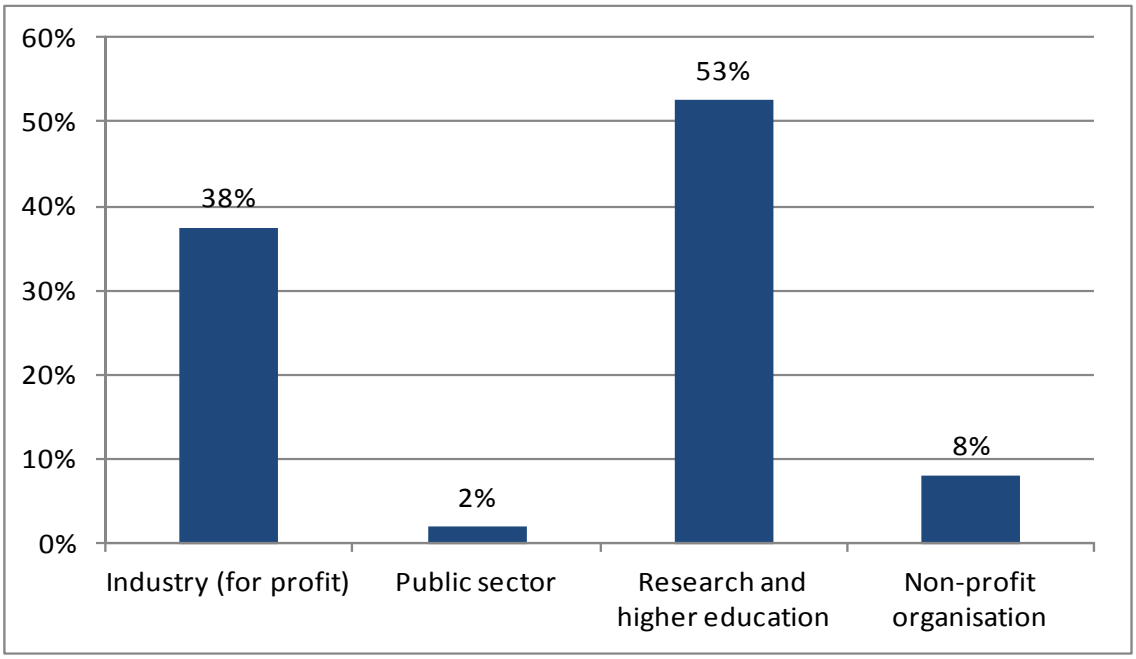
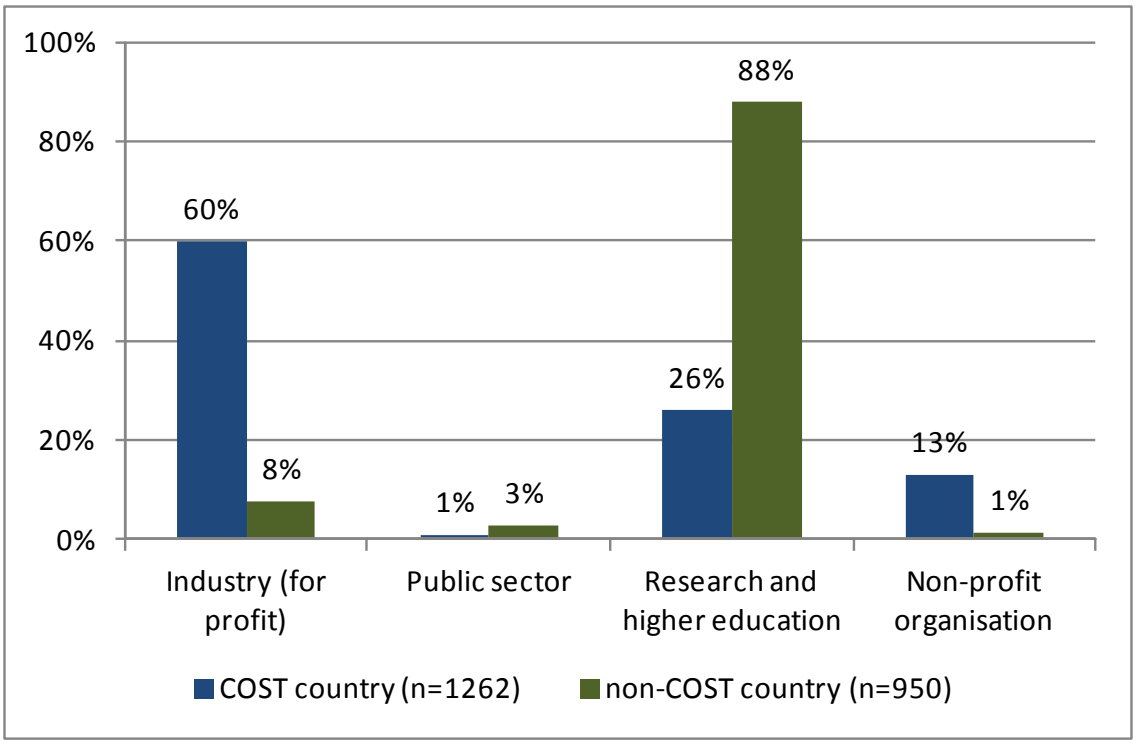


Figure 2: Merged employment status



In total, 1262 of the respondents work in COST countries (57%) and 950 in non-COST countries (43%). As shown in Figure 3, the employment background varies strongly between respondents from COST countries and respondents from non-COST countries. The vast majority of participants and respondents from non-COST countries work in research and higher education institutions. Only a small fraction works in industry (8%), in the public sector (3%) or for non-profit organisations (1%). The occupational and regional structure of respondents reflects the data set which was provided by the COST Association: the majority of potential participants have either a non-COST or an industrial profile.

Figure 3: Employment status by region



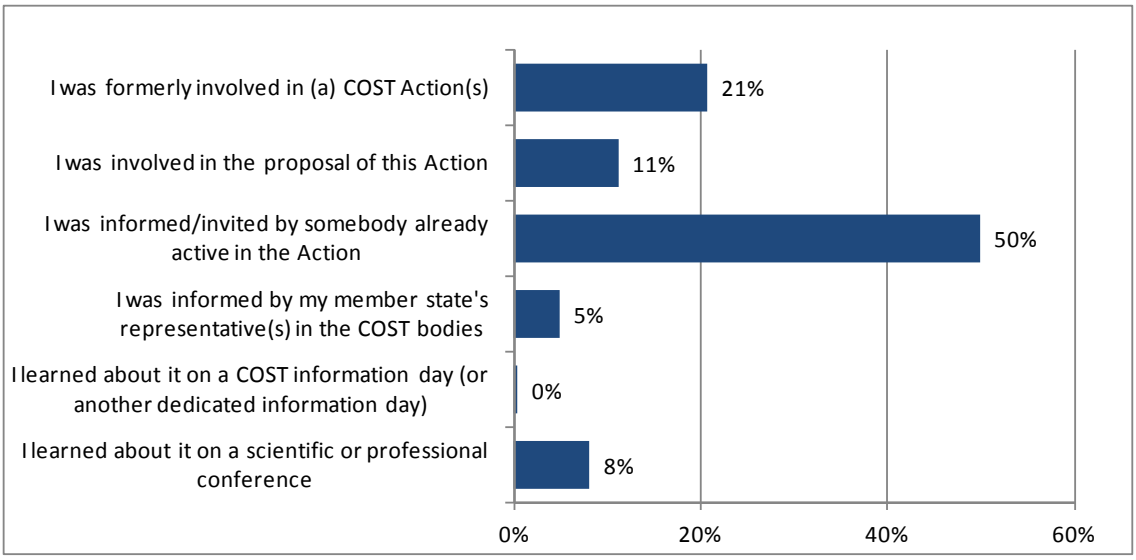
In the following analysis, the survey results are presented in three steps. First, the results of all the respondents are presented, then these results are analysed by occupational status and finally by COST/non-COST country.

2.3 Awareness level of the COST programme

2.3.1 General findings

The participants were asked how they learned about the COST programme and the COST Actions initially (question 1.2, single choice, see questionnaire in Annex). The results show that personal contacts are the main channel of information: exactly half of all respondents were informed about or directly invited to the COST Action by a person already active in the Action. A further fifth knew about COST from previous COST Actions and about 11% were actively involved in the proposal of the concrete Action about which they were contacted. Scientific or professional conferences are relevant for 8% of the respondents. Official channels like information days play only a minor role, at least for the total set of respondents.

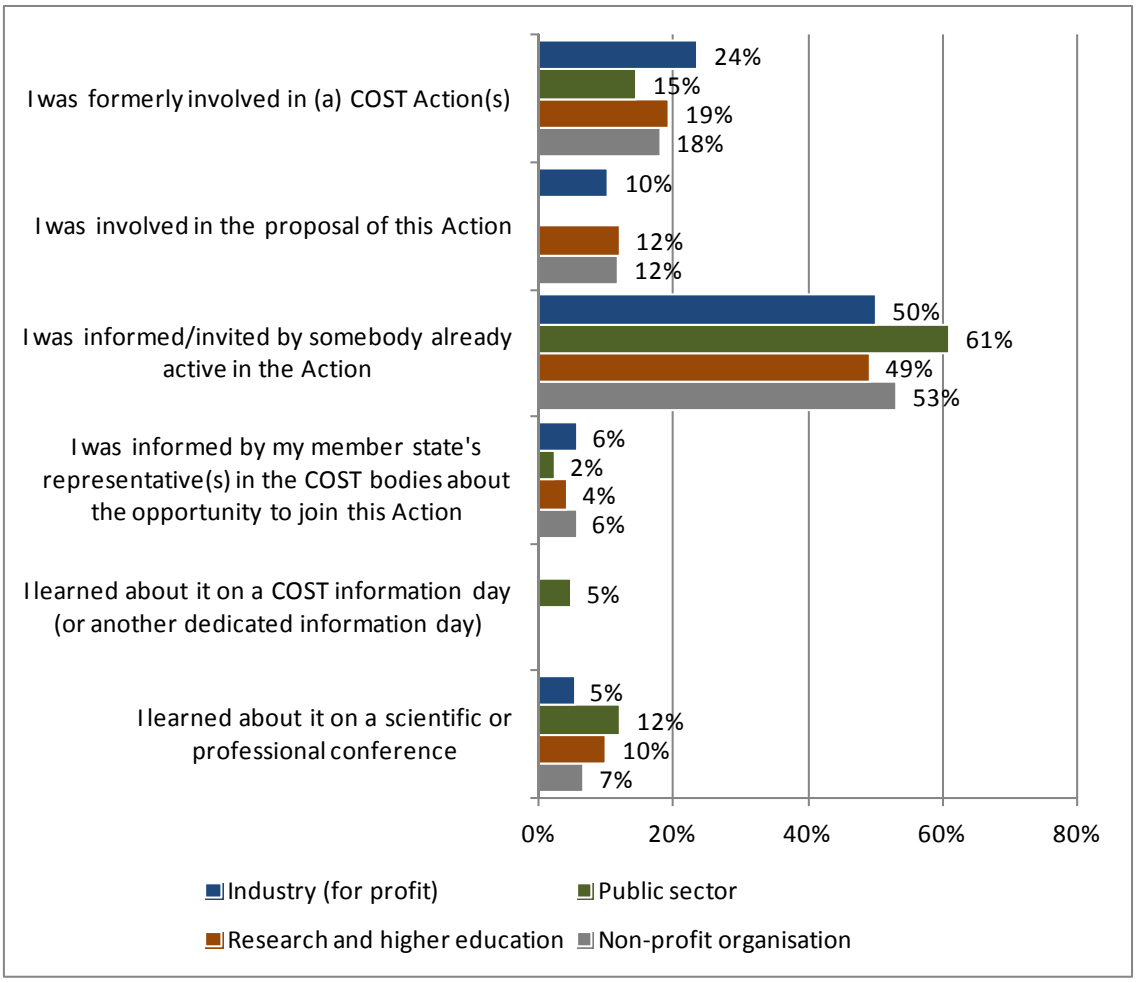
Figure 4: Point of entry for the COST programme (all respondents)



2.3.2 Findings differentiated by employment status

The findings concerning how people learned about the COST programme and the specific COST Action do not vary significantly across employment groups. Respondents from all employment groups were mainly contacted or invited by somebody already active in the COST Action. It is interesting to observe that 24% of the industrial respondents had been previously involved in COST Actions. This indicates that these participants already had positive experiences with COST Actions and were willing to take part in such Actions again.

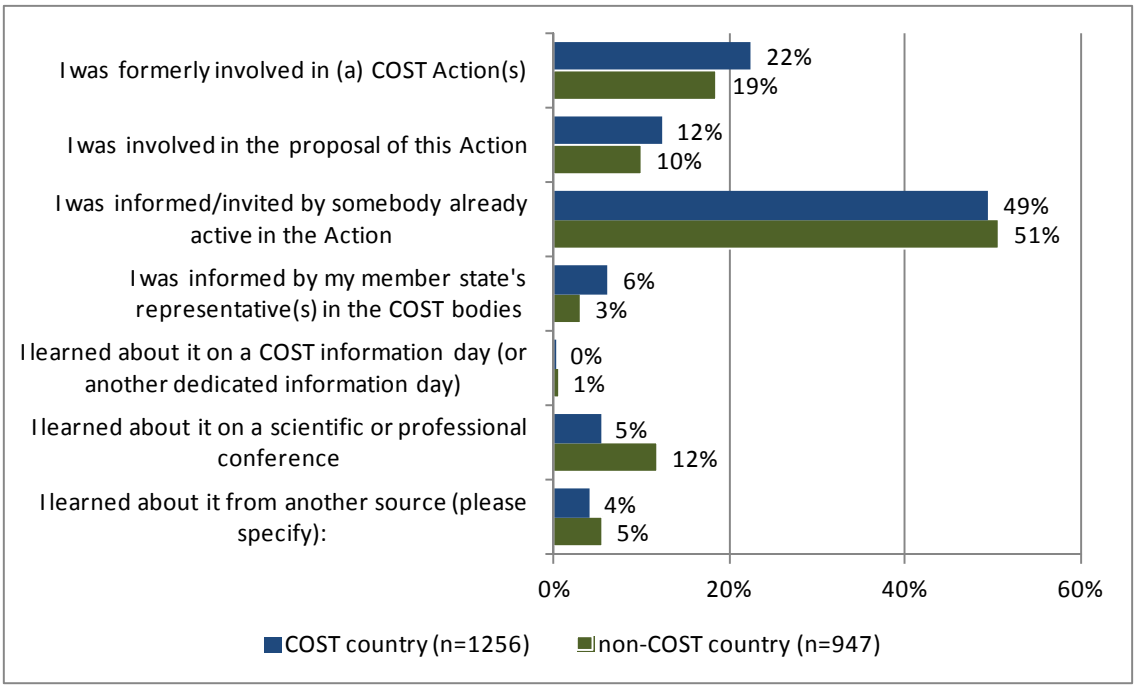
Figure 5: Point of entry for the COST programme by employment status



2.3.3 Findings differentiated by COST/NON-COST countries

Only slight differences can be found when analysing the dissemination of the COST programme according to COST or non-COST country background. However, the importance of scientific or professional conferences as an information platform is much higher for non-COST countries than for COST countries.

Figure 6: Point of entry for the COST programme by region

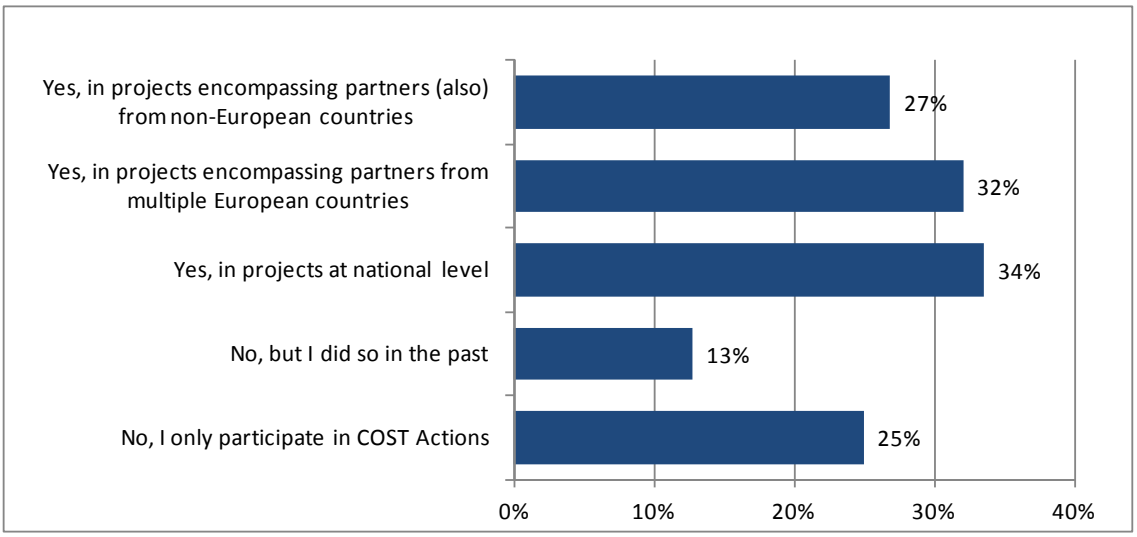


2.4 Participation in research or technology networks

2.4.1 General findings

The majority of respondents currently participate in other research or technology networks besides any COST-funded network (question 1.3. see questionnaire in Annex). The results show that COST participants are internationally well connected, independent of their COST Action activities. Most respondents are either currently or were previously involved in network-relevant projects: in projects with partners at national level, projects with partners from multiple European countries and projects with partners from non-European countries. COST Actions are the only formal involvement in research or technology networks for only one quarter of respondents.

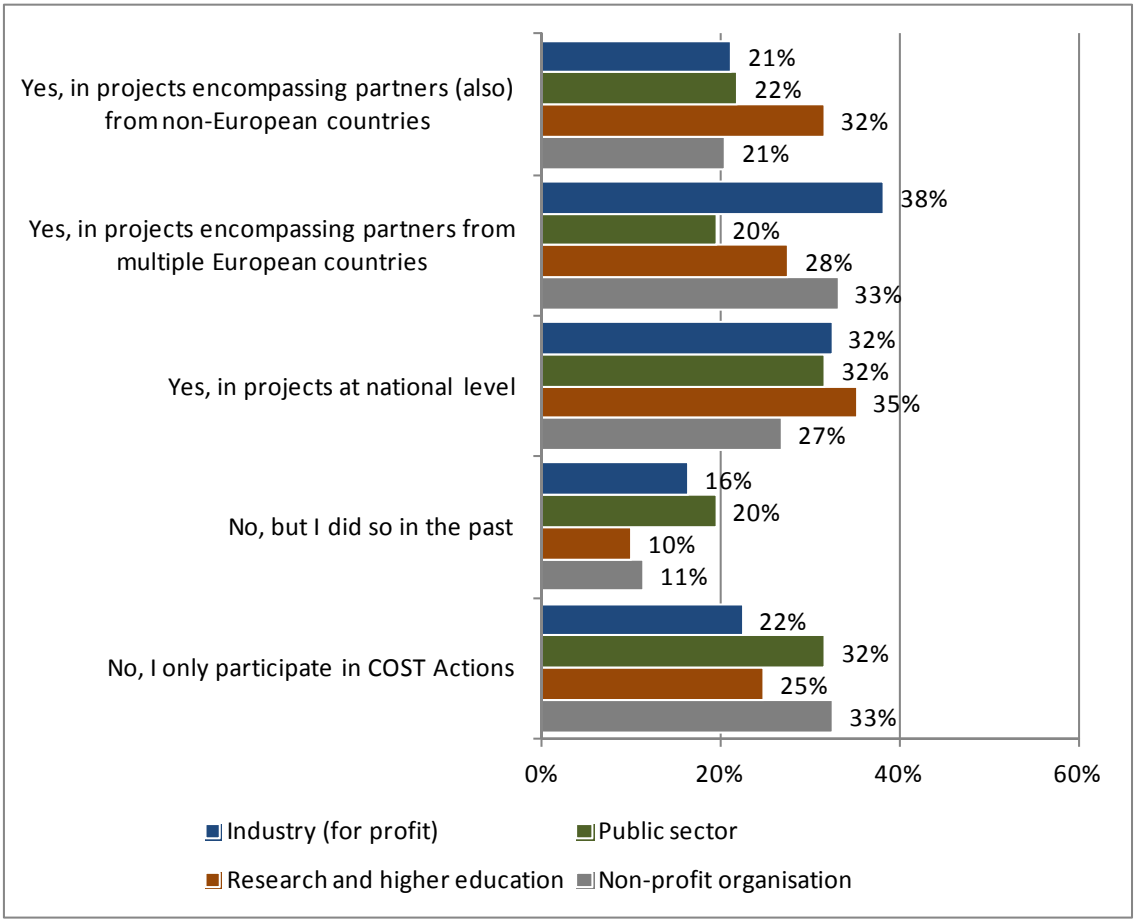
Figure 7: Participation in research or technology networks (all respondents, multiple answers possible)



2.4.2 Findings differentiated by employment status

Employment status differences in the participation in research or technology networks are especially noticeable when looking at projects with multiple European and also non-European partners. Almost a third of researchers and scientists answering this question are involved in projects with non-European partners, indicating the high global connectivity of these COST Actions' participants. The involvement of other employment groups in this kind of project is much lower, ranging from 20-22%. On the other hand, industry partners are the group with the highest participation in research or technology projects with European partners (38%).

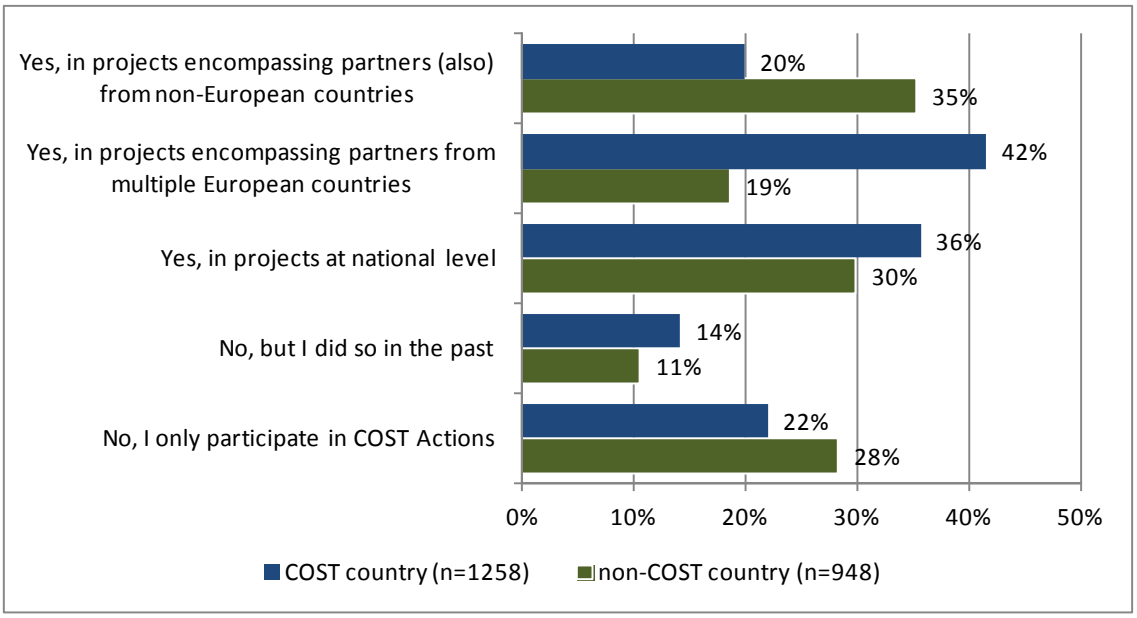
Figure 8: Participation in research or technology networks by employment status



2.4.3 Findings differentiated by COST/NON-COST countries

Participants from non-COST countries are more likely to work in projects with partners from non-European countries (35%) than participants from COST countries (20%). Consequently, their involvement in research and technology networks with partners from European countries is considerably lower (19% for non-COST countries compared to 42% for COST countries).

Figure 9: Participation in research or technology networks by region

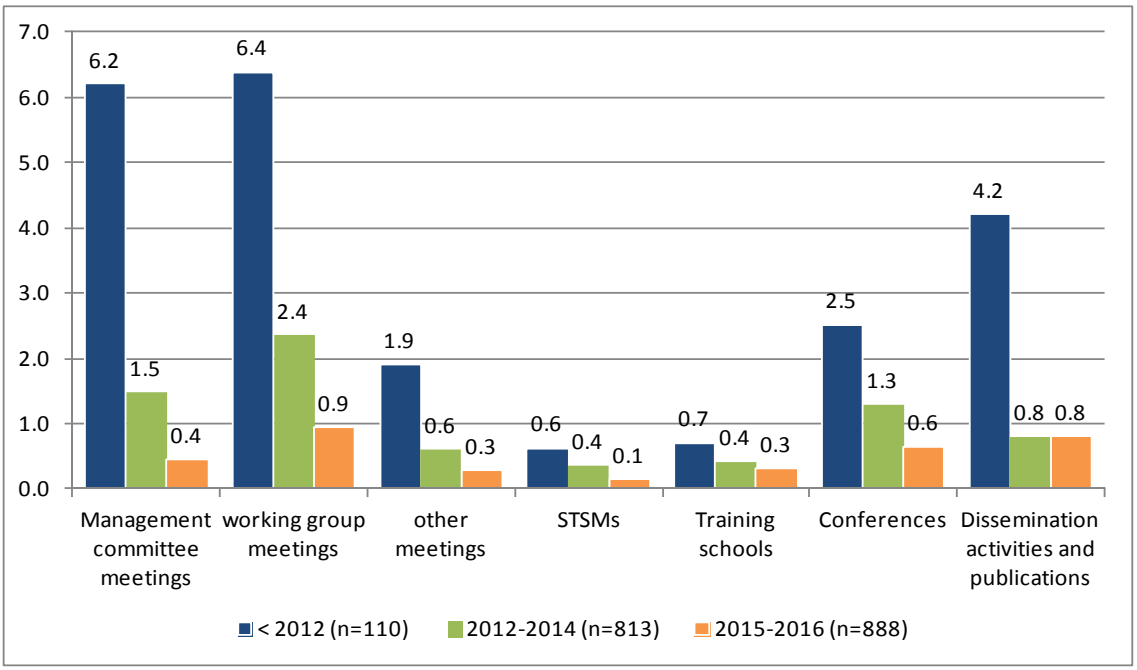


2.5 Frequency of participation in COST Action activities

2.5.1 General findings

Participants were also asked how often they participate in COST Action activities, such as management committee meetings, working group meetings, short-term scientific missions (STSM), training schools, conferences or dissemination activities. For a more detailed analysis, the COST Actions were divided into three groups according to their age. All in all, 110 respondents are or were active in older and/or closed COST Actions that began before 2012. 810 respondents are involved in still ongoing COST Actions that started between 2012 and 2014. 888 respondents are participating in young Actions that only started in 2015 or 2016. In all three groups of COST Actions, management committee meetings and working group meetings are activities the respondents participate in most frequently. In contrast, respondents rarely participate in activities such as short-term scientific missions (STSMs) or training schools.

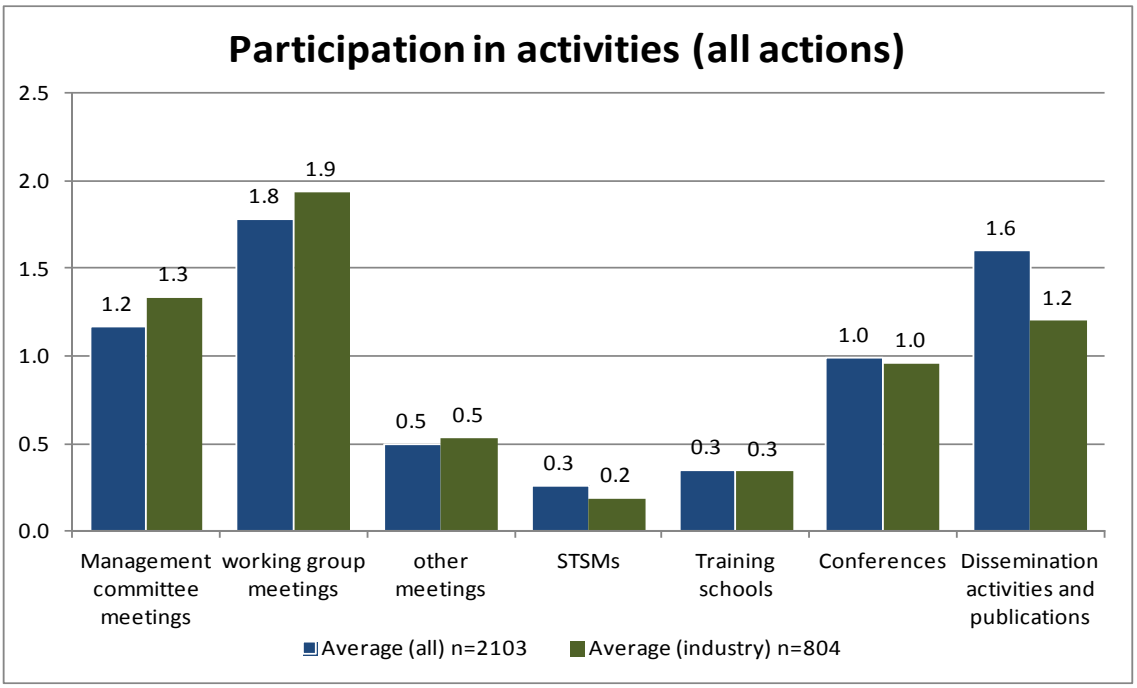
Figure 10: Number of visiting activities during the COST Action by the starting date of the COST Action



2.5.2 Findings differentiated by employment status

In the further step, the frequency of participation in various COST Action activities was analysed using only two employment groups – researchers/scientists and industrial partners. In general, participation does not vary significantly between these two groups. Industrial partners take part in management committee meetings and in working group meetings slightly more frequently than researchers, even though their participation is not reimbursed. In contrast, there is a lower participation of industrial partners in dissemination activities and publications.

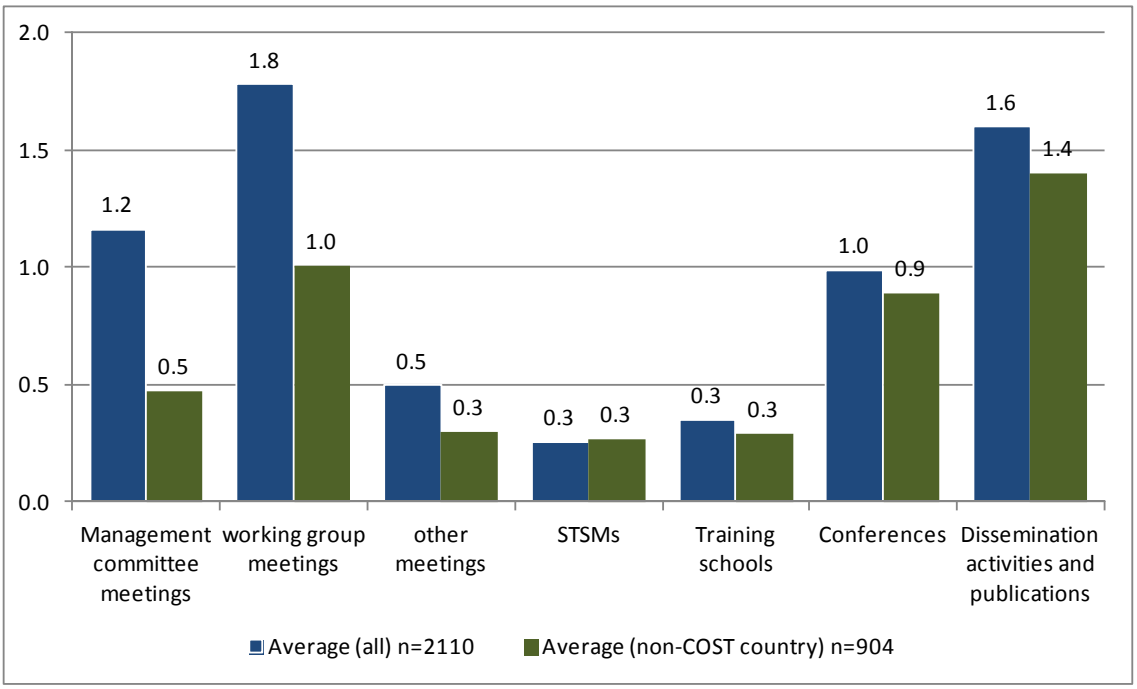
Figure 11: Number of visiting activities during the COST Action, comparison between industrial partners and total participants on average



2.5.3 Findings differentiated by COST/NON-COST countries

Looking at the countries of origin, the participation of respondents from non-COST countries in COST Action activities is much lower for activities like management committee meetings or working group meetings. However, Figure 12 shows their participation in training activities like short-term scientific missions (STSMs) or training schools almost equals the average participation of respondents from COST countries.

Figure 12: Number of visiting activities during the COST Action, comparison between non-COST countries and total participants on average

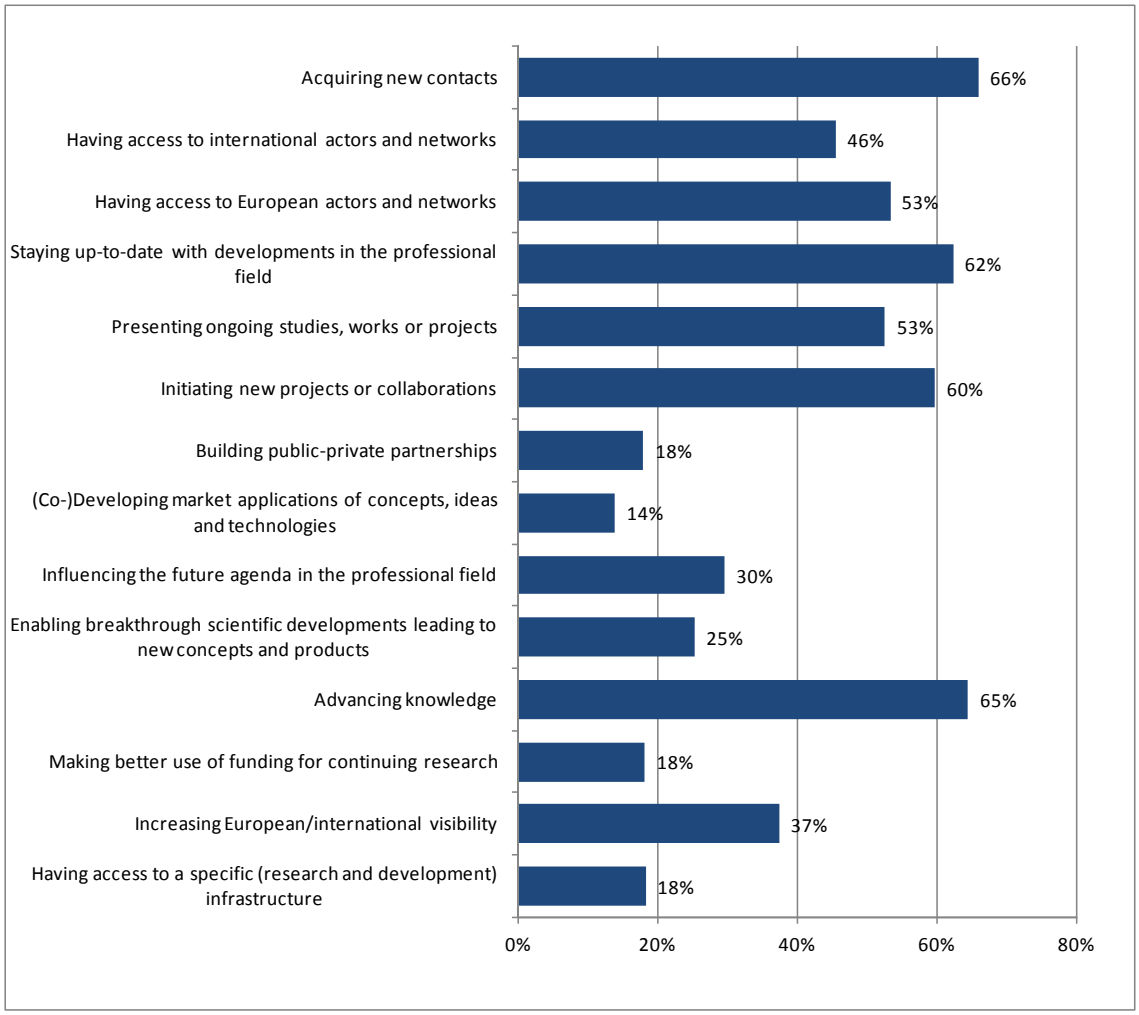


2.6 Motivation for participation in COST Action activities

2.6.1 General findings

Respondents were also asked about their motivation for participating in COST Action activities (question 1.5, see questionnaire in Annex). Multiple answers were possible. As shown in Figure 13, the most quoted ones are acquiring new contacts (66%), advancing knowledge (65%), staying up-to-date with current developments in the specific professional field (62%), and initiating new projects or cooperation (60%). Reasons like building public-private partnerships, (co-)developing market applications of concepts, ideas and technologies, as well as making better use of funding for continuing research or having access to a specific infrastructure concerning research and development play a relatively minor role.

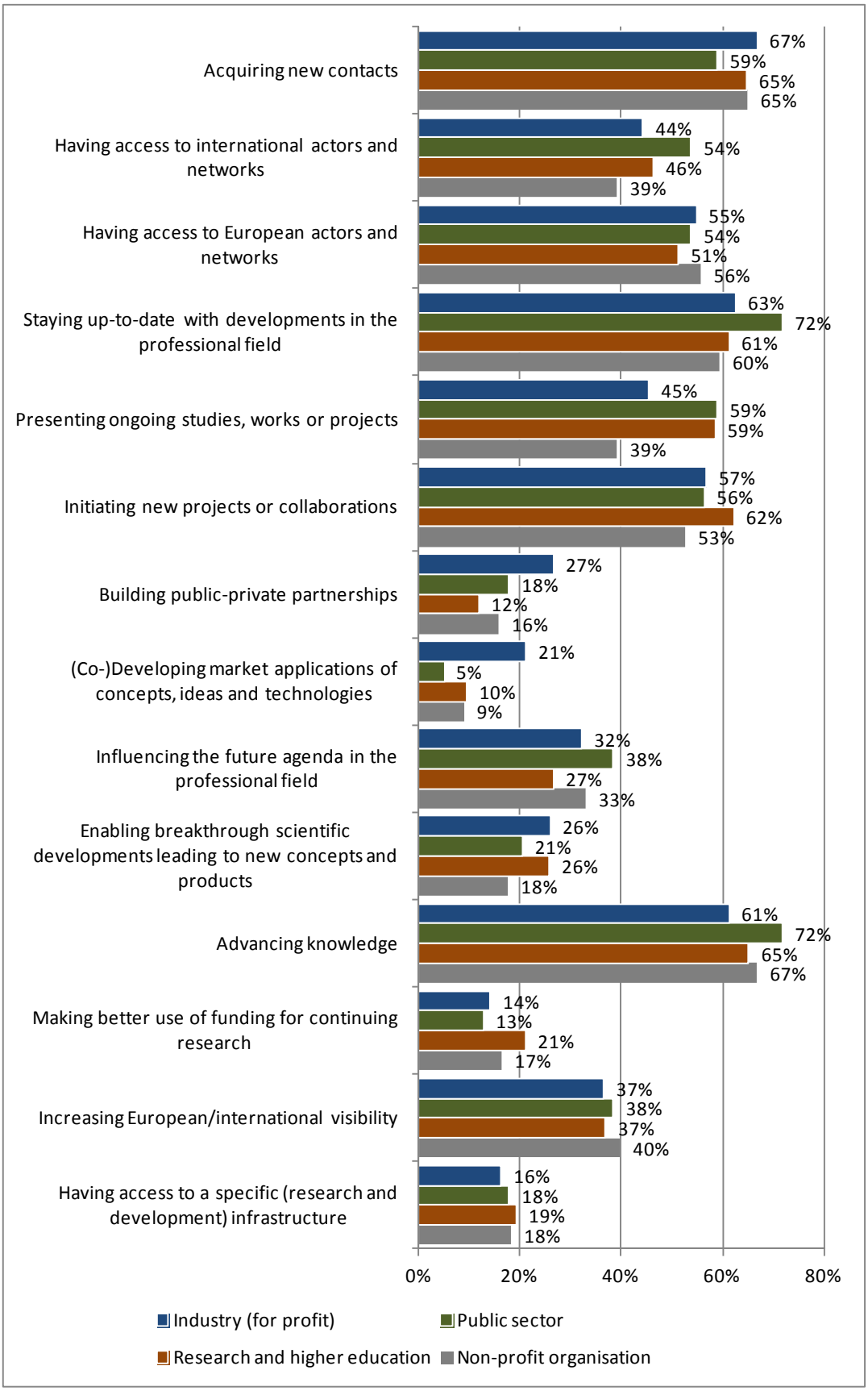
Figure 13: Motivation for participation (all respondents, multiple answers possible)



2.6.2 Findings differentiated by employment status

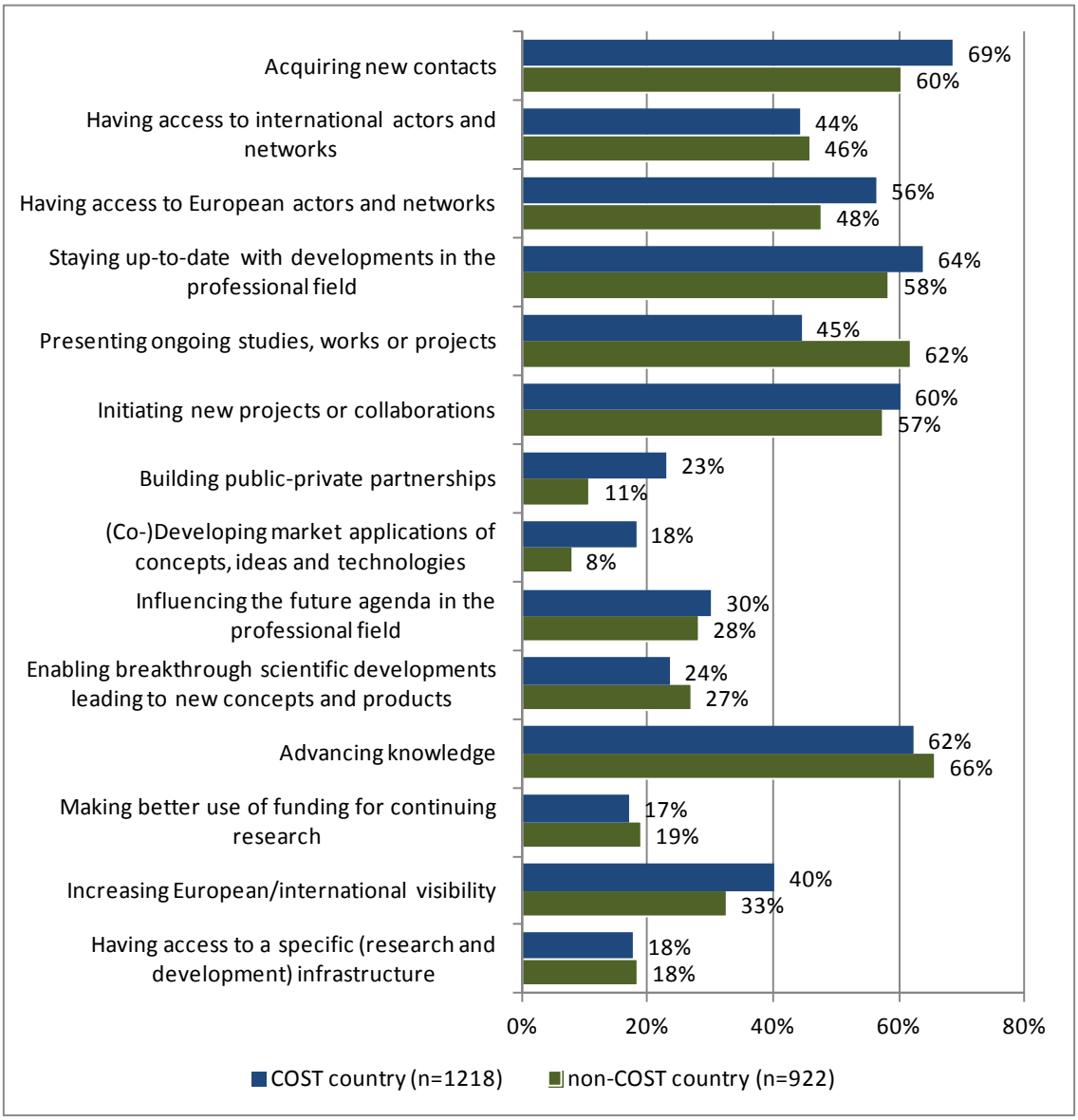
No major employment status differences can be found when analysing the reasons for participation in COST Action activities. All four employment groups have by and large the same main reasons for participation. However, there is a noteworthy difference in how the groups assess building public-private partnerships. Respondents from industrial partners chose this reason much more often than respondents from research and higher education (27% vs. 12%). The reason "(co-)developing market applications of concepts, ideas and technology" is also quoted much more often by respondents from industry compared to respondents from research and higher education (21% vs. 10%).

Figure 14: Motivation for participation by employment status



2.6.3 Findings differentiated by COST/NON-COST countries

Figure 15: Motivation for participation by region



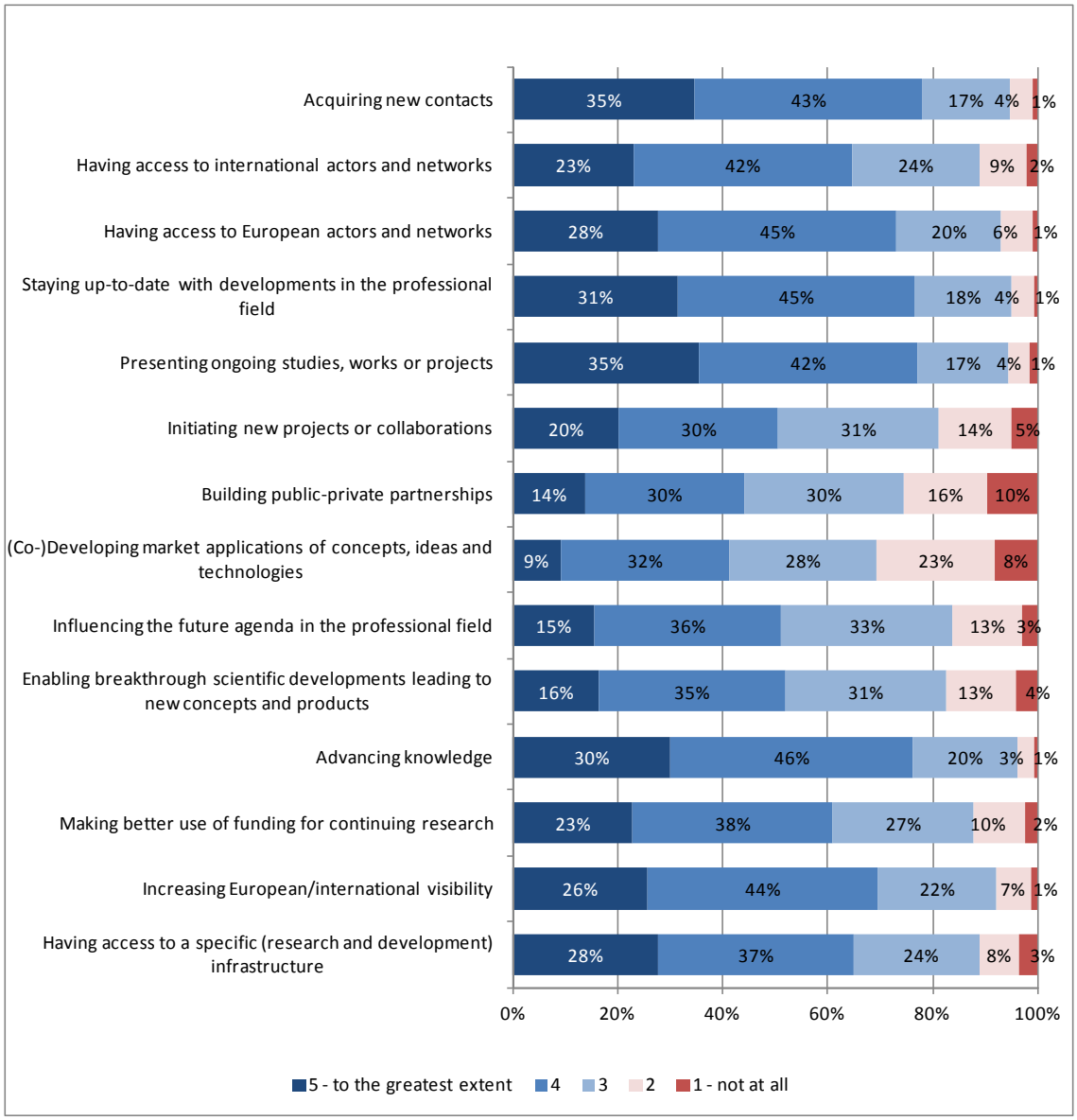
Building public-private partnerships and (co-)developing market applications of concepts, ideas and technologies are much less likely to motivate participants from non-COST countries than respondents from COST countries. However, these answers simply tend to mirror the higher share of researchers and scientists among participants from non-COST countries. "Advancing knowledge" and "presenting ongoing studies, works or projects", on the other hand, are much more important for the participation of non-COST countries. It shows this group's high interest in connecting with the European Research Area (ERA).

2.7 Degree of fulfilled expectations

2.7.1 General findings

Most expectations about participation have been fulfilled according to the respondents (question 1.6, see questionnaire in Annex). More than 75% of respondents confirmed that their expectations such as "acquiring new contacts", "having access to European actors and networks", "staying up-to-date in the professional field", "presenting ongoing studies, works or projects" had been fulfilled. However, only 50% of respondents (or less) confirmed expectations like "initiating new projects", "building public-private partnerships", "(co-)developing market application of concepts, ideas and technologies".

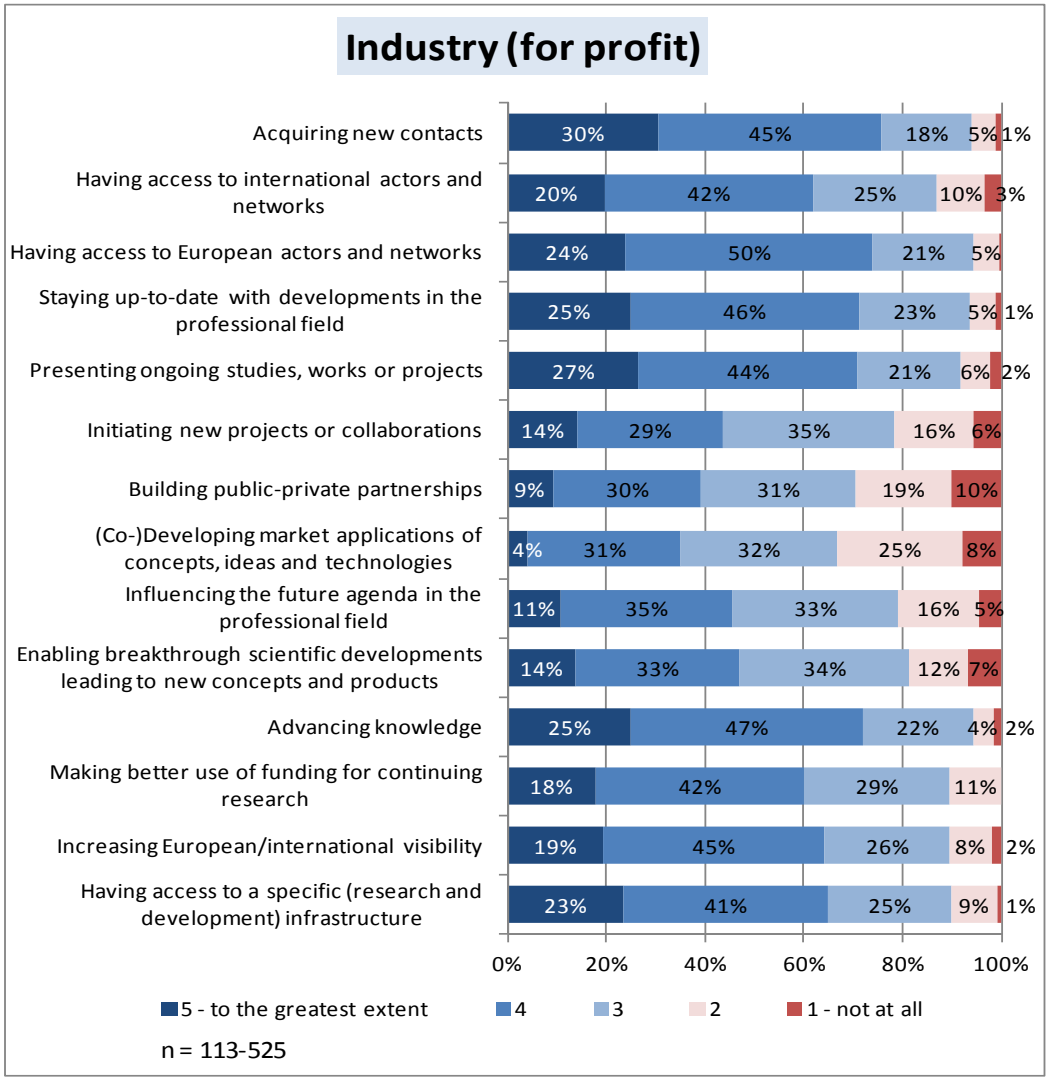
Figure 16: Fulfilled expectations (all respondents)

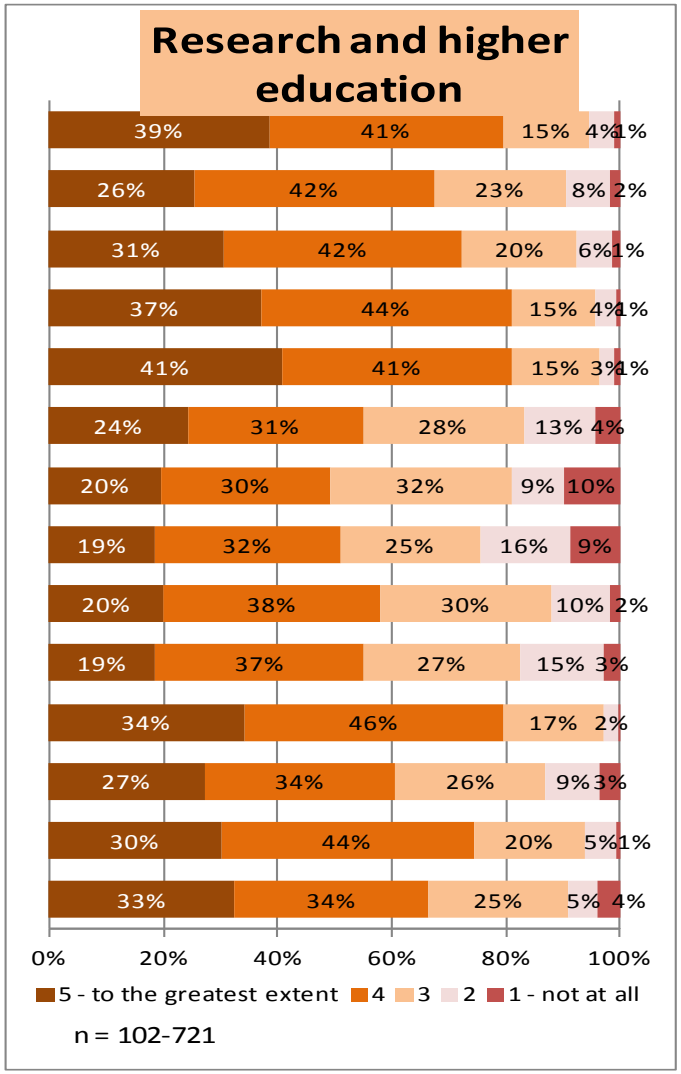


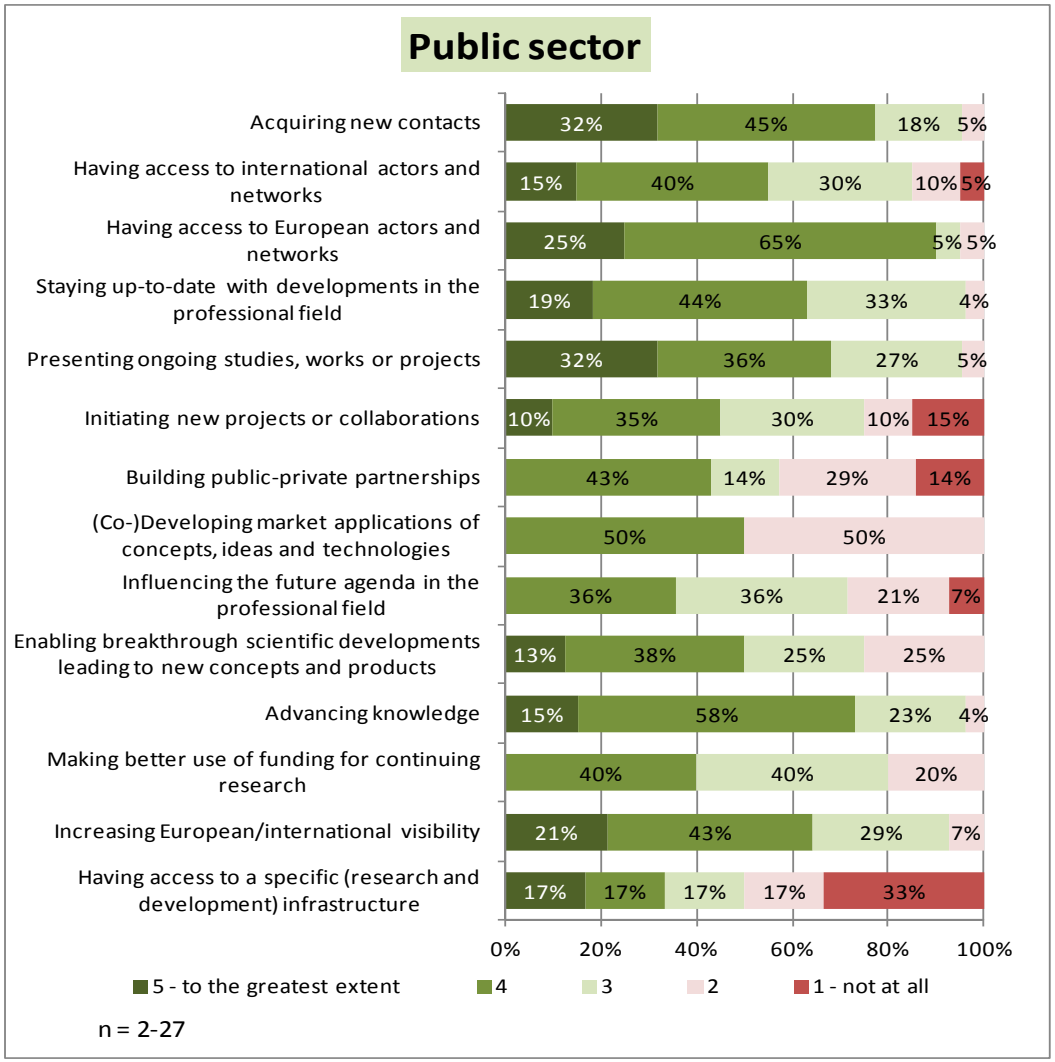
2.7.2 Findings differentiated by employment status

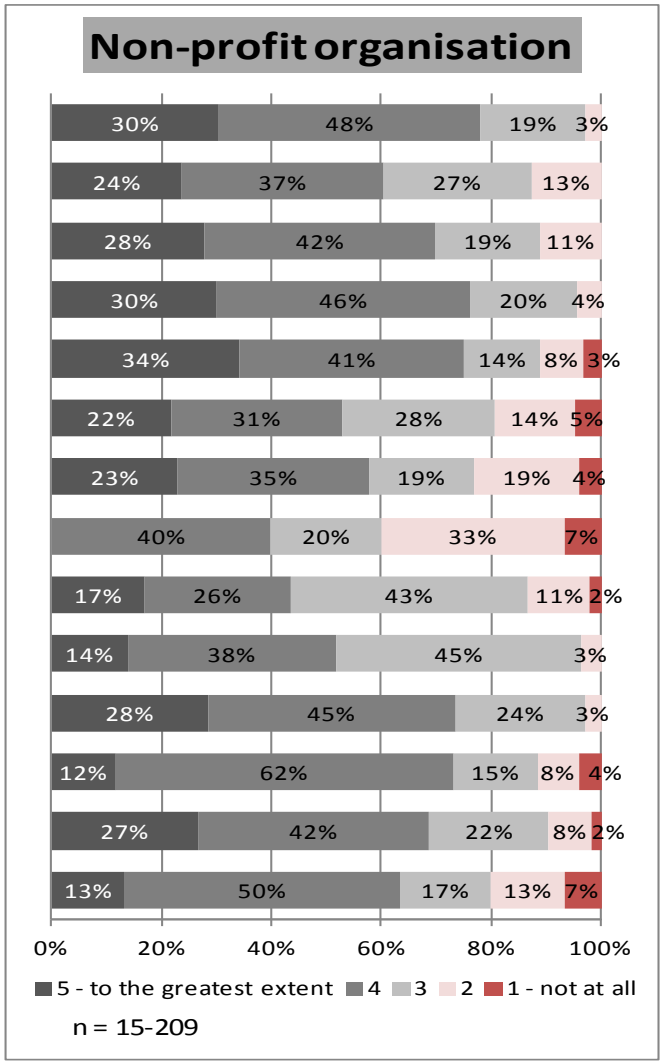
Researchers and scientists evaluate the fulfilled expectations much more positively than respondents from industry. Positive ratings for the different expectations among industrial partners range from 35% to 75%, while the ratings by researchers and scientists range from 50% to 82% (measured as answers "to the greatest extent" and "to some extent").

Figure 17-20: Fulfilled expectations by employment status





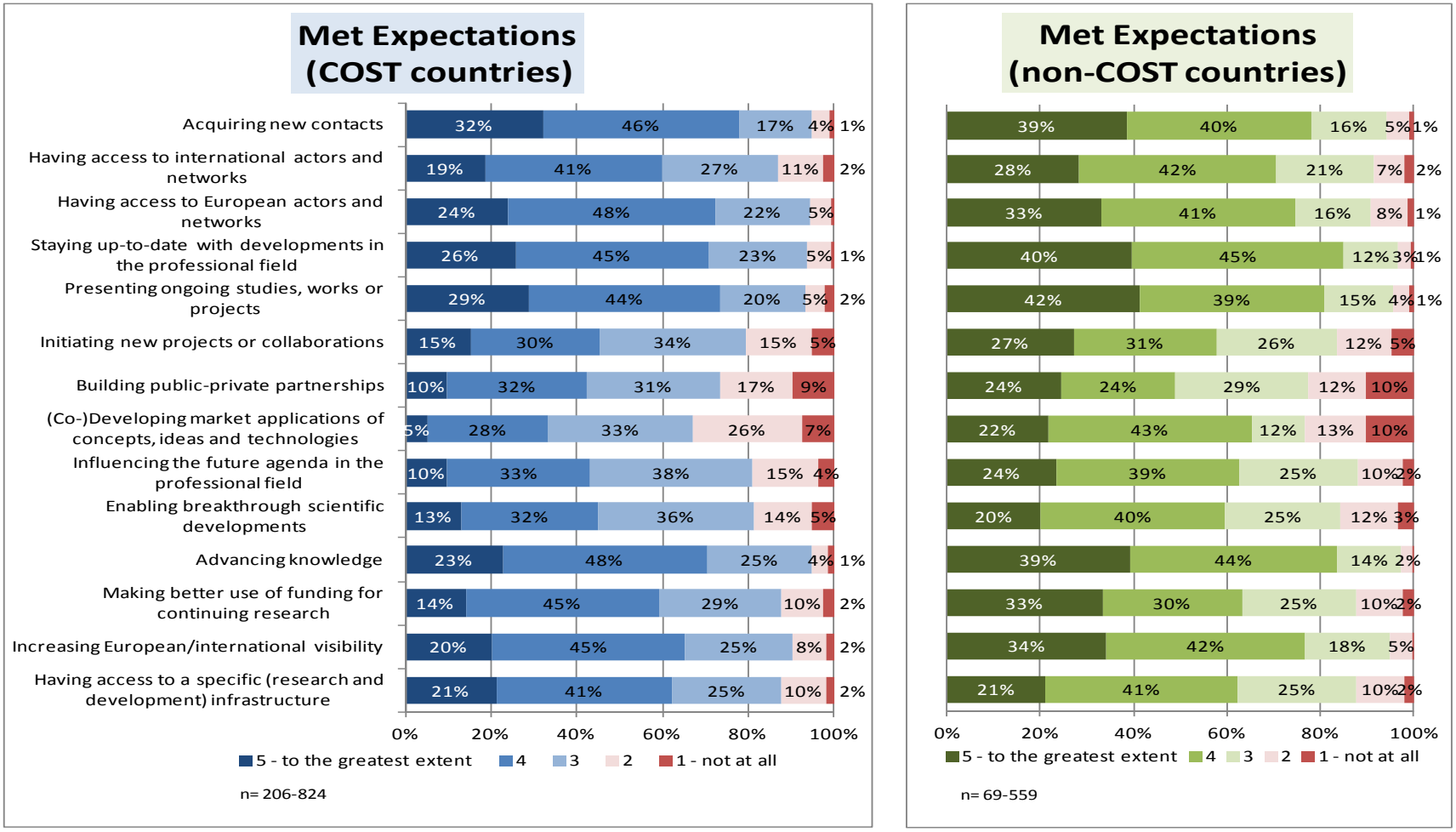

Public sector
Acquiring new contacts
32% 45% 18% 5%
Having access to international actors and networks
15% 40% 30% 10% 5%
Having access to European actors and networks
25% 65% 5% 5%
Staying up-to-date with developments in the professional field
19% 44% 33% 4%
Presenting ongoing studies, works or projects
32% 36% 27% 5%
Initiating new projects or collaborations
10% 35% 30% 10% 15%
Building public-private partnerships
43% 14% 29% 14%
(Co-)Developing market applications of concepts, ideas and technologies
50% 50%
Influencing the future agenda in the professional field
36% 36% 21% 7%
Enabling breakthrough scientific developments leading to new concepts and products
13% 38% 25% 25%
Advancing knowledge
15% 58% 23% 4%
Making better use of funding for continuing research
40% 40% 20%
Increasing European/international visibility
21% 43% 29% 7%
Having access to a specific (research and development) infrastructure
17% 17% 17% 17% 33%
0% 20% 40% 60% 80% 100%
5 - to the greatest extent
4
3
2
1 - not at all
n = 2-27


Non-profit organisation
30% 48% 19% 3%
24% 37% 27% 13%
28% 42% 19% 11%
30% 46% 20% 4%
34% 41% 14% 8% 3%
22% 31% 28% 14% 5%
23% 35% 19% 19% 4%
40% 20% 33% 7%
17% 26% 43% 11% 2%
14% 38% 45% 3%
28% 45% 24% 3%
12% 62% 15% 8% 4%
27% 42% 22% 8% 2%
13% 50% 17% 13% 7%
0% 20% 40% 60% 80% 100%
5 - to the greatest extent
4
3
2
1 - not at all
n = 15-209

2.7.3 Findings differentiated by COST/NON-COST countries

Respondents from non-COST countries generally rate the extent to which expectations are met for participating in COST Action activities higher than respondents from COST countries. Positive ratings for each expectation range from 48% to 85% among respondents from non-COST countries. The expectations of "staying up-to-date with developments in the professional field" (85%), "advancing knowledge" (83%) and "presenting ongoing studies, works or projects" (81%) are rated particularly highly. COST countries respondents' ratings range from 32% to 78%. For this group, especially the objective of acquiring new contacts has been reached.

Figure 21-22: Fulfilled expectations by region

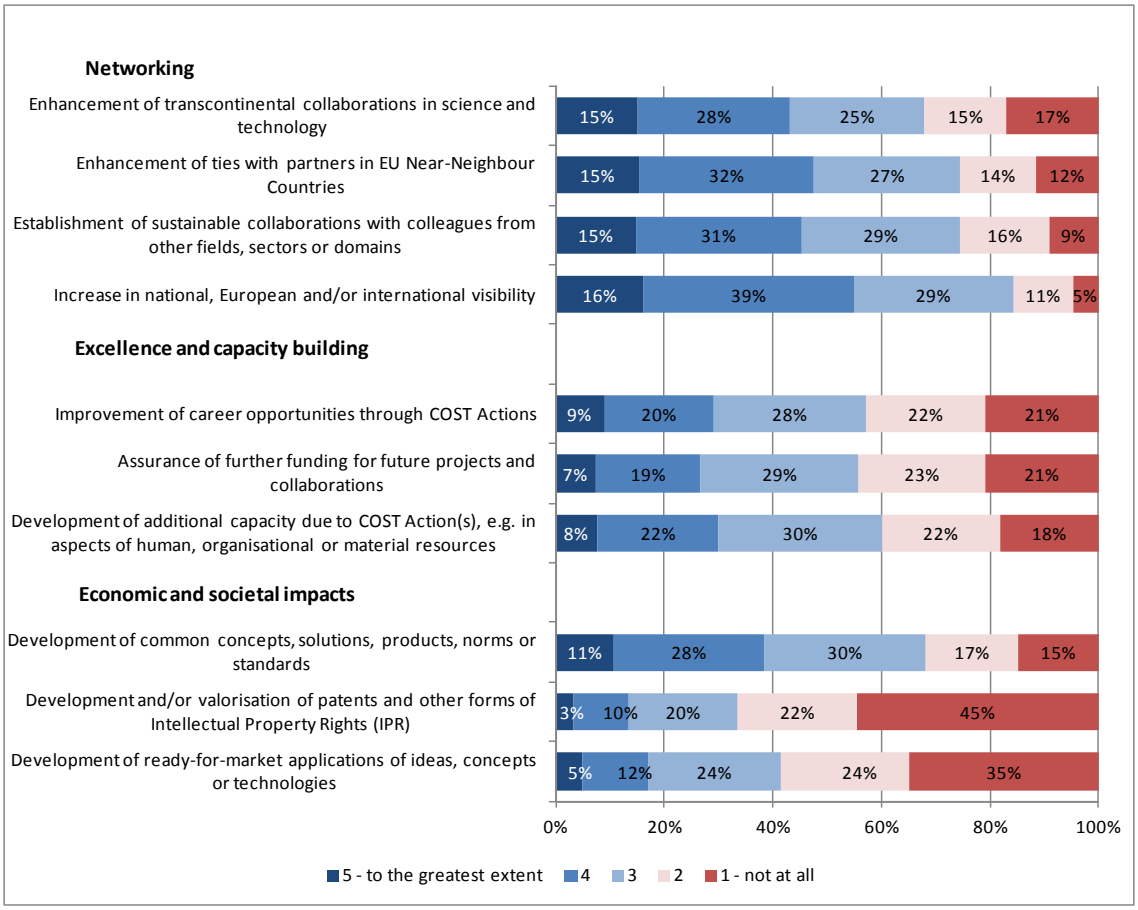


2.8 Results of participation in COST Actions

2.8.1 General findings

Survey participants were asked about the results of participation for themselves and their organisation. Results concerning networking were evaluated the highest. Between 43% and 55% say that participation in COST Actions has led to the enhancement of transcontinental collaboration in science and technology, to an enhancement of ties with partners in EU near neighbour countries, to the establishment of sustainable collaborations with colleagues from other fields, sectors or domains, and to an increase in national, European and international visibility.

Figure 23: Results of participation (all participants)

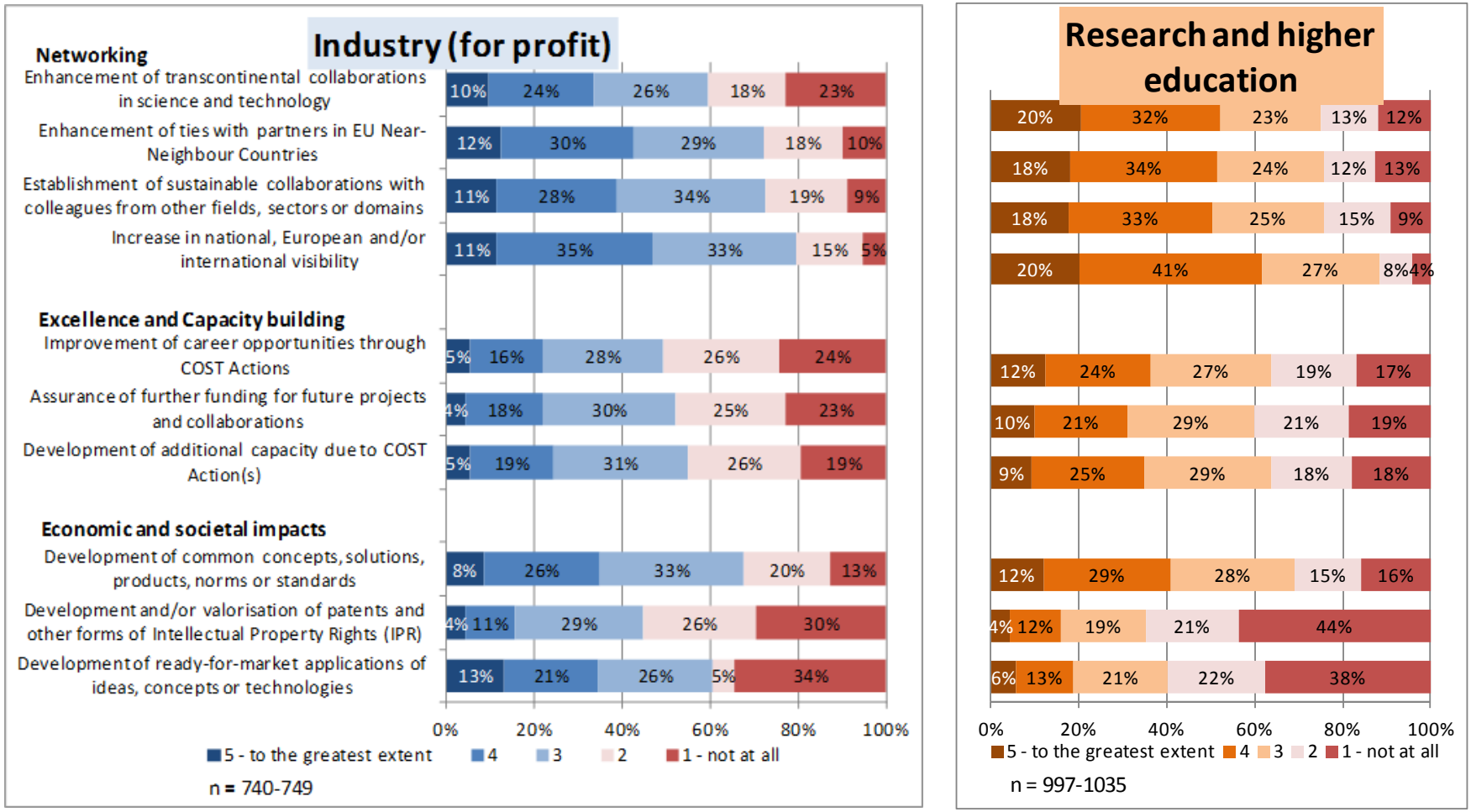


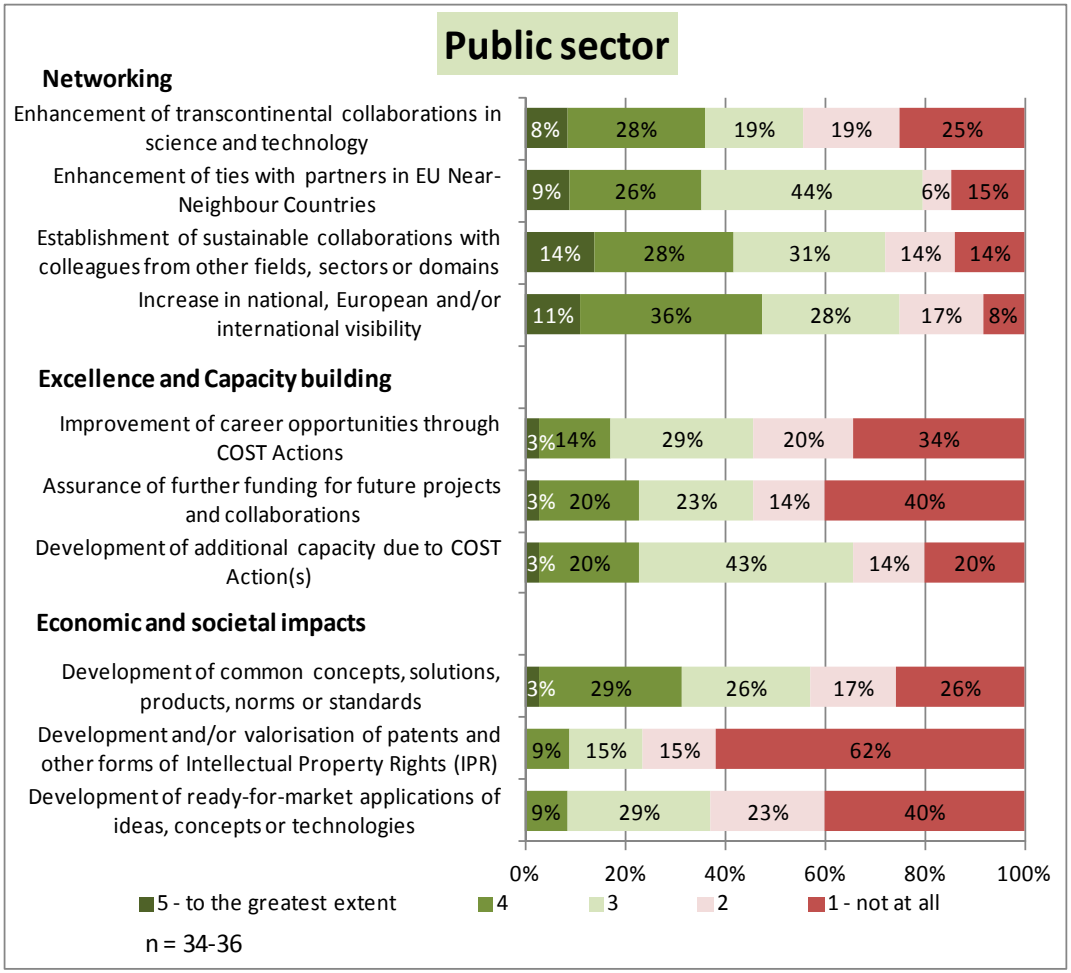
There are lower results for excellence and capacity building. Nearly 30% either fully agree or somewhat agree that participation in COST Action activities improves career opportunities, assures further funding for future projects and collaborations and develops additional capacity. The results concerning economic impacts are even lower. Only 13% to 17% agree that participation results in the development and valorisation of Intellectual Property Rights and the development of ready-for market applications of ideas, concepts or technologies.

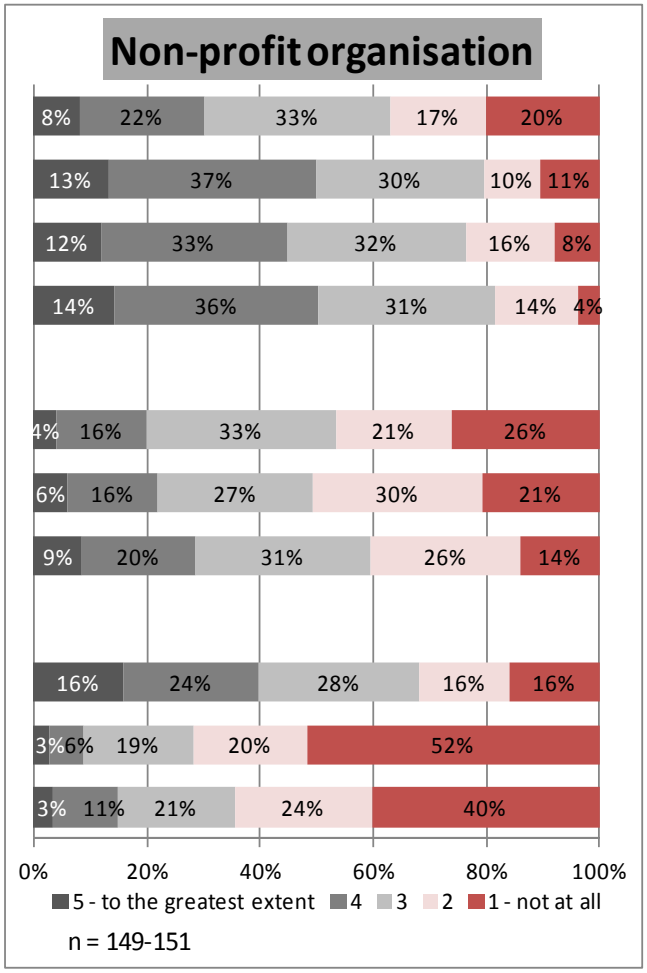
2.8.2 Findings differentiated by employment status

In general, researchers and scientists give more positive assessments of the impacts on the organisation from participating in COST Actions than the other groups. The positive evaluation of networking ranges from 51% to 61% for respondents from research, and from only 34% to 46% for industrial partners. Results concerning excellence and capacity are also evaluated higher among researchers and scientists. 31% to 36% of the respondents from this group indicate that participation led to an improvement of career opportunities, the assurance of funding for future projects and collaboration or the development of additional capacity. Positive ratings of these issues by industrial partners range from only 21% to 24%. The lowest assessment of potential economic impacts comes from respondents from the public sector and from non-profit organisations. Only 9% to 14% of the respondents from these groups say that participation in COST Action activities leads to development or valorisation of IPR or to the development of ready-for-market applications of ideas, concepts or technologies.

Figure 24-27: Results of participation by employment status



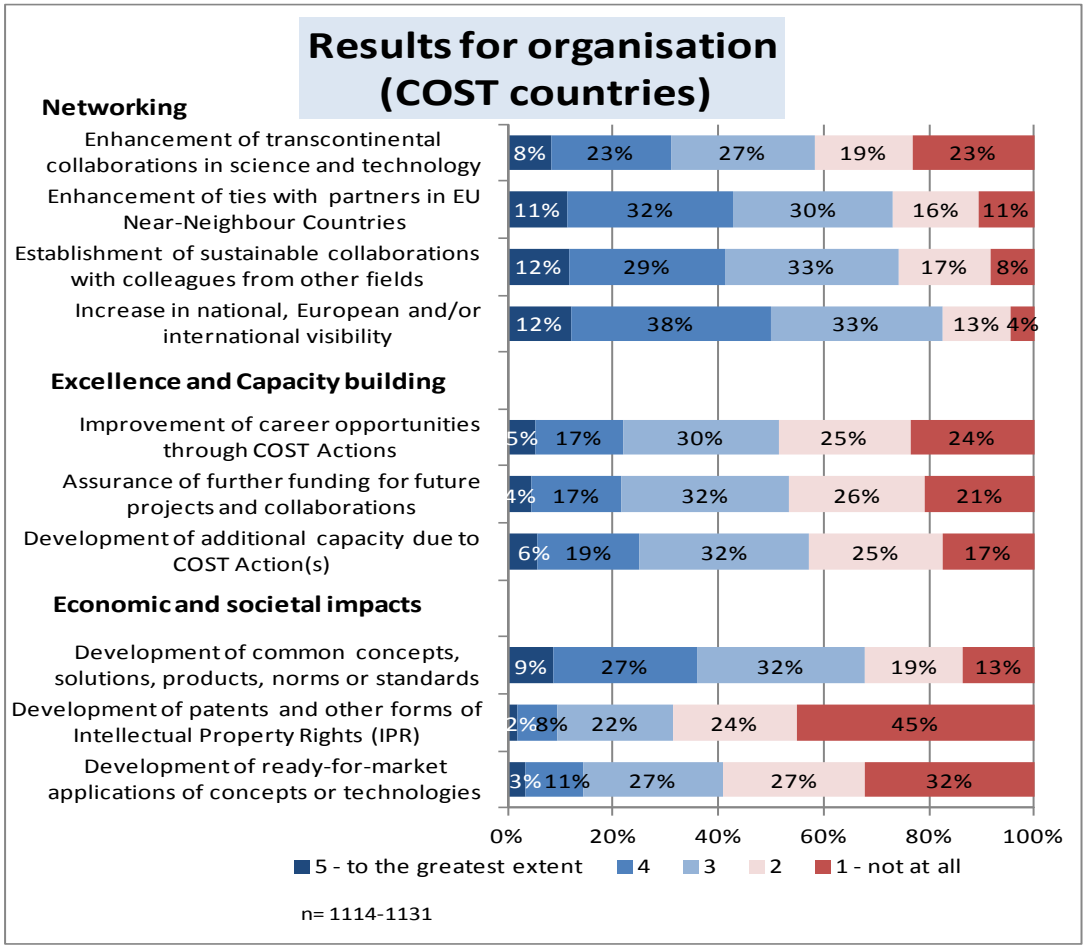

Public sector
Networking
Enhancement of transcontinental collaborations in science and technology
8% 28% 19% 19% 25%
Enhancement of ties with partners in EU Near-Neighbour Countries
9% 26% 44% 6% 15%
Establishment of sustainable collaborations with colleagues from other fields, sectors or domains
14% 28% 31% 14% 14%
Increase in national, European and/or international visibility
11% 36% 28% 17% 8%
Excellence and Capacity building
Improvement of career opportunities through COST Actions
3% 14% 29% 20% 34%
Assurance of further funding for future projects and collaborations
3% 20% 23% 14% 40%
Development of additional capacity due to COST Action(s)
3% 20% 43% 14% 20%
Economic and societal impacts
Development of common concepts, solutions, products, norms or standards
3% 29% 26% 17% 26%
Development and/or valorisation of patents and other forms of Intellectual Property Rights (IPR)
9% 15% 15% 62%
Development of ready-for-market applications of ideas, concepts or technologies
9% 29% 23% 40%
0% 20% 40% 60% 80% 100%
5 - to the greatest extent
4
3
2
1 - not at all
n = 34-36

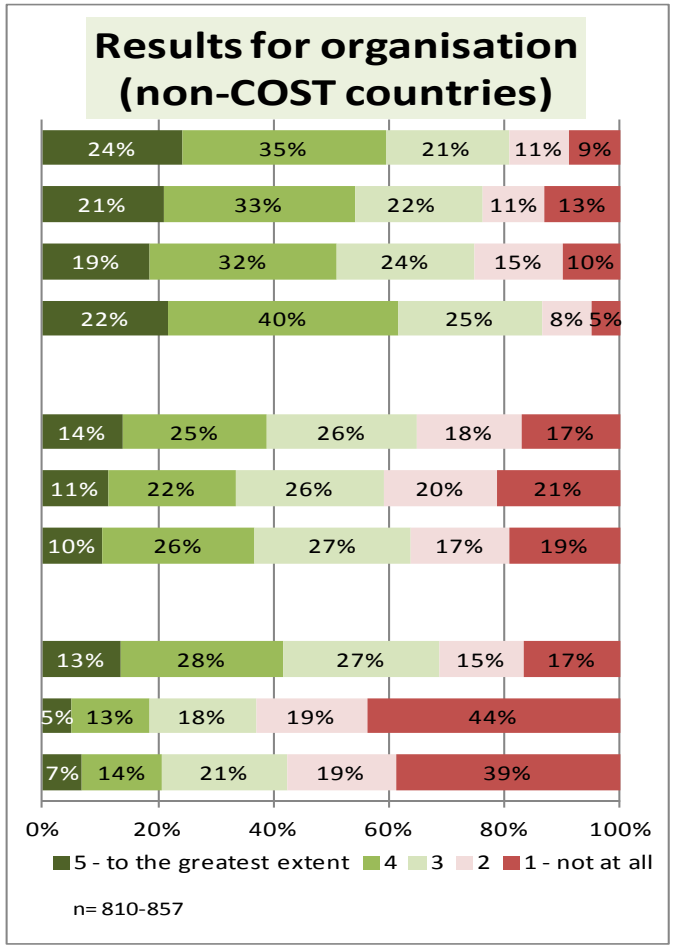

Non-profit organisation
8% 22% 33% 17% 20%
13% 37% 30% 10% 11%
12% 33% 32% 16% 8%
14% 36% 31% 14% 4%
4% 16% 33% 21% 26%
6% 16% 27% 30% 21%
9% 20% 31% 26% 14%
16% 24% 28% 16% 16%
3% 6% 19% 20% 52%
3% 11% 21% 24% 40%
0% 20% 40% 60% 80% 100%
5 - to the greatest extent
4
3
2
1 - not at all
n = 149-151

2.8.3 Findings differentiated by COST/NON-COST countries

Figure 28-29 show that the results of participating in COST Action activities will be assessed more positively by respondents from non-COST countries than respondents from COST countries. Positive ratings range from 18% to 62% for respondents from non-COST countries and from 10% to 50% for those from COST countries.

Figure 28-29: Results of participation by region





2.9 Contribution of COST Actions

2.9.1 General findings

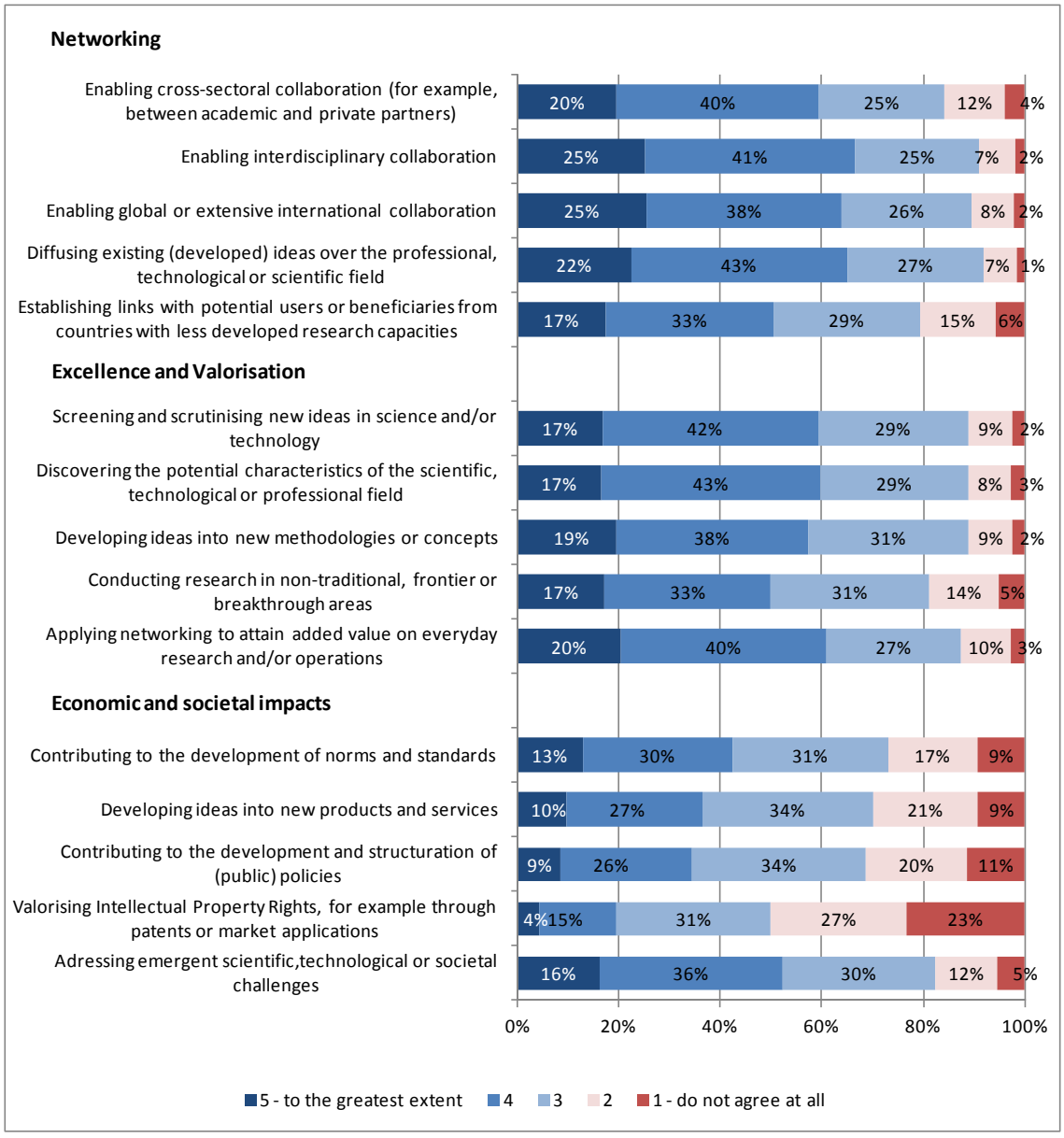
The participants were asked to assess the contributions of COST Actions in terms of "networking", "excellence and valorisation" as well as "economic and societal impacts" (question 1.8, see questionnaire in Annex). Several aspects were defined for each of these three main dimensions. In total, 1914 participants answered this question.

The majority of participants clearly confirm the contribution to networking. All five aspects are rated at more than 50% ("rather agree" and "agree to the greatest extent"). Despite this, more than 20% of respondents do not think that COST Actions make any relevant contribution to establishing links to partners from less developed countries.

Regarding "excellence and valorisation", all of the mentioned aspects are rated positively. More than 50% of the respondents see an essential contribution of COST Actions to all five aspects. However, almost 20% of the respondents see no clear contribution of COST Actions to conducting research in non-traditional frontier or breakthrough areas.

The "economic and societal impacts" dimension is not evaluated as highly as "networking" and "excellence and valorisation" by participants. Fewer than 20% of the respondents see a clear contribution to valorisation of IPR, while 50% believe there is no contribution. However, the aspect "addressing emergent scientific, technological or societal challenges" receives positive ratings of more than 50%.

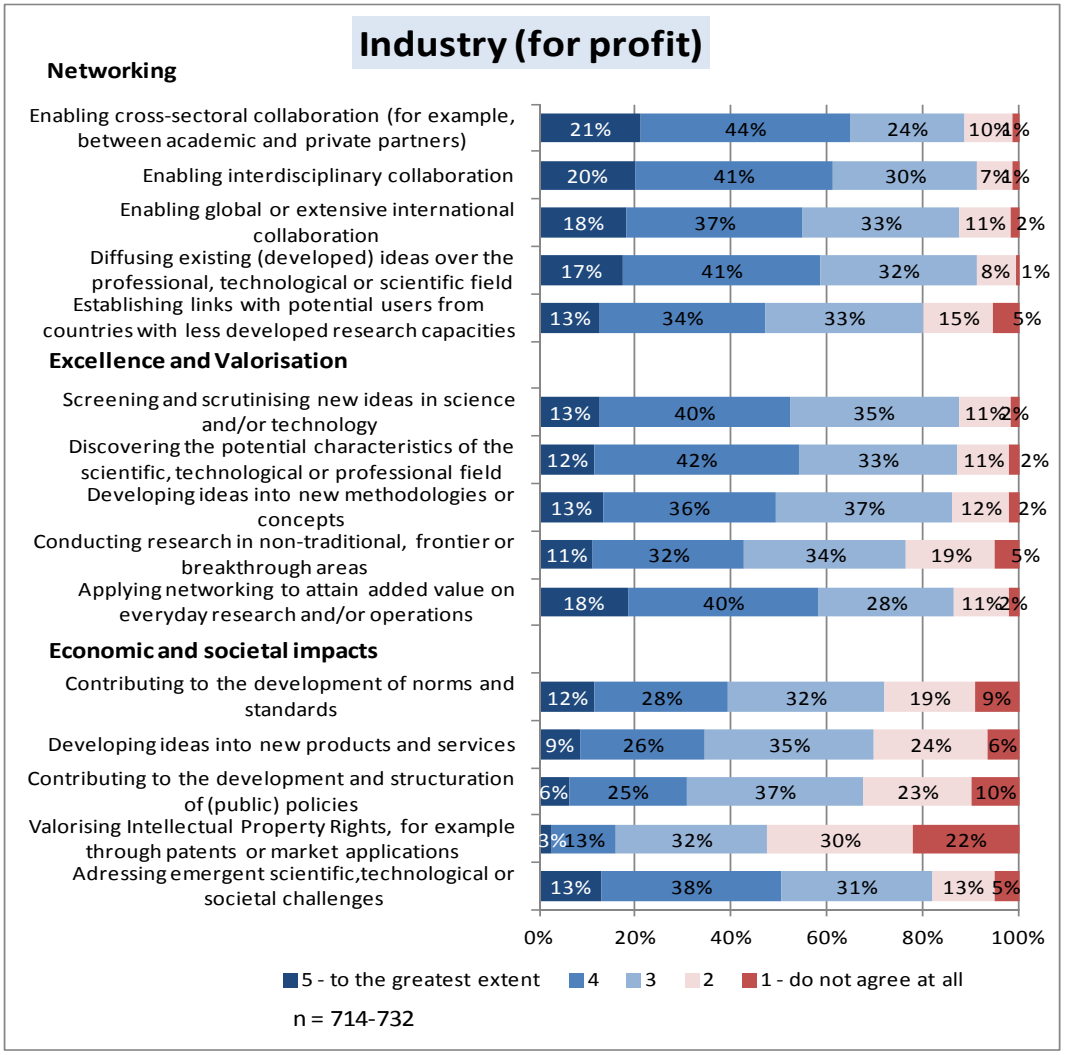
Figure 30: Contributions of COST Actions (all respondents)

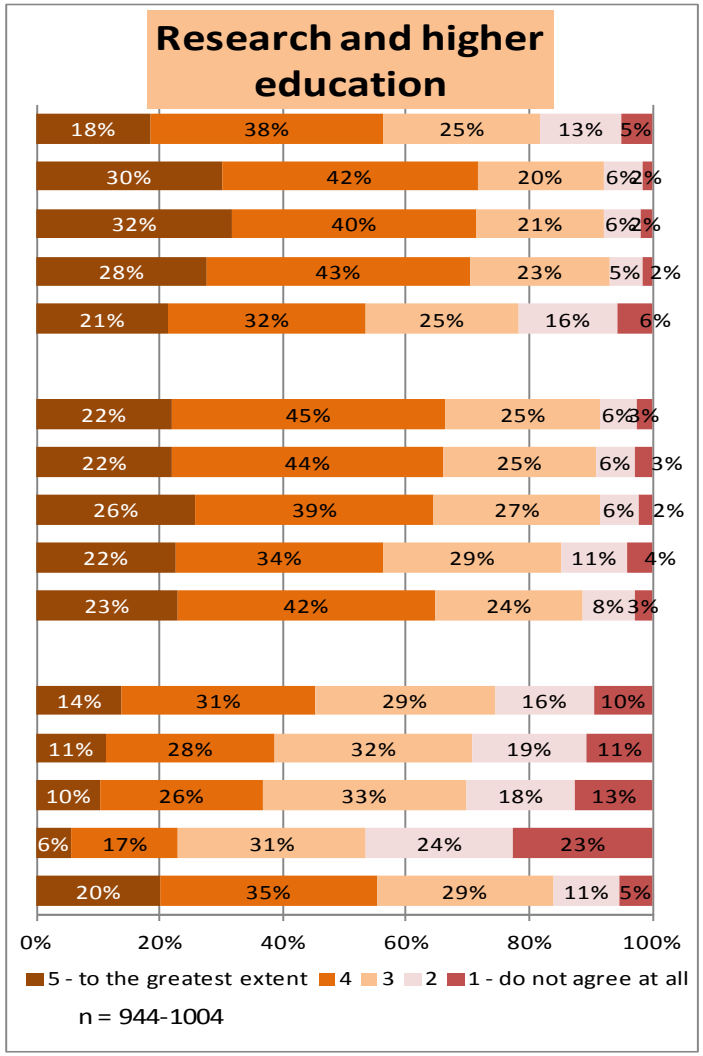


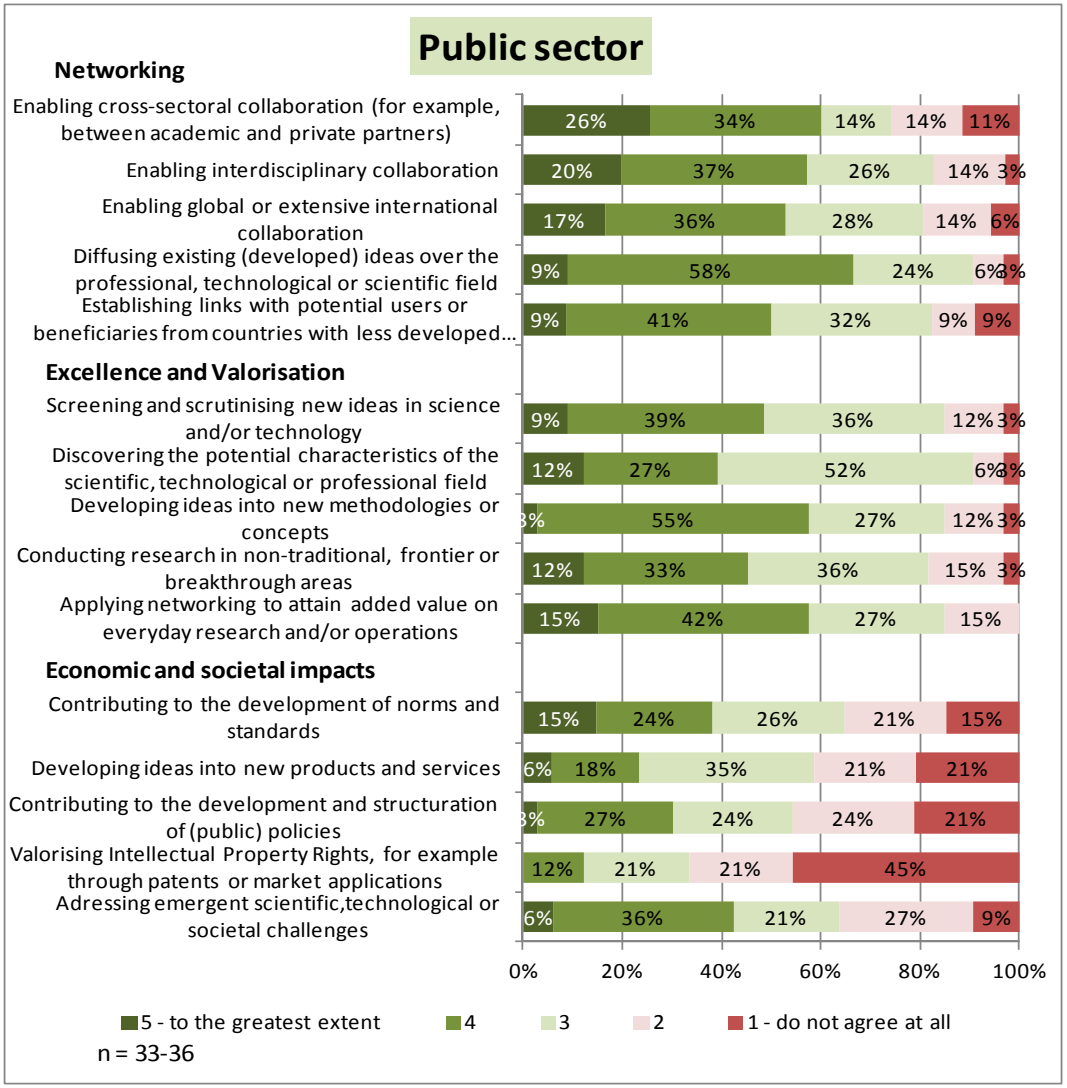
2.9.2 Findings differentiated by employment status

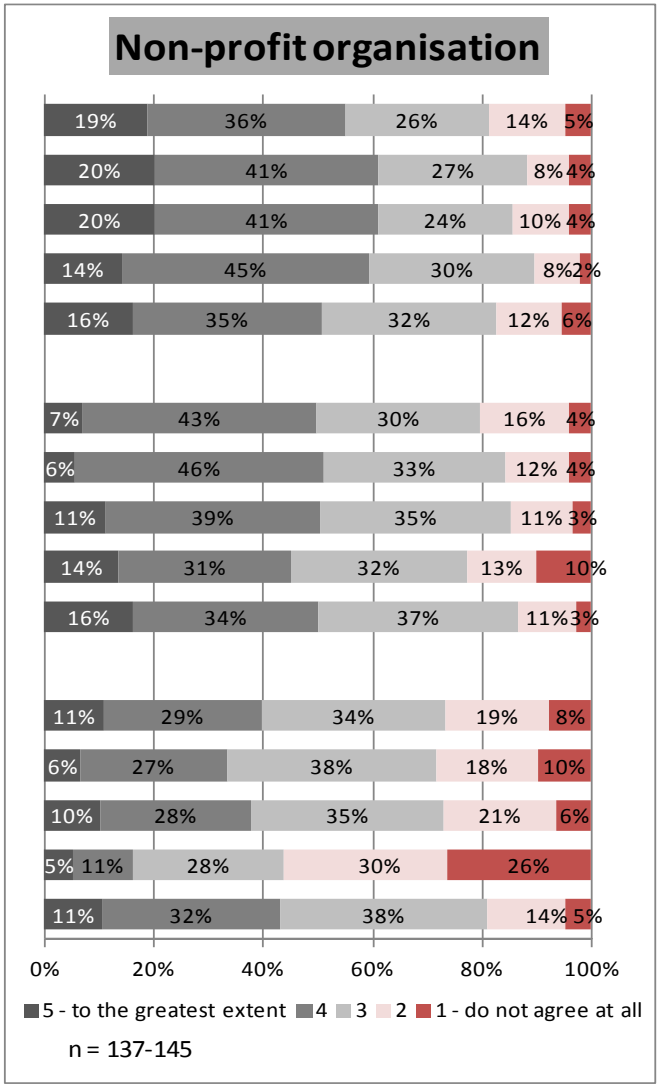
In general, the four employment groups make similar assessments of the potential contributions of COST Actions. One special point to be mentioned in this regard is that all of the aspects are evaluated more positively by academics than by the other three groups. For instance, the contribution to networking ranges from 53% to 72% ('rather agree' and 'agree to the greatest extent') among researchers and scientists and from 47% to 65% for industrial partners.

Figure 31-34: Contributions of COST by employment status





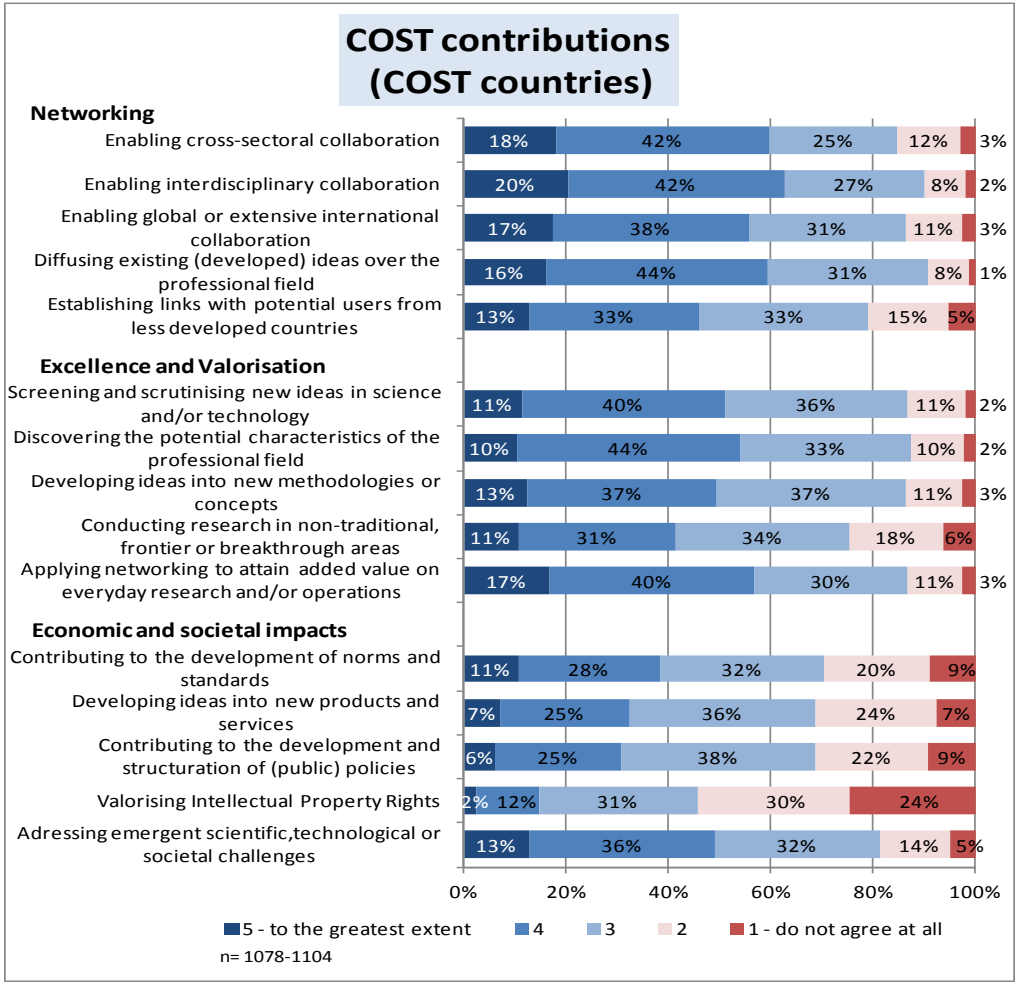

Public sector
Networking
Enabling cross-sectoral collaboration (for example, between academic and private partners)
26% 34% 14% 14% 11%
Enabling interdisciplinary collaboration
20% 37% 26% 14% 3%
Enabling global or extensive international collaboration
17% 36% 28% 14% 6%
Diffusing existing (developed) ideas over the professional, technological or scientific field
9% 58% 24% 6% 3%
Establishing links with potential users or beneficiaries from countries with less developed...
9% 41% 32% 9% 9%
Excellence and Valorisation
Screening and scrutinising new ideas in science and/or technology
9% 39% 36% 12% 3%
Discovering the potential characteristics of the scientific, technological or professional field
12% 27% 52% 6% 3%
Developing ideas into new methodologies or concepts
3% 55% 27% 12% 3%
Conducting research in non-traditional, frontier or breakthrough areas
12% 33% 36% 15% 3%
Applying networking to attain added value on everyday research and/or operations
15% 42% 27% 15%
Economic and societal impacts
Contributing to the development of norms and standards
15% 24% 26% 21% 15%
Developing ideas into new products and services
6% 18% 35% 21% 21%
Contributing to the development and structuration of (public) policies
3% 27% 24% 24% 21%
Valorising Intellectual Property Rights, for example through patents or market applications
12% 21% 21% 45%
Adressing emergent scientific,technological or societal challenges
6% 36% 21% 27% 9%
0% 20% 40% 60% 80% 100%
5 - to the greatest extent
4
3
2
1 - do not agree at all
n = 33-36

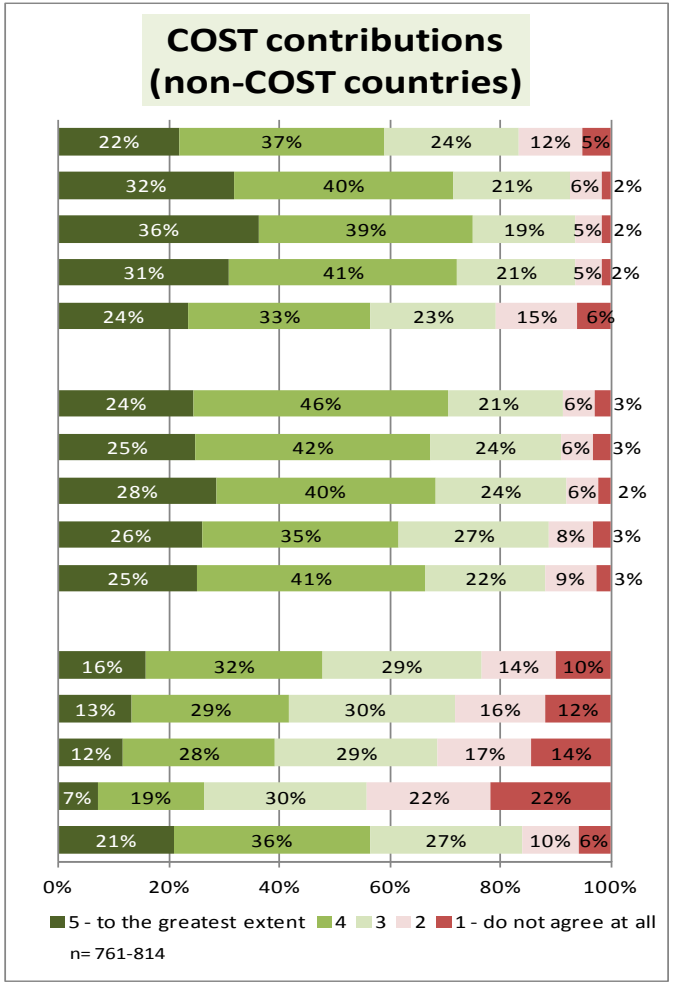

Non-profit organisation
19% 36% 26% 14% 5%
20% 41% 27% 8% 4%
20% 41% 24% 10% 4%
14% 45% 30% 8% 2%
16% 35% 32% 12% 6%
7% 43% 30% 16% 4%
6% 46% 33% 12% 4%
11% 39% 35% 11% 3%
14% 31% 32% 13% 10%
16% 34% 37% 11% 3%
11% 29% 34% 19% 8%
6% 27% 38% 18% 10%
10% 28% 35% 21% 6%
5% 11% 28% 30% 26%
11% 32% 38% 14% 5%
0% 20% 40% 60% 80% 100%
5 - to the greatest extent
4
3
2
1 - do not agree at all
n = 137-145

2.9.3 Findings differentiated by COST/NON-COST countries

The evaluation of the potential contributions of COST Actions to "networking", "excellence and valorisation" and "economic and societal impacts" is significantly higher among respondents from non-COST countries for each of the 15 individual aspects than among the respondents from COST countries.

Figure 35-36: Contributions of COST by region



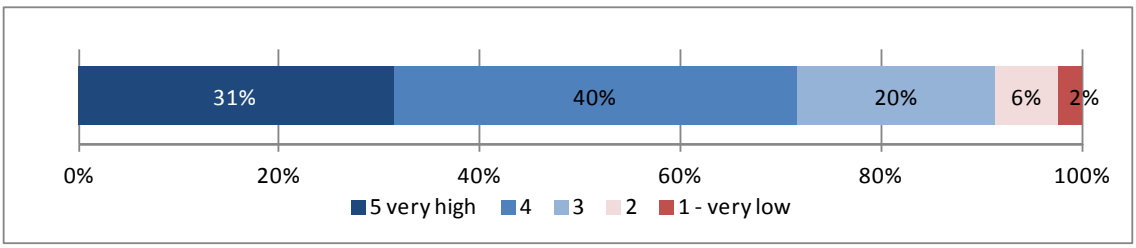


2.10 Assessment of attractiveness of COST Actions

2.10.1 General findings

2018 participants responded to the question regarding the attractiveness of COST Actions (question 1.9, see questionnaire in Annex). 72% of all respondents assess the attractiveness of COST Actions as "high" or "very high". Only 7% rate the attractiveness of Actions and their own activities as low.

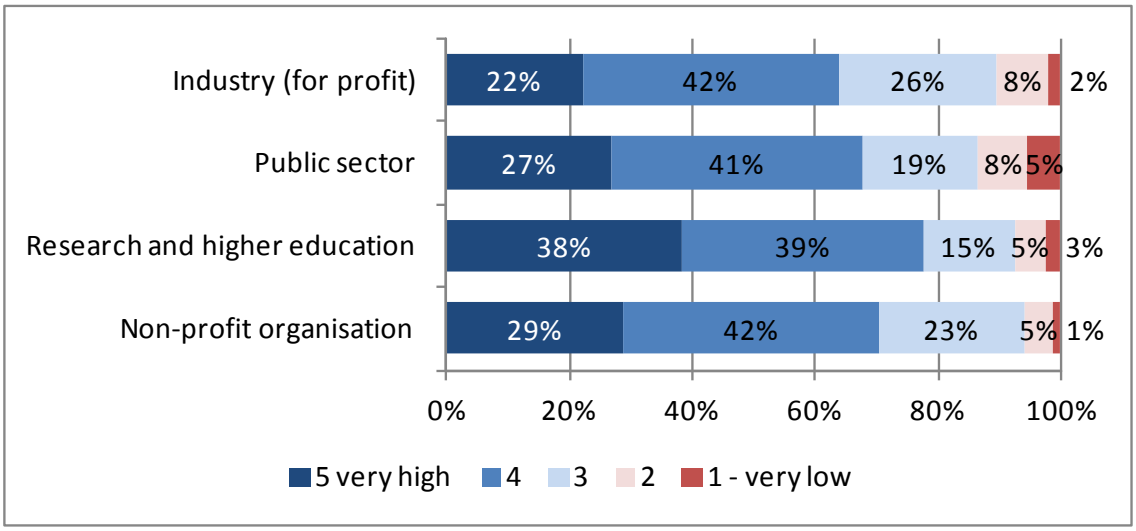
Figure 37: Assessment of attractiveness (all respondents)



2.10.2 Findings differentiated by employment status

As shown in Figure 38, 77% of respondents from the academic group assess the attractiveness as "high" or "very high", compared to 66% of respondents from industrial partners.

Figure 38: Assessment of attractiveness by employment status

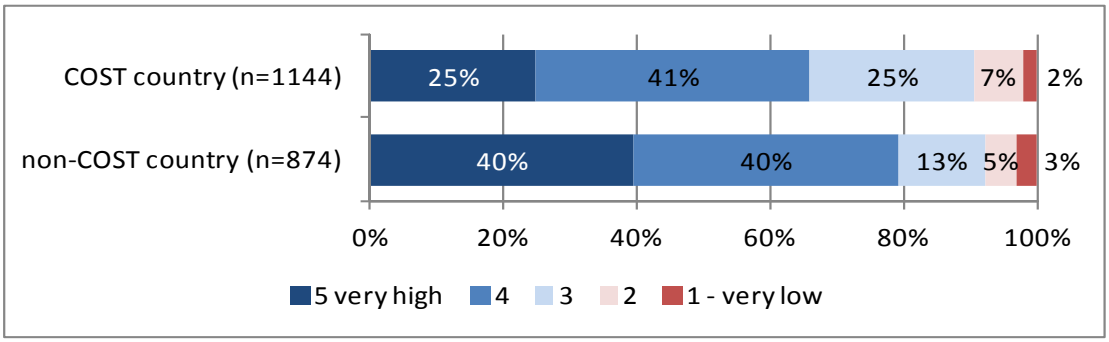


2.10.3 Findings differentiated by COST/NON-COST countries

Of the 2018 respondents to this question, 1144 are from COST countries, and 874 from non-COST countries. Respondents from non-COST countries evaluated the attractiveness

of COST Actions significantly higher than the respondents from COST countries. 80% assess the attractiveness of COST Actions as "high" or "very high", compared to 66% of respondents from COST countries.

Figure 39: Assessment of attractiveness by region



2.11 Open question: Suggested improvements

2.11.1 General findings

In total, 888 participants answered the open question (question 1.10, see questionnaire in Annex) about recommendations for how to improve participation in COST Actions. 484 text answers came from participants from COST countries, a further 404 from participants from non-COST countries. The main topics that were addressed can be categorized as follows: **administration** within the programme, **strategy and orientation** of the COST programme in general, **funding issues** and (project) **management** of COST Actions. It is noteworthy that a large number of participants also took this opportunity to express their satisfaction with the programme and praise the experience they had within their COST Actions.

The answers from **COST country participants** were quite diverse. Regarding the topic of **administration**, several participants criticise the amount of paperwork, administrative burdens, too binding policies or too strict rules for the organisation of meetings. They also hope there will be less bureaucracy in the future.

Concerning the **strategy and orientation** of the COST programme in general, some participants suggest a clearer focus of COST Actions. For instance, a wider range of external partners including some from industry is recommended.

Rules for stronger industrial participation should be improved, as companies give input for future research by presenting and reporting technical advancements as well as technical problems.

Several industry representatives complain about the financial barriers to participating in COST Action activities as this is not funded for industrial partners. Others criticise that the COST Action and the topics are too academia-oriented and too focussed on basic research. They therefore plead for more application orientation and suggest a stronger focus on technological applications, as well as on societal and economic impacts. Furthermore, several participants recommend opening up the COST programme even more to non-European researchers or researchers with less developed research capacities. This would help internationalise research and address research topics on a more global scale. Some criticise that, until now, COST communities mainly comprise groups of acquainted researchers who already knew each other.

A further topic was the funding issue within COST activities. Some participants demand a faster and simpler reimbursement of travel expenses, while others call for higher budgets in general. According to them, there should be a (higher) budget for equipment, rapid prototyping and other research-affiliated work. Some suggested the time-consuming work of COST Action chair holders should be financially compensated.

Regarding the **project management** of COST Actions, some participants suggest a more goal-oriented approach in the proposal process and in Action activities. Clear milestones should be set and the results and achievements of COST Actions should be strictly monitored and evaluated. Other respondents demand an upper limit on the number of participants or a clear monitoring of participation. This could make COST Actions more efficient and constructive and would also lower costs. Besides, respondents claim some participants in COST Actions activities do not contribute anything to the work pursued in the Action. According to them this should be more strictly monitored in the future. Defining contribution requirements for participation or implementing upper limits for participation could be helpful. This could also tackle the problem of free-riders. Some respondents report that only a few very committed people organised meetings and did most of the work, while others simply joined in later and only made minor contributions.

The majority of statements made by respondents from **non-COST countries** referred to the **strategy and orientation** of the COST programme. They mainly demand better access to the COST programme and more opportunities for cooperation with European partners. Numerous respondents describe the current access to COST as difficult. A further opening up of the programme to researchers from non-COST countries and raising awareness of it would increase the internationalisation and globalisation of research according to various statements. Access could be improved by organising meetings or other activities in non-European countries. Several participants claim this would raise the awareness and attractiveness of the COST programme on the one hand and help build stronger links to non-European researchers on the other hand. Furthermore, more information and greater transparency about how non-COST countries can participate should be included

on the website. Several respondents claim that it is difficult to understand and gather information on that issue. Similar to the respondents from COST countries, several statements plead for stronger cooperation with industry and better integration of industrial partners within COST Actions. Some also suggest a higher application orientation in COST Action proposals.

Several statements on **funding issues** also refer to the limited access for participants from non-COST countries. Respondents complain about the slow, burdensome, and in some cases only partial reimbursement of travel expenses. Several plead for better funding for participants from non-COST countries. A few respondents also criticise the amount of paperwork and the cumbersome administrative processes in general.

2.12 Open question: Assessment of achievements/benefits of COST Actions

2.12.1 General findings

This open question about the main benefits/achievements of COST Actions (question 1.11, see questionnaire in Annex) was answered by 1134 participants in total, of which 380 were from industry and 600 from research and/or higher education. 629 of the respondents come from COST countries and 489 from non-COST countries.

The main benefits can be categorized as **networking and exchange**, **learning and expanding knowledge**, **developing research projects at international level**, **enhancing personal career opportunities** as well as **commercial application** resulting from intensified cooperation between researchers and industrial partners.

For the 600 **respondents from research,** intensified **networking** is by far the most important benefit from participating in (at least) one COST Action. "People, people, people, it's all about people" is a common response. Many respondents describe how important it is to expand personal networks, establish personal long-lasting contacts, meet "leaders" in the specific field of research and bring together people with similar interests from different backgrounds. The intensified cooperation and meetings also help to continue and deepen personal networks, according to some statements.

A further important impact of participating in COST Actions is the **expansion of knowledge**. Numerous respondents state that due to the collaboration with other researchers and industrial partners, participants were able to learn new research methods and concepts, be up-to-date with research projects and research results, acquire and share relevant information about their own research, and be inspired by new ideas for future research. Many also praise the cross-fertilisation of ideas and the interdisciplinary approach of COST Actions. The intensified networks and cooperation also lead to greater dissemina-

tion of research results, according to some statements. Several respondents also name knowledge transfer to Early Career Investigators as an important impact.

Lots of respondents state that COST Actions also help to trigger and advance **new research projects**. Research methods, topics, questions and results are being addressed and discussed **at an international level**. This strengthens the internationalisation of research. It increases the exposure of researchers and makes their research more visible. It also helps to find ideas, open doors to new research projects, identify existing research gaps and enable new collaborations with new partners, according to several statements. The international networks between scientists and researchers from different countries within COST are also described by some respondents as an important and significant contribution to finding solutions to societal challenges on an international scale.

Other impacts described in the statements address **personal career opportunities**. Some respondents state that participating in COST Action activities like conferences or short-term scientific missions (STSM) was and is important to advance the careers of Early Career Investigators in particular. In some cases, participation also promotes scientific publication or helps to finish a doctoral thesis.

For the **respondents from industry, networking and exchange** are the greatest benefits of participating in COST Action activities, too. Most of them note that active exchanges between industry and research on the platform offered by COST Actions are helpful to meet important researchers, to know potential new employees in their companies, to contact new partners for future cooperation projects, and to access new potential clients.

Furthermore, participation in COST Action activities helps industrial partners to **expand knowledge**, as they can observe where contemporary research is heading. They can discover new agenda in research, new topics, key research objectives and hereby gather ideas for new potential products and markets.

The **economic impact** of their participation is especially important for respondents from industry. Numerous industrial partners describe that participating in COST Action activities brings better exposure of their work and their products. It enables them to bring technological solutions into the market and also to test newly developed products and to assess new ideas. A further outcome of their cooperation with research partners for several respondents is the definition and setting of common industry standards or guidelines and applying for patents.

Respondents from non-COST countries emphasize the benefit of intensified networking with colleagues even more, especially with those from European countries. For various respondents from non-COST countries, participation in COST Action activities is a great opportunity to find new collaborations, to learn new or enhance existing skills and knowledge, for example, by attending training activities like short-term scientific missions (STSMs).

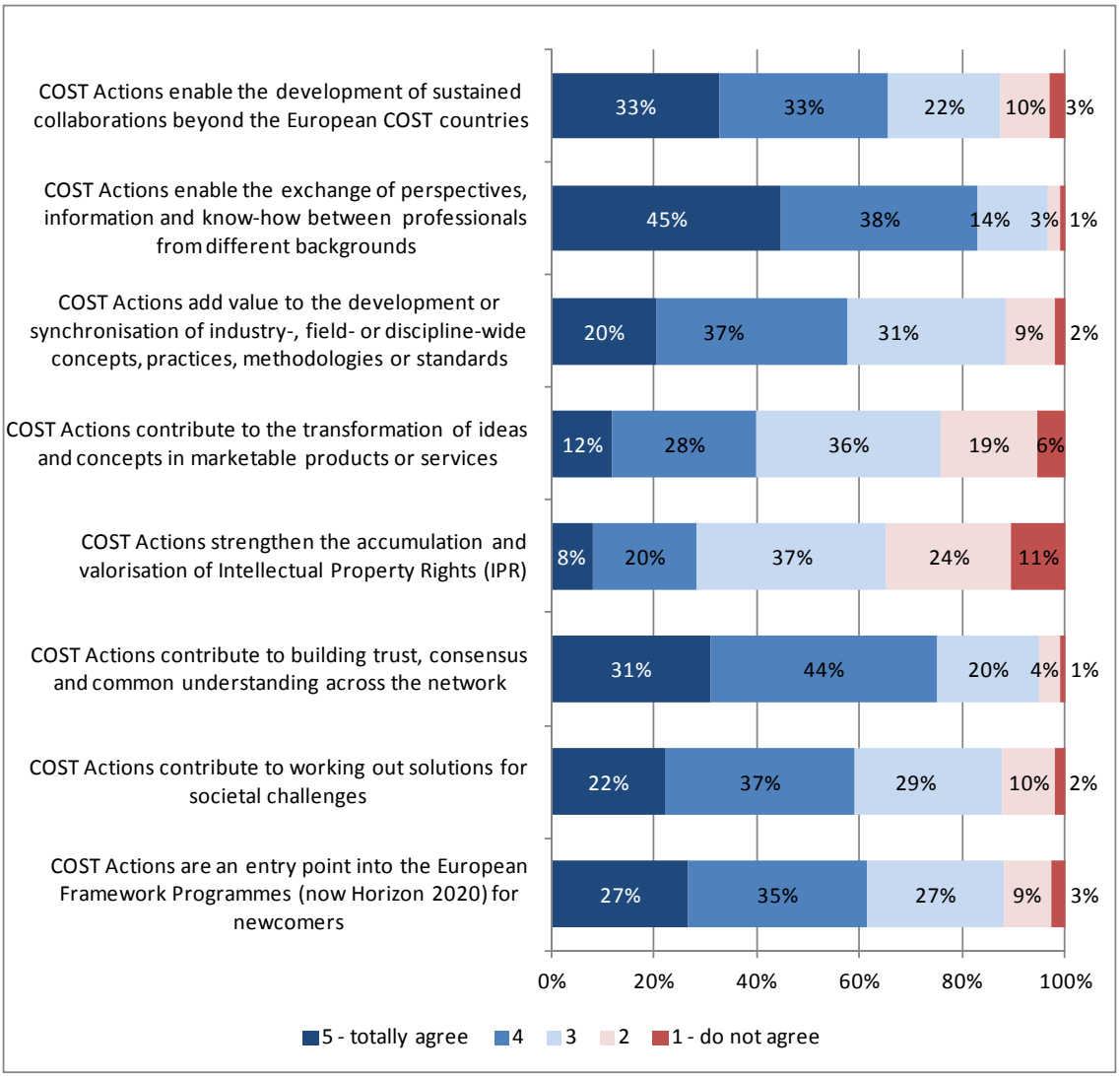
2.13 Assessment of the conclusion statements about COST Actions

At the end of the survey, the participants were asked to assess several conclusion statements about COST Actions (question 1.12, see questionnaire in Annex). In total, 1941 participants answered this question, which reflects a very high response rate.

2.13.1 General findings

The statements with the highest ratings among all respondents are "COST Actions enable the exchange of perspectives, information and know-how between professionals from different backgrounds" and "COST Actions contribute to building trust, consensus and common understanding across the network". Over 83% of all respondents assess the first mentioned statement either with "totally agree" or "rather agree"; 75% agreed on the second statement. These findings correspond to the statements made in the open questions. **Networking and learning / expanding knowledge** are the most important benefits for participants. The majority of respondents also supported statements such as "COST Actions enable the development of sustained collaboration beyond the European COST countries" (66%), "COST Actions add value to the development or synchronisation of industry-, field- or discipline-wide concepts, practices, methodologies or standards" (58%), "COST Actions contribute to working out solutions for societal challenges" (59%) as well as "COST Actions are an entry point into the European Framework Programmes" (61%).

Figure 40: Conclusion statements (all respondents)



The statement "COST Actions contribute to the transformation of ideas and concepts in marketable products or services" finds less support. Less than 40% of the respondents agreed. Indeed, a quarter of the respondents rejected it by answering "rather not agree" or "do not agree". Even less support is given to the statement "COST Actions strengthen the accumulation and valorisation of intellectual Property Rights (IPR)". The share of respondents disagreeing with this statement is higher (35%) than the share of supporters (28%). It is apparent that direct "outputs" like new patents or developed products are less likely to result from participating in COST Action activities.

2.13.2 Findings differentiated by employment status

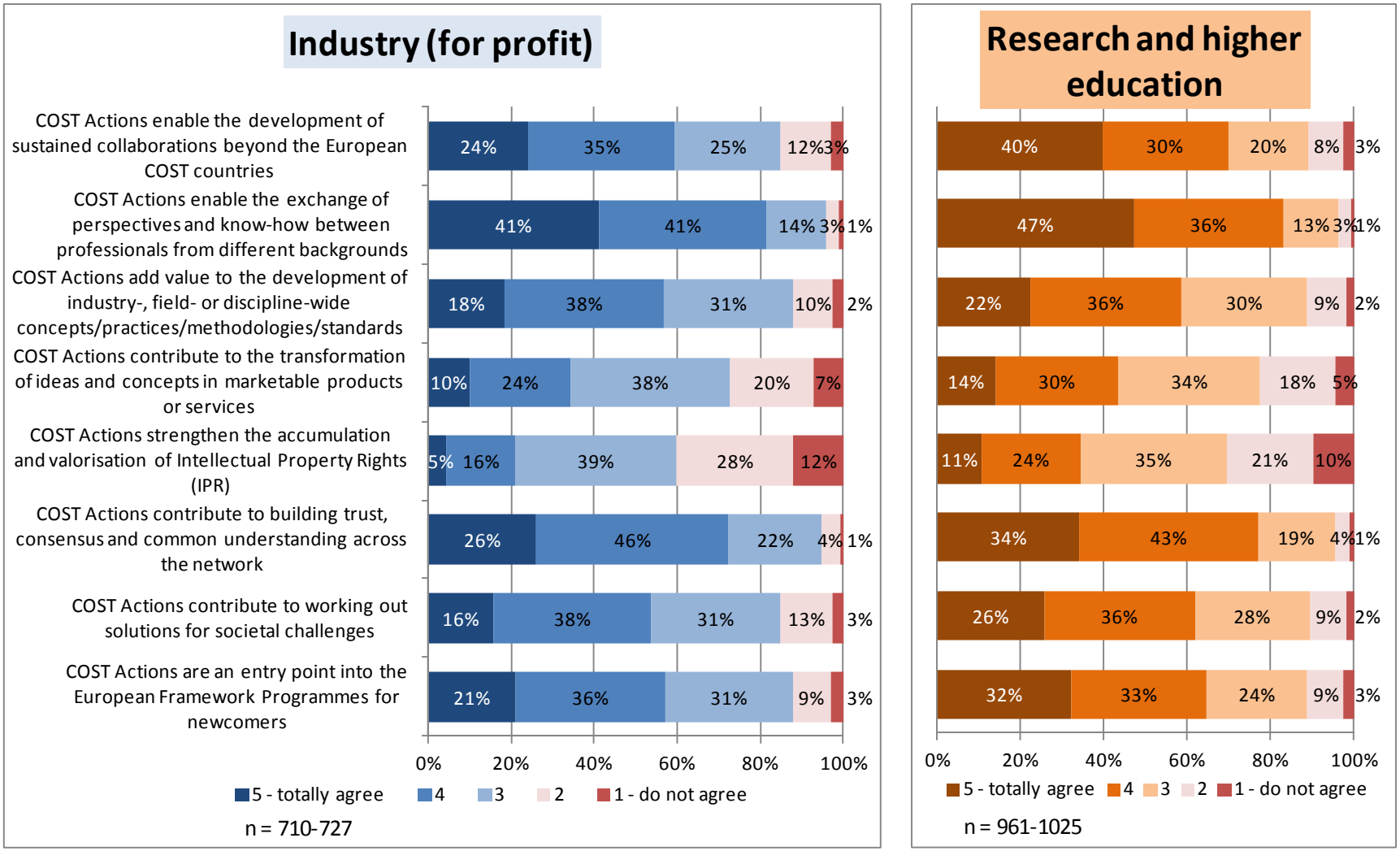
Industrial partners also support most of the statements about COST Actions. However, support is slightly lower for most statements. Especially the statements about direct outputs like IPR or the transformation of ideas and concepts in marketable product or service

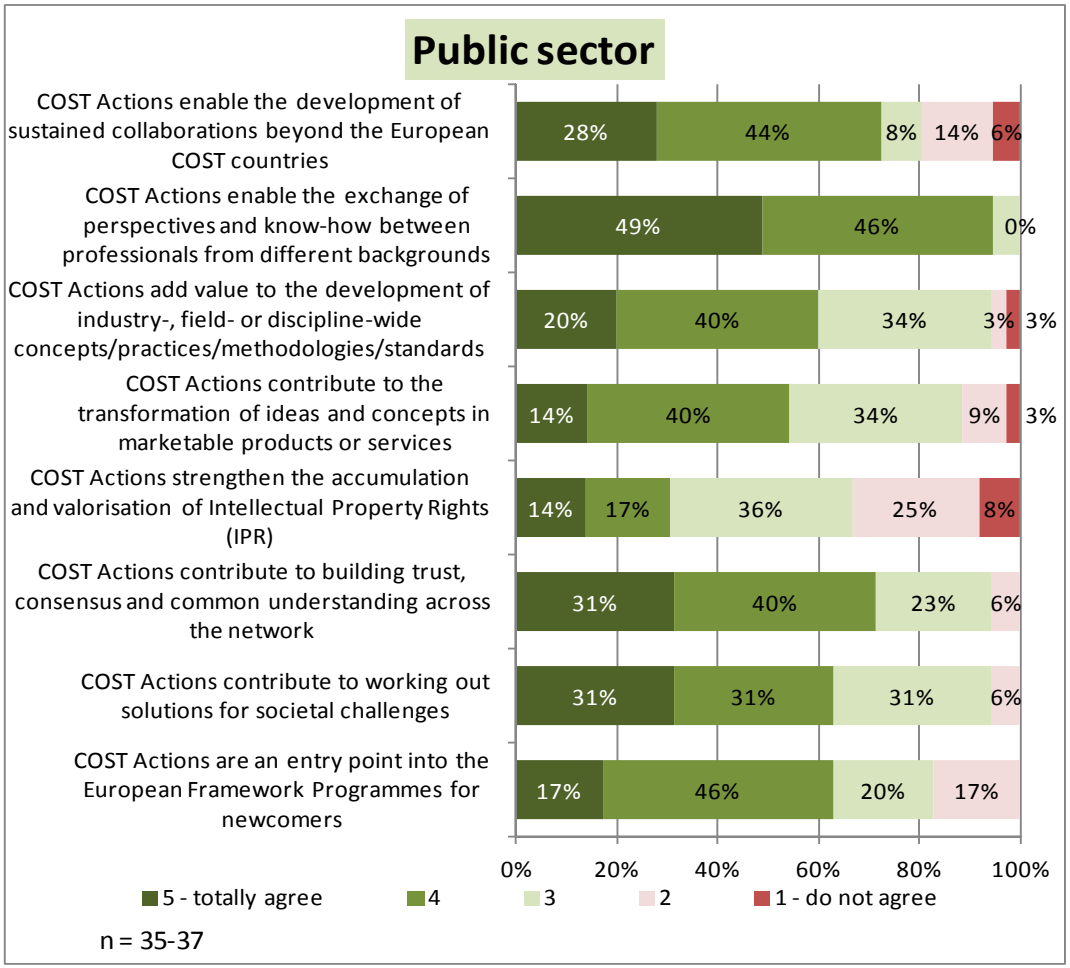
innovation find even less support among industrial partners. These seem to be overambitious and unrealistic expectations. There is no indication that industrial partners assessed this item differently than other respondents.

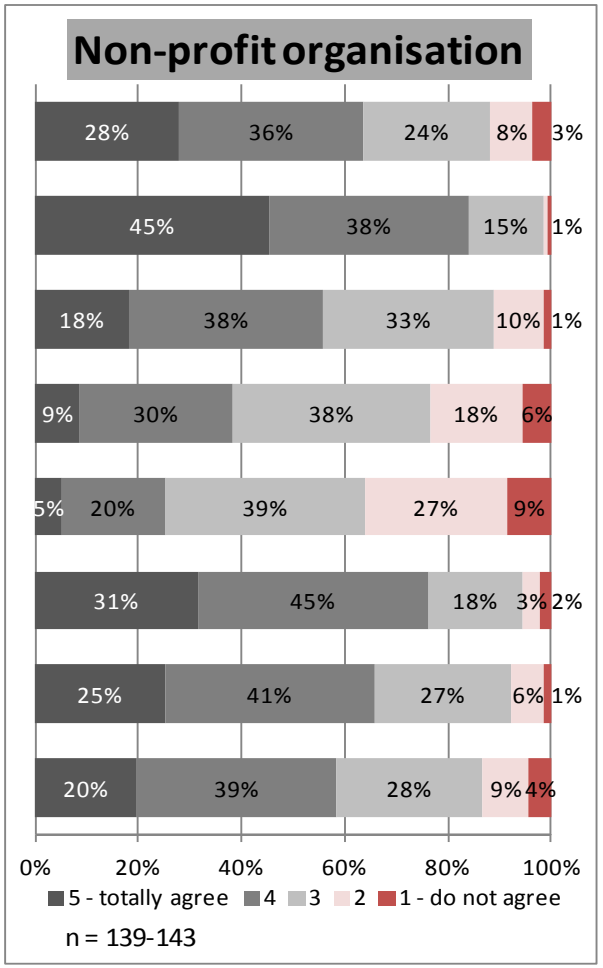
The small group of **public sector** representatives assess the statements very positively. Compared to the general findings, support was higher for almost all statements, with the exception of the statement "COST Actions contribute to building trust, consensus and common understanding across the network", where support was slightly lower. The highest support among respondents from the public sector was for the statement "COST Actions enable the exchange of perspectives and know-how between professionals from different backgrounds", with 95% of respondents who either fully agreed or rather agreed; no respondent disagreed with this statement.

Researchers and scientists also assess the statements about COST Actions slightly better on average. 35% agree with the statement "COST Actions strengthen the accumulation and valorisation of Intellectual Property Rights (IPR)", the highest support for this among all the employment groups.

Figure 41-44: Conclusion statements by employment status




Public sector
COST Actions enable the development of sustained collaborations beyond the European COST countries
28% 44% 8% 14% 6%
COST Actions enable the exchange of perspectives and know-how between professionals from different backgrounds
49% 46% 0%
COST Actions add value to the development of industry-, field- or discipline-wide concepts/practices/methodologies/standards
20% 40% 34% 3% 3%
COST Actions contribute to the transformation of ideas and concepts in marketable products or services
14% 40% 34% 9% 3%
COST Actions strengthen the accumulation and valorisation of Intellectual Property Rights (IPR)
14% 17% 36% 25% 8%
COST Actions contribute to building trust, consensus and common understanding across the network
31% 40% 23% 6%
COST Actions contribute to working out solutions for societal challenges
31% 31% 31% 6%
COST Actions are an entry point into the European Framework Programmes for newcomers
17% 46% 20% 17%
0% 20% 40% 60% 80% 100%
5 - totally agree 4 3 2 1 - do not agree
n = 35-37


Non-profit organisation
28% 36% 24% 8% 3%
45% 38% 15% 1%
18% 38% 33% 10% 1%
9% 30% 38% 18% 6%
5% 20% 39% 27% 9%
31% 45% 18% 3% 2%
25% 41% 27% 6% 1%
20% 39% 28% 9% 4%
0% 20% 40% 60% 80% 100%
5 - totally agree 4 3 2 1 - do not agree
n = 139-143

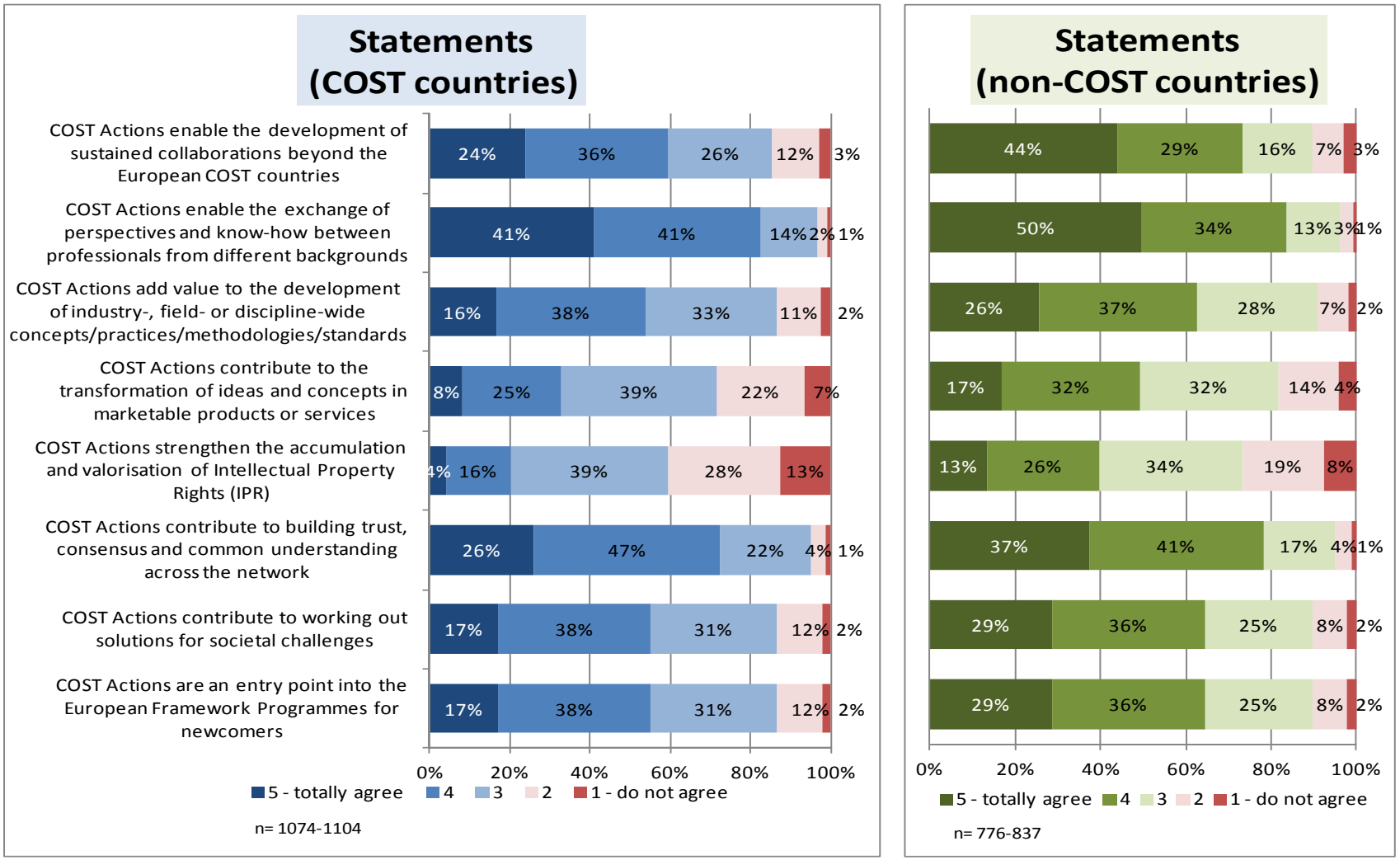
.

The assessment of statements by respondents from **non-profit organisations** corresponds to the general findings. Nevertheless, compared to other employment groups, non-profit organisation representatives give the highest support to the statement "COST Actions contribute to working out solutions for societal challenges". Two thirds of this group of respondents agree with that statement, mirroring the important perceived achievement of participating in COST Actions for non-profit organisations.

2.13.3 Findings differentiated by COST/NON-COST countries

1104 out of 1941 respondents stem from COST countries, 837 from non-COST countries. Respondents from non-COST countries rate almost all the statements higher than those from COST countries, especially "COST Actions enable the development of sustained collaborations beyond the European COST countries". This reflects the main motivation for participation – networking with European researchers – of respondents from these countries. Ratings of the statements "COST Actions contribute to the transformation of ideas and concepts in marketable products or services" and "COST Actions strengthen the accumulation and valorisation of Intellectual Property Rights (IPR)" are also significantly higher. The higher support for these two statements could be explained by the higher share of researchers and scientists among participants from non-COST countries. As shown above, researchers and scientists rate these statements higher than industrial partners that mostly come from COST countries.

Figure 45-46: Conclusion statements by region



3 Findings of the in-depth qualitative case studies of industrial and international participation

3.1 Introduction to the case studies

In parallel, a qualitative case study analysis was carried out by the project team from May to August 2016 as part of the targeted impact assessment for the COST Association. Their aim was to investigate the participation of non-academic partners and partners from non-COST countries in COST Actions in order to: 1) gain a thorough understanding of the nature and impact of their participation in COST Actions, and 2) to identify crucial factors influencing the participation of these two groups in order to increase both the frequency and effectiveness of their participation in COST Actions.

Altogether, 12 Actions were investigated. These Actions were identified by the COST Association staff based on their perceived success. The idea was to learn from those Actions which were able to produce interesting results and fulfil COST's mission. Document analysis and 4-6 semi-structured interviews were conducted for each Action, which provide in-depth insights into highly diverse COST Actions. The statements here therefore reflect the opinions of the interview partners from the 12 COST Actions analysed. In the rest of the chapter, we present our findings regarding the nature and impact of industrial and international participation, or, in other words, the impact and contributions of partners from industry and non-COST countries on a **case-by-case** basis for these 12 Actions. More detailed, first-hand interview results of these 12 Actions can be found in the annex.

3.2 General remarks on the 12 Actions

The 12 COST Actions are highly diverse with respect to topic, aim, research environment, as well as motivation of initiators and members. These factors strongly influence the organisational set-up, formats and group dynamics in each Action and render the nature and impact of non-academic and international participation very specific.

Despite all the observable differences between these cases, there was an identifiable core group in each Action. This normally includes the chair, who was the key person of the whole Action in all cases, especially during the first phases of preparing a COST proposal and building up the network. In most cases, the vice chair also had important functions, and often worked closely with the chair, sharing responsibilities from the beginning. In many cases, the working group leaders were very dedicated and therefore of considerable importance. A few other members of the Action often belonged to the core group, too. In most cases, these were Management Committee (MC) members. However, not every MC member was very active in his/her Action, since MC members are nominated by COST

National Contact Points (CNC) and cannot be chosen by the network itself - a point some criticised in the interviews.

The core group usually consisted of well-established academics. In almost all cases, the chairs and vice-chairs were well-known university professors from the EU. Most of them had already had (considerable) experiences with COST before taking their (vice-) chairmanships. Most chair persons were very aware of how to manage their Actions efficiently and effectively. This included how to attract important non-academic partners, promote Actions to stakeholders outside academia, facilitate communication, and motivate the members within their Actions and finally, how to help integrate new partners into their Actions. It seems that the 12 interviewed chairs are convinced about the benefits of networking with non-academic and non-COST partners.

3.3 The nature, impact and contributions of non-academic and non-COST participants

Case Study "CM1106 – Chemical Approaches to Targeting Drug Resistance in Cancer Stem Cells (StemChem)"

Industrial partners contributed to this Action in several aspects. Firstly, they made major contributions to the knowledge of this subject and supported the evolution of the subject. Secondly, they shared their knowledge and suggested issues that should be followed up. Thirdly, they provided new perspectives for this Action. According to the chair, the participation of the spin-offs is important. They made their results available to this Action. They disseminated this Action by organising different meetings. They are also involved in an application for H2020. To one Working Group leader, at least 30% of this Action's success was due to industrial participation.

As a clinician, the vice chair also provided valuable input such as data from clinician tests of drug effectiveness, sampling etc. for this Action. She could also offer the practical experiences of working with patients. And due to her mixed background of research and practice, her comments or questions were very useful for the research projects, especially for basic researchers.

Contributions from non-COST partners were relatively rare. However, the participant from Lebanon was involved in one task regarding "testing of compound", which is a very valuable research activity. Of course, he also gained knowledge from this Action.

All of the interviewees agreed that a high level of collaboration has been established and that many members will try to cooperate again in the future. The collaboration is not only between researchers, but also between academia and industry. For instance, some researchers are continuing to cooperate with the companies from Barcelona and Bratislava.

Moreover, some of the participants have started their own companies, mainly due to networking in this Action. According to one interviewee, at least 5-7 spin-offs have been founded in this context.

Interviewees indicated two ways to promote sustainability: The first one is a joint, follow-up project, which could be funded. This could be a smaller cooperation with fewer partners e.g. 2-3 countries and could be conducted under other funding schemes. Applications for H2020 funding are very competitive, but the members have already submitted several applications for H2020. The second possibility is to sign a bilateral agreement on a national basis. Triggered by this Action, Slovenia and Argentina have already begun bilateral cooperation.

Case Study "CM1404 - Chemistry of Smart Energy Carriers and Technologies (SMARTCATS)"

As this Action only started one year ago, not much can be reported about its impact or contributions. Most members hope for collaborations, e.g. to develop new products or for co-authorships. In general, the contribution of industry is to give direction and indications of how to proceed, it can offer insights into real-life applications, and give validation and feedback on the work of academia. For example, industry can test theoretical developments, optimize them and promote cost-effectiveness. On top of that, it provides the possibility for STSM positions. One academic interviewee complained that industry does not contribute any financial support.

The SMEs are usually spin-offs from universities or start-ups initiated by academics. These participants contribute – in contrast to large company representatives - new ideas and strategies, innovative approaches and are thus attractive as collaboration partners for applied science. Interviewees assessed them as extremely valuable for further developments in this research area. Other kinds of mutual exchange are also planned: one SME wants to provide software for academia.

With regard to NNCs, the chair is very interested in collaboration as this research topic has global implications. Their hypothetical contribution is also the hidden human potential ("although there is more to gain for them than for us"). The contribution of IPCs is basically their knowledge. An interview partner said that their input once triggered discussion of a key topic, which led to an external working group.

Case Study "FA1402 - Improving Allergy Risk Assessment Strategy for new food proteins (IMPARAS)"

The role of industry in this COST Action is to bring academia down to earth and consider the needs of end-users (i.e. cheap and applicable solutions, scientifically sound guidelines).

Industry has shared information among the members in a collaborative way. In addition, industry has access to decision-making at policy level through industry consortiums like ILSI and EuropaBio, which then interact with EFSA. (Awareness of this COST Action in industry was successfully raised by involvement in these consortia.) Industry representatives also helped to disseminate general information to EFSA as some are members of their expert groups.

Members from academia consider industry to be important primarily as a partner for research projects (mainly in cases where industry participation is obligatory). The COST Action works as a "contact exchange" in this respect. One academic member stated that she had not written a proposal without COST and is confident that the emerging academia-industry network is sustainable. This academic member also emphasized that the heterogeneous members provide the levers for change as a platform. The diverse key players act as catalysts for research and policy-making.

In this Action, the contribution of non-COST countries is limited to IPCs since these countries have gained experience in the application and development of such guidelines and can report on best practices.

Case Study "FP1204 – Green Infrastructure approach: linking environmental with social aspects in studying and managing urban forests (GreenInUrbs)"

In this Action, the international perspectives are essential and international examples are used as valuable input. American partners such as the US and Canada are very important, because they have been working on this topic and developing the concept since the last decade. This is why both these countries are members of the advisory board. Consequently, the limitations on international partners are counter-productive. Armenia's contribution includes the translation of Russian papers into English and bringing scientific Russian knowledge to Europe. Armenian participants also conducted a pan-European sampling project, in which tree leaves were collected from 40 European countries and a pollution-related analysis made. This was viewed as a very innovative approach.

Non-academics contributed know-how in content and organisation. This input enriched the discussion of the research topics with practical orientation. For instance, non-academics selected the cities for the evaluation of urban green capital. They also provided good cases and good networking with practitioners and translated academic language into 'everyday language'. Last, but not least, they organised a training school with practice orientation.

New funding plays an essential role for the sustainability of the collaboration, although the chair believes the partnership will extend beyond this Action. However, this Action has a good chance of maintaining further collaboration due to the "European Forum on Ur-

ban Forestry" (EFUF). Therefore, it is very useful to connect with a successful network. For Armenia, work triggered by the COST Action is in progress on two bilateral agreements with Italy and Belgium.

The meeting in Turin was viewed by most of the interviewees as very successful. This meeting has significant high-level policy-maker involvement, e.g. the deputy mayor of Paris. A group of very senior persons with budget control participated in the meeting such as the chief of planning from Helsinki and a globally active private water company for green infrastructure etc. The chair invited und convinced these people to come. Another very successful result is that the chair received an invitation from the European Commission, DG Research and Innovation, together with the leaders of other projects funded by the DG. In his opinion, this is a sign that DG Research and Innovation might have recognised the usefulness of COST Actions for the Commission's future activities.

Case Study "IC1004 - Cooperative Radio Communications for Green Smart Environments"

The COST Actions on radio communication have become a major player in the development of radio communication models and standards, serving as an important platform for the exchange of research results between academics and industrial partners alike. On top of the issues already mentioned regarding (pre)-standard-setting, access to cutting-edge research et cetera, they are valued highly by firms that only have smaller radio communication teams. Examples include BMW and Volvo, where radio communication plays an important role, e.g. for car-to-car communication. These companies can get access to fresh material and work through the COST Action. Also lab equipment manufacturers such as National Instruments are testing systems and in turn obtain proceedings of testing devices from standardisation groups.

A major success story of IC1004 was the White Paper on "Radio Channel Modelling in Millimetre Waves", which came out a year after the end of IC1004, but which was written by scientists involved in IC1004 and based upon the work presented and discussed there. The White Paper presented a model, which has since become a milestone in millimetre wave research (and which will form the basis for the 5G radio communication technologies expected to dominate the international markets in the 2020s).

Case Study "MP1206 - Electrospun nano-fibres for bio inspired composite materials and innovative industrial applications"

International integration is well-balanced whereas industrial participation is assessed as low and rather passive (besides the two companies). From the perspective of the COST members, industry can make a major contribution as a partner in research projects with

compulsory industrial participation. (According to the interview partner, several joint tenders have been submitted, but none has been successful so far.)

The IPC partners are invited as individual experts, who contribute by disseminating their further advanced research among the European scientific community. It is noteworthy that sustainable ties have emerged from this (e.g. one IPC partnered ElMarco and Nafigate Corporation by supporting their expanded product portfolio as well as their global market penetration). In contrast, NNC's contribution (as the 'recipients' of scientific knowledge) is smaller (and generally scarce due to weak ties with NNCs in this research field). COST Action members believe it is worth integrating NNCs and that they have great potential for this research field as it also bears great potential for this research field as Early Career Investigators from NNCs show excellent scientific capacities.

According to the chair, the impact of international and industrial integration is difficult to assess at present. He stated that the qualitative approach is the most promising one to understand Cause-and-effect relations (noting that such impact may materialise only decades after the COST Action has ended). According to him, these events and exchanges shape the ECI's scientific interests and networks which will very likely create impact in the future research field.

Case Study "MP1404 – Simulation and pharmaceutical technologies for advanced patient-tailored inhaled medicines (SimInhale)"

The goals of "SimInhale" are closely linked to developing useful new products/ new therapies etc. It is vital to cooperate and exchange information with industry. Through these exchanges, scientists were able to profit from the "question-driven" attitude of industrial partners and discover whether or not their research can be used practically or further developed. The scientists were also able to use this kind of feedback/influence to streamline the activities here. One particularly valuable contribution of the industrial partners in this Action is providing practise-based data that academia does not have. Here, the industrial partners provided data for simulation activities. The simulation results then served as a basis for a common understanding, which in turn is used as the first step for further discussions about more practical issues.

International involvement is particularly important in this area because it is not possible to find the necessary expertise in all the fields only within Europe. Experts outside Europe are essential. It is not easy to get these international experts involved, but the efforts should be put in this aspect by all means.

There will be very heterogeneous outcomes and impacts for different participants on an individual or organisational level. The first outcomes have been generated already: the first publication, bilateral agreements, submission of promising new projects to H2020 pro-

grammes, search for possible new European Grants such as Marie Curie exchanges. Summer schools and STSMs are trying to bring young talents together for further exchanges etc. Although it is too early to predict the specific contributions of this Action, the chair expects a high technological impact. To put it simply, the Action is trying to deliver a new product concept to people with asthma or other respiratory illnesses. This would have a large impact on industry and society.

Case Study "TD1006 - European Network on Robotics for NeuroRehabilitation"

The most notable positive result of the Action according to most interview partners were at intensive interdisciplinary exchange between practitioners, researchers and technology developers, the common understanding of technological solutions and the overcoming of cultural differences between disciplines and fields were the biggest positive result of the Action according to most interview partners. Practitioners learned more about technological solutions whereas and industry partners learned how to better tailor technical solutions to clinical problems.

Representatives from all four Action working groups noted that the assessment of new technologies is the focal point for further research. As a consequence, new research projects were initiated, including new EU funding for these research projects. COST was therefore an important step in the preparation of future research projects and research questions. Concerted research proposals were a visible result of this exchange (especially within ICT calls on Robotics, Marie-Curie Programme, etc.). A further strong point was that the Action was quite successful in providing support to young, female engineers in a very male dominated discipline.

For industry partners in particular, a positive impact of participation was to find new potential clients for their products. The definition and implementation of standards has not yet been achieved, because the definition of standards is usually the very last point after all the research and tests have been done. However, a clear result was the definition and publication of new guidelines. The main impact of integrating industry partners was that all the participants were able to catch up with cutting-edge technological developments. In addition, close connections have been established with IISART, an industrially led network dedicated to advancing and promoting modern healthcare technologies in rehabilitation. Participants also connected with another network (ICRA), which has now become the repository for all the documentation and guidelines. As a consequence, the COST Action has triggered a sustainable academic and industrial network.

The networks that were created and enhanced still exist, even after the end of the Action. However, the intensive dynamism of cooperation has clearly declined. According to some interview partners, it is difficult to maintain this kind of cooperation and exchange outside

the COST framework. The bigger and more heterogeneous the group, the more difficult it is to establish stable and long-term networks.

Case Study "TD1007 - Bimodal PET-MRI molecular imaging technologies and applications for in vivo monitoring of disease and biological processes"

In this COST Action, interview partners generally differentiate two types of industry participants: large companies and SMEs. Large companies are viewed as difficult to approach and driven by IPR issues when it comes to cooperation, so that academic participants do not see many benefits of their involvement. They perceive industry as a passive – partially even an unpleasant - onlooker. In contrast, SMEs are regarded as quite valuable partners as they are more likely to cooperate and be engines of innovation.

All in all, industry's contribution is assessed as rather low. Sustainable new collaborations between industry and academia will probably not emerge. However, some interview partners believe there are as yet unrevealed potentials in regard to research collaborations and possibilities for private funding.

Apart from that, STSMs in companies were assessed extremely positively and considered to be the driver of academic spin-offs.

There are different opinions on the hypothetical contribution of IPCs: they are partly regarded as unnecessary since Europe is the forerunner in this scientific realm. Yet, synergies are expected, in particular with Asian countries.

Case Study "TD1104 - European network for development of electroporation-based technologies and treatments (EP4Bio2Med)"

So far, research on electroporation has been funded by companies and national agencies, but there have not been any international activities. However, the number of researchers working on the topic worldwide is rather small, so an international network was needed in order to generate the required critical mass. In the view of one interview partner, the COST Action de facto mobilised the entire community in this field. The partners from Virginia Tech (Norfolk, US) are the organisers of the first world congress on electroporation. Now, after the end of the COST Action, the organisers want to establish a society that could take over the organisation of the conference.

STSMs played a decisive role in building a critical mass, and in particular in integrating non-COST countries. Similarly, the schools helped to transfer knowledge between application areas. Now, even though the Action is complete, a fourth school is planned in Vienna, and there is the hope that the network will be able to run these schools in the future on a self-sustaining basis (without COST support). Also, some STSMs will continue without COST support, e.g. between Algeria and Portugal.

Industry has made important contributions by "attending and presenting": giving information and insights into specific technologies and applications, as well as providing knowledge on the differences between lab equipment and industrial-scale equipment. Both interview partners from industry reported follow-up activities with academic partners, either bilateral or in a H2020-consortium. In terms of outcomes, good journal articles are also important for industry to demonstrate the high scientific standard to their customers.

According to the interview partner from Algeria, the COST Action has had a strong impact on his university, as it now has a group of people working on electroporation.

Case Study "TU1101 - Towards safer bicycling through optimization of bicycle helmets and usage"

All four working groups of the COST Action have produced results. Both the partner from Australia and the non-academic partners made relevant contributions to these results. Some results have the potential to have further impacts on bicycle helmet production or infrastructure for cyclists:

- The accident database from Australia was a very relevant contribution for working group 1 to validate European data and to draw conclusions on helmet optimisation and recommendations for helmet usage. Moreover, data from a survey among Australian cyclists served as starting point for a further survey prepared and run by working group 2.
- Industry participation was important for working groups 3 and 4. Both have produced results that could help to define new standards. So far, for example, bicycle helmet standards focus on protection issues, but not yet on thermal characteristics. "In working group 4, we came up with a way of how to make information about ventilation available to customers," it was explained.

All the interview partners extended their networks due to this COST Action. For example, the COST Action network quickly linked up with a group from TNO and TU Delft that organise the annual conference on bicycle safety. The COST people are now active co-organisers and contributors to this conference every year.

The interview partners reported at least about five joint proposals as a result of this COST Action. Three of them have been successful (two Marie Curie grants and one H2020 project).

Case Study "TU1103 - Operation and safety of tramways in interaction with public space"

The interviewees from academia said that the most important contributions from non-academics were experience and data. This viewpoint was echoed by most interviewees working in non-academic environments. One interview partner working in a non-academic setting stated that non-academics had also contributed to the practical nature of the Action, ensuring it had its "feet staying on the ground", as he put it.

One issue appreciated by a number of interview partners was that the network was new, and the topic important but so far underexplored. Non-academics and academics were both represented in different functions, with non-academics leading the Action. Both were part of the core group and both produced reports, papers et cetera. One academic interview partner pointed out that the academic dissemination was mainly carried out by participants in a university setting.

One important impact of the Action that was mentioned repeatedly was the awareness raised by the Action for the practices and philosophies of light-rail transport planning and operation in other countries.

The participants, academics and non-academics alike, greatly expanded their personal networks as a result of the Action. The network is still active, mainly through email exchanges. Dissemination efforts are still ongoing, with a meeting planned and participants paying their own expenses to attend an international transport conference.

4 Conclusion

4.1 Synthesised findings from the online survey and case studies

In this section, we will highlight our findings from the analysis of the online survey and case studies in the following aspects: network building in COST Actions, motivations of non-academic and non-COST partners and essential added values which COST provides.

An important finding of the study is that COST Actions are highly diverse with respect to topic, aim, research environment as well as motivation of initiators and members. These factors strongly influence the organisational set-up, formats and group dynamics in each Action and render the very specific nature and impact of non-academic and international participation.

In our sample we had Actions from fields, where research is driven by academia (nano-fibres), by industry (energy carriers) and by other groups (light rail transport). In some of the areas the EU is a dominant region (radio communication), in others, the EU is one actor amongst many (drug design). Some Actions were oriented more towards basic break-through science, although always with an application in mind (food technology), others were very close to societal and global application (urban forestry).

All of the above differences have, amongst other things, an impact on motivations, possibilities and activities of (potential) industry and non-COST country members.

Consequently, this background of - highly productive - diversity of COST Actions should be kept in mind when reading our suggestions in the following sections.

Network building in COST Actions

COST is truly a networking instrument. Our case studies have found that chairs or vice-chairs have played an essential role in building up and enlarging their networks. Based on their reputation and experience in their professional field, their broad contacts with relevant non-academic partners and international partners, or their connection with established networks, they were able to find the suitable members to create their "core group". Furthermore, the core group members can extend the network by using their **personal contacts**. This finding is consistent with the results of the online survey: half the survey respondents learned about COST through invitations from already existing members of COST Actions, who serve as a **bridge** to the COST Actions for the **newcomers**. Other channels seem to play a moderate role in raising awareness about COST.

It is noteworthy that in most cases, the chairs seem to be convinced about the benefits of networking with non-academic and non-COST partners and are therefore prepared to open up and promote their networks with enthusiasm.

Motivations of non-academic and non-COST partners

A large part of non-academic partners in COST Actions come from industry, but there are also partners from other sectors like the public sector or non-profit organisations. Amongst the non-academic partners in the case studies, the motivation for **industrial partners** to become a member of a COST Action is manifold and depends heavily on the research field. A major motivation for both industry and academia to integrate industry is that COST helps to find partners for research projects and proposals (as a "contact exchange"), stay up-to-date with research, exploit new technologies, retrieve first-hand information, and be aware of the key researchers in this field. These results correspond to the results of the online survey: the main motivations are **network-driven** (66%) and **knowledge and information-driven** (65%). However, according to the case study analysis, the differentiated interests between **large companies and** small or medium enterprises **(SMEs)** or start-ups or spin-offs could be identified in some cases: the participation of large companies aims rather at keeping informed about the latest discussion in their business area, while SMEs and start-ups or spin-offs tend to use this platform actively to demonstrate their abilities and ideas, in the hope that they could find potential collaboration partners for their business or career. In fact, in some COST Actions, STSMs provide a great advantage for industry by improving their employees' competences (but not all industry members know about this possibility).

The main motivation of **non-COST partners is network-driven.** Major benefits for them are network building, paving the way for joint research projects as well as exchange possibilities for their PhD students. International Partner Countries **(IPC)** partners' major motivation is to collaborate with world-class researchers in their scientific field. Members of Near Neighbour Countries **(NNC)** seem to be more isolated and are in need of wider research networks, in particular, access to the pan-European research community[1]. COST is today often the first collaborative European scheme for NNC and for some IPC partners, as it was 10-15 years ago for the young EU member states. It is an "**entry point**" to European collaborative research.

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1 NNC refer to Albania, Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Jordan, Lebanon, Libya, Mol-dova, Morocco, the Palestinian Authority, Russia, Syria, Tunisia and Ukraine

IPC refer to Argentina, Australia, Bangladesh, Brazil, Canada, Chile, China, Colombia, COSTa Rica, Hong Kong, India, Indonesia, Iraq, Japan, Republic of Korea, Mauritius, Mexico, Namibia, New Zea-land, Pakistan, Peru, Saudi Arabia, Singapore, South Africa, Sudan, Thailand, United Arab Emirates, United States of America and Uruguay

Essential added value resulting from the unique setup of COST Actions

By synthesising the results of the online survey and 12 case studies, we can find that COST generates a high degree of added value through its bottom-up, flexible and open approach, particularly in the following aspects:

1. *Knowledge network and networking effects:*

   Most of the participants are of the opinion that COST Actions contribute to building **trust, consensus and common understanding** within their network. This is due to the unique organisational setup of COST, which enables interdisciplinary and pan-European or international cooperation. Furthermore, the development of a common understanding is viewed as the foundation for further and more tangible collaboration. In this sense, **COST facilitates and consolidates a specific (scientific) Community** to bridge separate fields of science or to create a stakeholder platform or transnational practice community. For some specific research issues, COST can even mobilise the global research community.

   The informal networking in COST Actions is perceived to have clear **medium- and long-term impacts**. The direct and face-to-face interactions among participants facilitate the exchange of information and the obtainment of useful information. Informal contacts also serve as the main starting point for further collaboration. This is particularly essential in regard to networking among **Early Career Investigators** because they are the main players for joint research projects in the future.

   Moreover, the COST networking facilitates the **diffusion of ideas** over diverse but relevant areas and stakeholders such as industry, policy makers and the general public at national and international level.

   Finally, COST provides the possibility to advance and extend networks and therefore **enables the sustainability of networks** to a certain degree. COST allows researchers to prepare project proposals, either with a focus on EU Framework Programmes or with regard to other funding opportunities such as bilateral programmes. Besides, the connection with other established European or international networks or stakeholders have been strengthened in several Actions.

2. *Capacity building:*

   COST provides an **excellent platform for young talents**. Early Career Investigators have the opportunity to present their PhD theses at workshops of their Actions and receive helpful feedback for further research.

   STSMs (short-term scientific missions) and training schools help to integrate Early Career Investigators into pan-European or international networks. This plat-

form is especially valuable for non-COST partners from Near Neighbour countries **(NNC)** because COST is considered as an **entry point** into European knowledge hubs and the European Framework Programmes for them. Also, non-academic partners, in particular industrial partners, occasionally make use of STSMs to build up special capacities.

3. *Addressing societal challenges:*

   According to findings of the online survey, almost 60% of the respondents agree that COST Actions contribute to developing solutions to societal challenges. Since societal challenges need to be tackled by interdisciplinary or trans-disciplinary co-operation, COST's networking platform provides the highest value in this regard. The analysis of the 12 case studies shows that COST serves as **an incubator of new and sometimes also trans-disciplinary ideas** that can provide potential solutions to societal challenges or can generate meaningful economic and societal impacts, depending of course always on the problem area and disciplinary background of the specific Actions.

   These 12 cases demonstrate that COST networking provides the platform, which facilitates not only pre-competitive cooperation such as developing **common understanding, common concepts and in the case of technically oriented Actions, innovative technologies** but also the framework for market development in the future. **Guidelines and (pre-)standards** or new standards could be exchanged, co-shaped and prepared.

Compared to the previous impact assessment reports such as "COST Comprehensive Impact Assessment" in 2009 and "COST Impact Study and Customer Satisfaction Survey 2014"[2], this targeted impact assessment revealed mainly **why** and **how** non-academic and non-COST partners have been involved in their COST Actions. We have also identified the **outcomes and impacts** in the context of **non-academic and non-COST participation** which were recognised by the investigated participants.

COST's core business such as networking and capacity building, which were also very positively evaluated by the previous impact assessments, remain remarkably attractive and effective for non-academic and non-COST partners in this study. This finding corresponds to the results of the stakeholder and expert interviews at the very beginning of our study. Many experts and stakeholders are convinced that COST could be the entry point to the ERA and COST serves as a bridge to ERA. In this context, the inclusion of non-academic

2 Good, B. et al (2009), COST Comprehensive Impact Assessment, Final report; Jávorka, Z. et al. (2014), COST Impact Study and Customer Satisfaction Survey 2014, Final Report – Impact Assessment.

and non-COST is going beyond COST's already launched inclusiveness policy which suits the "widening participation" goal of H2020. This kind of addition is able to provide structural support to ERA, to extend the European research base and to promote Science and Technology cooperation on a global scale.

The contributions to addressing societal challenges are especially highlighted in this study. Compared to the impact assessment in 2014 the majority of stakeholders stated that their Actions contribute to these areas to a rather moderate extent (p. 61). By contrast, our study demonstrates that the majority of the survey participants agree with COST's contribution in this regard to a high or very high extent. Furthermore, the case studies also showed the potential and possibilities for this kind of contribution. This confirms also the experts' opinion: the major comparative advantage of COST is that (societal-related) topics can be developed at a relatively early stage, when a real community does not really exist. Besides, the importance of including non-academic partners, especially from the area of industry, regulatory agencies etc., lies in that pre-standard setting happens in the COST network. This is a real unique added value which the COST scheme can provide.

4.2 Strengths and weaknesses of non-academic and non-COST participation

According to the 12 case studies, the strengths and weaknesses of non-academic and non-COST participation can be illustrated as follows. Again, it is important to note that these 12 cases are highly diverse. All of them were identified by the COST association as good practice examples for non-academic and non-COST participation. The specificity of the research fields, in particular their basic or application-oriented nature, certainly makes a substantial difference to non-academic and non-COST participation.

4.2.1 Non-academic participation

From the analysis of these 12 Actions, the following types of non-academic partners could be identified: large companies, SMEs, micro enterprises, spin-offs, start-ups and consultant firms coming from industrial sector. Furthermore, amongst the non-academic participants, there was a large variety of actors such as clinicians, policy makers, civil servants, international organisations such as Food and Agricultural Organisation of the United Nations (FAO), regulatory authorities such as European Food Safety Authority (EFSA), industrial consortia such as EuropaBio and users' associations such as the European Cyclists Federation. This demonstrates a high inclusiveness of participation of relevant stakeholders in some COST Actions.

Our interviews with participants of these COST Actions confirmed (again) that differences between academic and non-academic rationales exist. The differences referred mainly to the following aspects: aims (advancing knowledge vs. business profit), orientation (knowl-

edge-oriented vs. application-oriented), preferred formats of communication (presentation at conferences vs. problem-oriented workshops). However, a sizeable number of interview partners were aware of the differences and reflected on them, sometimes self-critically.

Being aware of the differences, many researchers from industry and academia emphasize the need for platforms that help them to learn from each other, to find a common language for and a common understanding of the problems they want to address and to explore topics where they can work together.

Strengths of non-academic participation

The strengths of non-academic participation result principally from the contributions which non-academic partners bring to the respective Actions. As demonstrated in chapter 3, the major contribution of non-academic members to COST Actions is being a partner for research projects (especially when industry participation is obligatory) and bringing in **new perspectives** and **data** for testing research hypotheses and models. It is noteworthy that especially SMEs provide innovative momentum in this respect. This cooperation partly resulted in the development of new products and co-authorships.

In some COST Actions with successful non-academic integration, industry also offers **insights into real-life application**, gives **validation** and **feedback** on the work of academia and **redefines the research questions** or **streamlines the agenda** for further research. Participants from industry partly share data or provide software. Non-academic partners could also **widen the networks** or could provide good networking with other important practioners and therefore extend the potential impacts of their Actions (e.g. urban forestry, robotics). In a few cases, industry has **access to decision-making at policy level** through industry consortia (e.g. food industry).

Furthermore, the non-academic partners could help bridge these two different worlds between research and practice. For example, they provide STSM positions, they organise training schools with practice orientation and they provide examples of good practices. In the Action of "GreenInUrbs", one non-academic partner from a consultancy could help translate the academic language into everyday language for other non-academic stakeholders and undertake the role of knowledge transfer. Several times interviewees pointed out that non-academic partners - which however were not necessarily from industry – were important for the other network partners to "keep their feet on the ground", as one interview partner put it and got to the heart of it.

Weaknesses and concerns of non-academic participation

Industrial partners are very sensitive to business opportunities and adjust their behaviour accordingly. The more research development within an Action is near to market-use, the more Intellectual Property Rights (**IPR)** issues may arise and industrial partners may limit

their involvement resulting in mistrust of non-academic partners. According to the case study analysis, as long as one Action has no or little issue with market competition (e.g. food development), or as long as the exchanges mainly refer to pre-competitive cooperation (e.g. inhaled medicines), the easier it is to cooperate with industrial partners.

IPR issues seemed to turn up more often with large firms than with SMEs. Large firms, especially in contested areas such as the pharmaceutical industry, are acutely aware of competition and perceive cooperation and collaboration often against the background of a possible loss of proprietary information. Several interview partners recommended having regulatory solutions for COST Actions in this regard, however without making specific suggestions for solutions. In general, IPR issues turned up in several interviews, especially in pharmaceutical and (bio-) medical fields.

However, the **attitudes among industrial partners are very heterogeneous**. Driven by different motivations, SMEs are usually more willing to contribute than large firms (e.g. to pharmaceutical research). This was especially seen to be the case with spin-off companies, which were portrayed as often being very forthcoming and innovative. By contrast, large or established companies were rather passive participants in many cases. It was pointed out several times in interviews that industry representatives have only limited interest to belong to the core group of an Action and / or to steer a COST Action. One interview partner said that industry sometimes even becomes a "silent" partner - taking part as an observer and co-sponsoring workshops without even attempting to become a partner in an Action. In some cases, interviewees have the impression that established industrial partners are reluctant to disclose research findings (e.g. two cases in drug development). Interviewees have also pointed out that industrial partners sometimes are less cooperative than academic partners, i.e. more likely to take information than to provide any.

Some interviewees from industry pointed out that they sometimes lack immediate strong incentives to commit their time (and data) to their Actions. One interviewee from the public sector indicated that civil servants have to get permission from their employer i.e. (local) government to take part in the events of an Action. A precondition for permission is that the employer is willing to support this kind of participation.

The **low awareness** of COST for non-academics was mentioned in some of the investigated cases. This is viewed as a main barrier to non-academic participation. Nevertheless, in some research areas which are more directly linked to industrial application, there have already been intensive exchanges between academics and industrial partners such as Actions StemChem and Cooperative Radio Communications for Green Smart Environment. The industrial partners wanted to join these Actions because of their high interest in the cutting-edge research represented by the COST Action network.

Some non-academic partners mentioned that the **dominance of academic partners** is a barrier to their participation. Sometimes, it is difficult or not effective to follow specialised and high-level academic discussions.

Summary

To sum up, despite the previously listed problems between academia and industry and the difficulties to integrate partners with different backgrounds and ways of thinking, many interview partners had no fundamental reservations against (more) industry participation in COST, as long as the differences between nature and setup of problems in different fields are heeded and it is understood that not all fields and problems lend themselves in the same way to the participation of non-academic partners.

4.2.2 Non-COST participation

Many interview partners mentioned that the involvement of non-COST country participants in COST Actions is desirable. With the exception of chair persons, most interviewees were not sure about the definition of Near Neighbour Countries (NNC) and International Partner Countries (IPC). After being made aware of the difference, some interviewees pointed out that there was a higher likelihood that NNC (e.g. countries of Northern Africa) are included in order to foster their linkage with Europe. By contrast, IPC partners (e.g. the United States) more often have the function of providing knowledge, experience and best practices for European research.

Moreover, in many interviews the EU member states, which have joined in the two enlargement rounds in the 2000s, were and are still seen as privileged COST partners[3]. Interviewees pointed out that they are - and also should be - included as often as possible in networks in order to make it possible for them to develop their research, technology and innovation systems further and become more successful in EU framework programmes. **This was considered to be an important function of COST that could not be fulfilled by any other existing funding instrument**.

COST's instruments such as short-term scientific missions **(STSMs) and training schools were seen as especially helpful for the non-COST partners,** because Early Career Investigators can profit enormously through exchange schemes, research stays and workshops. Some interviewees mentioned that they had taken part in COST networks earlier as Early Career Investigators. The experiences they gained from the COST Actions had played

3 They are COST Inclusiveness Target Countries (ITC): Bosnia-Herzegovina, Bulgaria, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Luxembourg, Malta, Montenegro, Poland, Portugal, Romania, Slovenia, Slovakia, the former Yugoslav Republic of Macedonia, Republic of Serbia and Turkey.

an important role in their career and they could furthermore use the possibilities which COST Actions provided.

Contributions of non-COST partners

IPC partners are usually invited as individual experts in order to discuss their advanced research results or good practices with the European scientific community. NNC partners' direct scientific contribution is comparatively smaller. However, many COST members regard their integration as a worthy cause as it bears great **potential with respect to Early Career Investigators with excellent scientific capacities**. In some cases, these young Ph.D. students have indeed contributed a lot to some specific and important research tasks in their Actions (e.g. urban forestry, anti-cancer drug development). In one case, Armenia could build the bridge to Russian scientific knowledge and language and bring it into the European research community.

In the long-run, the non-COST partners could also help European partners to get **access to local markets** (e.g. electroporation-based technologies). Occasionally, chair persons are interested in collaborating with NNCs when their research topic refers to global dimension (e.g. urban forestry, smart energy carriers).

Weaknesses and concerns of non-COST participation

In general, interview partners supported the idea of including non-COST countries. However, they have recognised several **barriers** to this end. One of these was that non-COST country participants were more likely than others to be either passive members of Actions or not to appear at meetings at all due to the **strict regulation** for non-COST partners. This means first of all that partners from international partner countries (e.g. US, Australia) are not eligible for COST funding, which de facto creates a barrier to their presence at COST meetings. There were also a number of issues in the way individual countries or COST Actions handle things, which turn out to be barriers for non-COST participation (both from IPC and NNC). The following examples were mentioned by interviewees:

1. There were difficulties for international participants to receive reimbursement for their travel expenses.
2. The regulation regarding inviting international partners was strict. They could be invited only once per Action.
3. The international partners were not accepted to become an Management Committee (MC) member.
4. The application procedure for membership was time-consuming.
5. All of the COST Actions' events had to be held in COST countries.

Sometimes the communication problems over longer distances and cultural differences were mentioned as well.

Summary

In a nutshell, several interviewees were of the opinion that the involvement of Non-COST countries in the COST scheme was helpful for the success of a number of Actions. In some fields of research, the inclusion of Non-COST country participants was helpful, in others it was indispensable (e.g. drug development). Incidents were pointed out by interview partners in which they had learned from international partners (e.g. food treatment, urban forestry, bicycle helmets).

However, similar to the case of non-academic participation, the low awareness of COST in the international communities was also viewed as a barrier to non-COST participation, especially for NNCs.

4.3 Recommendations

In both the online survey (as open questions) and case study analyses, recommendations for how to improve participation of non-academic and non-COST partners in COST Actions were asked. It is noteworthy that a large number of participants of the online survey used this opportunity to express their satisfaction with the programme. In parallel, in the case study analysis most interview partners appreciated very much that COST provides this kind of platform and pointed to the excellent cost/benefit ratio of the scheme: Well-organised Actions develop a high level of activities and lasting impacts with the small budget at hand. Most importantly, not a single interviewee criticised the general objectives and concept of COST, which is a clear indication of the success of the COST scheme.

Nevertheless, some recommendations can be gathered from these two empirical tasks. In the following, these recommendations are categorised and aggregated into different issues and assigned to non-Cost and non-academic participation where possible.

General recommendations

- **Maintaining the well-organised communication and project management**

Communication in the investigated Actions in general was seen as well-organised. There are a few communication-related elements, which may have contributed to the success of the analysed case studies. Successful Actions share serious communication efforts, which are encouraged and sometimes regulated by chair and vice-chair, but never rest on their shoulders alone and cover more persons than just the core group of an Action. Means of communication always included websites with some open and some restricted access areas, newsletters abridging the results of the latest workshops and e-mail lists, utilised amongst others to prepare meetings. In smaller groups also other forms of online communication such as Skype-meetings were used regularly. Frequently effective communication amongst smaller sub-units, such as working groups was pointed out as critical for the

success of an Action. In general, most chair persons of these 12 Actions were viewed as good project managers. Their leadership qualities and management methods could serve as good practices for other chair persons of COST Actions, since some survey participants suggested the COST Association should provide a coaching service for project management.

- **Dilemma in the context of budget cuts**

An important issue which came up in a number of conversations was that interview partners, amongst them a number of chair persons, thought that until recently, the funding of COST Actions had not been not huge, but adequate to most goals. The success of COST Actions in the opinion of the interviewees was endangered by recent budget cuts, which made it impossible to fund enough meetings to enable effective communication networks on a face-to-face basis. This was seen as crucial for scientific work. This also means that the chair person has less freedom to manage an Action effectively in the future. On this condition, the risk of losing the attractiveness of COST Actions will arise - especially since COST is already heavily oversubscribed and the likelihood of receiving funding from COST has diminished over the last few years.

Recommendations on non-COST and non-academic participation

- **Raising the awareness of COST in non-academic areas and non-COST countries**

Some interview partners saw the communication of the COST Association with different professional communities critically. Whilst the interviewees pointed out how important they thought COST as such was, some also pointed out that if COST wants to open up more to non-academic participants, the communication efforts with international professional communities such as industrial consortia should be strengthened. COST could also make it visible at international conferences with the focus on applied research or on magazines with high professional profile. In order to raise awareness in non-COST countries, COST could improve its communication with national scientific authorities or institutions in these countries. One interviewee from NNC suggested setting up an official National Contact Point in non-COST countries for regular information exchange and information dissemination.

In addition, COST National Coordinators (CNC) should play an active role in disseminating the information about COST. CNC were perceived to be passive players by some interviewees, who in several cases were not very well engaged in inviting participants specifically interested in the topic of the Action. Several times interviewees mentioned that **MC members** from countries, which only recently have become COST member countries, attended meetings irregularly. Interviewees thought that this was linked to the passivity of the COST National Coordinators in these countries. In general, the COST Association should pay more attention to the function of CNCs and find a better way to realize their full potential for each Action.

- **Simplifying the rule for non-academic and non-COST participation**

A different challenge for COST is the internal bureaucratic regime. A number of interview partners were positive about the bureaucratic costs accruing from filing forms, adhering to rules etc. There are, however, some issues which have been pointed out as tedious in a number of interviews.

First and most importantly, the rules for reimbursement were criticised as complicated and sometimes non-sensible (e.g. a flight may be reimbursed; the same trip by car - under certain circumstances - may be not). Rules for grant holders were criticised regarding the strict, complicated and time-consuming budget rules, too. Reimbursement sometimes took a long time, since COST participants had to wait for the refund for several months.

There were a number of issues in the way individual countries or COST Actions handle things, which turn out to be barriers for non-COST participation (both from IPC and NNC). These include difficult or long-lasting application procedures for the acceptance as a member (sometimes taking almost a year until completion, e.g. Argentina), barriers to become MC members or sometimes a limited openness to inviting non-COST partners in Actions. It seems that different policies of COST member countries or of individual COST Actions can have counterproductive effects on international participation. Therefore, the COST Association should take up this issue and find a way to standardize some good practices which assist the openness of the scheme. Several chair persons advocated more flexibility in this regard.

Several examples of international partners in COST Actions (e.g. from US and Australia) clearly showed the difficulties for academics from these countries to fund their participation in COST by their institutional funding. In that respect, IPC partners face similar problems like partners from NNC. Therefore, COST Association could re-think the reimbursement policy for International Partner Countries (IPC), and e.g. consider covering part of the travel costs of IPC partners.

- **Enhancing the sustainability of networks**

The sustainability of networks after the end of the financing by COST was mostly evaluated positively. It was also pointed out that it was possible to receive funding again in cases of a further development and refocusing of the Action in a new proposal. However, several interview partners indicated that it would be helpful to have an additional meeting after the official end of an Action. Whereas in the official final meeting it would make sense to draw together all the participants and discuss the findings of an Action, it might make sense to have an extra meeting half a year after the end of an Action in order to review the achievements through this Action and to debate further plans developed in the meantime. If an Action decides to have such a future- and planning-oriented meetings (to

e.g. write a new COST proposal or plan a further dissemination of the results from the last proposal), they might ask for a small amount of funding from COST for these activities.

Moreover, one chair put forward the importance of a linkage between the COST Association and the Commission (e.g. DG Research and Innovation): if COST was able to demonstrate the linkage between COST Actions (networking) and the follow-up funded H2020 projects, this could motivate scientists to get involved in COST Actions and conduct more application-oriented research.

Recommendations on non-academic integration

- **Clarifying the role of academic and non-academic partners**

It was pointed out that there were a number of misunderstandings between both academic and non-academic partners. A possible solution of the problem is to clarify the role of partners from academia and from industry so that academics do not feel misused as "service providers" for industry and non-academic partners do not have the feeling of not being qualified enough to take part in an Action. One interview partner was speaking of the possibility of "industry delegates" with specific roles, duties and rights.

The COST Association shall therefore ask for each proposal to reflect on the potential role of non-academic participants in the Action. Action proposers must communicate clearly and in detail what the expectations towards non-academics and their contributions are. The COST Association might assist by providing good practice examples and acknowledge the differences among COST Actions e.g. research field, organizational set up, etc.

- **Increasing the share of non-academic participation**

When the topic of an Action is of high societal relevance, the inclusion of practice-partners might be obligatory for the application. Thus, the COST Actions can be used as a platform for exchange about how academics and non-academics might work together effectively towards addressing societal challenges. This might also help in the preparation of joint project proposals under Horizon 2020.

- **Addressing the conflict of interests between knowledge sharing and knowledge protection (the problem of Intellectual Property Rights)**

COST Actions focus on pre-competitive research, and in many Actions, where industry participants, there is a joint interest in an academic exchange and to moving forward basic research in the field. However, in nature, knowledge generation touches also upon industrial applications, which might generate sensitive issues when competitors are involved in an Action. The creation of a special function for participants from industry might contribute to the problem of firms to wanting to keep some knowledge private, which has led to a number of misunderstandings. The representatives of some firms, often in specific eco-

nomic sectors (drug development, biomedicine) chose to contribute only sparingly to Actions. This problem might be solved by the chairs of Actions, who ask for a specific minimum number of contributions per participant, including industry. It might also be solved by creating a deal with industry participants in which companies pay for the status of "industry delegates", which frees them from certain obligations and allows them to nevertheless take part in COST Actions. This solution mainly targets technically oriented Actions.

5 Annex

5.1 12 summary reports

Case Study "CM1106 – Chemical Approaches to Targeting Drug Resistance in Cancer Stem Cells (StemChem)"

Cheng Fan

1. History of Action

The COST Action "StemChem" aims to unite researchers with expertise in rational drug design and medicinal chemistry of synthetic and natural compounds with biomedical investigators dedicated to the understanding the mechanisms governing drug resistance in cancer stem cells. The run-time of this project was 2013-2016. Both non-academics and non-COST members joined this Action. Regarding non-academics, there are one Italian SME and a large company from Switzerland joining at the beginning of the Action. Both are pharmaceutical firms. Later on, some small companies joined the Action, too. They come from e.g. Barcelona, Malaga, Cyprus and Bratislava. Some of them are spin-off companies which stemmed from universities. Regarding international partners, they had participants from Argentina and Lebanon.

This Action is actually an extension of the previous Action "ANGIOKEM (CM 0602)". In the end of CM 0602, 3-4 members discussed about a kind of evolution of this Action. They had achieved already some results and saw the possibility to develop them further. Therefore, most of the interviewees were involved in CM0602, too. The title "StemChem" shows the consequence of the previous Action and demonstrates they aimed to work on anti-cancer drugs.

However, they extended the old network by using different data bases e.g. journal articles and invited a few groups of scientists from many different countries with different back-grounds such as chemistry, biology, medicine, biochemistry etc. The vice chair was invited to join due to her early research in stem cell. Therefore, at the very beginning, more than half of the members were new for the Chair.

All of the interviewees perceive the development of this Action very positive. The project management was conducted very well thanks to a project assistant. All of the meetings, communication and administration were managed very well. The Chair pointed out three issues for the successful dynamic of this Action: a good balance between chemists and biologists, well-organised meetings and the strong involvement of Early Career Investigators. Regarding com-

munication, one interviewee underlines that general meetings provide a big opportunity for interdisciplinary exchange. At this general meeting, all WGs were present (about 60-80 participants). In this way, the biologists and the chemists in this Action could come together for exchange. There were usually some general lectures for all participants. There were also coffee breaks, joint lunches etc. Participants found a good atmosphere to communicate with people spontaneously.

The greatest strength of this Action is enabling interdisciplinary exchange, which is very important for this research topic. Besides, Early Career Investigators could also profit from the STSMs and training schools. However, some members of the MC were nominated by their country and had no real interest in this topic. Consequently, their participation was zero. Some industrial partners were also very passive.

To sum up, all of the interviewees are very satisfied with this Action. A follow-up application for a new Action is already in progress. The potential for further cooperation was exploited during this Action.

2. Motivation and barriers

For the first two relative big companies, they could gain knowledge for their business without contributing much. Besides, they could stay in contact with other research groups.

Spin-off companies were very active in this Action. They tried to present their results to show their abilities and to find out the new contacts for their career or to search for partners to make an application for H2020.

The motivation for non-COST partners was the networking. These countries (Argentina, Lebanon) lack resources to establish networking for scientific research. By using the participation in COST Actions, they could go to international meetings 1-2 times each year.

Barriers are in particular to be found for international partners (e.g. Argentina). The process to accept them as non-Cost partners was very time-consuming. It took one year to complete the bureaucracy. Besides, reimbursement is hardly possible. They had a big desire to participate in workshops, meetings etc., but they could not get permission for financial subsidies. For industrial partners, they could not always join the meetings due to time constraints. The openness of this group is also very diverse. Some partners were reluctant to share anything because of IPR issues.

According to the chair, the industrial partners know about COST Actions in this regard, because chemistry is not far away from practice. There are always contacts between chemists and chemical companies. For example, the spin-off companies in Barcelona have already had collaboration with the University of Barcelona.

3. Impact and contributions

Industrial partners have contributed to this Action in several aspects. Firstly, the evolution of the subject: in these four years, they have learned much about this subject thanks to the industrial partners. Secondly, the industrial partners shared their knowledge and suggested the issues to be followed up. Thirdly, they provided new perspectives for this Action. According to the chair, the participation of the spin-offs is important. They gave their results to this Action. They disseminated this Action by means of organising different meetings. They are also involved in an application for H2020. To one interviewee, at least 30% of the success of this Action resulted from this industrial participation.

As a clinician, the vice chair provided also valuable input for this Action. For example, she could provide data of clinician tests regarding effectiveness of the drugs, sampling etc. for some research projects. She could provide the practical experiences of working with patients. And due to her mixed background of research and practice, her comments or her questions for the research projects especially for basic researchers were very useful.

Contributions from non-COST partners were relatively rare. However, the participant from Lebanon fulfilled the task “testing of compound” which is a very valuable research activity. Of course, he gained also knowledge from this Action.

All of the interviewees agreed that a lot of collaboration has been established and many members will try to cooperate in future. There is not only collaboration between researchers, but also collaboration between academia and industry. For instance, some researchers are continuing to cooperate with the companies from Barcelona and Bratislava. Moreover, some of the participants started their own companies mainly due to networking in this Action. According to one interviewee, at least 5-7 spin-off companies have been founded in this context. There is also a very successful spin-off story regarding a participant from Poland: she did not work very much on this subject, before she took part in this Action. But during this Action, she found cooperation with the partners from Italy and Austria. A few months ago, she started a company on this topic in Warsaw.

Besides, there is a very strong presence of participants from Middle and Eastern Europe in this Action. It is a good thing for them and it is also important for core COST members to integrate them into the European Research community.

Regarding sustainability, some interviewees indicated two ways to maintain sustainability. The first one is to have a follow-up joint project which could be funded. This kind of joint applications could refer to smaller cooperation with less partners e.g. 2-3 countries and could be conducted under other funding schemes. The application for H2020 funding is too competitive to be successful. However, the members made also already several applications for H2020. The second possibility is to sign a bilateral agreement on a national basis. Due to this Action, Slovenia and Argentina have begun their bilateral cooperation.

4. Concerns, recommendations and summary

Involvement of pharmaceutical firms remains a critical point. As soon as the development is near to market-use, their involvement will be problematic. They are very aware of the business opportunities and will adjust their behaviour.

Regarding participation of NNC partners, one interviewee predicts that many participants will come from NNCs and then a big boom will come up suddenly in the aftermath of raised awareness of COST Actions. The COST Association should be well-prepared for this big boom regarding financial issues for the whole COST activities.

In general, the Chair is worried about the reduced financial support. This means that the Chair has less freedom to manage an Action in the future. On the one hand, the budget is shortened; on the other hand, the number of participants should be high enough. Under this condition, there will be a risk to lose the attractiveness of COST Actions.

To sum up, all of the interviewees appreciate that the COST Association provides this kind of platform for networking, knowledge exchange and even building friendships. However, there are still some suggestions. Several of these addressed the promotion of non-COST participation:

- To simplify the bureaucracy
- To enable participation: it is odd that NNC members have no chance to take part in meetings due to lack of financial support.
- To organise COST events outside COST countries: it would be stimulating if they could also organise the events in non-COST countries. By that, more non-COST native Early Career Investigators could join, which could be viewed as a first step for raising awareness.

One suggestion addressed the promotion of industrial participation: a mechanism to protect the IPR of the participants shall be created (for those who have been involved from the very beginning of the process).

Case Study "CM1404 - Chemistry of Smart Energy Carriers and Technologies (SMARTCATS)"

Anja Köngeter

1. History of Action

The objective of this COST Action (running from 2015 to 2019) is to "create a Europe-wide network […] to promote the use of smart energy carriers on a large scale in order to increase fuel flexibility". The Memorandum of Understanding highlights the importance of "[s]trong industrial cooperation" in order to "ensure an intense knowledge transfer between the two sectors with increased benefits for European technological excellence," therefore, the aim is to have a high share of industry members (25%).

The Action currently comprises five working groups and has 78 members. In relative terms, industry participation is very strong with 20 members (of which five participated in STSMs). There are two international members (China, USA; Brazil has not yet been approved, Japan just asked to join). In respect to the strength of collaboration, there have already been some papers commonly published during the first year. One NNC applicant from Georgia was recently approved.

MC Chair and MC Vice Chair both work for partly publically funded research institutes. They formerly participated in another COST Action in which industry only played a minor role and considered that industry shall be involved more intensely in this research field. Therefore, they wanted to transfer the gained momentum of the former COST Action into this new one. Academia shall anticipate the needs of industry and conduct well-suited research that industry can then again adopt and implement. In order to achieve this, chair and vice chair changed the COST Action's subject in a way that it is closer to industry needs. That makes this COST Action an intriguing case with respect to its organisational setup and procedures (details see below). Chair and vice chair consider this Action as a 'test case' for future COST Actions.

The COST Action's scientific field is critical: energy scenarios change fast and are influenced by various factors such as other research fields but also politics. In this context, "fuel flexibility" is a buzz word that characterize the high societal, industrial and political interest. The research area shows application-oriented research topics as well as strong and established collaboration between industry and academia. The European research community is very active, advanced, and industry-driven. Currently, innovations are mainly incremental but the pressure continuously increases for radical innovation - which seems to be an important driver for industrial interest in this COST Action.

The chair describes the initial phase of networking as a big effort but then the members spread the word and further members joined from industry (especially SMEs). In practice, personal networks were decisive. Moreover, the chair of the "Industrial Advisory Committee"[1], a well-known representative of academia and also CEO of an SME, Professor Fabian Mauss, helped to build the network with industry partners, in particular SMEs. He seems to be a 'hybrid network hub' between the worlds of academia and industry.

It is noteworthy that about 25% of STSM exchanges are realized with companies and at least one event per year is managed by industry for industry. Another special organisational feature of this Action is that there is a WG dedicated to "Industrial Application". Nearly all industry members participate in this WG whose task it is to integrate and apply the knowledge of the other WGs. The WG leader is in charge of finding new industry partners and he manages the interaction between academia and industry.

Furthermore, communication is adapted: the chair and the vice-chair attempt to be 'interpreters' between industry and academia: they "translate" through articulation of clear common goals, simplified white papers and establishing clear roles of non-academic and academic participants.

Previous output of industry-academia collaboration are a Marie Curie proposal (rejected), two proposals recently handed in, and two research proposals of which an ERC grant proposal is at the final stage of the evaluation.

2. Motivation and barriers

For industry, COST is a platform for scientific exchange, stay up-to-date with research, retrieve first-hand information, and be aware of the key researchers in this field. In particular, they want to find partners for research projects and proposals. In addition, STSMs provide a great benefit for their employees who improve their competences and bring it back to the company (but not all industry members know about this possibility).

For IPCs, potential collaboration might be the most important motivation. One interviewee thinks that the motivation for the NNCs is to get out of an isolated situation and benefit from the knowledge shared.

All in all, there is little awareness about the opportunities of COST in industry and among potential NNC members. The vice-chair asks COST to publicize COST in these countries by their CNCs more intensely.

1 However, the interviewee from industry has not heard about the 'Industrial Advisory Committee'.

3. Impact and contributions

As this Action has started only one year ago, it is hard to tell about impact and contributions yet. Most members hope for collaborations, e.g. to develop new products or for co-authorships. In general, the contribution of industry is to give direction and indications how to proceed, they offer insights into real-life application, and give validation and feedback on the work of academia. For example, they test theoretical developments, foster optimization and discuss about cost-effectiveness. On top of that, they provide the possibility for STSM positions. One academic interviewee complains that industry does not contribute in terms of financial support.

The SMEs are usually spin-offs from university or start-ups initiated by academics. These participants contribute - opposed to large company representatives - new ideas and strategies, innovative approaches and are, thus, interesting as collaboration partners for applied science. Interviewees assessed them extremely valuable for further developments in this research area. Also other kinds of mutual exchange are planned: one SME wants to provide software for academia.

With regard to NNCs, the chair is very interested in collaboration as this research topic has global indications. Their hypothetical contribution is also the unrevealed human potential ("although there is more to gain for them than for us"). The contribution of IPCs is basically their knowledge. An interview partner told that their input once triggered a discussion on a key topic from which an external working group came up.

4. Concerns, recommendations and summary

From the members' perspective, chair and vice-chair integrate industry partners very well (international members play a minor role in this Action). Also, the interviewee from academia considers the industrial integration as a best practice example. This is due to their effective communication towards these industry members and giving industry a significant 'role'. Key factors of successful industry integration in this Action were the personal motivation of the chair and vice chair, their approach based on active integration and transparent communication, and the interactive formats applied (e.g. needs of companies are presented to the other COST members) in events.

Different views on concerns exist. One interview partner thinks that there are no concerns at all towards industry partners – on contrary: industry is mainly regarded as potential collaboration partner. In this research field, academics are usually not concerned with IPR issues because they are quite used to deal with it professionally. But there are also voices stating that there are some concerns: industry feels that academic problems are too fundamental - and academics find approaches of industry not systematic enough. Also, some members complain

about large companies that are merely passive observers of the COST Action. Additionally, different aims between fundamental research (e.g. excellence in high ranked journal publications) and applied research/industry (e.g. cost-effectiveness) can lead to concerns: academia is afraid that collaboration with industry might distract from their actual aims. One interviewee states that industry shall not get any reimbursement by COST since their companies would pay anyway.

According to the chair persons, the challenge has been to "bring a new soul into this Action" that unifies the application and the fundamental side. In order to strengthen industry-academia collaborations and foster a 'win-win' situation, the interviewees recommend to the decision-makers of COST Actions and the COST Association the following:

- Being aware of different industry needs such as more formalized structures, clear objectives, and more focused working. Then, introduce formats and methods accounting for that. This makes industry members more confident and makes interaction smoother.
- Not to attract as many industry members as possible but give some committed members an active role.
- Offering workshops on "funding opportunities for industrial-scientific collaboration" for academics in order to prevent IPR issues.
- Providing support and motivate for start-ups and spin-offs resulting from COST Actions, either through direct funding or consultation on funding.

Case Study "FA1402 - Improving Allergy Risk Assessment Strategy for new food proteins (ImpARAS)"

Anja Köngeter

1. History of Action

The objective of the COST Action ImpARAS (running from 2014 to 2018) is to build a new multidisciplinary scientific network that shall improve strategies to predict the allergenicity of novel proteins to "face a shortage of protein sources for human consumption in the near future." As stated in the Memorandum of Understanding, the industrial integration is an essential component of this Action that shall "allow the transfer of scientific advances to European food companies to develop safe products" and advise "food safety authorities on better risk assessment strategies."

The COST Action currently comprises four working groups[1], 29 countries have joined so far. Of these, two are Non-COST countries (Albania, USA). The Action furthermore comprises 226 members of academia, industry (in total 19 members), regulatory bodies, and potential implementers.

Characteristic for this research field are strong established ties between industry and academic research as well as basic research with distinct application orientation. (Food) industry is in need of radical innovation, therefore, academic and non-academic partners shall develop scientifically sound and economically applicable guidelines for industry. As a next step, they shall be presented to European policy-makers. Industry will be the implementer of these guidelines and, thus, presses for their fast development. Consequently, the interaction between academia, industry, and government is quite intense in this field.

Industry members are mostly large companies such as Unilever and Nestle. There are also a few SMEs and non-academic research institutes represented. Key members are also the regulatory authority EFSA (European Food Safety Authority; in charge of reviewing the implementation of EC guidelines) and consortia such as EuropaBio and ILSI. They represent the gateway for European decision-making processes. The members of the Action are mainly chosen by the chair.

The genesis of such heterogeneous membership lies in the initial motivation of the chair who works for TNO (non-academic research institute) and the vice-chair, employed by Unilever.

1 Physical/Chemical Properties of Proteins Impacting Allergenicity, In Vitro Methods to Predict Sensitization, In Vivo Methods to Predict Sensitization, Risk Assessment and Dissemination

Both organisations have interest in the further development of this research area. An important objective is to develop guidelines for industry feeling the need of innovative approaches. A subordinate aim is to create momentum by gathering information on the state-of-the-art research, involving new/young scientists, and offering room for cooperation. Chair and vice chair agree on the statement that COST was and is the appropriate instrument to build a research network that can tackle these issues through bringing together actors of academia, industry, and government.

According to the interviewees, the chair holds the Action in life. Only a limited number of members is pro-active (5-10) but a reasonable share of members work on the 'assignments' given by WG leaders. Industry partners are quite active. On average, 60-80 participants attend in a meeting, nearly all industry partners participate[2]. Non-COST countries play a minor role.

As successful example of collaboration, interviewees mentioned a state-of-the-art paper drafted collaboratively by industry (amongst others Nestle, Unilever), academia and TNO as a 'hybrid' research institute. There are furthermore lab-based working groups in which industry and academia cooperate and a first Horizon 2020 proposal has been handed in (not reviewed yet).

2. Motivation and barriers

The motivation of the food industry's 'big players' is to establish appropriate guidelines and tools for screening. Therefore, they are seeking for new research methodologies and strive for (radical) innovation in this research field[3]. SMEs are underrepresented since they do not directly benefit from this research and do not have the resources to occupy important positions in this network like large companies do.

The motivation for Non-COST countries is to learn from each other and to find collaboration opportunities for proposals. With respect to IPC's key note speeches, the chair shows low interest in engaging them in future due to the regulation that only one invitation is reimbursed.

The major barrier for industry is that participation is time-consuming and that there is partially a lack of awareness[4].

3. Impact and contributions

2 However, the perception interviewees varies in this regard.

3 Also stated in the MoU: "From an industry perspective, there is a need for: a) relatively cheap, easy and reliable tools for screening for allergenicity of new or modified food proteins, b) early risk based decision-making during product development; and, c) an improved risk assessment strategy accepted by regulatory authorities."

4 Therefore, the interviewee recommends COST to be more prominent at respective conferences, e.g. through an 'initial support action' to attract industry partners at its beginning.

The role of industry in this COST Action is to bring research "to its feet" and consider the need of end-users (i.e. cheap and applicable solutions, scientifically sound guidelines). Industry has shared much information among the members in a collaborative way. Above this, industry has access to decision-making at policy level through industry consortiums like ILSI and EuropaBio which then again interact with EFSA. (Awareness for this COST Action was moreover successfully raised among industry by involvement in these consortia.) Industry representatives also helped to disseminate general information towards EFSA as some are members of their expert groups.

Members from academia consider industry primarily important as a partner for research projects (mainly in cases where industry participation is obligatory). The COST Action works as a "contact exchange" in this respect. One academic member states that she had not written a proposal without COST and is confident that the emerging academia-industry network is sustainable. This academic member also emphasizes that these heterogeneous members provide the levers for change as a platform. These diverse key players catalyse research and policy-making.

In this Action, the contribution of the Non-COST country USA was very valuable since these it shared experience gained and best practices on application and development of such guidelines.

4. Concerns, recommendations and summary

Industrial participation is essential for this COST Action and has influenced its nature from the beginning whereas impact of international participation is limited to 'good practice' learnings from countries that also work on the implementation of guidelines. At the same time, one interviewee finds the Action euro-centric: more effort could have been undertaken to involve also Non-COST countries as this research topic tackles a global issue.

All in all, there is little direct output of this young Action so far but long-term impact of collaboration between academic and non-academic members is assessed very high by all interview partners, i.e. through communication and networks with policy-makers, creating a common language among academia and industry actors, improved self-confidence of (young) researchers, and emerging informal networks. Above that, this Action bears interesting insights in regards to academia-industry-government interaction as an example of the "Triple Helix" concept[5].

Different voices are heard in regards to concerns. According to the vice chair, information is shared among all members in a collaborative way (there is little reason to hold back information as it does not have a competitive character for industry). Although there seems to be no

5 Cf. http://triplehelix.stanford.edu/3helix_concept

free riders problem at first sight, there seem to be covert concerns: two interviewees told about cases that members seem to be suspicious towards 'the other side': one respondent expects academics to share less information than industry due to publication opportunities; on the other hand, an academic thinks that industry participants miss the understanding for the scarce economic resources and organisational restrictions academic partners have.

The reason for the good integration of industry is not primarily due to the Action's organisational setup, but it seems to mainly result from the established ties and co-operation between the key players in this research field (see description above). In this respect, the motives and the scientific networks of the non-academic chair and vice chair play a crucial role. They influenced the composition of members through their research/business networks and implemented communication channels typical for industry (e.g. LinkedIn). Furthermore, they explained the industrial and academic "roles" very well: future implementers communicate their needs towards academia, in turn, academic research develops these requested methodologies with the help (in terms of knowledge exchange) of industry. Members also appraised the methods used in events such as some kind of 'learning stations'.

All in all, this COST Action is a platform that facilitates communication of intertwined actors originating from different systems. This case adds hypotheses to the research field's conditions resulting in a fertile soil for industry integration. Historically strong and established ties between industry and academia resulted in established social interaction between academic and R&D researchers leading to similar culture and habitus[6], knowing rationales of the counterpart, and experience in joint research projects. Additionally, the research field is in need of the interest of industry sharing a common objective (see above) and regulatory bodies are involved that enable policy-making. In this case, the combination of the need of [radical] innovation combined with [basic] research conducted by academia, and low market competition lead to a 'win-win-win' situation with only minor concerns.

6 According to one interviewee, she could not tell whether a person belongs to academia, industry or a regulatory body because "they are all smart and have the same aims".

Case Study "FP1204 – Green Infrastructure approach: linking environmental with social aspects in studying and managing urban forests (GreenInUrbs)"

Cheng Fan

1. History of Action

The COST Action "GreenInUrbs" aims to increase the understanding on the role of "Urban Forestry" in the context of "Green Infrastructure" in terms of ecosystem services provision. This Action runs from 2013 until 2017. It might be the largest COST Action with 35 (out of 36) COST countries and 300 members involved. Besides, this Action has a very broad international spectrum. There are not only external participants coming from NNC, North Africa, USA and Canada etc., but also international organisations such as UN-Habitat and UNESCO (since 2015). The FAO (Food and Agricultural Organisation of the United Nations) has been involved in the proposal preparation. There are no industrial partners in the sense of "producers" in this Action. There is, however, a strong linkage with the private sector such as companies acting in environmental infrastructure. Besides, the stakeholders, such as administrators or urban managers/urban planners at political level, have been involved increasingly since 2015.

The Chair has long-lasting experience with the COST Association/COST Actions (since 2008). A previous COST Action with regard to urban forest triggered the Chair to initiate this Action, although he was not directly involved in that Action. Based on his knowledge and expertise, he is aware of the high importance of this issue. He and his colleagues made use of the already existing network "European Forum on Urban Forestry" (EFUF), which was built in 1998, and initiated this Action. According to the interviewees, the Chair is a very good "networker". He could find the right persons for respective positions and tasks. For example, one interviewee was invited due to his expertise in the training and consulting sector as well as his career backgrounds in academia, public sector and urban planning. He undertakes the cross-cutting role across all of the WGs and serves as a translator between non-academics and academics. In addition to the old contacts from the EFUF, such as the policy maker from Germany, the Chair invited also the new players into this Action, for example a participant from Armenia. It is obvious that the Chair is also very good at project management: most of the interviewees perceive this Action very well organised with an active programme on a regular basis. According to the Chair, this success is based on the clear definition of the WG and the clear division of work within each WG. By that, the members could dedicate themselves to specific targets in a small team with 6-7 persons. Concerning the communication management, the WG 4 "Integration and Dissemination" has done a good job, despite some recommendation of using more social media (such as facebook and twitter) or more small video conferences to facilitate exchange.

The strength of this Action is undoubtedly its large number of participants coming from diverse professional backgrounds. The wide geographic coverage is essential for their research work. Besides, it provides a high diversity of cultures and approaches which is a meaningful enrichment for all of the participants. However, the non-academics such as policy makers and practitioners acting in green infrastructure are underrepresented - although this issue has a much stronger link with human life and society (as a practice-oriented topic) than scientific analyses. The Chair is very aware of this weakness and put a lot of effort into changing this academic dominance. For example, videos and interactive websites were created for the public and a roadmap will be written for policy makers. The limitation of funding reduces also some potential positive effects. For example, the very good presentations at the congress could not be translated due to lack of funding.

All in all, the interviewees are very satisfied with this Action. Thanks to the connection with the EFUF, the sustainability of the collaboration could be secured and the results of this Action might be followed up in the context of EFUF and influence the direction of urban forestry in Europe. At its final conference in 2017, all of the involved international organisations will be involved too. Although there are some international networks concerning urban forestry , this Action has really involved/connected different communities from scientific, international and political areas. This kind of **inclusiveness** makes this Action unique.

2. Motivation and barriers

Municipal/regional policy makers have a strong interest in the urban environment and how to improve the quality of urban life. Policy makers want to see what the best practices are and how to maximise the economic benefits and minimize the costs in the related urban projects. The interviewee from the political sector emphasizes also the importance of exchanging experience among stakeholders. This kind of exchange could provide new ideas and new perspectives for their job. Besides, she is very willing to give input to this Action due to her expertise in the “Emscher Landschaftspark” in Ruhr area in Germany, especially in the context of a training school.

Private sector/practitioners try to find nation-based solutions in environmental mitigation, climate change, water management etc.. In the USA, cities like Philadelphia and Dallas have invested a huge amount (e.g. Philadelphia 2 billion USD) in green infrastructure. One multinational company that specialises in water control/water resource management has been in touch with this Action due to its high relevance with potential business opportunities. Besides, they have also interest in gaining knowledge from the research for the later application in their business.

International organisations have a possible similar interest to municipal/local policy makers.

Concerning barriers, three issues were raised. The first one is academic dominance and academic language. The academics have their own language. More practice-oriented people in

praxis, in NGO etc. are not familiar with that language. They feel not treated equally (they have to raise their hand and ask for explanation). Therefore, the 'translation skills' are very important for putting forward the Action. The second one is volunteer work and the very limited reimbursement for non-academics. High idealism is required for participants from non-academic area. Especially the time which they put into this Action is financially not compensated. For participants working in the public sector, they usually need a permission to participate, because COST Actions have a strong scientific image and it is not known in general that COST Actions could also generate political effects in the long run. The third one refers to high limitations for international participation. The reimbursement for them is a critical point. Besides, there is no chance to hold an event outside COST countries. It leads to a "one-way" exchange from COST to Non-COST countries in fact.

3. Impact and contributions

In this Action, the international perspectives are very important and necessary because these international examples serve as valuable input. American partners such as USA and Canada are very important, because they have been working on this topic and developing the concept since the last decade. This is the reason why both of these countries belong to members of the advisory board. Consequently, the limitations for international partners are counter-productive. Regarding the participation of Armenia, the contribution refers to the translation of Russian papers into English and bring Russian scientific knowledge to Europe. Armenian participants conducted also the task of a pan-European sampling project, in which tree leafs from 40 European countries were collected and then the pollution-related analysis was made. This approach was viewed as a very innovative approach.

Non-academics have contributed their knowhow in content and organisation. This input stimulated the discussion about the topics of research with practical orientation. For instance, the selection of cities for evaluation of urban green capital was done by non-academics. They provided also good cases and good networking with practitioners and translate academic language into 'everyday language'. Last but not least, they have organised a training school with practice orientation.

Concerning sustainability, new funding plays an essential role for sustainability of the collaboration, although the Chair believes that the partnership would go beyond this Action. However, this Action has a good chance to maintain further collaboration due to the EFUF. Therefore, to plug in or to tap into a good network is very useful. The good relationship of these two networks could be seen in the arrangement of their events: at the final conference of this Action, which takes place in April 2017 and two months before the meeting of EFUF in June, the key note of EFUF will be that this Action is connected with the European network very successfully. For Armenia, two bilateral agreements with Italy and Belgium are work in progress.

The Turin Meeting was viewed by most of the interviewees as very successful. This meeting has a significant high level policy maker involvement, e.g. the deputy mayor from Paris. A

group of very senior people who can control budgets was able to participate in the meeting such as the chief of planning officer from Helsinki and a private water company for green infrastructure which is acting worldwide etc. The Chair invited und convinced these people to come. It shows also the Chair deserves a lot of recognition. Another very successful event is that the Chair was invited by the European Commission, DG Research and Innovation, together with the leaders of other projects funded by the DG. This is a sign that DG Research and Innovation might have realized the usefulness of COST Actions for the Commission's future activities.

4. Concerns, recommendations and summary

Concerns were mentioned in several aspects: firstly, science officers change very often in the COST Association. It is difficult to find an appropriate contact person to consult for administrative aspects. Secondly, if COST wants to go beyond Europe, the limitations for the external partners should be removed. Thirdly, balance between academia and non-academia is not enough. There is a downside of the academic dominance: academics might be good at doing research, but not necessarily at knowledge transfer. Finally, there are very limited funding possibilities for further cooperation after this Action.

The interviewees made suggestions to solve these problems:

- To strengthen the linkage between the COST Association and the Commission (e.g. DG Research and Innovation/H2020): if COST could demonstrate the linkage between COST Actions (networking) and the follow-up funded H2020 projects, this could motivate scientists to get involved in COST Actions and conduct more application-oriented research.
- To increase the participation of non-academics: a certain percentage of practitioners, say 30%, should be obligatory for the application for COST Actions. It could be communicated by the COST Association in official documents. COST could learn from H2020 in this regard.
- To raise awareness: clarification of the role of CNCs and MC members. Until now they are often relatively passive. For example, MC members could report the result of COST Actions at relevant commissions at national level. The CNC could disseminate the information about the COST Association towards important scientific institutions in NNCs. The COST Association could also consider creating a system of coordinators to involve non -academics.
- To improve sustainability: a review/evaluation workshop could be held in the aftermath of an Action to see the achievements through this Action and to think about further cooperation.
- To improve the deliverables: An effective way to disseminate the results is to provide open access to good articles and good practices in everyday language. Books may be considered old-fashioned and expensive in the perspective of non-academics.

- To improve the financial support for non-academics and international partners.
- To simplify the bureaucracy.

Case Study "IC1004 - Cooperative Radio Communications for Green Smart Environments"

Peter Biegelbauer

1. History of Action

The COST Action IC 1004 was active from 2011 to 2015. It dealt with the further development of radio communication systems and networks within the framework of energy efficiency and smart environments. Radio communication networks are highly important for a number of issues, including the development of the upcoming Internet of Things (5G)/Industry 4.0.

The Action had already predecessors for more than two decades, also focusing on radio communication and featuring partially the same researchers. COST Action IC 231 was active in the early 1990s, was succeeded by Action IC 207, which was followed one after the other by IC 259, IC 273, IC 2100, IC 1004 and then (since the year 2016) by CA 15104. This series of Actions was successful for a number of reasons, several of which will be discussed later on.

The chairman of IC 1004 had joined IC 231 as a young scientist, became a member of IC 207 and IC 259, a vice chair of IC 273, the group leader in IC 2100 and, finally, the chair of IC 1004. In the COST Action CA 15104 he serves as vice chair. The vice chair of IC 1004 was the chair of IC 2100 so that in fact a form of rotating leadership structure has established itself in the network, with a form of incoming and outgoing chairs, who already in the years before were working group leaders.

In all these years the different Actions were targeting radio communications, more concretely radio propagation modelling, for the succeeding generations of mobile networking/radio communication technologies. For IC 1004 this e.g. included also medical wireless embodied devices, implemented and circulating in the body.

Action IC 1004 was initiated mainly by three persons, its later chair, the vice chair and a senior researcher from Portugal. Most of the Actions in this series of networks targeting radio communications were quite large and most importantly were growing in complexity and concomitant functional differentiation. IC 1004 featured a number of working groups in which disciplinary working groups and topical working groups were combined. These two forms of working groups have been developed in previous COST Actions of the radio communication network and have been kept because they have proven to be helpful in reducing the complexity of a large number of highly specialised experts from different countries.

Industry participation was high in IC 1004 with about a third of the participating organisations being non-academic and approximately 10% of the organisations coming from non-COST countries.

2. Motivation and barriers

According to the interview partners industry has several main reasons for joining the network: most importantly, industry can gain access to radio propagation models, which are still in the making and at the cutting edge of research. This is highly important, because in the framework of the network research/industry-standards are being set. In the Action IC 231 a standard model was developed for radio channel modelling, which eventually contributed to the international 3GPP group, which is highly important for the development of radio communication.

An interview partner also pointed out that industry does not need a major commitment when joining COST Actions. Industry representatives come as experts presenting their own results and in turn can engage into (pre-)standard-setting work, with this work being often carried forward in EU framework programme projects and finalised in international bodies.

Interestingly, the interviewed person from industry pointed out that he thought that COST Actions are so valuable for industry because firms cannot engage into marketing exercises and no biased work from companies has been allowed until now in the COST networks on radio communication he had been taking part in.

Academics have the motivation to gain access to industry data and an Early Career Investigator emphasised that IC 1004 has been vital for her work because she could develop her personal international networks with the help of the COST Action, present her PhD project and get important feedback. This, incidentally, has been pointed out also by chair and vice-chair of IC 1004, which both have joined earlier COST Actions as PhD students/postdocs in radio communication and profited highly from the experience.

All interview partners thought there are no barriers for firms in COST and also none for non-COST country participants. The interview partner from Motorola however pointed out that in general there is little awareness of COST in industry, despite there being no entry barriers.

3. Impact and contributions

The COST Actions on radio communication have become a major player in the development of radio communication models and standards, serving as an important platform for the exchange of research results between academics and industrial partners alike. On top of the issues already mentioned regarding (pre)-standard-setting, access to cutting-edge research et cetera, they are valued highly by firms that only have smaller teams on radio communication. Examples are BMW and Volvo, where radio communication has an important role e.g. for car to car communication and which can get access to fresh material and work through the COST

Action. Also lab equipment manufacturers such as National Instruments are testing systems and in turn get proceedings of testing devices from standardisation groups.

A major success story of IC 1004 was the White Paper on "Radio Channel Modelling in Millimetre Waves", which came out a year after the end of IC 1004, but which was written by scientists involved in IC 1004 and based upon the work presented and discussed there. The White Paper presented a model, which since then became a milestone in millimetre wave research (which will be the very basis for 5G radio communication technologies expected to dominate the international markets in the 2020s).

4. Concerns, recommendations and summary

The interview partners pointed out that there are major accomplishments of COST Actions, which are not covered by other instruments, such as the integration of Early Career Investigators from universities and companies in international networks as well as the fact that experts volunteer to share ideas, results and information thus creating an atmosphere of co-operation and exchange.

COST Actions moreover create the possibility for small universities, also from peripheral areas, to join international networks and become integrated into European projects, with framework programme projects being a major outcome of COST Actions.

Accordingly the drawbacks of COST Actions have been mostly characterised as minimal and the concomitant recommendations therefore are only a few. In general COST Actions are very specific in their concentration on certain topics and coverage of networks. For the technically oriented Actions the chair of IC 1004 pointed out that it might be possible to integrate industry in different forms in the COST framework, e.g. by providing money and then being granted some rights to have e.g. delegates to Actions. Industry representatives then might be included as "industry delegates" and not national ones. Industry then might reap some benefits, but would be required to contribute: in IC 1004 all COST country participants, including industry, had to contribute a single technical contribution per year in the form of measurements, software, resources, equipment, papers et cetera. Non-COST country participants had to come up with two contributions per year in order to make it less likely that somebody would just join the Action in order to reap benefits, but not contribute to its success.

The funding of IC 1004 was good, but since then funding has decreased seriously because of decisions of the European Commission. For the new Action succeeding IC 1004 this meant that there is not enough money for meetings, causing major problems for the Action.

A COST Action is no legal entity and therefore neither can become part of a standard-setting group such as 3GPP nor of the 5G partnership project of H2020. This should be changed.

The current way of selecting COST Actions does not take into account if an Action has been successful in soliciting the backing of the major representatives of the research field, which however is very important in order to draw the best researchers and also industry.

Bureaucracy in COST in general has been increasing over the last years, seriously hampering the freedom of the chairs, which however is very important for the success of an Action. The E-COST tool has introduced constraints, which have not been part of the Vademecum, the original device to control what the COST Actions are doing.

Case Study "MP1206 - Electrospun nano-fibres for bio inspired composite materials and innovative industrial applications"

Anja Köngeter

1. History of Action

The aim of this application-oriented COST Action (running from 2013 to 2017) is to "form a European multidisciplinary knowledge platform on electrospinning of nano-fibres to facilitate their rapid development and applications". As stated in the Memorandum of Understanding, the international and industrial integration is an integral element of this Action. Its scientific field is characterized by basic research with pronounced application orientation. Many participating researchers are active in application-oriented disciplines. The Action currently comprises five working groups[1], 237 active participants, and 31 projects have been launched in its first year. In comparison, non-academic participation is relatively strong (since COST networks are open), it is difficult to estimate the number of non-academic and international participants). International participation is also relatively strong and was well represented from the beginning.

This COST Action was initiated at a scientific conference during which participants came up with the idea to establish this Action in a newly emerging research field that was a "hot topic" at that time. The overarching aim was to build a research network that had not been established so far. Most of the current COST country members were involved from the beginning (30 of 33), the development of Non-COST country members (13 IPC institutions and 3 NNC partners)[2] was also very dynamic, nearly all institutional members joined within the first two years.

A reason for this rapid growth might be the initial steps taken by the chair who informed potential international and industrial partners of the new COST Action right from the start. He received positive reactions from half of the recipients of which some joined the Action. In the following, industrial and international partners have usually participated due to personal invitations from their scientific networks (of whom most are members, but there are also participants without formal membership). Two companies joined the COST Action right from the outset that are important players in this field (i.e. ELMARCO (CZ); BIOINICIA (ES)). According to

1 Materials, Processes, Biomedical applications, industrial/technical applications, Safety, Health and environmental issues

2 ZA, AU, CA, CN, JP, NZ, PR, SG, AR

the interviewees, International integration is well-balanced whereas industrial participation is assessed as low and rather passive besides the two companies mentioned beforehand.

According to the interview partners, the WG leaders, their members, and in particular the chair hold the Action 'in life'. They succeeded in creating a positive atmosphere in which a European electrospinning community has already emerged. Communication takes place via website and face to face contact during events (interviewees said that the latter is decisive in order to build a sustainable network and identify collaboration partners).

A successful example of industrial integration and subsequent collaboration is an event organised by the company ELMARCO (CZ), in which networks among industry and academia were built. A workshop dedicated to industry partners will take place in June 2016 (it is expected that half of the participants are from industry, in total 30-40.

2. Motivation and barriers

From the perspective of COST members, the benefit for industry is primarily network building and find collaborations for research funds (esp. when industrial participation is needed, e.g. Horizon 2020 programme). Though the industrial respondent confirmed this motivation, he pointed out that a major motivation is to improve business opportunities, i.e. contact to potential customers in order to offer services and devices, exploit new technologies for new products, and understand the current and future needs of potential customers.

An initial obstacle to industry participation is the low awareness of the existence of the COST Action. A barrier arising for the COST Action's industrial members is that the events are too time-consuming especially in respect to traveling time. Generally, there is less interest in the compensation of monetary expenses than in compensation of time. As industry members do usually not read the newsletter due to a lack of time they are not informed about the COST events. Even more, the nature of the events do not fit their interests: in their point of view, conferences with one-directional formats do not provide sufficient kinds of short- and medium-term benefit. All in all, it seems that two 'worlds of rationale', i.e. academia and industry, are put together: both motivation and communication patterns differ significantly, which partly discourages industry partners.

The major benefit for international and remaining non-academic partners is network building paving the way for joint research projects as well as exchange possibilities for PhD students. In this context, arising informal networks are particularly beneficial for academia, e.g. for direct cooperation and communication with partners at eye level. The financial support offered by COST is very meaningful for them and their interest in COST events is strong. Members of NNCs seem to be in need of wider research networks, project partners, and in particular funding opportunities.

A barrier for international participation is the bureaucratic administration for partners from non-COST countries. There are also difficulties to maintain contact to this group since regulations do only allow one invitation per international expert.

3. Impact and contributions

In the perspective of COST members, a major contribution of industry is being a partner for research projects with compulsory industrial participation. (According to the interview partner, a couple of joint tenders has been submitted, however, none has succeeded so far.)

In the following, international participation is presented by a split-up of IPCs and NNCs. The IPC partners are invited as individual experts who contribute by disseminating their further advanced research among the European scientific community. It is noteworthy that sustainable ties have emerged from this (e.g. one IPC partnered with ElMarco and Nafigate Corporation by supporting their product expansion in the range and as well as global market penetration). On the other hand, NNC contribution (as the 'recipients' of scientific knowledge) is rather poor (and generally scarce due to weak ties in NNCs within this research field). COST members regard their integration as a worthy cause but it also bears great potential for this research field as Early Career Investigators from NNCs show excellent scientific capacities.

According to the chair, the impact of international and industrial integration is difficult to assess at this moment. He states that the qualitative approach is most promising to understand cause relations that create impact (noting that impact may materialise only decades after this COST Action has ended). According to him, Early Career Investigators whose scientific interests and networks are shaped by these events and exchanges will very likely create impact in the future research field.

4. Concerns, recommendations and summary

According to the chair and the WG leader, industrial and international participants do not influence the nature of the COST Action, their role rather provides added value. None of the interviewees have concerns towards international or industry participation. However, an interview partner mentioned that academia shall stay in the first place and is therefore asking for not putting too much effort in adapting COST Actions to the needs of these groups.

With respect to international integration, IPC participation well-balanced, whereas NNC participation is poor and shall be fostered (cf. ch. 2, 3). Therefore, the following recommendations for international participation are provided by the interviewees:

- Reduce bureaucratic administration for international participants.
- Provide the opportunity to invite international experts on a regular basis.
- Provide not a yearly but flexible budget for dynamic network building and STSMs.
- Intensify support of young NNC researchers.

The interviewees consider non-academic - in particular industrial - integration important in order to increase the Action's impact through more efficient allocation of resources by enhanced integration of implementers. Nearly all respondents regard this integration as being insufficient in this COST Action[3]. An explanation is the COST Action's nature that does not match the needs of industry partners in various aspects (long-term vs. short-term orientation, way of communication, value of time and money, nature of [real-life and digital] networks, overarching aims and rationales, etc.).[4] If industry participants shall obtain the role of a scientific partner, this role is to be reconsidered, clarified, and institutionally developed in future. Therefore, the following direct and derived recommendations provided by interviewees aim at the role and benefit development for industrial participants as well as the reduction of barriers:

- Provide workshops with industry focus at the beginning and in the end of a COST Action.
- Provide collaborative and solution-oriented workshop formats (preferably offered by industry members as the successful event initiated by the company ELMARCO (CZ)).
- Offer attractive topics for industrial partners at events, e.g. feasibility and economic value of research and applications.
- Involve workshop moderators who facilitate system-specific communication.
- Share knowledge without physical meetings to save travel time (e.g. webinars).
- Provide a digital platform for both companies and researchers to facilitate communication (e.g. via LinkedIn/ResearchGate).
- cooperate with European/international research promotion programme that provide a small-budget start-up financing for COST collaborations between academia and industry in order boost small high-risk research projects (e.g. similar to the Austrian FFG programme with 5000€ funding).

A respondent made interesting suggestions for the role and tasks of industry within the 'COST Action innovation cycle'. Industry is supposed to provide input towards the scientific community (communicating relevant research needs, e.g. within a workshop format with professional moderation), being a scientific sparring and cooperation partner during the runtime of the COST Action (content-wise and optionally as a funding partner), and, when the Action runs out, academia hands back the research results and discusses them with industrial implementers.

3 An interview partner finds the collaboration sufficient between industry and academia outside the COST Action, internal collaboration is therefore redundant.

4 A striking indicator is that some industry partners seem to regard such a platform as a sales market.

Case Study "MP1404 – Simulation and pharmaceutical technologies for advanced patient-tailored inhaled medicines (SimInhale)"

Cheng Fan

1. History of Action

"SimInhale" aims to enhance R&D in the field of inhaled medicines in order to accelerate the development of a new generation of effective and safe medicines. This Action has some special characteristics which must be mentioned: first, this Action is still very young with its beginning in June 2015; and second, this Action is trying to bring together very diverse groups of people with different disciplines and sectors because the problem which this Action addresses is very complex and the relevant knowledge is vertically fragmented and compartmentalized in disciplines. Now there are 100 members distributed in five Working Groups. Many participants joining this Action have never interacted with each other before. Thus, it takes time for the participants to figure out how to work/cooperate with each other. The chair, Prof. Kassinos, specialist in Computational Fluid Particle Dynamics (CFPD), is absolutely the key person for this Action. He is currently involved in three COST Actions and has been involved in COST Actions before. Due to his previous positive experiences with COST, he used his personal contacts to approach the vice chair who has a mixed industrial and academic background as well as members of the core group and then initiated this Action.

Based on the excellent project management, featured by a professional project administrator, the extreme involvement of the chair and very good and motivated core members, this Action has been running very well in its first year. The members have found each other regarding expertise, experiences, motivations etc. Now they have a common understanding and are ready for the further concrete tasks. They have realized also the necessity of industrial participation as they are in need of the data from the clinics and patients for their research activities.

They are also working very hard on raising the visibility of this Action by advertising and marketing in scientific magazines, specific issues on scientific journals, conferences etc. Besides, they make use of linkedIn, facebook, website and flyers to communicate internally within the different Working Groups and externally with the public. All of the interviewees believe they are well on the road towards a positive development. Over the last months, two more companies have joined this Action. As a result, the number of industrial partners has risen from 8 to 10. The chair has been invited to attend the board meeting and to present this Action by a famous international pharmaceutical consortium in the coming month, which makes regulations about scientific issues. So this Action has raised awareness in the industrial arena already.

Regarding international partners, they have external partners from Singapore and the USA till now. According to the vice chair, now the time has come to bring them really into the Action. But the precondition to gain their involvement is to show them something tangible done till now. After that, this Action could raise concrete questions to these external partners such as advice, support etc. Singapore and the USA have excellent reputation in this regard and they should/could do some contributions for certain.

Consequently, for some interviewees it is time for this Action to set up the concrete agenda of Working Groups at the next meeting in August and then they could put their activities further forward. They have already their first publication on the journal to present their Action. This should be followed up by some more events.

2. Motivation and barriers

There are two types of industrial participation in this Action: the first one refers to start-up companies and the second group comprises established companies. For start-up companies, which usually develop devices and new products, the aim is to know the state-of-the-art and the feedback from members of this Action. This means that this Action functions like a scientific advisory board for them and the feedback is very helpful for their business. For the established companies, they want to prove their products because they have very specific or bottleneck questions. Therefore, they decided to join this Action and work with the members to find out how to solve their problems from a scientific view and how to develop new products/new formulations etc. After all, there are experts in all of the relevant areas in this Action. Besides, a member of the core group is working with the European regulatory authority and could also advise the regulatory authority about the guidelines and safety issues, which will be very interesting for industrial partners. According to the chair, 10 companies have been involved till now in this Action, 5-6 want to be involved in research actively and the remaining companies want to be aware of the development.

For industrial partners, the most important issue is to define what "pre-competitive cooperation" in this area is. At this phase, industry is willing to cooperate and publish the results, because this kind of publishing will be beneficial for all. The difficulties for industry are on the one hand to protect its knowledge/expertise, its IP and to keep a competitive advantage, and on the other hand, to open some knowledge, to share information/data it owns. It is not easy to share and protect its knowledge at the same time. Theoretically, it should be advantageous for industry if they are as open as possible. This is the only way to learn more deeply and comprehensively. But it refers to a kind of process of cultural change for industrial partners. One big issue for international participants is that they don't have any representative/observer in the Management Committee. It could produce difficulties if they want to bring this Action to an key international board with very high profile. Besides, the international partners have to pay their own expenses (e.g. some US participants said that they could not receive reimburse-

ment for attending the MC Meetings). For some of them, this is a problem. It would be helpful if there is more flexibility in this regard.

All of the interviewees don't think these two groups are aware of the opportunities COST is providing. They still used their personal and private contacts e.g. by attending conferences to build their network.

3. Impact and contributions

Industry could contribute enormously in this Action/in this field with i.e. feedback and information about the "real" world (industry knows where the question in the praxis is). The goals of "SimInhale" have strong linkages with developing new useful products/ new therapies etc. It is absolutely necessary to exchange with the industry. Through the exchanges, scientists could profit from the "question-driven" attitude of industrial partners and know if their research could be used or developed further or not. And the scientists could use this kind of feedback/influence to streamline the further work in this Action. Of course, the "academia-driven" approach should be considered, too. This means that it should be allowed to do something such as "blue sky" research. One special contribution of industrial partners in this Action is they could provide data in the praxis that academia does not have. In this Action, the industrial partners could provide data for simulation work. The results of simulation could serve as basis for a common understanding which serves as first step for further discussions about more practical issues.

In this area, the international involvement is important in particular because it is not possible to find expertise in all fields in Europe alone. The experts outside Europe are absolutely required. It is not easy to get these international experts involved, but the efforts should be put in this aspect by all means.

There will be very heterogeneous outcomes and impacts for different participants at individual or organisational level. The first outcomes have been generated already: the first publication, bilateral agreements, submission of new promising projects to H2020 programmes, search for possibilities of new European Grants such as Marie Curie exchanges, summer schools and STSMs trying to bring young talents together for further exchanges etc.

Although it is too early to predict special contributions of this Action, the chair is expecting high technological impact. To put it simply, the Action is trying to deliver a new concept of product for people with asthma or other respiratory illnesses. This would be very meaningful for the industry and society.

The way to create sustainability is to mature this Action into another collaboration i.e. trough bilateral cooperation between academia or through the EU funded research programmes. From the industrial side, Joint ventures etc. could be another form for further cooperation. No matter in which form, funding is actually the main issue for sustainability. Therefore, the mu-

tual discussions at the meeting refer often to how to ensure and develop the proposals which could be funded further.

4. Concerns, recommendations and summary

Regarding industrial participation, IPR is really an issue. Some industrial participants are competitors. They try to use disclosure agreements to keep the partner relationship. But in some specific situation, the industrial partners ask for confidentiality agreements. So it is important to find a balance between collaboration and interest conflicts. So maybe a concrete regulatory framework could provide more chances for further and long-term cooperation. Till now, the attitudes among industry partners are very heterogeneous. Some of them are cooperative, others are not very active because they don't have an immediate and strong incentives to give free time and free data for this Action.

Regarding international participants: More participants don't mean higher quality or higher possibility of success. Even a WG Meeting will be more effective and more efficient if the group is not so big. In the end, only the active members will contribute to the discussions. So to target the participants is more important than to increase the number of participants. On the other hand, it is not sure, if the international participants will keep actively involved, because they are just "passive members".

Suggestions for COST regarding raising awareness: in recognition of most interviewees, COST is Europe-oriented. There are administrative barriers for international participants such as complicated procedures for reimbursement. If COST really wants to open up and attract more international participants, COST should adjust the rule for international partners and extend its international exposure such as making campaign/advertising in publications with high profile like "Science" as well as at international large conferences in the USA, Asia, Australia. COST could also contact similar organisations outside Europe. In order to attract industrial participation, COST could disseminate more information about COST to some industrial associations and consortiums to communicate this kind of cooperative platform.

Case Study "TD1006 - European Network on Robotics for Neurorehabilitation"

Hendrik Berghäuser

1. History of Action

The duration of the COST Action "European Network on Robotics for Neurorehabilitation" was from 2011 and 2015. The Action was quite large with participants from 23 countries. It was led by Dr. Thierry Keller from Tecnalia, a private Spanish research organisation focussing inter alia on health and life quality. With 6 industry partners included the Action was very application oriented and had a very close link to technology developers.

The motivation for the COST Action that started in 2010 was the demographic change and the expected ageing of the population that leads to an increasing demand for treatments helping to restore motor function after events like strokes. Robotics is a potential research area to deliver optimized therapy solutions for neurorehabilitation. One advantage of rehabilitation robots is the possibility to assess motor impairments in an objective, accurate, and quantitative way. However, the acceptance of such devices among clinicians is still low. As research in robotics for neurorehabilitation is mainly driven by technological developments in engineering labs there is a high need for exchange with industry partners and technology developers. Industry partners were therefore very actively involved from the very beginning of the Action, and were, together with Dr. Keller, the initiators of the Action proposal.

The main objectives of the Action were to enable the development of innovative, efficient, and patient-tailored robot-assisted therapies for neuromotor recovery, incorporating the latest findings from clinical neurorehabilitation, rehabilitation robotics, computational neuro-science and motor neuroscience, promote the use of rehabilitation robots in clinics and therapy centers, advance research concerning mechanisms and models of motor recovery.

At first, three clusters of participants were integrated into the Action as there were several similar proposals for COST Actions. The proposal on robotics for neurorehabilitation was evaluated the best. The chair of this Action was then asked to integrate the participants of the other initiatives into the Action. As a result, a large and heterogeneous group consisting of clinicians, therapists, neuroscientists and engineers formed the Action. 4 working groups with different thematic foci were set up: (1) clinical application, (2) technology development, (3) motor recovery models, and (4) neurophysiological mechanisms of motor recovery.

Several interview partners described the COST Action as very active and vivid. The core group comprised the chair and vice chair, as well as several industry partners and clinicians. They were very pro-active and dedicated, which led to a high dynamism within the Action. Nine new

multi-national research technology developments and 26 national projects have been started in the first Action year. The Action partners organized 6 joint workshops at international conferences, published 196 articles related to Action topics, out of which 66 as joint publications. Furthermore a training school on emerging technologies for neurorehabilitation was organized with 80 student participants and 15 teachers. Some interview partners, however, also criticized that there were *too* many members within the Action, so that fluctuation was high and a sustainable cooperation in larger groups was more difficult.

2. Motivation and barriers

All interview partners agreed that within this field the integration of industry partners and technology developers is imperative. “We are heavily dependent on technology developers in that field, so we need input from and exchange with industry.” Consequently, it is seen as very important to bring these two groups together in order to facilitate the testing and application of new technologies or technological solutions and the transmission of these new products into the market. Impact for society in general can only be achieved by integrating technology developers, especially in medical fields. Industry partners develop devices that are being applied in clinical rehabilitation. Without integrating industry partners into research and vice versa, lots of inventions and technological solutions will never be tested and applied.

However, a natural barrier exists for the translation of new technological developments into application. One interview partner described industry as very sophisticated and technologically further advanced than the clinics. There is a high number of research industry labs that produce robots and other technological solutions, but most of them never get tested and applied. Very often, practitioners do not have the time to test new technologies. It takes high financial and time efforts. Moreover, many practitioners are rather reluctant when it comes to assess and apply new technologies. One clinician stated that technology developers would often lack the understanding for practical application in neurorehabilitation and for the direct interaction with patients and their needs. As a consequence, the feasibility and integration of new technical components into the clinical application is still very low. “We get many new technological solutions presented, but we don’t know what to do with them.” Several interview partners described this cultural difference between engineers and therapists as the main barrier.

Industry partners and researchers or clinicians have, by nature, very different interests when it comes to research collaborations. Companies want to see clear results fast. They have a huge pressure to go to market and show efficacy very early, which could be also one barrier for open cooperation or long-lasting testing periods. These cultural differences also stem from different financial interests. Companies (mostly) have to invest time and money for cooperating with research. So they have a high interest in getting fast and clear results.

Nevertheless, the need for testing new devices is the most important motivation for technology developers and industry partners in order to assess their developments and to sell it later.

The interviewed industry partner expressed a high motivation for cooperation and for networking within this COST Action as it addressed the core business of the company. They were trying to find applicants and potential clients and wanted to assess their technology. Due to the existing lack of regulation and uniformity in the technology development in that field, companies in general are highly interested in searching exchange and collaborating with researchers and practitioners. The companies therefore try to implement and assess clear, objective criteria in therapies. If standards can be identified and defined, industry partners, by nature, are interested in influencing the definition of these standards.

As a result, both sides – industry partners and practitioners - were very open, interested and willing to cooperate with each other. Besides, rehabilitation industry is still very young and characterised by rather small companies and spin-offs from universities. Most technology developers come from academia and are therefore still closely connected to academia. A strong connection between research and industry partners on the individual level already existed, so it was easy to integrate them into the COST Action. All in all there were about 6 industry partners, most of them world market leaders in a very specific branch and field.

3. Impact and contributions

According to most interview partners, the biggest strength of the Action was the intensive interdisciplinary exchange of practitioners, researchers and technology developers and the common understanding of technological solutions and practical clinical problems. The different groups had not been working together a lot in the past, so the main impact was to overcome *cultural differences* between disciplines and fields. It was important to learn from each other, bringing together new insights, analysing new methods of therapy, assessing new technological solutions, and communicating the basic needs in clinical rehabilitation to industry partners. Practitioners learned more about technological devices and new technological solutions. Furthermore, industry partners learned to better address technical solutions to clinical problems.

According to the chair, this intensive exchange helped defining new aims during the Action. The participants noticed after some time that it was not about new robotic therapies but about the assessment of these new therapies. All four working groups noted that the assessment of new technologies is the focal point for further research. As a consequence, new research projects were initiated, including new EU funding for these research projects. COST was therefore an important step to prepare future research projects and research questions. Concerted research proposals were a visible result of this exchange (especially within ICT-calls on Robotics, Marie-Curie-Programme, etc.). A further strength was that the Action was quite successful in providing support especially to young, female engineers in a highly male dominated discipline. Female participation in activities was very high throughout the whole COST Action.

For industry partners in particular a positive impact of the participation was to find new potential clients for their products. The definition and implementation of standards has not been

achieved especially because the definition of standards is usually the very last point after all tests and research. It takes a very long time for standards to evolve and to diffuse. However, a clear impact was the definition and publication of new guidelines. Guidelines are one important step to defining industry wide standards. The companies further describe the strength of the Action that it addressed a topic that is of great interest to the company. According to them, it was important to create a platform for exchange on this topic, as the Action was a start for further developments and cooperation. It initiated new developments: the companies were able to get in contact with other researchers and prepared new proposals and research questions for further research projects. An important outcome was definitely the "learning" due to an intensive exchange with experts from academia, developers etc. from the same field. The main impact of integrating industry partners was for all participants to catch up with the cutting edge lines of technological developments. Plus there have been made close connections with IISART, an industrially led network dedicated to advance and promote modern healthcare technologies in rehabilitation. Also participants linked up to another network (ICRA), which has now become the repository for all of the documentation and guidelines. As a consequence the COST Action has been inherited by a sustainable academic and industrial network.

The networks that were created and strengthened still exist, even after the Action has ended. However, the intensive dynamism of cooperation clearly declined. According to some interview partners, it is difficult to uphold this kind of cooperation and exchange outside of the COST framework. The bigger and the more heterogeneous the group, the more difficult it is to establish stable and long-term networks.

Another weakness was the short time span and the non-binding character of the Action. It was unlikely that companies were going to get new robotic designs developed, assessed and used within four years. Some interview partners were rather sceptical also about a potential contribution of technology developers to the COST Action. According to them, lots of ideas from industry partners are not realistic and have little chance for clinical application, either because the technology devices are too complicated or the (additional) benefit is too low.

4. Concerns, recommendations and summary

According to several interview partners, COST is an important and well-designed programme to intensify academic and technological exchange between industry partners, researchers or practitioners. The COST Action also helped to broaden the networks and created a framework in which people with different backgrounds meet, come together and learn from each other. For this very complex topic with so many different, regionally dispersed experts, COST was absolutely necessary to form and to intensify a network. This kind of exchange would not have been possible in publicly funded research projects, where usually the same group of researchers write a proposal. As such COST perfectly complements big (EU) research programmes.

Asked about their opinion on further development of the COST programme, several interview partners said that it is important that cooperation initiatives are not too academically oriented. According to them, politics or researchers often define research questions or needs for research in cooperation with industry partners, but industry partners have different interests. There is a tendency too, one interview partner said, that these kinds of research proposals are promising too much and overloaded with political and scientific expectations. Then later, these projects lack results. As a consequence it would be better to first bring Actions together and then define clear and realistic research objectives together. Asked for further improvement, the chair said, it would be simpler if the COST Actions were more decentralized and more output-oriented. If, for example, working groups had an own budget they could better plan activities with industrial partners. This would also help to increase the awareness among industrial partners. One interview partner further suggested coaching and support instruments for project managers. These instruments could help to implement a more efficient Action management, help define clearer goals and guidelines. This would increase and impact of the projects. Otherwise there would be a high danger for drowning in complexity when agenda and goals are too broad.

Case Study "TD1007 - Bimodal PET-MRI molecular imaging technologies and applications for in vivo monitoring of disease and biological processes"

Anja Köngeter

1. History of Action

The overarching objective of the COST Action "Bimodal PET-MRI molecular imaging technologies and applications for in vivo monitoring of disease and biological processes" (running from 2011 to 2015) is to satisfy the "increased interest in vivo preclinical molecular imaging" by fulfilling "the need for European coordinated research in the development and application of peak technologies, aiming to bridge the gap between basic biological research and preclinical application." As stated in the Memorandum of Understanding, the "continuous interaction with end users and industry" shall facilitate the technology transfer into the market.

The COST Action's research field is quite developed resulting in mainly incremental innovation conducted by academic researchers. Although there are some ties between academia and industry, it is rather uncommon to collaborate directly in research projects. The interview partners state that this is mainly due to IPR problems (resulting from competition among large companies). The interview partners did not miss international cooperation since Europe is the academic forerunner. Yet, collaborative attitude and ties between industry and academia are much more common in the USA whereas these systems operate quite independently in Europe.

The Action currently comprises five working groups and 22 member countries. There was no member from a Non-COST country but one SME member (Dr Domokos Mathé, CroMED; see interview protocol) in this COST Action. Large companies attended some events as 'observers' but were no official members (about twelve; e.g. Siemens, Philips, Mediso). Collaboration with large companies was originally planned but potential partners insisted on financial compensation for joint Actions. For this reason, cooperation has not come into being. SMEs were more active as they are interested in being a partner for testing innovative approaches. All in all, the chair did not put much effort in attracting industrial and international partners (he anticipated that interested organisations would apply autonomously) - although he would have welcomed their participation.

Success stories were two accepted FP7 projects which were carried out with SMEs of this Action and two 'Innovative Training Networks' that scored high, but did not receive funding.

2. Motivation and barriers

The motivation for large companies to join the events is to show oneself as an important player and present their products. Moreover, they want to keep in touch with academics since they are potential contractors for their software and they have links to their customers (i.e. hospitals). The interest in the COST Action's actual research topic seems to be subordinate. SMEs are interested in being a partner for testing innovative approaches and to become project partners in European research projects.

There seem to be no severe barriers of participation. Potential industry partners are aware of COST Actions in their field and attend if they are interested.

3. Impact and contributions

In this COST Action, interview partners generally differentiate two types of industry participants: large companies are difficult to approach and driven by IPR issues when it comes to cooperation. Academic members do not see what they can offer. They perceive industry as passive – partly even unpleasant - onlooker. Whereas they regard SMEs as quite valuable as they are more likely to cooperate and to be engines of innovation.

All in all, the contribution of industry has been assessed rather low apart from the two successful FP7 projects. Sustainable new collaborations between industry and academia have most likely not emerged. However, interview partners partly believe in unrevealed potential in regards to research collaborations and possibilities for private funding.

Apart from that, STSMs in companies were assessed extremely positively and considered to be the driver for academic spin-offs.

There are different opinions on the hypothetical contribution of IPCs: they are partly regarded as unnecessary since Europe is the forerunner in this scientific realm. Yet, synergies are expected, in particular with Asian countries.

4. Concerns, recommendations and summary

In retrospect, the potential of industry in a COST Action was not exploited as per the Chair. He is convinced that both sides have something to offer to each other: if another COST Action is accepted, he would actively foster industry participation. In future, there is still low interest in the integration of international partners.

Opposed to the chair's perspective, academic members seem to be more critical towards industry participation. They think that it did not work out well in this Action (but also generally in this research field). A major reason is that there are great worries when sharing knowledge on ideas which are not patented yet. One academic interviewee feels that these large companies attend COST events mainly to retrieve information and exploit their work by 'outsourcing' their R&D departments to university institutions. European academic researchers are not well edu-

cated in this cooperation with industry in the field of medical devices (one interviewee recommends that PhDs should be trained in this regard). But also European industry imposes many restrictions on research that hinder collaborations with other potential research partners and the dissemination of knowledge.

In the perspective of academia, COST should clearly define the role of - and demand for - non-academic members and include cost-effectiveness considerations when it comes to the allocation of the budget. Great tools as STSMs shall be intensified and not spent for industry integration.

One interviewee had very positive experiences with academia-industry collaboration in the USA where researchers in this field are used to work together (from which the European Research Area might learn). A historical difference is indeed that European academia and industry are not used to work together. According to the interview partner, both sides keep their attitude: academia does not want to work for industry and industry only wants to conduct research for themselves, not willing to share knowledge if there is no financial compensation. These attitudes result in mistrust, especially with regard to IPR. Due to the general tight and historical intertwining of academic and industrial research in the USA, different kinds of incentives and frameworks foster industry-academia collaboration (as per the interviewee, resulting in a better technology transfer performance): In these research programs, the needs of industry is often integrated from the beginning by bottom-up funding (industry is regularly the initiator of project proposals). The interviewee finds this approach inspirational for the Europe Research Area. Another typical European pattern is that there is more exchange of researchers between academic and industrial employers in the USA. STSMs are seen as a great instrument to trigger future exchange.

Case Study "TD1104 - European network for development of electroporation-based technologies and treatments (EP4Bio2Med)"

Stephanie Daimer

1. History of Action

Some time ago, Damijan Miklavcic from the University of Ljubljana was contacted by Russian and Ukrainian colleagues who worked in the food area and applied electroporation-based technology. While he used to apply electroporation in the biomedical area, he recognized that there was "a parallel universe" in the food area (It was not called electroporation, but it was the same technique). So, there were two different research communities studying the same phenomenon for different applications, and the question was how to bring them together. This was how the COST Action was born. He mainly wrote the proposal and informed potential partners. As a vice-chair, he chose somebody from the food area to accommodate the different communities (Javier Raso from Spain).

The COST Action was active from April 2012 to April 2016 and had 44[1] participating countries among them four NNCs (Algeria, Morocco, Russian Federation, and Ukraine) and four IPCs (Australia, Argentina, New Zealand and the United States of America). As it was the first international network activity on the rather new phenomenon of electroporation, the chair aimed at a very open network that puts into contact different people working in different areas. One interview partner emphasized that the main task of the COST Action was to streamline research: from basic research to applied oriented research. They ended with 580 individual members coming from 247 institutions. The website and the newsletter were open to everybody, and they ended with 2300 subscriptions to the electroporation newsletter.

The way the chair describes the management of the Action, indicates that the approach has been different as compared to other COST Actions. Like in many other Actions, there was a very small group of particularly active people: next to the chair and the vice-chair, a partner from Romania who organised the short-term scientific missions (STSM) and some working group leaders. However, besides, there were many participants who kept the Action running, because they organised COST activities at their places. In a very open, bottom-up process, the chair invited partners to propose these activities. Proposals could be sent to the management committee, to the working groups or to the local members. The peculiar thing, which might differentiate the management approach of this Action from others, is that only the local organ-

[1] Including five countries participating informally.

izers of an activity got reimbursed by the COST Action. So, e.g. Management Committee members did not always get reimbursement for their travel costs. By this, they tried to avoid that the funding of the Action was only spent to the benefit of a small (core) group of the Action.

The kind of activities that was used most were STSMs, schools (3 within the runtime of the Action), and workshops and conferences. There were also 5 working groups. The main channel for communication was the monthly newsletter where everybody could contribute to share knowledge and information. Everybody who did an activity sponsored by the COST Action had to write a report for the newsletter.

Among the large group of organizers of activities were also many from NNCs, IPCs and from industry. When being asked about potential interview partners from these groups for this study, the chair could easily drop a lot of names, e.g. from Algeria and Ukraine, from the US and New Zealand as well SMEs from Portugal and the Netherlands and a couple of large companies (e.g. Pepsi, Philips, Unilever, Nestle). One partner from an Algerian university and two representatives from SMEs were available for interviews for this study.

2. Motivation and barriers

The views of the four interview partners on motivation for industrial or non-COST country participants lead to a complementary picture:

- Industry: Small companies are looking for access to academic knowledge. They need to team up with researchers who are open towards application-oriented research. The chair added that in comparison, large companies “want to be invisible partners.” They want to be aware of what is going on, so they send researchers to training schools or become a silent sponsor of schools, without becoming officially a member of the Action.
- NNCs: Partners can benefit, in particular students who take part in STSMs. This makes a big difference for their academic education. The chair is of the opinion, that this also holds true for students from IPCs, so he does not like the differentiation between country groups. He thinks that also IPCs should benefit at least from getting some reimbursement for student exchange.

Potential barriers: In the view of the SME representatives, competition between companies was no problem in this Action, as the electroporation-based technologies are at the beginning and the market is very big. In this phase, each step is also helping the others. The main problem is that the clients are sceptic, so each progress in the application of electroporation-based technologies that shows the reliability of the technique for example as regards the quality and safety of food, is helpful for all companies.

3. Impact and contributions

So far, research on electroporation has been funded by companies and national agencies, but there were no international activities. So, the COST Action was intended to serve the building of an international research community – not only within Europe, but worldwide. The number of researchers working on the topic worldwide is rather small, so it was needed to build an international network in order to generate a critical mass. In the view of one interview partner, the Action de facto mobilised the whole community.

STSMs played a decisive role in building a critical mass, and in particular for the integration of non-COST countries. Similarly, the schools served to shuffle the knowledge between the application areas. Now, after the end of the runtime of the Action, a fourth school will take place in Vienna, and there is the hope, that the network will be able also in the future to run these schools now on a self-sustaining basis (without COST support). Also, some STSMs will go on without COST support, e.g. between Algeria and Portugal.

The partners from Virginia Tech (Norfolk, US) are the organizers of the first world congress on electroporation. Now, after the end of the COST Action, the organizers want to establish a society allowing for individual and institutional memberships. The society could take over the organisation of the conference. And members shall get access to the "Handbook of electroporation", which is currently being finalized as the final dissemination activity of the COST Action.

Industry has contributed importantly by "attending and presenting": giving information and insight into specific technologies and applications, as well as providing knowledge on the differences between lab-type equipment and industrial-sized equipment.

Both interview partners from industry reported about follow-up activities with academic partners, either bilateral or in a H2020-consortium. In terms of outcomes, good journal articles are also important for industry, according to one interview partner. They need this for their customers (companies from food industry) to confirm that their food processing systems are based on the latest scientific knowledge. In this COST Action, articles have been produced, and companies show it to their customers.

According to the interview partner from Algeria, the COST Action has created strong impact for his university, as there is now really a group of people working on electroporation. He also thinks, there is benefit for the European partners in this Action from linking up with non-COST countries, because the local partners can help to get access to local markets, e.g. local food producers or local biomedical research and related markets. Actually, this has not happened during the lifetime of the COST Action, but to bring together local producers with European researchers is one of his aims for further Action.

4. Concerns, recommendations and summary

Overall, all four interview partners are very positive about the value of COST Actions – in particular as compared to other European formats of research cooperation. One interview partner said: "COST really allows this soft streamlining of research and avoiding the duplication of research, in particular by sending or exchanging staff in STSMs." In this sense, he thinks that COST works better than ERA-Nets that are by far less flexible as regards participating countries, because countries have to put money in. Another interviewee said, COST Actions are the most effective and efficient European sponsored projects. "With COST Actions, people start cooperating with each other. It's a different world than just research projects." He compares this to FP7-projects, where he took part, and which in his view did not go well. One interview partner put emphasis on the openness of the network instrument: "Everything that puts all the players – even the clients – in Europe in contact is good." Finally, for the interview partner from Algeria, COST is something special. It has helped to build the bridge to European partners.

The chair thinks that four years are not enough time in such a case, when you build a network from scratch: bring together, organize, build trust ("We have just begun to develop trust"), building awareness of the researchers for the differences between the fields of applications and what you can learn from this. COST should allow in such cases for a continuation of the network. Moreover, COST should not differentiate between different types of countries (COST-members, NNCs, IPCs). The scheme should be entirely open that all can fully participate.

Finally, the management approach applied in this COST Action might serve as a role model: open, bottom-up and avoiding benefiting only an inner circle of participants.

Case Study "TU1101 - Towards safer bicycling through optimization of bicycle helmets and usage"

Stephanie Daimer

1. History of Action

The Action "Towards safer bicycling through optimization of bicycle helmets and usage" was initiated by two scientists (chair and vice-chair of the Action) who had previous experience with COST Actions and who had already worked together. The case with research on bicycle helmets was that there were activities in many countries, but largely unconnected, so this was not efficient. The proposal was not successful when being submitted for the first time. As for the narratives about the re-submission the views of the interview partners are different.

The divergent views about why the re-written proposal was successful are relevant for this study, as in one view the involvement of industry was decisive to win the grant. Another interview partner agrees that industry involvement is a requirement when a COST Action focuses on an application-oriented topic. The industry people involved in the proposal phase where already known to them, because they are also holding academic positions or had academic positions previous to their industry affiliation. However, in his view several other reasons made a difference for the success. He mentioned that the resubmitted proposal benefitted from a proposal writing workshop with the group, from the inclusion of further partners and also from a better gender balance.

Although Niels Bogerd acted as the chair of the Action, Professor Otte from Hannover Medical School was the grant-holder, as Niels changed his institutional affiliation twice in the course of the proposal phase and duration of the Action (coming from EMPA, Switzerland and now being affiliated with TNO in the Netherlands). So, coordination of the four working groups (WG) was mainly done by the vice-chair.

The Action started with a core group of members in the proposal phase. They took more members on board, when the Action was granted and in the course of the project. In the end, 21 countries were participating as well as two institutions from Australia (IPC).

The interview partners could not tell the exact numbers of non-academic partners in the Action, as these partners showed different degrees of activity. In principle, the most active industry partner was Lazer Sports from Belgium, a helmet producer, represented by Guido de Bruyne, who at the same time has an academic affiliation with the University of Antwerp. He was available for an interview for this study. There was another active partner, Peter Halldin, who represented a company for helmet technology (MIPS, Sweden) and Stockholm University.

Other industry partners were not highlighted in the interviews. Besides industry, also two user associations were present.

The Action has worked quite well with two meetings a year, which included WG meetings and a management committee meeting each time. WGs have worked largely independent from each other, so the WG leaders were important people to push forward the activities. According to two interview partners, leadership capacities are important, in particular when the groups are interdisciplinary.

All interview partners pointed to a number of other partners, who were quite active in their working groups, so it indeed looks like this was a very lively COST Action. The Action was active from 2011-2015. All interview partners were very positive about the Action and they are ready to take part in other COST Actions.

2. Motivation and barriers

This COST Action was very application-oriented, so all academic interview partners were convinced of the need to include non-academic partners. In their view, industry partners are strongly needed to give ideas and feedback to the process. The benefit for the scientists is to see the barriers for industrial application and the demands of industry.

The interview partner from industry considers COST to be particularly successful. For industrial partners this is a useful instrument to get an overview on the research done in the field. He was able to identify the most knowledgeable partners in the field. The interview partner was very happy with the participation, because of his company's collaboration with the EMPA researchers from Switzerland. EMPA is in the favourable position that in Switzerland, researchers can apply for research funding for COST Actions. The team has won a project, which funded the work of a doctoral student.

Two interview partners spoke about potential barriers to industrial participation: industry might not know about COST Actions or does not see where the benefits may arise, when there are no specific R&D activities. One interview partner acknowledged that companies might be hesitant to disclose confidential information in the presence of competitors. Another interview partner considers the involvement of competitors also to be problematic. According to his experience, industry will be very cautious. They will try to give as little information as possible to competitors. So, for the Action on bicycle helmets, it would have been desirable to have one producer of helmets, one producer of foam for the helmets and maybe a producer of bicycles. In the end, there was more than one helmet producer, as also MIPS is involved in helmet production (being part of GIRO, an Italian helmet production company) – and despite the initial worries, it was considered to have worked quite well.

A partner from Australia was recruited later on, because of her research on accidents and behaviour in road traffic (traffic psychology). According to the interview partners, her motivation

to join was that the focus of the COST Action (in particular WGs 1 and 2) fitted very well with her core research interests. In the beginning, funding by the Australian government was available to cover costs. After the government had stopped support for COST Actions, she was able to link her COST activities with other activities in Europe, so she could still join the meetings. Actually, there was another Australian university participating, but that was after the government had stopped their funding for COST Actions. "So, they couldn't travel, and this makes a big difference, because physical meetings are so important," said one interview partner about the fact that these partners have not contributed remarkably to the Action.

3. Impact and contributions

All four WGs have produced results. The partner from Australia and non-academic partners made relevant contributions to these results. And some results have the potential to have further impact on bicycle helmet production or infrastructure for cyclists:

- WG 1 was able to build on the accident statistics, which different partners had brought to the project. The accident data base from Australia was a very relevant source to validate results from European surveys. The analysis of head injuries and helmet usage lead to a number of recommendations for helmet design and helmet usage to increase the safety of bicyclists.

- The main activity of WG 2 was to run a survey among cyclists in order to find out about the usage of helmets and cyclists' behaviour as well as road accidents of cyclists. A few partners were extremely important for the survey. This was mainly Narelle Haworth, the partner from Australia. She had done a large survey among cyclists in Australia, which served as a starting point. One of the non-academic partners, the European Cyclists Federation tried to mobilise cyclists in Belgium to participate in the survey, but that was a rather low number (something around 60 responses). Nevertheless the association contributed actively in the working group discussions.

- Actually some survey results on the usage of helmets are of interest to helmet manufacturers, for example that there is need for improved visibility in twilight hours.

- Industry participation was important for WGs 3 and 4. Both have produced results, that could help to define new standards, but they are not being followed up at the moment. After the end of the Action, this is difficult to realise. So far, for example, bicycle helmet standards concentrate on protection issues, but not yet on thermal characteristics. "In WG 4, we came up with a way on how to make information about ventilation available to customers," it was explained. This is already helpful for industry.

The COST Action has planned several dissemination activities. Not all of them could take place during the runtime of the Action. For example a video to present the results to a larger audience was made only afterwards, and therefore paid from the chair's private pocket. But as the

Action has ended, the participants are a bit disappointed to realise that it is now very difficult to find time and resources to engage further with the material.

All interview partners have further extended their networks with this COST Action. For example, the COST Action network linked very soon up with a group from TNO and TU Delft that organised the annual conference on bicycle safety and they soon helped them to organize the conference. The COST people are now active contributors to this conference every year.

The interview partners reported about at least five joint proposals as a result of this COST Action. Three of them were successful (two Marie Curie grants and one H2020 project).

4. Concerns, recommendations and summary

In general, there is a positive assessment of industry participation, because of the application-oriented nature of the COST Action. As the benefit for the users is the main aim, they should be involved, and the producers as well to increase the chances of realization.

There is evidence that one industry partner benefitted from this engagement in the Action. They are using the results and are currently engaged with a research partner from the Action in a follow-up development activity. However, the relevant research results have been documented in a doctoral thesis and are thus publicly available. And the COST Action had invited more industry partners, however these did not engage as actively as expected.

The participation of Australia was also welcomed, but it was clearly pointed out, that conditions for IPC partners are not favourable and it has only worked here, because the Australian partner had other opportunities to find funding for her travels.

Although the interview partners were very positive about the work and the results of the Action, some agreed that it would be beneficial if a small amount of the COST Action budget (about 10%) could be used to fund research activities. This could help to trigger partners to engage more or it could help to finance small contributions from partners which do not at all have a chance to pay their time from their own institutional funding.

Two interview partners mentioned leadership qualities of the core people as important success factors, and the need to define clear goals for the Action (e.g. common papers, joint project proposals). At this end, one interview partner missed information or guidance from the COST Association in the end on what the Action had to deliver.

There are a few experiences which lead to a critical view on the role of COST National Coordinators (who act as gate-keepers to the Actions, which might turn out to be counter-productive) and on the role of the rapporteur (who sometimes does not engage much with the Action).

Case Study "TU1103 - Operation and safety of tramways in interaction with public space"

Peter Biegelbauer

1. History of Action

The Action "operation and safety of tramways in interaction with public space" was active from 2011-2015. It was relatively small, with 16 countries taking part. It was led by Laetitia Fontaine, from the French governmental agency "Le Service Technique des Remontées Mécaniques et des Transports Guidés" and approximately half of the participants were from non-academic organisations, mostly transport safety agencies, transport authorities and transport operators.

The chair of the Action, Laetitia Fontaine, and a colleague of hers from a neighbouring agency, Dominique Bertrand, knew each other from university and from working on similar issues regarding transport. They decided to establish a network of professionals working on the area of light-rail transport, specifically concerned with issues of safety regarding the human factor and urban planning. In the ensuing network, a number of contacts came from the Action "buses with high level of service", the two French civil engineers having chosen a snowball principle for setting up the network. The Action finally was made up of operators, agencies for transport safety and academics from planning and technical universities. The two persons setting up the network have no formal experience with COST.

In addition to Fontaine, who served as chair, and Bertrand, who took over the working group on dissemination and was the webmaster of the homepage, Manuel Teixeira, an urban planner who had helped in setting up the light-rail transport system of Porto, took the position of a vice-chair. These three, together with the working group leaders and a few partners formed the core group of the Action, consisting of 8 to 10 participants, who did a large part of the work, including writing up the report. The Action included no member from industry in the strict sense of the word, but most came from non-academic institutions, bringing in a distinct viewpoint on problems and problem solutions of this kind of non-academic institutions.

There was only one country from outside of Europe involved, which was Israel, the participation of which was helpful, as new perspectives were brought into the group. One interview partner pointed out that at the first meeting of the group in 2011 there were little terror related safety concerns in light-rail transport, a situation which has changed since. This perspective was introduced early on by Israeli participants. Efforts to include Australia were not further pursued by the chair due to differences in transport philosophies and the management of

members from faraway countries (leading to higher transaction costs, i.e. communication, but also travel problems).

The Action which was active from 2011-2015, saw three phases (state-of-the-art, discussion, reporting and dissemination) and was organised in three working groups (regulation, data and infrastructure design, analysis and outcomes, dissemination). There were regular meetings, one per year for the MC, four for the working groups, with one working group featuring several subgroups. The chair was generally seen as very professional and helpful. There were, however, problems with participants being nominated by CNCs without the chair being asked.[1] This resulted in a situation with several disinterested members who were not interested in the Action. One member stayed at meetings only shortly and left the running meeting during the first coffee break.

Several communication channels were being used: most important was the restricted area of the website, which was utilized to disperse papers and reports and exercises. In between the face-to-face meetings, a number of meetings were held via Skype. Email was also an important way of communication.

All six interview partners evaluated the Action as highly valuable, with a good combination of non-academics and academics supporting each other: the non-academics were key for delivering data and helping to evaluate them, whereas the academics were important for structured analysis and report writing.

2. Motivation and barriers

The main motivation for the participation of non-academics was the exchange of tramway operator and agency experiences. For the academics, access to data and experiences of practitioners was most important. No barriers were mentioned for either academics or non-academics, yet there were only a few partners who had experience with COST. This was important as several participants mentioned that the knowledge on how COST works was not widely available and, especially for non-academics, COST was difficult to understand.

Every interview partner pointed out that they would gladly take part in COST again and that they have learned immensely from the Action and appreciated the fact that a scheme like COST exists. In fact, a continuation of the Action is currently being debated in the group, although the Action has ended already in fall 2015. If the Action is to be continued, it will have new research questions. The interview partners had limited ideas to offer regarding how to make COST easier to be understood and increase visibility for non-academics. One interview partner pointed out that awareness may be raised through opinion leaders and professional

[1] Chairs in general are not asked for their opinion in the process of nominating Management Committee members.

networks, whilst others supposed that there should be a short and non-technical introduction to COST on the webpage (incl. FAQ for newcomers).

3. Impact and contributions

The interviewees from academia said that the most important contribution from non-academics were experiences and data. This was echoed by most interviewees working in non-academic environments who thought that their experiences were very important. One interview partner working in a non-academic setting stated that it was also important that non-academics had contributed to the fact that the Action had its "feet staying on the ground".

An important issue appreciated by a number of interview partners was that the network was new, the topic was underexplored, and previously not covered systematically - although it in general was deemed to be important. Non-academics and academics were both represented in different functions, with non-academics leading the Action. Both were part of the core group and both were writing reports, papers et cetera. One academic interview partner pointed out that the academic dissemination was mainly carried out by participants in a university setting.

One important impact of the Action, which was mentioned time and again, was that awareness was raised by the Action for practices and philosophies of light-rail transport planning and operating in other countries.

The personal networks of the participants were hugely extended, for academics and non-academics alike. The network is still active, mainly through email exchanges. Dissemination efforts are still ongoing, with a meeting planned and participants coming on their own money on the side of an international transport conference.

4. Concerns, recommendations and summary

The interview partners pointed out several issues as recommendations for the COST Association. Non-academics were very important for the success of this Action. In lieu of the specific topic of the network, it would have been difficult to imagine such a success without practitioners taking part and even having important positions in the Action. Yet a problem for people not employed with government or fully financed university positions, i.e. professors, was that they had to pay their salaries/time. So they often were not that engaged in the Action. This problem) was specifically mentioned by several interview partners regarding possible roles of industry partners. Compensation may be an option, if participants are not paid otherwise.

The budget regulations were seen as a problem by all interview partners: they are difficult to understand and, more importantly, difficult to come by with. The budgetary procedures were described as painstaking for the group. Compensations took several months - in a process that was perceived as very bureaucratic.

Furthermore, the dissemination phase after the end of the Action should be funded when papers are written and presented at conferences - yet there is no funding available from COST.

Another recommendation is that the chair of an Action should have the possibility to exclude members proposed by the CNCs on grounds of missing expertise. There should be a possibility to dismiss participants in case of repeatedly demonstrated unwillingness to cooperate.

In a nutshell, the Action was successful in creating a new network in a new field, establishing a well-functioning core group inside the Action and combining skills and knowledge of non-academic and academic participants. Further outputs were a rich and problem-adequate report including safety and accident reporting guidelines, presentations at international conferences as well as publications. In this case of a problem-oriented Action the cooperation between academics and non-academics was key to the success of the network. This was the case because said cooperation was structured by an active chair and because a number of participants were ready to engage into such an equally interdisciplinary as well as transdisciplinary exchange.

5.2 Questionnaire

1.1. How would you describe your (primary) occupational status?

Employed in…

- Large company (Number of employees > 250 and Turnover > 50 m € or Balance sheet total > 43 m €)
- Small or medium-sized company (Number of employees < 250 and Turnover ≤ 50 m €, or Number of employees < 250 and Balance sheet total ≤ 43 m €)
- Self-employed or independent
- Public body (excluding research and education)
- Research organisation (excluding education)
- Higher education establishment
- Non-profit organisation such as NGOs and private foundations (excluding research and education)
- Other, please specify: _____

1.2. How did you (initially) learn about COST and COST Actions?

- I was formerly involved in (a) COST Action(s)
- I was involved in the proposal of this Action
- I was informed/invited by somebody already active in the Action
- I was informed by my member state's representative(s) in the COST bodies about the opportunity to join this Action
- I learned about it on a COST information day (or another dedicated information day)
- I learned about it on a scientific or professional conferenceI learned about it from another source (please specify): _____

1.3. Do you currently participate in other research or technology networks, besides any COST-funded network?

(Multiple answers possible)

- Yes, in projects encompassing partners (also) from non-European countries
- Yes, in projects encompassing partners from (multiple) European countries
- Yes, in projects at the national level
- No, but I did so in the past
- No, I only participate in COST Actions

1.4. How frequently do or did you participate in the following COST activities or events during your COST Action(s)? Please enter a number.

	Number of visiting
Management Committee meetings	_____
Working Group meetings	_____
Other meetings	_____
Short-Term Scientific Missions (STSMs)	_____

Training Schools _____
Conferences _____
Dissemination Activities and Publications _____
Others, please specify:_____

1.5. For which reasons do or did you participate to COST Action activities? (Alternativ: What were your main motives to participate in a COST Action?)

(Multiple answers possible)

- Acquiring new contacts
- Having access to international actors and networks
- Having access to European actors and networks
- Staying up-to-date with developments in the professional field
- Presenting ongoing studies, works or projects
- Initiating new projects or collaborations
- Building public-private partnerships
- (Co-)Developing market applications of concepts, ideas and technologies
- Influencing the future agenda in the professional field
- Enabling breakthrough scientific developments leading to new concepts and products
- Advancing knowledge
- Making better use of funding for continuing research
- Increasing European/international visibility
- Having access to a specific (research and development) infrastructure
- Others, please specify:_____

(Filter): only for the options which are chosen

1.6. From your personal view, to which extent have your expectations been met?
(1-5 scale, with Answer categories: 1 "not at all" and 5 "to the greatest extent")

- Acquiring new contacts
- Having access to international actors and networks
- Having access to European actors and networks
- Staying up-to-date with developments in the professional field
- Presenting ongoing studies, works or projects
- Initiating new projects or collaborations
- Building public-private partnerships
- (Co-)Developing market applications of concepts, ideas and technologies
- Influencing the setting the future agenda in the professional field
- Enabling breakthrough scientific developments leading to new concepts and products
- Advancing knowledge
- Making better use of funding for continuing research
- Increasing European/international visibility
- Having access to a specific (research and development) infrastructure

(Filter) end

1.7. From your personal view, to what extent has your participation in COST Actions led to the following results for you or your organisation?
(1-5 scale, with Answer categories: 1 "not at all" and 5 "to the greatest extent")

Networking

- Enhancement of transcontinental collaborations in science and technology
- Enhancement of ties with partners in EU Near-Neighbour Countries
- Establishment of sustainable collaborations with colleagues from other fields, sectors or domains
- Increase in national, European and/or international visibility

Excellence and Capacity building

- Improvement of career opportunities through COST Actions
- Assurance of further funding for future projects and collaborations
- Development of additional capacity due to COST Action(s), e.g. in aspects of human, organisational or material resources

Economic and societal impacts

- Development of common concepts, solutions, products, norms or standards
- Development and/or valorisation of patents and other forms of Intellectual Property Rights (IPR)
- Development of ready-for-market applications of ideas, concepts or technologies
- Others, please specify: _____

1.8. To what extent would you say COST Actions generally contribute to:
(1-5 scale, with Answer categories: 1 "do not agree at all" and 5 "to the greatest extent")

Networking

- Enabling cross-sectoral collaboration (for example, between academic and private partners)
- Enabling interdisciplinary collaboration
- Enabling global or extensive international collaboration
- Diffusing existing (developed) ideas over the professional, technological or scientific field
- Establishing links with potential users or beneficiaries due to integration of "newcomers" from countries with less developed research capacities

Excellence & Valorisation

- Screening and scrutinising new ideas in science and/or technology
- Discovering the potential characteristics of the scientific, technological or professional field
- Developing ideas into new methodologies or concepts
- Conducting research in non-traditional, frontier or breakthrough areas
- Applying networking to attain added value on everyday research and/or operations

Economic and societal impacts

- Contributing to the development of norms and standards
- Developing ideas into new products or services
- Contributing to the development and structuration of (public) policies
- Valorising Intellectual Property Rights, for example through patents or market applications
- Addressing emergent scientific, technological or societal challenges

1.9. How would you assess the attractiveness of COST Actions to participants with your specific professional profile?
(1-5 scale, with Answer categories: 1 "very low" and 5 "very high")

1.10. Are there any aspects regarding the participation in COST Actions that you would like to see improved?
<Open question>

1.11. From your personal view, how would you describe the main benefits or achievements of your COST Action(s)?
< Open question >

1.12. To what extent do you agree with the following statements about COST Actions?
(1-5 scale, with Answer categories: 1 "do not agree" and 5 "totally agree")

- COST Actions enable the development of sustained collaborations beyond the European COST countries
- COST Actions enable the exchange of perspectives, information and know-how between researchers, engineers and professionals from different backgrounds
- COST Actions add value to the development or synchronisation of industry-, field- or discipline-wide concepts, practices, methodologies or standards
- COST Actions contribute to the transformation of ideas and concepts in marketable products or services
- COST Actions strengthen the accumulation and valorisation of Intellectual Property Rights (IPR)
- COST Actions contribute to building trust, consensus and common understanding across the network
- COST Actions contribute to working out solutions for societal challenges
- COST Actions are an entry point into the European Framework Programmes (now Horizon 2020) for newcomers from countries with less developed research capacities.
- Please complete the statement, if you still have another suitable description: COST Actions ... _____