Council of the European Union

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COVER NOTE

From:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	29 May 2017
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union
No. Cion doc.:	SWD(2017) 221 final - PART 4/16
Subject:	COMMISSION STAFF WORKING DOCUMENT INTERIM EVALUATION of HORIZON 2020 ANNEX 1

Delegations will find attached document SWD(2017) 221 final - PART 4/16.

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EUROPEAN
COMMISSION

Brussels, 29.5.2017
SWD(2017) 221 final

PART 4/16

COMMISSION STAFF WORKING DOCUMENT

INTERIM EVALUATION
of
HORIZON 2020

ANNEX 1

{SWD(2017) 220 final}
{SWD(2017) 222 final}

G. TOP 50 HORIZON 2020 PARTICIPANTS PER TYPE OF ORGANISATION

G.1. Organisations

Table 27 Top-50 (all) organisations in terms of EU funding

Rank	Participant legal name	Type of organisation	Country	EU contribution (EUR million)	Number of participations
1	MAX-PLANCK-GESELLSCHAFT ZUR FORDERUNG DER WISSENSCHAFTEN EV	REC	Germany	443.5	213
2	CENTRE NATIONAL DE LA Research Organisations (REC)HERCHE SCIENTIFIQUE CNRS	REC	France	361.4	505
3	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	REC	Germany	223.9	407
4	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	REC	France	218.7	246
5	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD	HES	United Kingdom	174.5	251
6	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE	HES	United Kingdom	172.1	267
7	UNIVERSITY COLLEGE LONDON	HES	United Kingdom	159.1	239
8	IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	HES	United Kingdom	120.0	192
9	CONSIGLIO NAZIONALE DELLE RICERCHE	REC	Italy	114.2	250
10	AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS	REC	Spain	110.1	237
11	ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE	HES	Switzerland	106.6	142
12	TECHNISCHE UNIVERSITEIT DELFT	HES	Netherlands	104.7	155
13	KATHOLIEKE UNIVERSITEIT LEUVEN	HES	Belgium	104.2	170
14	KOBENHAVNS UNIVERSITET	HES	Denmark	101.8	196
15	THE UNIVERSITY OF EDINBURGH	HES	United Kingdom	100.7	142
16	INTERUNIVERSITAIR MICRO-ELECTRONICACENTRUM	REC	Belgium	93.0	86
17	COST ASSOCIATION	OTH	Belgium	89.6	1
18	DEUTSCUniversities (HES) ZENTRUM FUER LUFT - UND RAUMFAHRT EV	REC	Germany	86.1	163
19	INSTITUT NATIONAL DE LA SANTE ET DE LA Research Organisations (REC)HERCHE MEDICALE	REC	France	85.3	113
20	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH	HES	Switzerland	74.7	145
21	DANMARKS TEKNISKE UNIVERSITET	HES	Denmark	72.8	136
22	THE UNIVERSITY OF Manchester	HES	United Kingdom	71.7	119
23	UNIVERSITEIT VAN AMSTERDAM	HES	Netherlands	68.7	96
24	KAROLINSKA INSTITUTET	HES	Sweden	68.6	99
25	KARLSRUHER INSTITUT FUER TECHNOLOGIE	HES	Germany	67.2	106
26	TECHNISCHE UNIVERSITAET MUENCHEN	HES	Germany	66.9	105
27	GEANT LIMITED	OTH	United Kingdom	64.6	8
28	Teknologian tutkimuskeskus VTT Oy	REC	Finland	64.3	127
29	POLITECNICO DI MILANO	HES	Italy	63.9	133
30	FORSCHUNGSZENTRUM JULICH GMBH	REC	Germany	62.0	82
31	UNIVERSITY OF SOUTHAMPTON	HES	United Kingdom	60.8	83
32	LUNDS UNIVERSITET	HES	Sweden	60.4	84
33	UNIVERSITY OF BRISTOL	HES	United Kingdom	60.1	98
34	UNIVERSITEIT GENT	HES	Belgium	60.0	109
35	STICHTING KATHOLIEKE UNIVERSITEIT	HES	Netherlands	59.4	90
36	UNIVERSITEIT UTRECHT	HES	Netherlands	59.1	109
37	TEL AVIV UNIVERSITY	HES	Israel	58.6	60
38	THE PROVOST, FELLOWS, FOUNDATION SCHOLARS & THE Other (OTH)ER MEMBERS OF BOARD OF THE COLLEGE OF THE HOLY & UNDIVIDED TRINITY OF QUEEN ELIZABETH NEAR DUBLIN	HES	Ireland	57.9	81
39	FUNDACION TECNALIA RESEARCH & INNOVATION	REC	Spain	57.6	122
40	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO	REC	Netherlands	55.7	109
41	LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN	HES	Germany	55.5	84
42	STICHTING VU	HES	Netherlands	54.7	100
43	TECHNISCHE UNIVERSITEIT EINDHOVEN	HES	Netherlands	54.6	100
44	RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	HES	Germany	53.2	91
45	EUROPEAN MOLECULAR BIOLOGY LABORATORY	REC	Germany	52.9	60
46	THE UNIVERSITY OF BIRMINGHAM	HES	United Kingdom	52.8	116
47	KUNGLIGA TEKNISKA HOEGSKOLAN	HES	Sweden	52.2	104
48	THE HEBREW UNIVERSITY OF JERUSALEM	HES	Israel	51.9	57
49	AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE	REC	Italy	51.6	53
50	AARHUS UNIVERSITET	HES	Denmark	51.6	104

Corda, Signed Grants cut-off date by 1/1/2017; Higher and Secondary Education Institutions (HES); Research rganisations (REC); Other (OTH).

G.2. Higher and secondary education institutions (HES)

Table 28 Top-50 higher and secondary education institutions in terms of EU funding

Rank	Participant legal name	Country	EU contribution (EUR million)	Number of participations
1	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD	United Kingdom	174.5	251
2	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE	United Kingdom	172.1	267
3	UNIVERSITY COLLEGE LONDON	United Kingdom	159.1	239
4	IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	United Kingdom	120.0	192
5	ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE	Switzerland	106.6	142
6	TECHNISCHE UNIVERSITEIT DELFT	Netherlands	104.7	155
7	KATHOLIEKE UNIVERSITEIT LEUVEN	Belgium	104.2	170
8	KOBENHAVNS UNIVERSITET	Denmark	101.8	196
9	THE UNIVERSITY OF EDINBURGH	United Kingdom	100.7	142
10	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH	Switzerland	74.7	145
11	DANMARKS TEKNISKE UNIVERSITET	Denmark	72.8	136
12	THE UNIVERSITY OF MANCUniversities (HES)TER	United Kingdom	71.7	119
13	UNIVERSITEIT VAN AMSTERDAM	Netherlands	68.7	96
14	KAROLINSKA INSTITUTET	Sweden	68.6	99
15	KARLSRUHER INSTITUT FUER TECHNOLOGIE	Germany	67.2	106
16	TECHNISCHE UNIVERSITAET MUENCHEN	Germany	66.9	105
17	POLITECNICO DI MILANO	Italy	63.9	133
18	UNIVERSITY OF SOUTHAMPTON	United Kingdom	60.8	83
19	LUNDS UNIVERSITET	Sweden	60.4	84
20	UNIVERSITY OF BRISTOL	United Kingdom	60.1	98
21	UNIVERSITEIT GENT	Belgium	60.0	109
22	STICHTING KATHOLIEKE UNIVERSITEIT	Netherlands	59.4	90
23	UNIVERSITEIT UTResearch Organisations (REC)HT	Netherlands	59.1	109
24	TEL AVIV UNIVERSITY	Israel	58.6	60
25	THE PROVOST, FELLOWS, FOUNDATION SCHOLARS & THE Other (OTH)ER MEMBERS OF BOARD OF THE COLLEGE OF THE HOLY & UNDIVIDED TRINITY OF QUEEN ELIZABETH NEAR DUBLIN	Ireland	57.9	81
26	LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN	Germany	55.5	84
27	STICHTING VU	Netherlands	54.7	100
28	TECHNISCHE UNIVERSITEIT EINDHOVEN	Netherlands	54.6	100
29	RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	Germany	53.2	91
30	THE UNIVERSITY OF BIRMINGHAM	United Kingdom	52.8	116
31	KUNGLIGA TEKNISKA HOEGSKOLAN	Sweden	52.2	104
32	THE HEBREW UNIVERSITY OF JERUSALEM	Israel	51.9	57
33	AARHUS UNIVERSITET	Denmark	51.6	104
34	THE UNIVERSITY OF WARWICK	United Kingdom	51.6	85
35	HELSINGIN YLIOPISTO	Finland	49.8	92
36	WEIZMANN INSTITUTE OF SCIENCE	Israel	49.7	61
37	THE UNIVERSITY OF SHEFFIELD	United Kingdom	48.2	104
38	TECHNISCHE UNIVERSITAET DRESDEN	Germany	47.4	82
39	UPPSALA UNIVERSITET	Sweden	46.7	79
40	UNIVERSITY OF GLASGOW	United Kingdom	46.0	86
41	CHALMERS TEKNISKA HOEGSKOLA AB	Sweden	45.3	80
42	RIJKSUNIVERSITEIT GRONINGEN	Netherlands	44.8	67
43	UNIVERSITEIT LEIDEN	Netherlands	43.9	60
44	TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY	Israel	41.5	56
45	KING'S COLLEGE LONDON	United Kingdom	40.2	75
46	THE UNIVERSITY OF EXETER	United Kingdom	39.6	61
47	UNIVERSITY OF LEEDS	United Kingdom	38.6	83
48	UNIVERSITY COLLEGE CORK - NATIONAL UNIVERSITY OF IRELAND, CORK	Ireland	37.5	70
49	NATIONAL UNIVERSITY OF IRELAND, GALWAY	Ireland	36.9	77
50	UNIVERSITETET I OSLO	Norway	36.5	50

Corda, Signed Grants cut-off date by 1/1/2017.

G.3. Other organisations (OTH)

Table 29: Top-50 other organisations in terms of EU funding

Rank	Participant legal name	Country	EU contribution (EUR million)	Number of participations
1	COST ASSOCIATION	Belgium	89.6	1
2	GEANT LIMITED	United Kingdom	64.6	8
3	CSC-TIETEEN TIETOTEKNIIKAN KESKUS OY	Finland	8.2	14
4	ICLEI EUROPEAN SECRETARIAT GMBH (ICLEI EUROPASEKRETARIAT GMBH)*	Germany	7.9	22
5	BIO BASE EUROPE PILOT PLANT VZW	Belgium	7.1	10
6	Stichting EGI	Netherlands	5.9	14
7	FUNDACION BANCARIA CAIXA D ESTALVIS I PENSIONS DE BARCELONA LA CAIXA	Spain	5.0	3
8	EUN PARTNERSHIP AISBL	Belgium	4.7	5
9	OSTERREICHISCHE ENERGIEAGENTUR AUSTRIAN ENERGY AGENCY	Austria	4.5	14
10	FUNDINGBOX ACCELERATOR SP ZOO	Poland	4.4	1
11	OSLO MEDTECH FORENING	Norway	4.4	2
12	NORDUNET A/S	Denmark	4.4	4
13	ISTITUTO DI STUDI PER L'INTEGRAZIONE DEI SISTEMI SC	Italy	4.3	13
14	PARTNERSHIP FOR ADVANCED COMPUTINGIN EUROPE AISBL	Belgium	4.1	6
15	FORUM VIRIUM HELSINKI OY	Finland	4.0	7
16	UNION INTERNATIONALE DES TRANSPORTS PUBLICS	Belgium	3.9	10
17	YOURIS.COM	Belgium	3.9	14
18	GRAND EQUIPEMENT NATIONAL DE CALCUL INTENSIF	France	3.7	2
19	UMWELTBUNDESAMT GMBH	Austria	3.6	9
20	GESELLSCHAFT FUR ANGEWANDTE MIKRO UND OPTOELEKTRONIK MIT	Germany	3.5	6
21	FONDATION EUROPEENNE DE LA SCIENCE	France	3.5	9
22	European Business and Innovation Centre Network	Belgium	3.4	14
23	CYBERFORUM EV	Germany	3.3	1
24	SYNESIS-SOCIETA CONSORTILE A RESPONSABILITA LIMITATA	Italy	3.3	8
25	POLIS - PROMOTION OF OPERATIONAL LINKS WITH INTEGRATED SERVICES,	Belgium	3.3	15
26	ASSOCIATION EUROPEENNE DES EXPOSITIONS SCIENTIFIQUES TECHNIQUES ET	Belgium	3.2	8
27	SONDERBORG FORSYNINGSSERVICE AS	Denmark	3.1	1
28	Fachagentur Nachwachsende Rohstoffe e.V.	Germany	2.9	13
29	EUROCITIES ASBL	Belgium	2.9	8
30	INFRAFRONTIER GMBH	Germany	2.9	5
31	ASSOCIATION INTERNATIONALE EXTREME-LIGHT-INFRASTRUCTURE DELIVERY	Belgium	2.8	4
32	IDRYMA PROOther (OTH)ISIS EREVNAS	Cyprus	2.7	28
33	STICHTING PROSAFE (THE PRODUCT SAFETY ENFORCEMENT FORUM OF	Netherlands	2.7	2
34	BIOPRAXIS RESEARCH AIE	Spain	2.6	3
35	EIT DIGITAL	Belgium	2.6	2
36	FOMENTO DE SAN SEBASTIAN SA	Spain	2.6	3
37	STICHTING OPEN TICKETING	Netherlands	2.6	1
38	VEREIN ZUR FOERDERUNG EINES DEUTSCHEN FORSCHUNGSNETZES DFN VEREIN	Germany	2.6	4
39	UNION INTERNATIONALE DES CHEMINS DE FER	France	2.6	9
40	STICHTING TUBERCULOSIS VACCINE INITIATIVE	Netherlands	2.5	1
41	IMP'ROVE - EUROPEAN INNOVATION MANAGEMENT ACADEMY EWIV	Germany	2.5	2
42	ASSOCIATION 2 INVESTING INITIATIVE	France	2.2	3
43	AquaTT UETP Ltd	Ireland	2.2	7
44	AEROSPACE VALLEY	France	2.1	8
45	ASSOCIACAO UNIVERSIDADE EMPRESA PARA DESENVOLVIMENTO TECMINHO	Portugal	2.1	3
46	FEDERATION EUROPEENNE DES GEOLOGUES	France	2.1	8
47	OPEN DATA INSTITUTE LBG	United Kingdom	2.1	4
48	ASSOCIATION DES CITES ET DES REGIONS POUR LE Research Organisations	Belgium	2.0	7
49	INSTRUCT ACADEMIC SERVICES LIMITED	United Kingdom	2.0	6
50	EUROPEAN MARINE ENERGY CENTRE LTD	United Kingdom	2.0	6

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G.4. Private for profit companies (PRC)

Table 30 Top-50 private for profit companies in terms of EU funding

Rank	Participant legal name	Country	EU contribution (EUR million)	Number of participations
1	SIEMENS AKTIENGESELLSCHAFT	Germany	48.7	43
2	ATOS SPAIN SA	Spain	31.9	74
3	BORREGAARD AS	Norway	26.7	3
4	ROBERT BOSCH GMBH	Germany	23.6	39
5	AVL LIST GMBH	Austria	22.4	34
6	ENGINEERING - INGEGNERIA INFORMATICA SPA	Italy	18.9	35
7	ACCIONA INFRAESTRUCTURAS S.A.	Spain	18.7	37
8	ASML NETHERLANDS B.V.	Netherlands	18.0	3
9	IBM ISRAEL - SCIENCE AND TECHNOLOGY LTD	Israel	15.5	19
10	INDRA SISTEMAS SA	Spain	14.4	37
11	DAIMLER AG	Germany	14.4	12
12	GlaxoSmithKline Biologicals	Belgium	14.1	2
13	ENERGOCHEMICA TRADING AS	Slovakia	13.4	1
14	ALSTOM TRANSPORT S.A.	France	12.7	9
15	SOLIDPOWER SPA	Italy	12.7	5
16	ITM POWER (TRADING) LIMITED	United Kingdom	12.6	8
17	D'APPOLONIA SPA	Italy	11.8	39
18	RENAULT SAS	France	11.7	18
19	TELEFONICA INVESTIGACION Y DESARROLLO SA	Spain	11.3	33
20	THALES COMMUNICATIONS & SECURITY SAS	France	11.2	20
21	IBM IRELAND LIMITED	Ireland	10.9	18
22	IBM RESEARCH GMBH	Switzerland	10.2	38
23	PHILIPS ELECTRONICS NEDERLAND B.V.	Netherlands	9.9	20
24	INFINEON TECHNOLOGIES AG	Germany	9.7	10
25	THALES ALENIA SPACE FRANCE	France	9.5	24
26	WELLO OY	Finland	9.4	1
27	MATRICA SPA	Italy	9.3	1
28	INNOVACIO I Research Organisations (REC)ERCA INDUSTRIAL I SOSTENIBLE SL	Spain	9.2	13
29	NEC EUROPE LTD	United Kingdom	9.2	19
30	JOHNSON MATTHEY PLC	United Kingdom	9.2	18
31	BOSCH THERMOTECHNIK GMBH	Germany	9.0	2
32	LEONARDO - FINMECCANICA SPA	Italy	9.0	30
33	ESTEYCO SAP	Spain	8.9	3
34	VAILLANT GMBH	Germany	8.7	3
35	STMICROELECTRONICS SRL	Italy	8.7	21
36	VOLKSWAGEN AG	Germany	8.4	11
37	FONROCHE GEOther (OTH)ERMIE SAS	France	8.4	1
38	ARTTIC	France	8.3	22
39	GEO@SEA NV	Belgium	8.3	1
40	NOVAMONT SPA	Italy	8.0	5
41	SOITEC SA	France	7.9	5
42	DNV GL NETHERLANDS B.V.	Netherlands	7.9	6
43	ANSALDO STS S.p.A.	Italy	7.8	13
44	AIR LIQUIDE ADVANCED TECHNOLOGIES SA	France	7.8	2
45	AIRBUS DEFENCE AND SPACE GMBH	Germany	7.8	20
46	PHILIPS MEDICAL SYSTEMS NEDERLAND BV	Netherlands	7.7	13
47	SIEMENS PUBLIC LIMITED COMPANY	United Kingdom	7.7	7
48	THALES AIR SYSTEMS SAS	France	7.7	23
49	RICARDO UK LIMITED	United Kingdom	7.7	12
50	BULL SAS	France	7.6	10

Corda, Signed Grants cut-off date by 1/1/2017.

G.5. Public sector organisations (PUB)

Table 31 Top-50 public sector organisations in terms of EU funding

Rank	Participant legal name	Country	EU contribution (EUR million)	Number of participations
1	REGION HOVEDSTADEN	Denmark	19.5	31
2	AGENCE NATIONALE DE LA Research Organisations (REC)HERCHE	France	19.4	36
3	NORGES FORSKNINGSRAD	Norway	17.4	42
4	BUNDESAMT FUER STRAHLENSCHUTZ	Germany	14.8	2
5	BUNDESMINISTERIUM FUER BILDUNG UND FORSCHUNG	Germany	12.9	17
6	CENTRO PARA EL DESARROLLO TECNOLOGICO INDUSTRIAL.	Spain	12.6	30
7	MINISTERIE VAN ECONOMISCHE ZAKEN	Netherlands	11.6	31
8	OESTERREICHISCHE FORSCHUNGSFOERDERUNGSGESELLSCHAFT MBH	Austria	10.5	29
9	The Department Of Energy and Climate Change	United Kingdom	9.6	4
10	WELSH ASSEMBLY GOVERNMENT	United Kingdom	9.6	2
11	FUNDACAO PARA A CIENCIA E A TECNOLOGIA	Portugal	8.8	63
12	ENERGISTYRELSEN	Denmark	8.6	8
13	VETENSKAPSRADET - SWEDISH RESEARCH COUNCIL	Sweden	8.1	10
14	MINISTERIO DE ECONOMIA Y COMPETITIVIDAD	Spain	8.0	29
15	THE SECRETARY OF STATE FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS	United Kingdom	7.6	22
16	NARODOWE CENTRUM NAUKI	Poland	7.6	10
17	FORSKNINGSRÅDET FÖR MILJÖ, AREELLA NÄRINGAR OCH SAMHÄLLSBYGGANDE	Sweden	7.5	14
18	NARODOWE CENTRUM BADAN I ROZWOJU	Poland	7.5	26
19	MET OFFICE	United Kingdom	7.4	14
20	STOCKHOLMS LANS LANDSTING	Sweden	7.1	5
21	LANDESHAUPTSTADT MUENCHEN	Germany	6.9	3
22	ENTERPRISE IRELAND	Ireland	6.5	9
23	MINISTERIE VAN INFRASTRUCTUUR EN MILIEU	Netherlands	6.5	20
24	STOCKHOLMS STAD	Sweden	6.2	4
25	MINISTERO DELL'ISTRUZIONE, DELL'UNIVERSITA' E DELLA RICERCA	Italy	6.1	28
26	AGENCIA PER A LA COMPETITIVITAT DE LA EMPRESA	Spain	6.0	6
27	SERVICIO MADRILENO DE SALUD	Spain	5.9	17
28	STATENS ENERGIMYNDIGHET	Sweden	5.9	12
29	INNOVATIONSFONDEN	Denmark	5.7	17
30	TARTU LINNAVALITSUS	Estonia	5.4	1
31	SERVICIO ANDALUZ DE SALUD	Spain	5.4	12
32	CAMARA MUNICIPAL DE LISBOA	Portugal	5.4	11
33	COMUNE DI FIRENZE	Italy	5.3	5
34	SVERIGES METEOROLOGISKA OCH HYDROLOGISKA INSTITUT	Sweden	5.1	14
35	MINISTERO DELLA SALUTE	Italy	5.0	13
36	AN TUDARAS UM ARD OIDEACHAS	Ireland	5.0	4
37	SERVIZO GALEGO DE SAUDE	Spain	4.6	9
38	Nottingham City Council	United Kingdom	4.5	2
39	TRAFIKVERKET - TRV	Sweden	4.2	11
40	Vivienda y Suelo de Euskadi, S.A.	Spain	4.2	2
41	AGENCE DE L'ENVIRONNEMENT ET DE LA MAITRISE DE L'ENERGIE	France	4.2	9
42	AYUNTAMIENTO DE VALLADOLID	Spain	4.2	3
43	MATIMOP - THE ISRAELI CENTER FOR R&D	Israel	4.1	18
44	KOBENHAVNS KOMMUNE	Denmark	4.1	10
45	BRISTOL CITY COUNCIL	United Kingdom	3.9	5
46	CENTRE HOSPITALIER UNIVERSITAIRE VAUDOIS	Switzerland	3.9	11
47	BRITISH BROADCASTING CORPORATION	United Kingdom	3.8	5
48	TEPEBASI MUNICIPALITY	Turkey	3.8	1

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G.6. Research Organisations (REC)

Table 32 Top-50 public sector organisations in terms of EU funding

Rank	Participant legal name	Country	EU contribution (EUR million)	Number of participations
1	MAX-PLANCK-GESELLSCHAFT ZUR FORDERUNG DER WISSENSCHAFTEN EV	Germany	443,5	213
2	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	France	361,4	505
3	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	Germany	223,9	407
4	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France	218,7	246
5	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy	114,2	250
6	AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS	Spain	110,1	237
7	INTERUNIVERSITAIR MICRO-ELECTRONICACENTRUM	Belgium	93,0	86
8	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Germany	86,1	163
9	INSTITUT NATIONAL DE LA SANTE ET DE LA RECHERCHE MEDICALE	France	85,3	113
10	Teknologian tutkimuskeskus VTT Oy	Finland	64,3	127
11	FORSCHUNGSZENTRUM JULICH GMBH	Germany	62,0	82
12	FUNDACION TECNALIA RESEARCH & INNOVATION	Spain	57,6	122
13	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO	Netherlands	55,7	109
14	EUROPEAN MOLECULAR BIOLOGY LABORATORY	Germany	52,9	60
15	AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE	Italy	51,6	53
16	STICHTING WAGENINGEN RESEARCH	Netherlands	44,4	75
17	ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS	Greece	44,1	100
18	INSTITUT NATIONAL DE RECHERCHE ENINFORMATIQUE ET AUTOMATIQUE	France	40,1	63
19	STIFTELSEN SINTEF	Norway	39,0	76
20	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Greece	38,1	96
21	EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH	Switzerland	36,1	46
22	AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH	Austria	29,8	55
23	INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE	United Kingdom	29,3	58
24	NATURAL ENVIRONMENT RESEARCH COUNCIL	France	29,3	75
25	INSTITUT PASTEUR	France	28,5	46
26	VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK N.V.	Belgium	28,0	46
27	UNITED KINGDOM ATOMIC ENERGY AUTHORITY	United Kingdom	27,8	3
28	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA	Italy	25,9	36
29	KONINKLIJKE NEDERLANDSE AKADEMIE VAN WETENSCHAPPEN - KNAW	Netherlands	25,3	35
30	HELMHOLTZ ZENTRUM MUENCHEN DEUTSCHES FORSCHUNGSZENTRUM FUER GESUNDHEIT UND UMWELT GMBH	Germany	24,7	29
31	VIB	Belgium	24,3	34
32	INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	Greece	24,0	54
33	CENTRO RICERCHE FIAT SCPA	Italy	23,9	47
34	FUNDACIO INSTITUT DE CIENCIES FOTONIQUES	Spain	23,7	37
35	BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION	Spain	22,5	49
36	ISTITUTO NAZIONALE DI FISICA NUCLEARE	Italy	21,3	39
37	FUNDACIO CENTRE DE REGULACIO GENOMICA	Spain	19,8	27
38	SCIENCE AND TECHNOLOGY FACILITIES COUNCIL	United Kingdom	19,8	45
39	FRIEDRICH MIESCHER INSTITUTE FOR BIOMEDICAL RESEARCH	Switzerland	19,7	13
40	TWI LIMITED	United Kingdom	19,0	30
41	HELMHOLTZ ZENTRUM POTSDAM DEUTSCHESGEOFORSCHUNGSZENTRUM GFZ	Germany	18,9	24
42	INSTITUTO DE MEDICINA MOLECULAR	Portugal	18,5	19
43	INSTITUT JOZEF STEFAN	Slovenia	18,3	60
44	UMWELTBUNDESAMT	Germany	18,3	7
45	MEDICAL RESEARCH COUNCIL	United Kingdom	17,6	36
46	INSTITUT CURIE	France	17,0	25
47	CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT	Spain	16,8	31
48	FORSCHUNGSVERBUND BERLIN EV	Germany	16,4	28
49	STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM	Netherlands	16,1	39
50	TURKIYE BILIMSEL VE TEKNOLOJIK ARASTIRMA KURUMU	Turkey	15,8	44

Corda, Signed Grants cut-off date by 1/1/2017.

G.7. SMEs

Table 33 Top-50 SMEs in terms of EU funding

Rank	Participant legal name	Country	EU contribution (EUR million)	Number of participations
1	GEANT LIMITED	United Kingdom	64.6	8
2	SOLIDPOWER SPA	Italy	12.7	5
3	SWEREA MEFOS AB	Sweden	12.6	5
4	ITM POWER (TRADING) LIMITED	United Kingdom	12.6	8
5	WELLO OY	Finland	9.4	1
6	INNOVACIO I Research Organisations (REC)ERCA INDUSTRIAL I SOSTENIBLE SL	Spain	9.2	13
7	ESTEYCO SAP	Spain	8.9	3
8	ARTTIC	France	8.3	22
9	ICLEI EUROPEAN SECRETARIAT GMBH (ICLEI EUROPASEKRETARIAT GMBH)*	Germany	7.9	22
10	Centre for Process Innovation Limited	United Kingdom	7.7	8
11	Kompetenzzentrum - Das Virtuelle Fahrzeug, Forschungsgesellschaft mbH	Austria	7.4	23
12	BIO BASE EUROPE PILOT PLANT VZW	Belgium	7.1	10
13	H2 Logic A/S	Denmark	6.8	5
14	HS ORKA HF	Iceland	6.6	2
15	SYMBIOFCELL SA	France	6.3	3
16	EURICE EUROPEAN RESEARCH AND PROJECT OFFICE GMBH	Germany	6.3	15
17	FUNDACION CENER-CIEMAT	Spain	6.3	13
18	GEANT VERENIGING	Netherlands	6.1	8
19	SPACE APPLICATIONS SERVICES NV	Belgium	5.9	6
20	AVANTIUM CHEMICALS BV	Netherlands	5.3	8
21	AMONETA DIAGNOSTICS	France	5.0	1
22	TC LAND EXPRESSION SA	France	5.0	1
23	Agendia NV	Netherlands	5.0	2
24	ALACRIS THERANOSTICS GMBH	Germany	4.9	4
25	NOVA INNOVATION LTD	United Kingdom	4.8	3
26	INTELLIGENT ENERGY LIMITED	United Kingdom	4.8	4
27	METGEN OY	Finland	4.7	6
28	META Group S.R.L	Italy	4.7	8
29	GREEN MARINE(UK)LTD	United Kingdom	4.6	1
30	LATERIZI GAMBETTOLA SRL	Italy	4.5	5
31	TRUST-IT SERVICES LIMITED	United Kingdom	4.5	15
32	RADISENS DIAGNOSTICS LIMITED	Ireland	4.5	1
33	GENERAL EQUIPMENT FOR MEDICAL IMAGING SA	Spain	4.4	2
34	FUNDINGBOX ACCELERATOR SP ZOO	Poland	4.4	1
35	OSLO MEDTECH FORENING	Norway	4.4	2
36	NORDUNET A/S	Denmark	4.4	4
37	TECHNIKON FORSCHUNGS- UND PLANUNGSGESELLSCHAFT MBH	Austria	4.4	12
38	EryDel S.p.A.	Italy	4.3	1
39	ECOLOGIC INSTITUT gemeinnützige GmbH	Germany	4.3	9
40	PMD DEVICE SOLUTIONS LIMITED	Ireland	4.3	1
41	ISTITUTO DI STUDI PER L'INTEGRAZIONE DEI SISTEMI SC	Italy	4.3	13
42	IMMUNOVIA AB	Sweden	4.2	1
43	P1VITAL LIMITED	United Kingdom	4.1	2
44	NEMO HEALTHCARE BV	Netherlands	4.1	2
45	HOLONIX SRL-SPIN OFF DEL POLITECNICO DI MILANO	Italy	4.1	13
46	THE SCOTTISH ASSOCIATION FOR MARINESCIENCE LBG	United Kingdom	4.1	9
47	EXUS SOFTWARE LTD	United Kingdom	4.0	7
48	XLAB RAZVOJ PROGRAMSKE OPREME IN SVETOVANJE DOO	Slovenia	4.0	13
49	UNION INTERNATIONALE DES TRANSPORTS PUBLICS	Belgium	3.9	10
50	YOURIS.COM	Belgium	3.9	14

Corda, Signed Grants cut-off date by 1/1/2017

H. THE COVERAGE OF CROSS-CUTTING ISSUES IN HORIZON 2020

H.1. Introduction

Regulation (EU) No 1291/2013 Annex 1 highlights that cross-cutting issues will be promoted between specific objectives of the three priorities of Horizon 2020 as necessary to develop new knowledge, key competences and major technological breakthroughs as well as translating knowledge into economic and societal value. Furthermore, in many cases, interdisciplinary solutions will have to be developed which cut across the multiple specific objectives of Horizon 2020. Horizon 2020 will provide incentives for actions dealing with such cross-cutting issues, including by the efficient bundling of budgets.

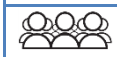
According to Article 32 the interim evaluation shall assess the progress of the different parts of Horizon 2020 against {…} the efficiency and use of resources, with particular attention to cross-cutting issues and other elements referred to in Article 14(1). Article 14(1) provides an indicative list of cross-cutting issues:

- The development and application of key enabling and industrial technologies as well as future and emerging technologies;
- Areas relating to bridging from discovery to market application;
- Interdisciplinary and cross-sectoral research and innovation;
- Social and economic sciences and humanities;
- Climate change and sustainable development;
- Fostering the functioning and achievement of the ERA and of the flagship initiative 'Innovation Union';
- Framework conditions in support of the flagship initiative "Innovation Union";
- Contributing to all relevant Europe 2020 flagship initiatives (including the Digital Agenda for Europe);
- Widening participation across the Union in research and innovation and helping to close the research and innovation divide in Europe;
- International networks for excellent researchers and innovators such as European Cooperation in Science and Technology (COST);
- Cooperation with third countries;
- Responsible research and innovation including gender;
- SME involvement in research and innovation and broader private sector participation;
- Enhancing the attractiveness of the research profession; and
- Facilitating trans-national and cross-sector mobility of researchers.

Article 31 further states that the Commission monitoring activities as regards the implementation of Horizon 2020, its specific programme and the activities of the EIT shall include information on cross-cutting topics such as social and economic sciences and humanities, sustainability and climate change, including information on the amount of climate related expenditure, SME participation, private sector participation, gender equality, widening participation and progress against performance indicators.

The following sections provide an in-depth analysis of each cross-cutting issue; including the rationale, implementation, main achievements so far and lessons learnt. The table below provides an overview of the indicators to monitor progress on the cross-cutting issues.

Figure 47 Overview of progress on coverage of cross-cutting issues in Horizon 2020

	Cross cutting issue	Indicator	Progress
	**Contribution to the realisation of the European Research Area**	Annual number of research positions advertised on EURAXESS Jobs	The number of research positions advertised on EURAXESS Jobs between 1 January and 31 December 2015 comprised 286,525 job vacancies and 62,088 fellowships.
		Number of national research infrastructures networked (in the sense of being made accessible to all researchers in Europe and beyond through Union support)	National research infrastructures networked thanks to Horizon 2020 support by the end of 2015 were 363. The target by the end of Horizon 2020 is 900.
		Number and share of Open Access articles published in peer-reviewed journals	65% (CORDA)
		Number of projects that make scientific data accessible and re-usable and number of scientific datasets made accessible and re-usable	So far, 65% of the projects covered by the scope of the pilot (2014-2015 figures) participate in the pilot and 34.6% opt-out. Furthermore, outside the areas covered by the pilot, a further 11.9% of projects participate on a voluntary (opt-in) basis.
		Number of Multiannual Implementation Plans adopted by Joint Programming Initiatives	In 2015 all 10 Joint Programming Initiatives have adopted their Multiannual Implementation Plan.
	**Widening participation**	Share of participations to EU-13 Member States	8.5%
		Share of financial contribution to EU-13 Member States	4.4%
	**SME participation**	Percentage of EU financial contribution going to SMEs (LEIT and SC) TARGET: 20% of allocation	In LEIT and Societal Challenges, the SMEs received 23.9% of the funding and had 26.9% of the participation fulfilling the 20% target of funding to SMEs in LEIT and SC.[1] SMEs had 16.0% of the total funding of Horizon 2020 and had 20.7 % of the participations
		Percentage of EU financial contribution committed through the SME instrument (LEIT and SC)	5.6%[2]

[1] Results based on data extracted from CORDA; compilation of budgets allocated to SMEs in the framework of Horizon 2020 grant agreements signed in 2014, 2015 and 2016

[2] Results based on financial commitments under the different parts of the Horizon 2020 Work Programmes 2014-2015 and 2016-2017 contributing to the budget for the SME instrument call.

	**Social Science and Humanities**	Percentage of SSH partners in selected projects in all Horizon 2020 priorities and percentage of EU financial contribution allocated to them	SSH partners comprised 26% of partners in selected projects under SSH-flagged topics, receiving 22% of the budget within these projects.
	**Science and Society (Responsible Research and Innovation)**	Percentage of projects where citizens, Civil Society Organisation (CSOs) and other societal actors contribute to the co-creation of scientific agendas and scientific contents	In 11.0% of the projects.
	**Gender**	Percentage of women participants in Horizon 2020 projects.	40.3%
		Percentage of women coordinators in Horizon 2020.	31% of the coordinators of the projects are women
		Percentage of women in EC advisory groups expert groups, evaluation panels, individual experts, etc.	53% of the members of Advisory Groups in 2016 were women 36.7% of the evaluators were women.
		Percentage of projects taking into account the gender dimension in research and innovation content.	NA
	**International Cooperation**	Share of Third Country participations in collaborative projects[3].	Third countries had 2.5% of the participations (for all Horizon 2020 projects third countries had 1.9% of the participations)
		Share of EU financial contribution attributed to Third Country participants of collaborative projects.	Third countries received 0.8% of the funding in collaborative projects (0.6% of the funding of all Horizon 2020 projects)
		Share of budget of topics in the Work Programme 2014-15 mentioning at least one Third Country or region.	23.3%
	**Sustainable development**	Share of EU financial contribution that is climate related in Horizon 2020 (EUR) Target: 35%	27.0%
		Share of EU financial contribution that is sustainability related in Horizon 2020 (EUR) Target: 60%	53.3%
		Share of EU financial contribution that is biodiversity related in Horizon 2020 (EUR) (no target):	4.0%
	**Bridging from discovery to market application**	Share of projects and EU financial contribution allocated to innovation actions in Horizon 2020.	17.2%
		Within the innovation actions, share of EU financial contribution focussed on demonstration and first-of-a-kind activities.	86.5% was focussed on demonstration and 7.7% of first of a kind activity.
	**Digital Agenda**	Share of EU financial contribution that is ICT Research & Innovation related in Horizon 2020 (EUR)	30.0%
	**Private sector participation**	Percentage of Horizon 2020 beneficiaries from the private for profit sector	62.2% of the beneficiaries came from the private sector and represented 33.2% of the participations.
		Share of EU financial contribution going to private for profit entities (LEIT and Societal Challenges).	Private sector entities received 42.8% LEIT and SC and 27.7% in all of Horizon 2020.

Source: CORDA, 01/01/2017 cut-off date

[3] "Collaborative" projects refer to all Horizon 2020 projects apart from ERC, SME Instrument, MSCA, projects under "Access to Risk Finance", JRC and EIT.

H.2. The development and application of key enabling and industrial technologies as well as future and emerging technologies

An in-depth analysis of the development and application of key enabling and industrial technologies as well as future and emerging technologies is provided under the Annexes 2.E, 2.F 2.G and 2.B related to the specific objectives Leadership in Enabling and Industrial Technologies (LEIT-ICT, LEIT-NMBP, LEIT-Space) and Future and Emerging Technologies (FET).

H.3. Bridging from discovery to market application

H.3.1. *Overview*

The Europe 2020 strategy focusses on smart, sustainable and inclusive growth, highlighting the role of research and innovation as key drivers. Horizon 2020 puts a specific focus on innovation under its second and third pillars (Industrial Leadership and Societal Challenges).

According to Regulation (EU) No 1291/2013 linkages and interfaces shall be implemented across and within the priorities of Horizon 2020. Particular attention shall be paid in this respect to {...} areas relating to bridging from discovery to market application. {...} Bridging actions throughout Horizon 2020 are aimed at bringing discovery to market application, leading to exploitation and commercialisation of ideas whenever appropriate. The actions should be based on a broad innovation concept and stimulate cross-sectoral innovation.

H.3.1. Rationale

Previous framework programmes were effective in strengthening scientific excellence, in involving leading international scientific and technological talent*, and* in fostering increased Europe-wide research and innovation collaboration, but less effective in taking innovative products to market. Horizon 2020 also supports innovation to help discoveries make it into applications. The term "innovation" means the introduction to the market of new or improved products, services, processes, and solutions. These activities support the market uptake and should lead to job creation, economic growth and social benefits.

H.3.2. *Implementation*

The programme is based on a broad innovation concept which is not limited to the development of new products and services on the basis of scientific and technological results, but which also incorporates the use of existing technologies in novel applications, continuous improvement, non-technological and social innovation. It includes activities closer to the market and to end-users (e.g. prototyping, testing, demonstrating, piloting, product validation and market replication) and demand-side approaches (such as pre-commercial procurement and procurement of innovative solutions). It deploys new instruments for this: innovation actions, innovation procurement and inducement prizes.

Innovation actions: these actions focus on demonstrations, tests and other activities close to applications. These innovation actions can build on the results of previous projects. They can also complement *research and* innovation actions that contain more research. These innovation actions are used for areas where the scientific and technology insights are available and the focus shifts to turning these into applications.

Innovative procurement: the pace of adoption of innovations in the public sector is slow despite the potential of innovation procurement to modernize the public sector (public

procurement accounts for approximately 14% of EU GDP[4]). Companies – in particular SMEs - identify the lack of first buyers as the number one barrier for company growth. Innovative procurement has the ability to improve the quality and efficiency of public services whilst also opening up market opportunities for innovative companies.

Inducement prizes: R&I funding often follows the path of technological innovation through incremental steps. Horizon 2020 introduced Prizes to support open innovation. Prizes are a 'test-validate-scale' approach that brings together new-to-industry players and small players that may pursue more radically new concepts than large, institutionalized contestants. Inducement prizes offer an incentive by mobilising new talents and engaging new solver communities around a specific challenge. Smart prize designs can activate this huge potential and leverage private investment into R&I, often manifold of the prize offering. Prizes are a prime example of 'value for money' as inducement prizes are only awarded based on the achievement of the target set, solving the challenge defined.

Other modalities are also expected to improve the uptake of results:

- The Innovation Radar: external monitoring experts with innovation and market knowledge assess the innovations and innovators coming out of Horizon 2020. They register their assessment in structured data which allows for early identification of high potential innovations and innovators in projects. This also may provide insights on support needs of individual innovators to get their innovations to the market.
- Additional tailored support for projects[5] through a consultancy service. It assists projects by analysing their key exploitable results and by developing strategies for their exploitation. The services are tailored to the projects' needs and levels of maturity (such as an exploitation strategy seminar or the development of a business plan).
- The InnovFin instruments to provide investment for taking results to the market, implemented by EIF and by private investors. Companies taking part in the SME instrument are informed about these opportunities, can get coaching and are offered sessions to pitch for investors.

These support measures are expected to help Horizon 2020 deliver economic impact by bridging the gap between scientific discoveries and their market application.

H.3.3. *Achievements so far*

Innovation Actions (IA): at the beginning of Horizon 2020, no targets were set for the share of Innovation Actions close to the market. At the end of 2016, 6.2% of the signed grants and 17.2% of the funding is allocated to these (Excellent Science does not have IAs; within the other two pillars Industrial leadership and Societal Challenges, 10.2% of the projects are IAs with 23.6% of the EU contribution). Especially in the programme parts related to Energy, Security, the Fast Track to Innovation and the SME instrument, innovation actions are often used. Under the Societal Challenges of Health and 'Europe in a changing world' which are more research-oriented, their share is much lower..

[4] Public procurement for Innovation – Good Practices and Strategies, OECD, 2016: http://www.oecd.org/gov/ethics/Procurement-Innovation-Practices-Strategies.pdf

[5] Applied for projects in nano- and material technologies, energy, and in one action that covers in potential all parts of FP7 and Horizon 2020. A private consultancy provides the support.

Currently, 87% of the funding within innovation actions is allocated to demonstration actions and 8% to first-of-a-kind activities[6]. This shows that Horizon 2020 is moving towards higher Technology Readiness Levels (TRLs).

Table 34 Percentage of projects and EU financial contribution allocated to Innovation Actions (IA) per Horizon 2020 programme part

Programme Part Description	Nr of Signed Grants	EC contribution to Signed Grants (EUR million)	Nr of Signed Grants in Innovation Actions (IA)	EC contribution to Signed Grants in Innovation Actions (IA) (EUR million)	Share of Innovation Actions (IA) Signed Grants	Share of EC contribution to Innovation Actions (IA)
FTI - Fast-Track to Innovation	75	161.2	75	161.2	100.0%	100.0%
ERC - European Research Council	2 440	3 874.2				
FET - Future and Emerging Technologies	129	654.4				
MSCA - Marie Skłodowska-Curie Actions	3 246	2 114.9				
RI - Research Infrastructures	149	870.9				
LEIT-ICT	1 005	2 600.6	176	854.9	17.5%	32.9%
LEIT-NMBP	512	1 505.3	95	581.6	18.6%	38.6%
LEIT-SPACE	211	356.3	45	94.7	21.3%	26.6%
ARF - Access to risk finance	7	7.9				
Innovation in SMEs	198	69.8	7	29.7	3.5%	42.6%
SC1 - Health, demographic change and well-being	570	1 705.8	4	13.6	0.7%	0.8%
SC2 - Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy	365	832.1	27	198.8	7.4%	23.9%
SC3 - Secure, clean and efficient energy	640	1 735.2	70	768.6	10.9%	44.3%
SC4 - Smart, green and integrated transports	655	1 376.8	99	372.4	15.1%	27.1%
SC5 - Climate action, environment, resource efficiency and raw materials	340	912.6	34	199.0	10.0%	21.8%
SC6 - Europe in a changing world - Inclusive, innovative and reflecting societies	194	342.1	16	50.9	8.2%	14.9%
SC7 - Secure societies - Protecting freedom and security of Europe and its citizens	177	446.9	36	188.4	20.3%	42.2%
SEWP - Spreading excellence and widening participation	118	209.1				
SWAFS - Science with and for society	53	108.9				
Euratom	24	514.9				

Source: CORDA data, extraction 1 January 2017

Looking into the proposal texts of 227 innovation actions that started in 2015, a study[7] identified three categories of projects:

- **'Pioneering'** projects: scoring high on technological novelty, market scope and innovation readiness, but low on ecosystem embeddedness (64 projects out of the 227 projects). They focus on breakthrough technological results that may create markets. Pioneering projects involve relatively more private companies, esp. SMEs, and research institutions.
- **'Diffusing'** projects: emphasising ecosystem embeddedness and scoring lower on the other three aspects (58 projects). They aim at the diffusion and exploitation of the innovative solution in the ecosystem. The diffusing projects involve less companies and more public bodies.

[6] The remaining 5% of the projects are not classified.

[7] Grimpe, C. et al., Study on innovation in Horizon 2020 Innovation Actions, EC, 2017. For this study, 227 Innovation Actions were selected that started in 2015, most of them in the PPPs such as Ecsel (LEIT-ICT), Clean Sky (Societal Challenge 4), Factories of the Future (LEIT-NMBP), Energy Efficient Buildings (LEIT-NMBP), Clean Vehicle (Societal Challenge 4), but also in other calls. The texts of the granted projects were analysed using content analysis methodology, based on keywords that indicate four innovation aspects: technological novelty, market scope, ecosystem embeddedness and innovation readiness.

- **'Sustaining'** projects: the remaining 105 projects pay only modest attention to each of the four aspects. They are dominated by higher education institutions.

Whereas it is still too early to characterise these innovation actions and their impacts, these initial findings indicate that a quarter of innovation actions have a disruptive, market-creating potential, and that companies and research institutions play a leading role in these initiatives.

Looking closer at Horizon 2020 initiatives in the field of **pre-commercial public procurement (PCP) and public procurement for innovation (PPI),** both in 2014 and 2015, some topics supporting the implementation of innovation procurement did not receive eligible proposals. However, in 2015, six projects were signed that are implemented through PCP or PPI with a total EC contribution of EUR 18.5 million. Three additional projects submitted under a deadline in 2015 were signed in the first semester of 2016 with an overall EC contribution of EUR 7.9 million.

As regards inducement and recognition **prizes**, the first ones were launched in 2015: five inducement prizes with a budget of EUR 6 million[8] together with three recognition prizes with an overall budget of EUR 1.33 million[9] were selected. Up to the end of 2016, 12 Horizon inducement prizes have been launched and six more will follow in 2017. All prizes are 'best-in-class prizes' which reward contestants that best meet the predefined objective. They target challenges such as Sharing of Spectrum, Breaking the Optical Barrier, Aging population, Mother and child health, CO2 reuse, Clean car engines, Cyber security etc.[10]

The Fast Track to Innovation (FTI) was launched as a pilot action in 2015, aiming at bringing close-to-market innovation by consortia to the market. It supports innovation actions under Industrial Leadership and the Societal Challenges, relating to any technology field, on the basis of a continuously open call (bottom-up). The pilot action had seen a high number of submitted proposals (887) that requested an EU contribution mounting to EUR 1.7 billion while the budget was EUR 100 million. After evaluation, 181 proposals scored above threshold and 46 proposals were finally retained (average amount of EC budget allocated per grant: EUR 2.1 million). Participation in 2015 in the FTI shows that participation from the private sector (76.7% budgetwise) and SMEs (48.0%) is high. Close to 60% of the FTI project coordinators are SMEs.

Other indicators signalling the bridging efforts from discovery to market:

- 93% of all projects in Horizon 2020 pillars 2 (Industrial Leadership) and 3 (Societal Challenges) has one or more participating businesses, which indicates a market interest;
- Innovation Radar: at the end of 2016, 800 FP7 and over 150 Horizon 2020 collaborative projects in the ICT area were monitored and assessed, with a pilot going on to extend this further to non-ICT themes of Horizon 2020. The 150 Horizon 2020 projects are expected to deliver over 300 distinct innovations;
- The additional support for recognising exploitable results and developing measures for their exploitation has been applied to 355 projects in the nano- and material technologies. A second round that would cover all sorts of projects is being prepared for ca. 250 projects by April 2018;

[8] There has been no budget executed yet.
[9] EUR 0.15 million of the budget has been executed so far.
[10] http://ec.europa.eu/research/horizonprize/index.cfm?lg=en&pg=prizes

- Out of the 10,000 companies taking part in Horizon 2020, in the first three years 225 benefitted from the financial instruments in InnovFin for investments in scaling up[11]. Out of the 1,640 SMEs taking part in the SME instrument, 134 companies secured venture capital recently, out of which 31 during or after the project[12]. These numbers are expected to increase in the years to come when more projects start delivering results.
- Also in the 'Excellent Science' pillar of Horizon 2020 innovation is targeted. The European Research Council (ERC) has funded around 400 'proof of concept' projects that bring an invention towards application. The first 140 were analysed which showed that 42% use a spin-off company (existing, new or planned) to take the results to the market. Out of 2 460 distinct beneficiaries of the Marie Skłodowska Curie Actions (MSCA), more than 40% are private for profit organisations. Although they tend to participate in fewer projects than universities they account for 16% of all participations, i.e. the number of projects in which they are beneficiaries. Furthermore, around 45% of all MSCA fellows benefit from some form of cross-sectoral mobility out of or into an academic setting.

H.3.4. *Lessons learnt/Areas for improvement*

In the first years of Horizon 2020, experience was gained with how to evoke innovation-oriented projects (innovation actions, procurement projects, prizes) and how to link best to follow-up investment. An area for improvement is monitoring the results of these projects. Quantitative indicators like science publications and patents have to be complemented by other indicators such as the number of spin-off companies, the realised or expected additional employment and turnover, venture capital raised for scaling up, and examples of realised impacts on policies, markets, environment and society.

H.4. Interdisciplinary and cross-sectoral research and innovation

H.4.1. Overview

*According to Regulation (EU) No 1291/2013 linkages and interfaces shall be implemented across and within the priorities of Horizon 2020. Particular attention shall be paid in this respect to {…} **interdisciplinary and cross-sectoral research and innovation.** {…} In many cases, interdisciplinary solutions will have to be developed which cut across the multiple specific objectives of Horizon 2020.*

The general objective of Framework programmes is to contribute to building a society and an economy based on knowledge and innovation across the EU and the world, by leveraging additional research, development and innovation funding. Interdisciplinarity research and cross-sectoral collaboration push fields forward and accelerate scientific innovation and discovery through research breakthroughs that address societal problems and foster innovation.

H.4.2. Rationale

Interdisciplinarity research integrates information, data, techniques and perspectives from two or more disciplines of specialised knowledge to solve problems whose solutions are beyond the scope of a single discipline or area of research practice.

[11] Source : European Investment Bank, data per January 2017.
[12] Source: www.ventureradar.com

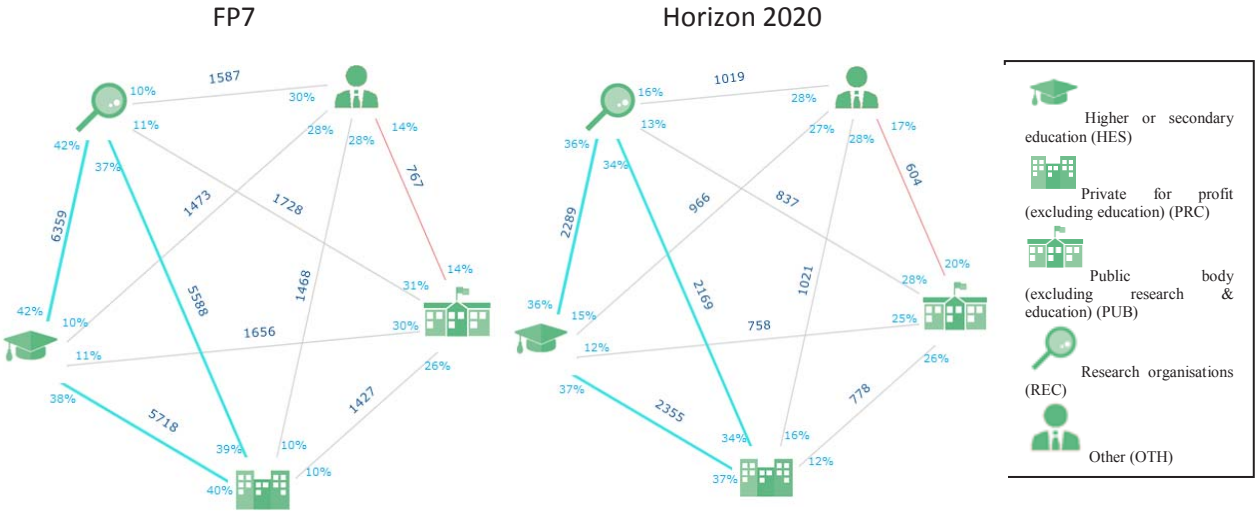
Part of the FP7 ex post evaluation stated that *FP7 "was effective in fostering inter-disciplinary research and increased Europe-wide research and innovation collaboration and networking…. FP7 reinforced a new mode of collaboration and an open innovation framework*". This was achieved through a more decentralised approach to the design, structure and direction of projects across the ERC, JTIs and the EIT.

H.4.3. Achievements so far

H.4.3.1. Collaboration between types of institutions

When comparing the collaborations of different types of institutions in Horizon 2020 and FP7, the private for profit sector (PRC) appears as the main collaborative partner of academia (HES) as opposed to research organisations (RECs) in FP7. As can be seen from the figure below the main collaborations in Horizon 2020 occur between the higher education sector and private firms (2355 collaborative projects), the higher education sector and research organisations (2289 collaborative projects) and between the private-for-profit sector and research organisations (2169 collaborative projects). Participants classified in the category 'Other', which include Civil Society Organisations, collaborate more with the private sector (1021 collaborative projects) than with research organisations (1019 collaborative projects) and with the higher or secondary education sector (966 collaborative projects), while the public bodies are the least preferred hub (604 collaborative projects).

Figure 48 Number of collaborative projects between different types of institutions in FP7 and Horizon 2020



Source: JRC Technology Innovation Monitoring. Cut-off date: 01/01/2017, Graph: European Commission – DG RTD

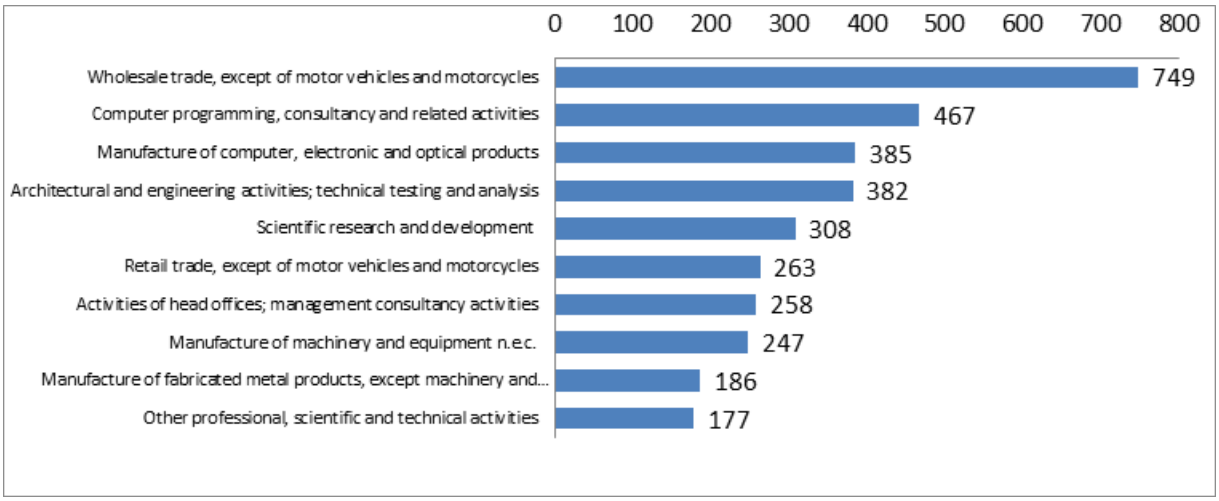
H.4.3.1. Collaboration between industry sectors

The NACE sector classification of the companies participating in Horizon 2020 is used to examine the collaborations between companies from different industry sectors. As detailed in Part O of this annex, most of the Horizon 2020 companies are from the Professional, Scientific and Technical activities sector (33 %), the Manufacturing sector (27 %) and the Information and communication sector (17 %). However while the overall sector of Wholesale trade and retail trade represent 5% of the companies in Horizon 2020, the sub-sector of wholesale trade is the main sector when looking at collaborative projects only (749 collaborative projects), which

illustrates the interconnected nature of the sector (i.e. connections with producers, industrial demand and retail trade from various sectors). The digital sector is strongly represented in collaborative networks, with computer programming, consultancy and related activities (467 collaborative projects) and the manufacture of computer, electronic and optical products (385 collaborative projects) being respectively the second and third sectors in terms of collaborative projects.

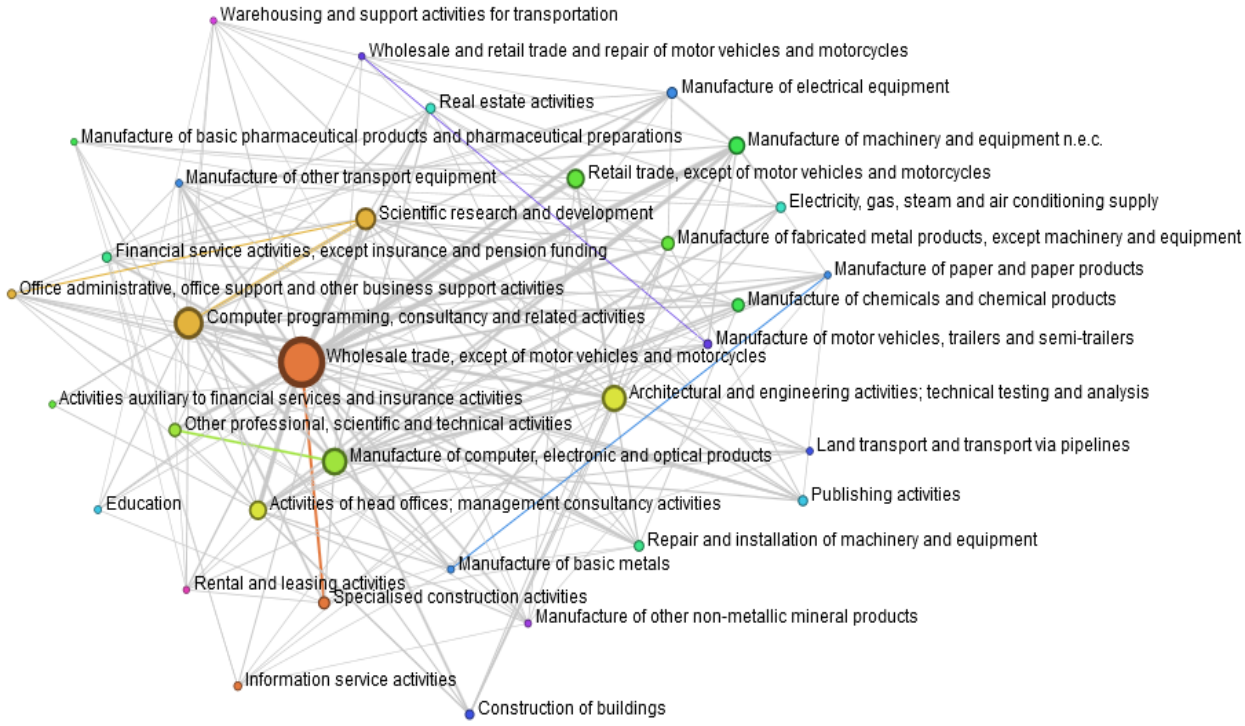
Collaborations between the wholesale trade sector and the digital sector are also the most recurrent type of inter-industry collaborations in Horizon 2020.

Figure 49 Horizon 2020 Top 10 industry sectors by number of collaborative projects



Source: JRC Technology Innovation Monitoring. Cut-off date: 01/01/2017, Graph: European Commission, DG RTD

Figure 50 Industrial inter-sector collaboration networks in Horizon 2020



Source: JRC Technology Innovation Monitoring. Cut-off date: 01/01/2017, Graph: European Commission, DG RTD

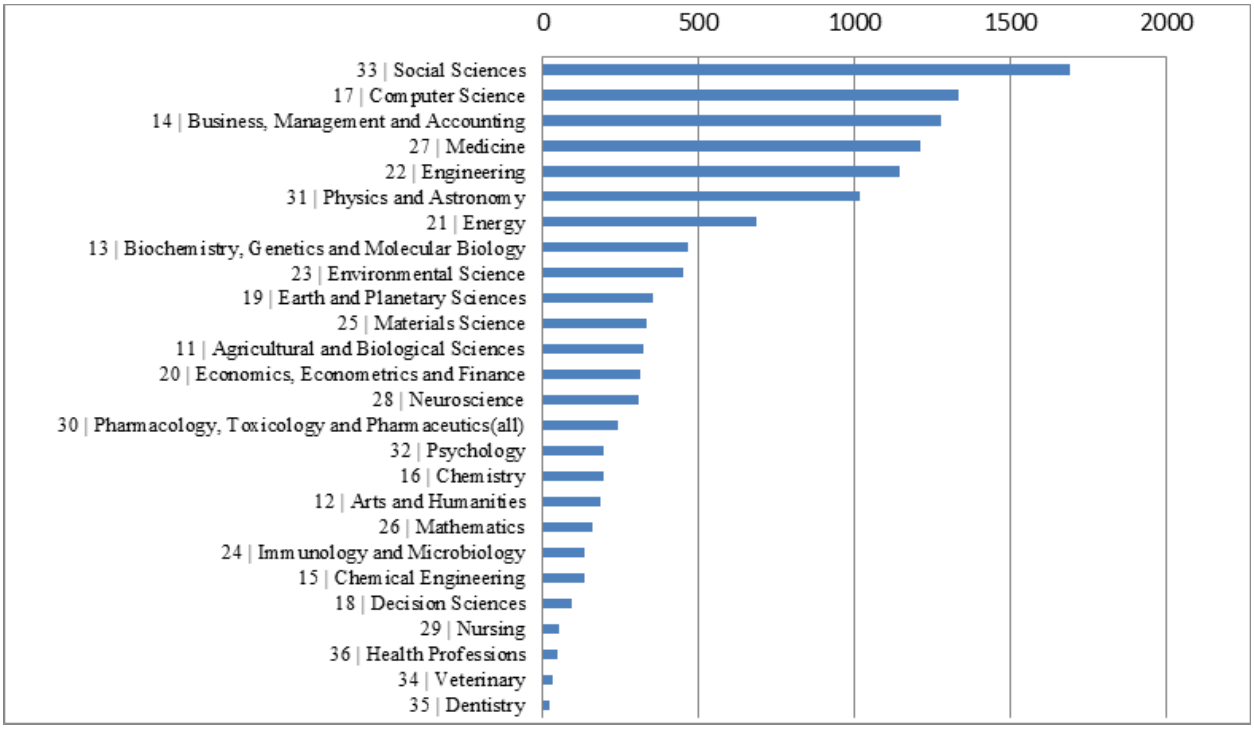
H.4.3.2. Collaborations between academic fields based on projects' participations

Taking a closer look at how knowledge circulates between academic fields in Horizon 2020, an analysis of the projects' focus was carried out. Projects were classified according to the Scopus bibliographic database which includes scientific, technical, medical, and social sciences (including arts and humanities). The classification was done based on text mining of the projects' description and machine learning performed by the Joint Research Centre, the science and knowledge service of the European Commission.

Social sciences lead the field in terms of collaborative projects that involve at least one representative of the field, with business, management and accounting scoring very high as well. They are followed close behind by the STEM field with Computer Science, Medicine, Engineering and Physics and Astronomy all containing at least 1000 collaborative projects in Horizon 2020. Of note is the fact that sciences related to the medical field such as Immunology and Microbiology, Chemical Engineering, Dentistry, Veterinary, Nursing and other Health Professions occupy 6 of the last 7 positions in the ranking of fields in terms of number of collaborative projects.

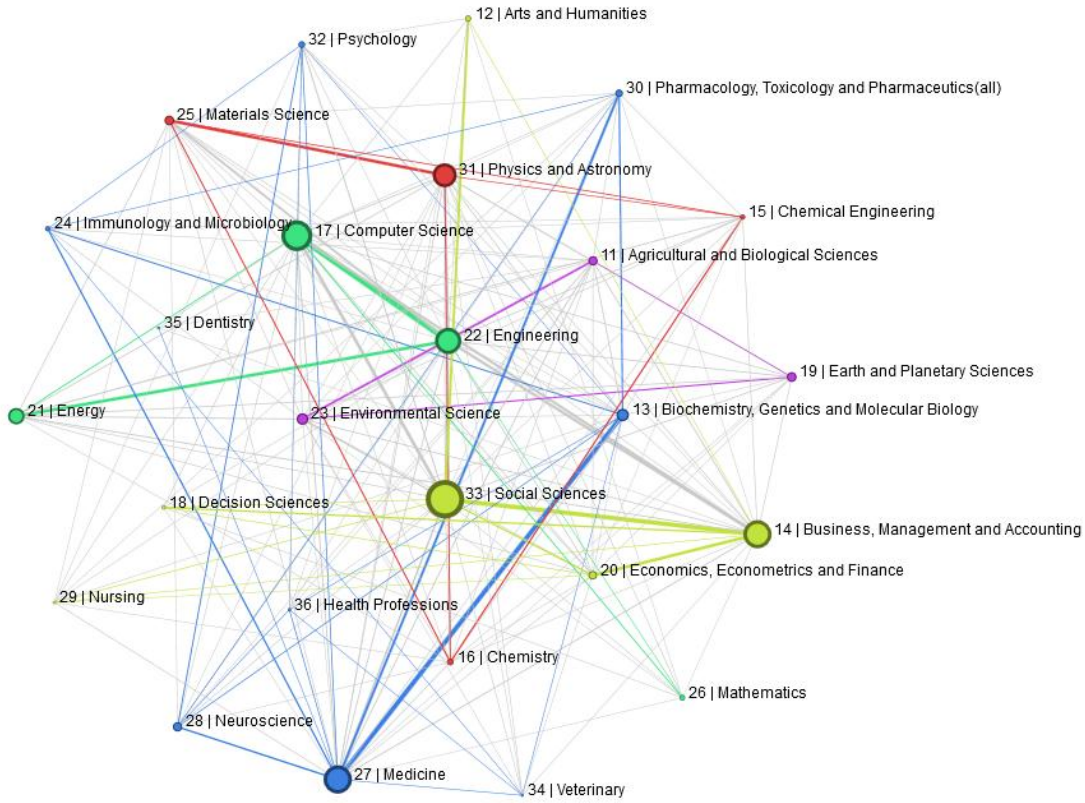
Noticeably, the disciplines of Computer Science and Engineering are the most connected within Horizon 2020 projects.

Figure 51 Main academic fields represented in Horizon 2020 collaborative projects, based on projects' keywords, by number of projects



Source: JRC Technology Innovation Monitoring. Cut-off date: 01/01/2017, Graph: European Commission, DG RTD

Figure 52 Collaboration networks in Horizon 2020 projects between different academic fields, based on projects' keywords, by number of projects



Source: JRC Technology Innovation Monitoring. Cut-off date: 01/01/2017, Graph: European Commission, DG RTD

H.4.3.1. Collaborations between academic fields based on publications

Interdisciplinary publications accounted for 7.45% of total EU-28 publications in FP7 while they represent 7.55% of publications in Horizon 2020 (based on publications during the first three years of both Programmes). EU-15 and EU-13 shares were respectively 7.53% and 5.87% in FP7 and 7.29% and 10.19% in Horizon 2020. In both Programmes the share of interdisciplinary publications was the lowest for third countries (approximately 6%). Overall, interdisciplinarity is noticeably reinforced in Horizon 2020, especially for EU-13 and Associated countries. In comparison with publications that were not funded by the Framework Programmes, the proportion of interdisciplinary publications is similar for EU countries.

For both framework programmes, the field weighted citation impact of interdisciplinary publications is high, and higher than for non-FP publications.

H.4.3.2. Examples of interdisciplinary projects

A case study of DG Connect[13] analyses the implementation and experiences of interdisciplinary collaborative research in Horizon 2020, and exemplifies the lessons learnt so far based on the achievements of selected FET projects. Overall, major scientific advances in research have come from the interstices and synergies among different disciplines (e.g. molecular biology,

[13] CARSA-Annex XII on Interdisciplinarity Research- Support study for the Interim Evaluation of Horizon 2020- DG CONNECT Activities.

psychology, nanotechnology)[14] and this was possible thanks to the complementarities of interdisciplinary research collaboration. The results achieved with the contribution of interdisciplinary research clearly show that the complementarity of the different disciplines can lead to innovative and novel solutions beyond traditional research paradigms. FET has always been welcomed interdisciplinary research. In this sense, recent Horizon 2020 FET projects (including both FET-open and FET-proactive) are significant examples of how complementarity plays a key role and what kind of achievements have been made through the contribution of interdisciplinary research.

IBSEN[15] (Bridging the gap: from Individual Behaviour to the Socio-tEchnical Man) is a FET-open research project that intends to provide a real breakthrough by creating a repertoire of human behaviours in large (more than 1000 people) structured groups using controlled experiments. In particular, the project builds on a novel experimental protocol, software and analytical tools to allow large scale experimentations. To achieve these results, IBSEN requires a high-degree of interdisciplinary which is reflected in its team composition, consisting of physicists, economists, social psychologists, and computer scientists. This variety will allow to create a technology providing a basis for socio-economic simulations that are expected to radically change many fields, from robotics to economics, with technological and societal impacts, including policy-making in socially pressing issues.

CONQUER[16] (Contrast by Quadrupole Enhanced Relaxation) is a highly interdisciplinary project combining expertise in quantum physics, chemical and biomedical engineering, material characterisation as well as nano-toxicology. In particular, the combination of quantum-mechanics and cutting-edge imaging technologies has the potential to create Molecular Imaging solutions with significant impact: the radically new diagnostic and therapeutic treatments developed in the project are key elements to achieve the healthy well-being of European citizens.

The purpose of **2D-INK**[17] (Redesigning 2D Materials for the Formulation of Semiconducting Inks) is to develop inks of novel 2D semiconducting materials for low-cost large-area fabrication processes on insulating substrates through a new methodology, which will exceed the properties of state-of-the-art graphene- and graphene oxide based inks. The inherent high-risk of 2D-INK is countered by a strongly interdisciplinary research team composed of 9 partners with experience in their corresponding fields and with different highly complementary backgrounds: only this synergy can address the challenges of the multiple research and innovation aspects of 2D-INK. Thanks to this interdisciplinary, the project shows the potential to revolutionize research on 2D semiconducting materials, since it enables the applications of these materials over different scientific and technological disciplines, such as electronics, sensing, photonics, energy storage and conversion and spintronic.

NuClock[18] (Towards a nuclear clock with Thorium-229) is developing a novel type of clock, based on a unique nuclear transition in Thorium-229, which will be largely inert to perturbations and holds the potential to outperform existing atomic clocks in terms of precision. The next-generation satellite-based navigation technology and other precision timing applications will greatly benefit from more precise and robust clocks. Research related to this specific topic

[14] Nigel Gilbert, University of Surrey, *Thrills and spills in interdisciplinary research: the case of Future and Emerging Technologies in Horizon 2020*; https://www.ukro.ac.uk/aboutukro/Documents/150618_fet.pdf.
[15] http://ibsen-h2020.eu/.
[16] http://cordis.europa.eu/project/rcn/196966_en.html
[17] http://www.2d-ink.eu/
[18] http://www.nuclock.eu/

demands supreme expertise in a variety of fields, encompassing nuclear and atomic physics, quantum optics, metrology, as well as detector- and laser-technology: in NuClock, the interdisciplinary consortium precisely matches all these requirements.

GOAL-Robots[19] (Goal-based Open-ended Autonomous Learning Robots) intends to develop a new paradigm to build open-ended learning robots, addressing pressing societal needs. The interdisciplinary project consortium consists of leading international roboticists, computational modellers and developmental psychologists, working with complementary methods. This interdisciplinary approach will allow to greatly advance the understanding of the fundamental principles of open-ended learning and to produce a breakthrough in the field of autonomous robotics, by creating robots that can autonomously accumulate complex skills and knowledge in a real open-ended way.

The aim of **Lumiblast**[20] (A paradigm shift in cancer therapy – using mitochondria-powered chemiluminescence to non-invasively treat inaccessible tumours) is to establish a breakthrough technology by providing proof-of-concept in extracellular systems, particular cancer cell cultures and animal models, with the vision to advance to a different treatment for cancers of various origins in the next years. To this end, the project relies on a concerted interdisciplinary action involving expertise in various fields: photo-medicine, synthetic chemistry, photo-chemistry, pharmaceutical formulation, ROS-activated luminescence.

LiRichFCC[21] (A new class of powerful materials for electrochemical energy storage: Lithium-rich oxyfluorides with cubic dense packing) is based on a long-term vision to develop a novel class of materials into practical use, involving foundational aspects in S&T with breakthrough character, high novelty and risk. Indeed, the project intends to explore and optimise possible compositions, synthesis methods, structural properties and dynamics of Li-rich FCC materials through a broad interdisciplinary approach, involving predictive computational work, advanced chemical synthesis and high-end characterisation. This will lead to a paradigm change in the design of battery materials and unexpected effective mechanisms: it could revolutionise the use of batteries in applications involving a need for supplying large amounts of energy and power from small spaces.

The FET-Proactive project **ESCAPE**[22] (Energy-efficient SCalable Algorithms for weather Prediction at Exascale) aims to develop world-class, extreme-scale computing capabilities for European operational numerical weather prediction (NWP) and future climate models, based on a holistic understanding of energy-efficiency for extreme-scale applications using heterogeneous architectures, accelerators and special compute units. In this way, the project will provide the necessary means to take a huge step forward in weather and climate modelling, through interdisciplinary research on energy-efficient high-performance computing and the combination of complementary skills of all project partners, including global NWP and high-performance computing centres.

Based on the evidence collected, the main success factor of interdisciplinary collaboration seems to lie in the fact that it involves interactions between disciplines with focus on major real-life problems and practical solutions. Such an approach implies new forms of knowledge and

[19] http://cordis.europa.eu/project/rcn/203543_en.html
[20] http://cordis.europa.eu/project/rcn/203541_en.html
[21] http://cordis.europa.eu/project/rcn/203539_en.html
[22] http://cordis.europa.eu/project/rcn/197542_en.html

research that go beyond the bounds of validity of existing disciplines and are more suitable for specific inherently complex problems.

H.4.4. Lessons learnt/Areas for improvement

Horizon 2020 projects illustrate how the knowledge triangle of research, education and innovation is deeply embedded in the programme, with significant numbers of collaborations being observed between the academic sector, private companies and research organisations but also with the public sector. The private for profit sector appears as the main collaborative partner of academia as opposed to research organisations in FP7.

In terms of inter-industry collaborations of companies, the wholesale trade sector and the digital sector appear to collaborate more with other sectors. Computer sciences and engineering are at the core of the interdisciplinary collaborations within projects.

Interdisciplinarity seems to be slightly reinforced in Horizon 2020 compared to FP7, especially for EU-13 and Associated countries. Furthermore, the research quality of these publications, as proxied by the Field Weighted Citation Index, is particularly high in the Framework Programmes.

H.5. Social and economic sciences and humanities

H.5.1. *Overview*

Social sciences and humanities research is integrated into each of the priorities of Horizon 2020 and each of the specific objectives and shall contribute to the evidence base for policy making at international, Union, national, regional and local level. In relation to societal challenges, social sciences and humanities (SSH) are mainstreamed as an essential element of the activities needed to tackle each of the societal challenges to enhance their impact.

H.5.2. Rationale

The approach of integrating the SSH as a cross-cutting issue has meant that inter-disciplinary cooperation is dealt with in a different way as compared with FP7. A strong network of SSH liaison officers has thus been established across all Societal Challenges and LEIT parts of the programme to facilitate this task. It also requires applicants to submit proposals and build consortia that transcend disciplinary and sectorial boundaries, bringing together scholars from SSH and from life and physical sciences, technology, engineering and mathematics (STEM) as well as researchers and practitioners across these fields.

This way of cooperating across sectors and disciplines is fairly new to many researchers in Europe while others have worked in such a way for a long time already. It is clear that both inside the European Commission and amongst stakeholders and potential applicants such as universities, research institutes and companies it will take some time before everyone is fully aware of the principle of interdisciplinarity and willing to somewhat change their practice.

The challenge approach with the principle of integrating SSH aspects wherever relevant has gradually gained more support since the start of Horizon 2020. Inputs from all the different Expert Advisory Groups across Horizon 2020 on which direction the programme parts should take certainly confirm that SSH aspects, and perhaps especially economic, are essential for the programme to deliver concrete societal impact. Amongst many of these experts there seems to be

an agreement that the need of interdisciplinary solutions to current challenges faced by society has never been more obvious.

H.5.3. *Implementation*

Every year a monitoring report of the SSH Integration in Horizon 2020 is carried out by the European Commission (DG RTD). The table below shows the key findings of the reports based on SSH flagged topics in 2014 and 2015, including comparisons between the two. There are quite large differences between the programme parts both in quantitative and qualitative terms. It is to be noted however that due to the focus areas which combine funding from several Societal Challenges and the LEITs these numbers do not present the entire picture.

The second monitoring report assesses to what extent the 2015 calls for proposals under the Societal Challenges and the Industrial Leadership priorities have delivered on the integration of SSH as a cross-cutting issue. It provides data on the budget dedicated to SSH activities, the share of SSH partners as well as their country affiliation and type of activity, the prevalence of various disciplines and the overall quality of integration.

As data collection for the report progressed, the lessons learnt have been gradually fed into the preparation of the 2016-17 Work Programme. In particular, corrective measures have been identified that could improve the qualitative integration of SSH in upcoming and future Horizon 2020 calls. The report also provides a baseline against which performance in terms of quantitative integration of SSH can be benchmarked in the upcoming years of Horizon 2020.

Table 35 Budget allocated to SSH flagged topics and to SSH partners (EUR million) 2014 - 2015

Programme part	Number of SSH flagged topics and other actions (2014-2017)	Share of SSH partners in the SSH flagged topics (2014 and 2015 projects)	Share of budget going to SSH partners from the SSH flagged topics (2014 and 2015 projects)
Societal Challenge 1	37	19%	14%
Societal Challenge 2	83	22%	22%
Societal Challenge 3	43	19%	19%
Societal Challenge 4	60	18%	16%
Societal Challenge 5	44	11%	11%
Societal Challenge 6	90	79%	75%
Societal Challenge 7	34	43%	35%
LEIT-ICT	22	20%	14%
LEIT-NMBP	24	22%	10%
LEIT-SPACE	4	8%	6%
Total	**441**	**26%**	**22%**

Source: European Commission, DG RTD analysis

H.5.4. Achievements so far

Societal Challenge 6 and its calls and topics attract many of the SSH disciplines. The 2015 calls focused on social cohesion, the young generation, the EU crisis, social innovation and cultural heritage, all fields being relevant for and demanding contributions from SSH disciplines. Other Societal Challenges have also flagged many SSH topics. In the 2014-15 Work Programme 37%

of the topics have been flagged for SSH in the Societal Challenges pillar and the Industrial Leadership pillar. For WP 2016-17 this increased to 41%.

Regarding the variety of SSH disciplines in the funded projects, contributions from economics, sociology, political science and public administration are well integrated while many other SSH disciplines are underrepresented. This is especially the case for geography/demography and philosophy/anthropology. The low participation of the humanities and the arts remains a challenge which has to be addressed.

According to the two SSH reports on SSH integration, EUR 433 million went to SSH partners in SSH flagged topics. Overall, the share of budget going to SSH partners amounted to 22% of the estimated total budget for the SSH flagged topics. While in projects funded under SSH flagged topics exclusively SSH partners account for 32% of the total number of consortia partners. In terms of countries represented, the SSH partners and coordinators in projects flagged as SSH relevant come predominantly from a group of 5-6 Member States. This concentration is not surprising that due to, for example, the size of the country and number of researchers in the field some countries do have comparative advantages. However more efforts should be done to see how this situation compares to for example programme parts such as the societal challenges.

The quality of SSH integration in 2014-15 – according to the methodology used in the reports – is highly uneven across projects. Almost half of the projects funded under SSH flagged topics show good or fair integration of SSH in terms of share of partners, budget allocated to them, and variety of disciplines involved. In terms of financial contributions to signed grants, most funding to SSH relevant projects are to be found in SC1 "Health, demographic change and well-being" (EUR 308 million to 72 projects) followed by SC5 "Climate action, environment, resource efficiency and raw materials" (EUR 304 million allocated to 54 projects) and SC6 "Europe in a changing world - Inclusive, innovative and reflecting societies" (EUR 228 million to 92 projects).[23]

H.5.5. *Lessons learnt/Areas for improvement*

Important work has already been done since the launch of Horizon 2020. Almost half of the projects selected for funding under SSH flagged topics show a good or fair integration of SSH in terms of participation and budget. Call drafters in the different services of the Commission have become more familiar with social sciences and humanities and what researchers and innovators from these disciplines can contribute with. Many SSH scholars in Europe say that there were more interesting interdisciplinary topics in 2016-17 than was the case in 2014-15. However, there is still room for improvement, notably when it comes to the qualitative integration of the SSH.

A weakness of the two first reports has been that the comparison between different programme parts when it comes to for example the number of SSH partners - and budget going to SSH - has not fully taken into account focus areas cutting across different societal challenges and LEITs. As the reports show some disciplines are well represented but others are not. This is particularly the case for the humanities and the arts. This may have different explanations. Partly it may be

[23] One issue with the monitoring report to track the progress of the SSH integration across societal challenges and the LEITs is the existence of Focus areas (FA). Topics in the FA are attributed to the WP part where the FA call is located, rather than to the WP part funding the individual topics. This partly explains the differences between the programme parts. In the case of SC5 for example 11% of partners and budget within SSH flagged topics go to the SSH community is quite low, but also a bit misleading as SC5 contributed with funding to other topics for example in SC2 and SC3.

because the relevant research community is not fully aware of the opportunities Horizon 2020 present for these disciplines.

Box 1 Examples of SSH relevant Horizon 2020 projects

Project NANORESTART: NANOmaterials for the REStoration of works of ART Budget: EUR 7.9 Million ; Type of action: IA; WP Part: LEIT; Call: Nanotechnologies & Advanced Materials http://www.nanorestart.eu *In BBC Science in Action:* http://www.bbc.co.uk/programmes/p03zzgnj	NANORESTART will develop nanomaterials to ensure long term protection and security of modern and contemporary cultural heritage, taking into account environmental and human risks, feasibility and materials costs. NANORESTART brings together specialists in chemistry, materials science, art conservation, art restoration as well as museum curators and cultural heritage educators. They will priorities and assess the new materials on modern and contemporary artefacts in urgent need of conservation, then disseminate the knowledge among conservators on a worldwide perspective.
Project LIFEPATH: Life course pathways underlying social differences in healthy ageing Budget: EUR 6 Million; Type of action: RIA; WP Part: SC1 Health; Call: Personalised Healthcare http://www.lifepathproject.eu/	There are significant differences in the biological pathways to aging among individuals. In particular, healthy ageing, quality of life and life expectancy differ significantly between individuals of different socioeconomic groups. To understand what determines this variation, LIFEPATH integrates biology, biostatistics, epidemiology and epigenomic approaches with social science approaches (sociology, economics and public health policies).

H.6. Sustainable development, climate change and biodiversity

H.6.1. *Overview*

The EU has committed to collect and publish the Horizon 2020 expenditure on sustainable development and climate change. The whole programme is accordingly indeed expected to invest 60% of its overall budget in sustainable development and 35% in climate action.

H.6.2. Rationale

Regulation 1291/2013 establishing Horizon 2020[24] requires the tracking of and reporting on sustainability and climate-related expenditure. That regulation specifies that:

(...) it is expected that at least 60 % of the overall Horizon 2020 budget should be related to sustainable development. It is also expected that climate-related expenditure should exceed 35 % of the overall Horizon 2020 budget, including mutually compatible measures improving resource efficiency. The Commission should provide information on the scale and results of support to climate change objectives. Climate-related expenditure under Horizon 2020 should be tracked in accordance with the methodology stated in that Communication

This is linked with the Communication of 29 June 2011 entitled 'A Budget for Europe 2020', where the Commission committed to mainstream climate change into Union spending programmes and to direct at least 20 % of the general budget of the Union to climate-related objectives. The policy expectations of the co-legislator led to the mainstreaming of sustainability and climate action in EU's spending programmes, including Horizon 2020.

[24] Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 – the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC, recital (10).

It should be noted that, in addition, biodiversity-related expenditure is tracked as a result of the Aichi Biodiversity Target 20, as adopted by the Conference of Parties to the Convention at its 12th meeting to the Convention on Biological Diversity, held on 6-17 October 2014 in the Republic of Korea. There are no targets for biodiversity and biodiversity is not covered in this section[25].

Politically, the tracking of sustainable development and climate change expenditure has become even more important in the framework of implementing the UN's Sustainable Development Goals (SDGs)[26] and the Paris Agreement on Climate Change[27].

H.6.3. Implementation

The methodology, which builds on the so-called "Rio Markers" developed by the OECD[28], is similar for tracking climate-related expenditure across all the EU's expending programmes and has been adapted for applying to sustainable development. Overall consistency of approach at across all EU funding programmes is monitored by DG CLIMA (for climate action). The approach for assessing sustainable development (and biodiversity) has been developed in close collaboration with DG ENV.

The contribution of Horizon 2020 to these objectives is assessed:

- For those parts of Horizon 2020 with a thematic focus ("programmable actions"), at the level of the Work Programme's topics. Each topic is assigned a 0%, 40% or 100% coefficient, corresponding to the relevant qualitative "Rio Marker" category, which is then applied to the EU budget contribution to the individual projects that derive from such topics in order to achieve a quantitative result;
- For bottom-up actions (e.g. European Research Council , Marie Sklodowska-Curie), the coefficients were assigned individually at the level of individual projects for 2014 actions. For subsequent years, proxies based on the 2014 results of the thematic evaluation panels have been used;
- For some parts of the programme (e.g. Financial Instruments, EIT, Article 185 initiatives) reporting is done on an ad hoc basis.

The Commission services in charge of this cross-cutting issue (DG RTD, Directorate "Climate action and resource efficiency") prepare an annual forecast based on the indicative budgets published in the Work Programme. Then, when all evaluations related to a Work Programme year are concluded, the total expenditure in support of climate action and sustainable development respectively is calculated on the basis of the actual EC budget contribution to the projects selected. Final data for the whole of Horizon 2020 per year are therefore only available with a considerable time lag after the publication of the calls.

The Commission organises training sessions for project officers and policy officers within the Commission services and Executive Agencies and has drafted guidelines to facilitate the

[25] The estimated funding proportion, based on the same methodology, is 4.04% between 2014 and 2016.
[26] http://ec.europa.eu/environment/sustainable-development/SDGs/implementation/index_en.htm
[27] http://ec.europa.eu/clima/policies/international/negotiations/paris_en
[28] The "Rio Markers" are based on a scoring system with three values (See: OECD (2011) *Handbook on the OECD-DAC Climate Markers*. Paris: OECD):

- principal objective (score 100%),
- significant objective (score 40%), and
- not targeted (score 0).

assessment of both projects and Work Programme topics. Moreover, information has also been provided to evaluators, applicants and Horizon 2020 National Contact Points (NCPs) on the cross-cutting objectives of climate action and sustainable development.

It is worth mentioning that the data collected measure only the EU expenditure in support of sustainable development and climate action, not the results and actual impacts of such investments.

H.6.4. Achievements so far

The table below presents the ongoing results of Horizon 2020 expenditure for sustainable development and climate change, for 2014, 2015 and 2016. It shows that Horizon 2020 still falls behind the expected expenditure for these objectives. However, the programme seems to have considerably increased its financial effort in this field as regards FP7. The "Cooperation" part of FP7 is estimated to have contributed EUR 2.4 billion to projects related to climate action, whereas for only the first three years (2014-2016) of Horizon 2020 the equivalent figure (i.e. LEIT and Societal challenges together) is EUR 4.2 billion.

Table 36 Horizon 2020 expenditure relating to sustainable development and climate change, 2014-2015

Topic Unique Programme Part Code	Topic Unique Programme Part Description	Total Max GA	CC in €	CC in %	SD in €	SD in %
EU.1.1.	European Research Council (ERC)	€3.892.415.850	€350.317.427	9,00%	€1.206.648.914	31,00%
EU.1.2.	Future and Emerging Technologies (FET)	€655.431.712	€96.405.365	14,71%	€103.044.580	15,72%
EU.1.3.	Marie-Sklodowska-Curie Actions	€2.140.167.785	€492.238.591	23,00%	€1.326.904.027	62,00%
EU.1.4.	Research Infrastructures	€870.924.665	€112.229.571	12,89%	€159.618.398	18,33%
Sum Pillar 1		**€7.558.940.012**	**€1.051.190.954**	**13,91%**	**€2.796.215.918**	**36,99%**
EU.2.1.1.	Information and Communication Technologies	€2.600.625.571	€169.750.563	6,53%	€782.674.517	30,10%
EU.2.1.2.	LEIT- Nanotechnologies	€364.913.028	€14.413.667	3,95%	€209.014.778	57,28%
EU.2.1.3.	LEIT- Advanced materials	€355.548.010	€142.271.539	40,01%	€248.521.298	69,90%
EU.2.1.4.	LEIT- Biotechnology	€145.591.736	€30.809.110	21,16%	€136.064.144	93,46%
EU.2.1.5.	LEIT- Advanced manufacturing and processing	€642.456.139	€304.039.088	47,32%	€498.846.983	77,65%
EU.2.1.6.	LEIT- Space	€344.897.303	€59.355.382	17,21%	€145.797.628	42,27%
EU.2.2.	Access to risk finance	€7.471.875	€48.000	0,64%	€1.871.430	25,05%
EU.2.3.	Innovation in SMEs	€63.698.824	€10.686.098	16,78%	€29.436.265	46,21%
Sum Pillar 2		**€4.525.202.485**	**€731.373.447**	**16,16%**	**€2.052.227.041**	**45,35%**
EU.3.1.	Societal Challenge 1 - Health, demographic change and wellbeing	€1.731.996.562	€51.738.591	2,99%	€679.826.875	39,25%
EU.3.2.	Societal Challenge 2 - Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy	€841.635.074	€421.322.698	50,06%	€785.349.303	93,31%
EU.3.3.	Societal Challenge 3 - Secure, clean and efficient energy	€1.773.811.033	€1.761.420.873	99,30%	€1.753.218.498	98,84%
EU.3.4.	Societal Challenge 4 - Smart, green and integrated transport	€1.380.622.074	€776.660.946	56,25%	€1.125.279.867	81,51%
EU.3.5.	Societal Challenge 5 - Climate action, environment, resource efficiency and raw materials	€912.498.191	€443.694.709	48,62%	€875.308.822	95,92%
EU.3.6.	Societal Challenge 6 - Europe in a changing	€339.547.784	€5.737.295	1,69%	€107.754.721	31,73%

	world - inclusive, innovative and reflective societies					
EU.3.7.	Societal Challenge 7 - Secure societies - protecting freedom and security of Europe and its citizens	€446.884.784	€43.385.004	9,71%	€183.869.324	41,14%
Sum Pillar 3		**€7.426.995.502**	**€3.503.960.116**	**47,18%**	**€5.510.607.411**	**74,20%**
EU.4.0.	Spreading Excellence and Widening Participation - Cross-theme	€1.749.999	€600.000	34,29%	€1.499.999	85,71%
EU.4.a.	Teaming of excellent research institutions and low performing RDI regions	€15.841.868	€3.705.210	23,39%	€5.636.748	35,58%
EU.4.b.	Twinning of research institutions	€67.263.941	€7.632.541	11,35%	€26.905.577	40,00%
EU.4.c.	ERA chairs	€34.024.659	€6.836.140	20,09%	€13.609.864	40,00%
EU.4.e.	Supporting access to international networks for excellent researchers and innovators who lack sufficient involvement in European and international networks	€89.619.171	€0	0,00%	€35.847.668	40,00%
EU.5.0.	Science with and for Society - Cross-theme	€800.000	€0	0,00%	€0	0,00%
EU.5.a.	Science with and for Society - Make scientific and technological careers attractive to young students, and foster sustainable interaction between schools, research institutions, industry and civil society organisations	€30.151.169	€0	0,00%	€22.806.208	75,64%
EU.5.b.	Science with and for Society - Promote gender equality in particular by supporting structural change in the organisation of research institutions and in the content and design of research activities	€18.634.809	€0	0,00%	€11.119.623	59,67%
EU.5.c.	Science with and for Society - Integrate society in science and innovation issues, policies and activities in order to integrate citizens' interests and values and to increase	€34.107.173	€0	0,00%	€29.973.807	87,88%

	the quality, relevance, social acceptability and sustainability of research and innovation outcomes in various fields of activity from social innovation to areas such as biotechnology and nanotechnology					
EU.5.f.	Science with and for Society - Develop the governance for the advancement of responsible research and innovation by all stakeholders, which is sensitive to society needs and demands and promote an ethics framework for research and innovation	€21.852.379	€0	0,00%	€15.814.398	72,37%
Sum Pillar 4+5		**€314.045.168**	**€18.773.891**	**5,98%**	**€163.213.891**	**51,97%**
Sum Pillars 1 to 5:		**€19.825.183.167**	**€5.305.298.407**	**26,76%**	**€10.522.264.261**	**53,08%**
Ad-hoc part:						
	EMPIR	€24.948.914,00	€5.377.490,60	21,55%	€16.738.152,00	67,09%
	art.185+187 (adhoc)	€ 27.800.000,00	€ 0,00	0,00%	€ 11.120.000,00	40,00%
	JRC	€150.500.000,00	€ 48.800.000,00	32,43%	€ 95.000.000,00	63,12%
	EIT	€ 218.500.000,00	€ 103.280.000,00	47,27%	€ 174.460.000,00	79,84%
	Financial Instr.	€ 50.320.000,00	€ 15.808.000,00	31,41%	€ 7.200.000,00	14,31%
Sum ad-hoc part		**€472.068.914,00**	**€173.265.490,60**	**36,70%**	**€304.518.152,00**	**64,51%**
TOTAL		**€20.297.252.081,11**	**€5.478.563.898,06**	**26,99%**	**€10.826.782.412,96**	**53,34%**

NB: Data extraction from CORDA: January 2017. Actions EU.4.a. and 5.0. are not included for 2014 and 2015; actions EU.4.b. are not included for 2014 and 2016; actions EU.4.c. are not included for 2015 and 2016; and actions 5.b., 5.c. and 5.f. are not included for 2014 and 2015. "Ad-hoc" parts not available for 2016, and Art.185 not available for 2015 either.

H.6.5. Lessons learnt/Areas for improvement

As shown in the previous section, the main difficulty to reach the expected investment in sustainable development and climate change comes from the bottom-up parts of Horizon 2020. The content of bottom-up actions is unpredictable by nature. The Commission has no means to steer the orientation of the projects that are funded, while they represent a very substantial part of the budget. On the contrary, figures for the Societal Challenges pillar are well beyond the targets: 47.2% on Climate Change and 74.2% on Sustainable Development. In addition, experience shows that the "Rio Markers" methodology is not always suitable for assessing the contribution of fundamental research to policy objectives.

Monitoring the Horizon 2020 expenditure on sustainable development and climate action was particularly difficult during the two first years of the programme due to IT-related issues. These problems are still in the process of being resolved.

The alignment of the sustainable development tracking methodology with SDGs in 2015 has facilitated implementation, because this has clarified the scope of sustainable development in relation to globally-recognised goals. There is indeed a substantial increase of the share of the budget devoted to sustainable development between 2014 (51.6%) and 2015 (58.4%), but this trend is not confirmed in 2016.

One major positive aspect of tracking expenditure for sustainable development and climate action is the mainstreaming effect. The level of awareness about this cross-cutting issue amongst the Commission services and Executive Agencies has substantially increased since the beginning of Horizon 2020. This not only facilitates data collection but – more importantly – has increased the attention paid to sustainable development and climate change objectives in drafting Horizon 2020 Work Programmes.

In November 2015 the Commission services devised an internal action plan[29] in order to remedy Horizon 2020's sub-optimal progress towards the expected funding objectives. The plan included the following measures:

a) Priority setting and programme phase:

- Ensure that all Horizon 2020 Advisory Groups are aware of cross-cutting objectives and expenditure targets, so that climate change and sustainable development challenges are taken into account in their advice, where relevant.
- Ensure that all Horizon 2020 Programme Committee (PC) configurations are aware of these objectives and expenditure targets, with a view to future programming (strategic programming and Work Programme drafting).

b) Work Programme drafting phase:

- Ensure that actions which are 'horizontal' or address up-stream/enabling technologies consistently reference embedded cross-cutting objectives, where relevant.
- In the Societal Challenges/LEIT-NMBP, ensure that the expected impact on climate change and/or the dimensions of sustainable development are more explicitly taken

[29]The Strategic Research and Innovation Group of Directors-General endorsed on 12 November 2015 the measures included in the Action Plan for increasing mainstreaming of sustainable development and climate action in Horizon 2020.

into account by moving from a technology focus to a more systemic approach in topics.

c) Proposal and evaluation phase:

- Ensure that potential climate action/sustainable development impacts are mentioned by applicants and can therefore be taken into account by evaluators, by adjusting proposals templates where relevant and providing information to applicants and evaluators.

d) Bottom-up actions:

- Ensure that potential climate action/sustainable development impacts are mentioned by applicants and can therefore be taken into account by evaluators, by adjusting proposals templates where relevant and providing information to applicants and evaluators
- Ensure that sectors and communities particularly relevant for climate-change/sustainable development-related R&I are aware of opportunities in bottom-up parts of Horizon 2020.

e) Improving the tracking methodology:

- Ensure consistency by adapting guidance to specific needs of services.
- For ERC/MSCA bottom-up actions, reduce the burden of assessing all projects selected for funding by focusing on those where contribution to climate action and / or sustainable development can be expected (e.g. panel approach).
- Improve the reporting on Horizon 2020 Financial Instruments' contribution to climate action and sustainable development.
- Improve technical/IT issues to ensure completeness and consistency of data.
- Treat more parts of the programme as 'bottom-up' (project-level assessment) to better quantify their contribution to climate action and sustainable development.

f) Aligning the method for sustainable development with the Sustainable Development Goals (SDGs)

- Demonstrate the contribution of Horizon 2020 to the implementation of the SDGs by referencing them in the Work Programme.
- Alignment of definition used for guidance on sustainable development with the Sustainable Development Goals (SDGs), for use from 2015 calls;

g) Communicating on climate action and sustainable development in Horizon 2020

- Develop an overall 'story' on climate action and sustainable development goals to supplement the tracking results for communication purposes.

Most of these measures have already been implemented or are ongoing. The R&I Directors-General also noted that the critical moment is the preparation of the Work Programme 2018-2020, when Horizon 2020 would need to make up the shortfall acquired in the initial years of Horizon 2020. The preparation of the Work Programme 2018-2020 is on-going and identifies climate action as a strong priority.

H.7. Fostering the functioning and achievement of the ERA

H.7.1. *Overview*

It is the European Union's objective to strengthen its scientific and technological bases by achieving a European Research Area ('ERA') in which researchers, scientific knowledge and technology circulate freely, and by encouraging the Union to advance towards a knowledge society and to become a more competitive and sustainable economy in respect of its industry. Horizon 2020 should contribute to achieving the ERA, encouraging the development of framework conditions to help European researchers to remain in or to return to Europe, attract researchers from around the world and make Europe a more attractive destination for the best researchers.

H.7.2. Rationale

As the earlier Framework Programmes, Horizon 2020 is the financial pillar of the Union's actions and the key instrument to support ERA development. Funding measures are crucial to the realisation of ERA and have important effects on coordination and governance, common agenda setting, researcher's mobility and pooling of resources. As a leverage, Horizon 2020 should also be crucial in driving ERA reforms at national level.

H.7.3. Implementation

Horizon 2020 provides support to Member States and the main stakeholders in implementing the ERA reform agenda across the following key priorities:

1. **More effective national research systems**: using Horizon 2020's new tool 'Policy Support Facility' (PSF), providing tailor-made services at the request of Member States and Associated Countries. Its support is either topic-specific (mutual learning exercises) or country-specific (peer reviews of national R&I systems, or specific support to a policy reform). Four Member States and one associated country have already been reviewed, while many other requests are arising. The recurrent feedback received on the PSF work has shown that the operational recommendations formulated by leading experts and policy practitioners prove valuable as catalysers and to support countries in implementing national R&I reforms. For example, the renewed Science Agenda of Bulgaria pays particular attention to the recommendations formulated by the dedicated PSF Peer Review.

2. **Optimal transnational co-operation and competition on common research agendas, grand challenges and infrastructures**: Public to Public Partnerships P2P's (funded through the various Societal Challenges of Horizon 2020's third pillar), the European Strategy Forum on Research Infrastructures ESFRI [30]objectives, supported by the Research Infrastructures Programme (funded by Horizon 2020's 'Excellent Science' first pillar, € 2.488 M in regulation (EU) No 1291/2013), and the ERIC Regulation (EU legal status for Research Infrastructures)[31];

[30] http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri
[31] ESFRI: European Strategy Forum on Research Infrastructures; ERIC: European Research Infrastructure Consortium.

3. **An open labour market for researchers facilitating mobility, supporting training and ensuring attractive careers**: Euraxess network[32] and Resaver[33], both funded through Horizon 2020's 'Science with and for society' programme.

4. **Gender equality and gender mainstreaming in research**: it encompasses three objectives: remove barriers and biases to women's careers in science, gender balance in decision-making and the integration of the gender dimension in research content. These objectives are implemented through institutional change. Horizon 2020 supports the implementation of the ERA objectives in two ways: by integrating gender as a cross-cutting issue and by funding institutional change in research organisations through the 'Science with and for society' programme.

5. **Optimal circulation and transfer of scientific knowledge to guarantee access to and uptake of knowledge by all**: communication and dissemination of programme results, demonstration and pilot projects, Open Access, including to data, to become the default regime in Horizon 2020.

6. **International cooperation to ensure that Europe as a whole is able to take maximum advantage of the best R&I opportunities in a global setting.**

In order to measure the contribution of Horizon 2020 to the realisation of the ERA, the following indicators have been identified:

- Annual number of research positions advertised on EURAXESS Jobs;
- Number of national research infrastructures networked (in the sense of being made accessible to all researchers in Europe and beyond through Union support);
- Number and share of Open access articles published in peer-reviewed journals;
- Number of projects that make scientific data accessible and re-usable and number of scientific datasets made accessible and re-usable[34];
- Number of Multiannual Implementation Plans adopted by Joint Programming Initiatives.

H.7.4. Achievements so far

The implementation of ERA Priority 1 ("More effective national research systems") relies much more on national reforms than on the Framework Programme. The analysis carried out in the context of the 2016 ERA Progress Report shows that "*most countries have made progress in the field of research excellence and almost all of them have adopted national strategies for research and innovation. Several Member States are redefining their National R&I strategies further based on a broad concept of innovation, encompassing education, research and innovation to achieve greater efficiencies*". *A first inventory of the ERA NAPs shows a more holistic strategic approach to R&I will be strengthened in the future. A necessary condition, however, is to ensure more stable funding mechanisms of government investment."*

[32] Pan-European initiative providing access to a complete range of information and support services to researchers wishing to pursue their research careers in Europe or stay connected to it.
[33] Retirement Savings Vehicle for European Research Institutions, state of the art retirement savings product that will enable mobile and non-mobile employees to remain affiliated to the same pension vehicle when moving between different countries and changing jobs.
[34] The data on number of scientific datasets made accessible is collected in the reporting template of Horizon 2020 projects. No data on this is yet available

Regarding ERA Priority 2A, the Joint Programming Initiatives (JPIs) stem from the Joint Programming Process, one of the building blocks of the European Research Area (ERA) launched in December 2008. In this structured and strategic process, Member States agree, on a voluntary basis and in a partnership approach, on common visions and they implement Strategic Research Agendas (SRA) together. Ten Joint Programming Initiatives (JPIs) have been launched to date and all have adopted Multiannual Implementation Plans. In addition, in the period 2014-2016, 48 ERA-NET Cofund actions were selected under Horizon 2020 for a total budget in excess of EUR 1300 million. The total EU contribution to the ERA-NET Cofunds will be around of EUR 380 million.

Preliminary results indicate that the number of national research infrastructures (ERA Priority 2B) networked thanks to Horizon 2020 support was 363 by the end of 2015. The target by the end of Horizon 2020 is 900.

As a good example of achievement obtained in the context of ERA priority 3, 289.981 job vacancies have been advertised on EURAXESS until February 2017.

Horizon 2020 supports the implementation of the ERA priory 4's objectives in two ways: by integrating gender as a cross-cutting issue and by funding institutional change in research organisations through the 'Science with and for society' programme.

Regarding the ERA priority 5, aiming at "Optimal circulation, access to and transfer of scientific knowledge" a major challenge is to broadly implement Open Access - i.e. free online access to and use of publicly-funded scientific publications and data - given the uneven state of advancement of Member State policies in this area. The Commission is leading by example by making open access to peer-reviewed scientific publications resulting from Horizon 2020 mandatory and by running a aflexible pilot in Horizon 2020 ('ORD pilot'). In the Work Programmes 2014-2016, this ORD pilot concerned selected areas of Horizon 2020. However, in the Communication 'a European Cloud Initiative – Building a competitive data and knowledge economy in Europe' the Commission committed itself to "make open research data the default option, while ensuring opt-outs, for all projects of the Horizon 2020 programme" as of 2017. As of the revised version of the Work Programme 2017, the ORD pilot has therefore been extended to all thematic areas of the Horizon 2020 Research and Innovation Programme. While open access to research data thereby becomes applicable by default in Horizon 2020, the Commission also recognises that there are good reasons to keep some or even all research data generated in a project closed. It has, therefore, provided robust opt-out possibilities at any stage..A further new element in Horizon 2020 is the use of Data Management Plans (DMPs) detailing what data the project will generate, whether and how it will be exploited or made accessible for verification and re-use, and how it will be curated and preserved.

For the uptake of the pilot from 2014 to 2016 (when its scope was more restricted), figures show an opt-out rate of 35% in the core areas of the pilot. In other words 65% of projects in the core areas participate in the ORD pilot. The most important reasons for opt-outs were (i) IPR concerns (ii) projects which do not expect to generate data or (iii) over privacy concerns. Outside the core areas, 14% of projects make use of the voluntary opt-in possibility. Since Horizon 2020 projects have yet to produce a significant number of scientific publications or datasets, no specific quantitative data on the indicators related to scientific publications can yet be provided.

H.7.5. Lessons learnt/Areas for improvement

Horizon 2020's instruments that directly support some of the ERA priorities (especially PSF, P2Ps and the 'Science with and for society' programme) provide satisfactory results. Other parts of the Framework Programme provide more diffuse results, with an impact difficult to assess.

The article 32 of grant agreement contracts within Horizon 2020 (Recruitment and working conditions for researchers) is also a strong catalyst regarding the implementation of the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, in particular regarding working conditions, transparent recruitment processes based on merit, and career development.

H.8. Framework conditions in support of the flagship initiative "Innovation Union"

H.8.1. *Overview*

The Innovation Union was launched in 2010 as a flagship initiative of the Europe 2020 strategy to build on Europe's strengths and address its weaknesses with respect to innovation. It aimed to tackle both the supply and demand side elements of the innovation eco-system: the public sector, businesses, academia and finance. The activity was evaluated in 2015 (State of the Innovation Union 2015)[35] to take stock of the progress and set out next steps under six building blocks:

- Strengthening the knowledge base and reducing fragmentation;
- Getting good ideas to market;
- Maximising social and territorial cohesion;
- Pooling forces to achieve breakthroughs: European Innovation Partnerships;
- Leveraging our policies externally; and
- Making it happen.

The overall conclusion was: *'Six years after the Innovation Union was launched as one of the pillars of the Europe 2020 growth strategy, the evaluation shows that impressive progress has been made in numerous fields. Great progress has been achieved in making Europe a more innovative continent since the launch of the Innovation Union in 2010. Nevertheless, the world has evolved since then and new elements need to be taken into account so as to better tackle the challenge of innovation in Europe*'. Innovation has been embedded in initiatives as the Digital Single Market, the Energy Union, the Capital Markets Union, the work on ERA, the European Social Fund, European Structural and Investments Funds and Horizon 2020.

H.8.1. Rationale

In 2010, innovation was recognised as essential to make Europe more competitive in times of budgetary restraints and increased global competition. It marked a step forward. Since then, innovation has been regarded as a mainstream policy to be embedded in policy areas wherever relevant.

[35] http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2015/state_of_the_innovation_union_report_2015.pdf

H.8.1. *Implementation*

Horizon 2020 contributes to the framework conditions for innovation by its focus on both research and innovation. Some specific elements are the innovation actions, innovation through public procurement, inducement prizes for innovative solutions for societal challenges, the access for innovation projects to risk finance.

H.8.2. *Achievements so far*

The Innovation Union initiative succeeded in building momentum around innovation, mobilising stakeholders and mainstreaming innovation in key European, national and regional policies. The evaluation in 2015 provided an overview. There is still uncertainty about some of the legislative actions mentioned in the Innovation Union, regarding the Unitary Patent. Twelve Member States have ratified the Agreement on the Unified Patent Court. When ratified by the United Kingdom and Germany the Unitary Patent package will enter into force. The commitments that require greater involvement of Member States appear to have progressed to a lesser extent, either because of the long legislative processes (e.g. directives ratification), or because they are less binding in nature. The European Innovation Scoreboard (latest issue 2016)[36] keeps track of indicators for innovation.

H.8.3. *Lessons learnt/Areas for improvement*

The European Innovation Scoreboard 2016 shows that since 2008, the EU continues to be less innovative than South Korea, the United States and Japan, but performance differences with the last two countries have become smaller. However, South Korea has managed to improve its performance at a much faster pace than the EU over the last eight years. The EU still has a considerable performance lead over many other countries, including China. However, China is catching up, with a performance growth rate five times that of the EU. It is necessary to continue paying attention to Europe's innovation performance. Attention is also needed for innovation at sectorial level. Fit-for-purpose regulatory frameworks are essential for EU industry; they allow specific sectors to benefit from opportunities in the internal and global markets. Moreover, a pro-innovation regulatory climate attracts international investment. A Commission Staff Working Document[37] evaluated how supportive to innovation the EU regulatory framework is at sectorial-level. It highlighted the need for forward-looking regulatory approaches, innovation-friendly and innovation targeting regulatory policies.

H.9. Contributing to the Digital Agenda for Europe

H.9.1. Overview

The Digital Agenda for Europe, one of seven EU2020 flagship initiatives, has established 'digital' as a policy brand in its own right, by aspiring to make every European digital. The EU's Digital Single Market Strategy, launched in May 2015, builds on these foundations, aiming to remove regulatory barriers and move from 28 national markets to a single one, to unlock online opportunities and make the EU's single market fit for the digital age.

[36] http://ec.europa.eu/DocsRoom/documents/18062
[37] (SWD 2015) Better regulations for innovation driven investment at EU level

H.9.2. Rationale

ICT R&I is key to the realisation of the Digital Single Market. ICT R&I has dedicated topics in all Horizon 2020 pillars. EU investments in ICT R&I are expected to contribute to the Digital Single Market in various aspects, addressed in 2014 and 2015 calls:

- A multidisciplinary approach to lay the foundations for radically new technological possibilities. EU support allows exploring novel and visionary ideas (FET Open), fostering transformative research in most promising thematic domains (FET Proactive) and tackling grand scientific and technological challenges by large-scale, science driven research initiatives (FET Flagships).

- e-Infrastructures to make every European researcher digital, increasing creativity and efficiency of research and bridging the divide between developed and less developed regions.

- Investments in several domains to support the digital transformation of industry and enable progress and growth of many other sectors. These include for example Photonics, Robotics, Internet of Things (IoT), Future Internet, micro- and nano-electronic technologies, electronic components and systems, Big Data, 5G, HPC technologies. Actions in these areas also support Public Private Partnerships which link up European industry (large players and SMEs), researchers, academia and the European Commission to cooperate in research and innovation and define strategic roadmaps in key sectors.

- Investments in investigating ICT contribution to the industrial-scale roll-out of multi-disciplinary solutions to address societal challenges. For example ICT Research and innovation helps build a digital society caring about individuals by supporting active and healthy ageing, assistive robotics, eHealth for personalised care, security and privacy, and services for inclusiveness.

ICTs have an enabling and pervasive nature, which permeates countless aspects of the economy and personal lives, impacting areas as varied as banking, retail, energy, transportation, education, publishing, media, health or social interactions. Given its enabling and pervasive nature, the presence of ICT goes beyond the above dedicated topics, and is expected to span into the activities of the ERC, MSCA grant-holders and JTIs.

H.9.3. Implementation

The cross-cutting indicator aims at tracking the ICT-related activities and the related spending at the EU level. This should provide a more accurate estimate of how Horizon 2020 contributes to the realisation of a Digital Europe. This indicator relates to the expenditure in ICT related research and innovation activities, meaning ICT and ICT-enabled new products, services or processes (within and outside the ICT sector). This is computed as the share of EU financial contribution that is ICT Research & Innovation related in Horizon 2020 (EUR), based on the "RIO markers" methodology[38].

[38] Projects for which ICT R&I is the principal (primary) objective are marked with 100%, indicating that 100% of the project budget contributes to ICT R&I. Projects for which ICT R&I is a significant, but not predominant objective are marked with 40%, indicating that 40% of the project budget contributes to ICT R&I.

H.9.4. Achievements so far

The Digital Agenda indicator allows tracking spending related to digital R&I throughout the Programme. Preliminary estimates for the calls up to January 2017 show that about 30% of the EC financial contribution under Horizon 2020 (about EUR 5.3 billion) went to actions promoting to some extent research and innovation in information and communication technologies[39], thus showing the enabling nature of such technologies, e.g. in helping address the Societal Challenges..

Table 37 EC Contribution through Horizon 2020 projects to the Digital Agenda

Programme Part	EC contribution to Digital Agenda (overall) (EUR million)	Share of EC contribution to Digital Agenda (only flagged projects)
LEIT-ICT	2 594.6	99.8%
FET	447.6	68.4%
RI	492.0	56.5%
SC6	119.3	34.9%
ARF	1.0	34.2%
SC7	152.9	34.2%
Total	5 330.0	**30.0%**
SC1	303.3	18.4%
SEWP	21.3	18.2%
SC4	228.3	16.7%
LEIT-NMBP	225.5	16.2%
SC5	122.6	13.4%
FTI	20.1	12.5%
MSCA	202.4	10.4%
ERC	172.7	7.7%
SC3	133.9	7.7%
LEIT-SPACE	26.6	7.5%
SC2	57.2	6.9%
SWAFS	7.3	6.7%
Innovation in SMEs	1.4	3.6%

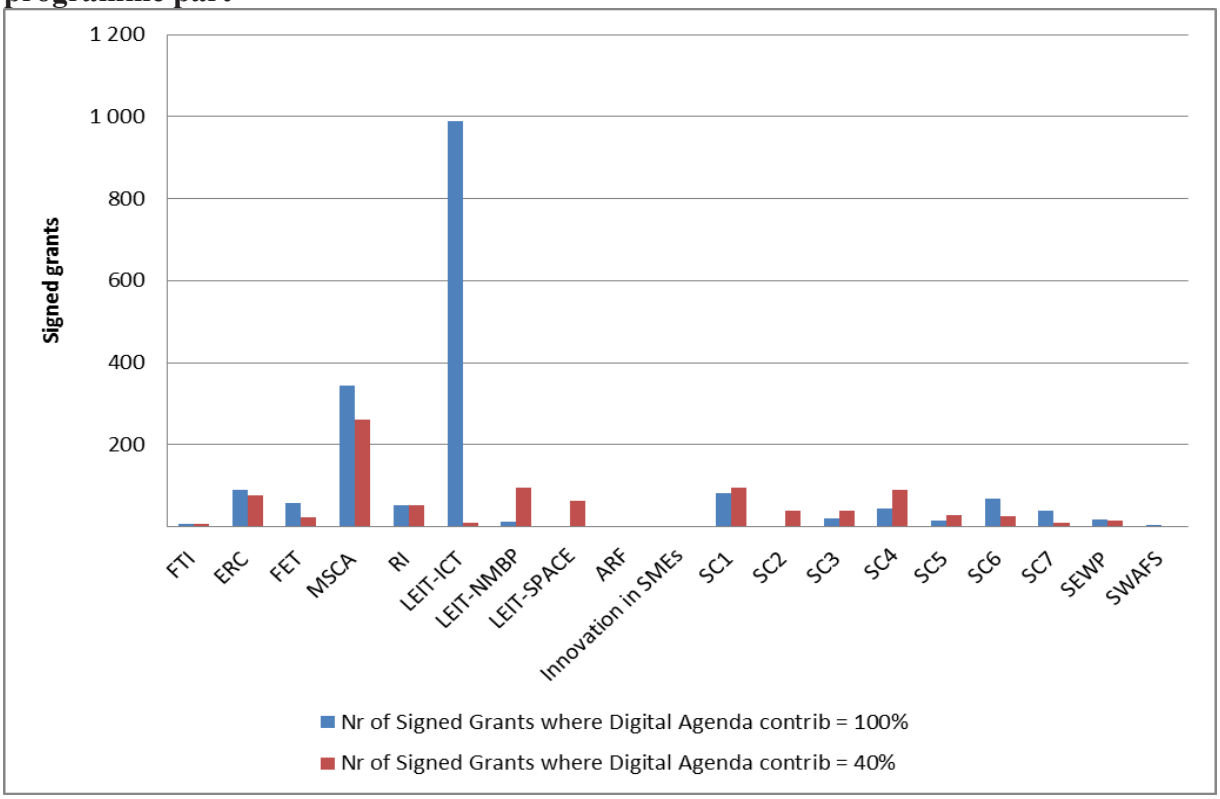
Source: CORDA data, extraction 1 January 2017. Data provided by Work Programme Drafters during WP preparation (topic level) and by Project Officers during Grant Agreement Preparation (bottom-up), calculated on the basis of the RIO methodology

This figure shows the presence of ICT R&I throughout the programme: by design, all the projects within LEIT ICT contribute to the indicator, and about 68% of FET projects. Research Infrastructures contribute to ICT R&I with 57% of the budget. In the Societal Challenges, contribution to ICT R&I is at 35% of the total budget of SC6 and 34% of SC7, although the highest number of projects and EC contribution to ICT are found in SC1 (EUR 303 million, representing 18% of the total budget of SC1). In terms of budget, projects in SC4 also contribute significantly to ICT (EUR 228 million, representing 17% of the total budget of SC4). These figures reflect budget allocation to ICT topics within the SC1, SC6, SC7, but go beyond it, in particular for SC4, 2 and 3: they show contributions from individual projects that have ICT as primary objective, or as significant objective thus indicating the enabling nature of ICT. Concerning LEIT, the contributions from NMBP are at 17%, whereas they are very

[39] This excludes the 1,271 signed grants where information is missing, and which represent 11% of the total signed grants, out of which 77% are supported under the Excellent Science priority, otherwise – if included - the share would be 26%.

low for LEIT Space (at 7% only). A high number of projects contributing to ICT is also found within MSCA grants: 603 (19% of total signed grants), representing 10% of the total budget.

Figure 53 Projects for which ICT R&I is a primary or a significant objective, by programme part



Source; CORDA data, extraction 1 January 2017

H.9.1. *Lessons learnt/Areas for improvement*

The Digital Agenda indicator allows tracking spending related to digital R&I throughout the Programme. The preliminary data up to January 2017 show that about EUR 5.3 billion or slightly less than one third of the overall EC funding are contributing to ICT R&I, thus providing an important input to the progress towards the Digital Single Market objectives.

This budget goes beyond what allocated through dedicated topics to ICT and signals the cross-cutting nature of digital technologies and their societal relevance.

Estimates from the Digital Agenda indicator should be treated with caution. The application of the OECD 'Rio Markers' methodology to bottom-up and thematic research funding still requires further optimisation and fine-tuning. In addition, due to the reporting issues in the first year of Horizon 2020, it is not possible to draw comparisons on the evolution of the indicator. This needs to be monitored in the years to come.

H.10. Widening participation across the Union in research and innovation and helping to close the research and innovation divide in Europe

H.10.1.Overview

Despite efforts at national and European level, disparities in terms of research and innovation performance persist among EU Member States. Especially in advanced economies like Europe's, scaling up and improving investment in research and innovation is an essential

pathway to economic growth and competitiveness. Increasing the R&I performance of low performing Member States and integrating their unexploited potential into the European Research Area and single market will maximise the impact of R&I investment, for Europe as a whole and for each Member State concerned.

Widening Participation is therefore a **cross-cutting issue** in Horizon 2020 mentioned under Article 14 of the Framework Programme regulation[40]: *'Widening participation across the Union in research and innovation and helping to close the research and innovation divide in Europe*'.

H.10.2.Rationale

According to an analysis by the European Commission[41], some of the main causes of low participation to past EU Framework Programmes of certain countries were:

- Insufficient R&D investments in those countries;
- Lack of synergies between certain countries' national research systems and EU research;
- Lagging system learning effects and access to existing networks;
- Differential wage levels between countries;
- Insufficient and ineffective information, communication advice and training.

Additionally, the High Level Expert Group on the Ex-post evaluation of FP7 concurred that "*some of most important reasons for the comparably lower share and lower success rates of the EU-13 organisations are information and language barriers; lack of professional contacts and research networks; lack of leading Universities and Research organisations leaders in proposal matters; limited understanding of FP7; weak training in preparing successful proposals; insufficient motivation to participate in FP7; lack of practice in project management; little experience in cross-country cooperation; generally low focus on R&D in policy and in business; few options for exploitation of research results at the national level*."

As it can be seen in Table 39 the need/problem to address was the low participation of certain countries in Framework Programmes with EU-13 participation in FP7 being only 4.2% of the total EU contribution. Despite a small increase to 4.4% in Horizon 2020 the situation of low participation is still valid today, although **participation is in line with the share of the EU-13 in total EU R&D expenditure (GERD), as is shown in table 40.**

Table 38 EU-13- EU-15 budget share in overall programme (FP7 & Horizon 2020)

	FP7		Horizon 2020	
	EU-13	**EU-15**	**EU-13**	**EU-15**
EU Funding (% of total contribution)	4.2%	85.2%	4.4%	88.6%

Source: For FP7: Data from SWD FP7 Ex-Post Evaluation, for Horizon 2020: European Commission, CORDA data, cut-off date 1 January 2017

[40] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0104:0173:EN:PDF

[41] Commission analysis of September 2011, at the request of the Polish Presidency, see http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%2014728%202011%20INIT This has been confirmed by other studies, analysis and public discussions, for instance the FP7 MIRRIS project http://www.mirris.eu/.

Looking at the weight of the **science and innovation systems** of the EU-13 and EU-15 (table 40) within the overall European R&I system across a number of dimensions, leads to the conclusion that the **role of the EU-13 in the EU's R&I system is in 2015 still limited**, and overall slightly below its weight in total GDP. The exceptions to this are the number of scientific publications and the number of researchers, where the weight of the EU-13 is above its GDP share. A second conclusion that can be drawn is that the EU-13's role has developed considerably over the past 10 years. The weight of the EU-13 has been growing most considerably for the expenditure indicators and somewhat less for the patenting and publication indicators. As regards the number of researchers, the weight has been more or less stagnant, yet it continues to be well above the investment and outcome shares, which may point to remaining inefficiencies in the research and innovation systems of these countries.

Table 39 Share of the EU-13 and EU-15 in the overall EU-28 performance for key science and innovation indicators

Indicator	% share of EU-13		% share of EU-15	
	2005	2015	2005	2015
Distribution of R&D expenditure				
Gross domestic expenditure on R&D (GERD)	2.6	4.5	97.4	95.5
Business enterprise expenditure on R&D (BERD)	1.9	3.6	98.1	96.4
Public expenditure on R&D (GOVERD plus HERD)	3.9	6.1	96.1	93.9
Distribution of scientific publications				
Total number of scientific publications	8.8	11.9	91.2	88.1
Top 10% highly cited publications	4.2	5.8	95.8	94.2*
Distribution of Researchers				
Total number of researchers	12.5	13.1	87.5	86.9
Distribution of PCT patent applications				
PCT patent applications	1.7	2.7	98.3	97.3
Distribution of GDP (in current euro)				
GDP	6.2	8.0	93.8	92.0

*2014 *Note: *The latest year available is 2014.*

Source: European Commission, DG RTD.Data: Eurostat, OECD, CWTS based on Web of Science database

H.10.3. Implementation

In order to increase the excellence of the scientific output, the international connectivity, capacity to attract funding, as well as the reform process of EU-13, a different range of measures have been put in place within Horizon 2020 to help spread excellence and widen participation.

Horizon 2020's Specific Programme **'Spreading Excellence and Widening Participation'** (SEWP), with its specific and targeted measures, aims to *'fully exploit the potential of Europe's talent pool and to ensure that the benefits of an innovation-led economy are both maximised and widely distributed across the Union in accordance with the principle of excellence'*. It has a total budget of EUR 816 million (proposed by the Commission to be

increased by EUR 110 million following the mid-term review/revision of the Multiannual Financial Framework (MFF) of September 2016[42]).

Teaming, Twinning and ERA Chairs are the key measures falling under SEWP. In addition, other initiatives falling under the SEWP pillar of Horizon 2020 that provide indirect support to low performing countries are COST[43] (promoting networking and connecting pockets of excellence) the Policy Support Facility[44] (PSF) (providing on-demand advice to policy makers on national R&I systems) and the Widening National Contact Points (NCPs)[45] through the NCP WIDE_NET[46] project that provides support to SEWP calls applicants. The rationale and achievement of this part of Horizon 2020 are detailed in the relevant part of the Thematic annex.

Furthermore, during the negotiations of Horizon 2020, Member States paid special attention to low participation. The emphasis was put on the differences **in remuneration of participants** in the same FP projects. A special provision was therefore introduced to allow FP projects to pay researchers a "bonus" (i.e. an additional salary of up to EUR 8000 per year). However, following concerns of some Member States (e.g. Romania) that this provision was not helping to address the issue, the Commission very recently agreed to revise the model grant agreement (formal adoption in February). According to the new approach, all elements that are paid under national programmes are considered basic salary, while only additional bonuses for working in international programmes are considered as additional remuneration (with the 8000 Euro capping).

In addition, widening participation is also recognised and addressed as a **cross-cutting issue** by other parts of Horizon 2020 (Societal Challenges/LEIT/ERC/EIT). This takes different forms, going from an in-depth analysis of the situation, to specific actions such as Coordination and Support Actions to establishing Memoranda of Understanding with relevant stakeholders and multipliers or again through targeted awareness raising events. This is done without putting into question the objective and principle of excellence that is at the heart of the Framework Programme.

Box 2 Examples of initiatives to widen participation across Horizon 2020

The **European Research Council (ERC)** set up in 2013, in preparation to Horizon 2020, a Working Group on Widening European Participation[47] with a mission to capitalize on the full potential for frontier research in Europe without departing from the ERC's principle of excellence. Its main task was to facilitate an all European dialogue, exchange of experiences, networking and learning about good practices in supporting the very best researchers to successfully apply to the ERC.

In 2015 the **European Institute of Innovation and Technology (EIT)** took targeted action to widen the geographical coverage of its Knowledge and Innovation Communities (KICs) and further integrate the knowledge triangle outside the KIC framework. To this end, the EIT decided to mainstream the EIT Regional Innovation Scheme (RIS) actions into KICs activities and earmarked a dedicated budget for 2016 activities. Activities undertaken as part of the EIT RIS aim at ensuring the flow of both knowledge and people between KICs and selected partnerships with a view to enhancing the regional

[42] http://ec.europa.eu/budget/mff/lib/COM-2016-603/COM-2016-603_en.pdf
[43] http://www.cost.eu/
[44] https://rio.jrc.ec.europa.eu/en
[45] National Contact Points are national structures established and financed by governments of the 28 EU MS and the states associated to the framework programme. NCPs give personalised support on the spot and in applicants' own languages.
[46] http://www.ncpwidenet.eu/
[47] https://erc.europa.eu/about-erc/organisation-and-working-groups/working-groups/working-group-widening-participation

innovation capacity by fostering the integration of the Knowledge Triangle. The RIS initiative is targeted at countries which have no participating organisations into the existing KICs and belong to the 'moderate and modest innovators' groups identified in the 2015 Innovation Union Scoreboard.

In the area of **Health** the RegHealth-RI project[48] was completed in 2016 that aimed at analysing, discussing and improving the performance of health research & innovation across the different low performing EU regions and countries.

In **Research Infrastructures**, a Memorandum of Understanding was signed on 25 October 2016 between CERIC-ERIC (Central European ERIC) and SHARE-ERIC that aims to both boost regional cooperation and collaboration between these infrastructures in different fields (active ageing, transport and connectivity, education, research and innovation) and will support scientists from low R&I performing countries to access different research infrastructures.

In the area of **Transport** a Memorandum of Understanding (MoU) has been signed in June 2016 by the Transport NCPs network and the Enterprise Europe Network transport sector groups; Under the MoU, an action plan is currently in preparation – among other issues, one of the key aspects is organising targeted support activities for EU-13 SMEs for the last Horizon 2020 Transport calls, including the SME instrument. The action plan covers information sharing, trainings, joint activities that aim to raise awareness of the available opportunities and support EU13 SMEs participation to Horizon 2020 programme – increased access to consortia, for instance networking researchers and SMEs, support for proposal building, including high quality business plans and improving business readiness of ideas.

In the **Bioeconomy** field a **Letter of Intent (LoI)** was signed[49] in 2016 between the Bio-based Industries Joint Undertaking, its private member, Bio-based Industries Consortium, and 8 Polish regions for cooperation and awareness raising in the regions (in synergies with Regional Operational programmes, Smart Specialisation Strategies and to related and available EU structural funds managed at regional level). Also, a **Lodz Bioregions Declaration**[50] was signed with the aim to establish a Central and Eastern European Bioregions Forum for the further development of the bioeconomy at local and regional levels, and to help establish synergies in the implementation of ESIF, including research, education and training, transfer of knowledge and other activities.- Following a call in Societal Challenge 2 in 2016 on the regional dimension of **bio-based industries,** BioREG CSA project was selected titled "Absorbing the Potential of Wood Waste in EU Regions and Industrial Bio-based Ecosystems". The project will create a Stakeholder platform of regional and local organisations (regional authorities or mandated agencies or clusters) interested to develop ambitious strategies in support of bio-based products/industries. Building on the "model demonstrator regions", successful case studies shall be shared and transposed to other interested European regions, among which also EU13 with the aim to widen the participation of countries developing regional bio-based strategies.

In **Industrial technologies**[51], a series of targeted awareness raising events started in 2016 and will continue on a more systematic basis in 2017. A first event was organised in Romania in June 2016 on the topic of smart specialisation in nanotechnology and advanced materials.

Complementing the above actions under Horizon 2020, also strengthened **synergies** of Horizon 2020 with the European Structural and Investment Funds (ESIF) and with the Instrument of Pre-Accession (IPA II) for Associated Countries are a way to increase the impact of investments in low R&I performing countries.

[48] http://rhing-net.eu/reghealth-ri/
[49] European Bioeconomy conference, Lodz/Poland, 6-7/10/2016; http://www.bbi-europe.eu/news/bbi-ju-signs-letter-intent-develop-bioeconomy-partnerships-central-and-eastern-regions-0
[50] http://bioeconomy.lodzkie.pl/wp-content/uploads/dekl_en.pdf
[51] Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing

The **European Structural and Investment Funds (ESIF)** include in fact support for research infrastructures and research centres; promoting business R&I, technological and applied research and key enabling technologies, as well as networking and development of clusters. An important example of synergies between ESIF and Horizon 2020 is the ELI - Extreme Light Infrastructure (distributed), located in Czech Republic, Hungary and Romania. ELI[52] will be the first and the world's biggest international laser infrastructure fully dedicated to external users with an investment volume exceeding EUR 850 million. It is the first ESFRI project to be fully implemented in the newer EU Member States and pioneers an innovative funding model, pooling FP7 – Horizon 2020 funds for the preparatory phase, EU Structural Funds (ERDF) and EIB loans for the construction phase.

The **Seal of Excellence** is another practical manifestation of the development of synergies between Horizon 2020 and ESIF. It is a quality label granted to proposals submitted under Horizon 2020, which succeeded in the highly competitive evaluation but could not be funded under the available budget. The Seal allows regions, Member States or any other funding sources (including ESIF) to identify and support these high quality proposals.

While both Horizon 2020 and ESIF aim to maximizing synergies, and there are good examples as demonstrated above, challenges remain in order to achieve such synergies easily and systematically on the ground. Overcoming these difficulties would enable especially Widening countries to better enhance their R&I capacities and enter successfully in the competitive funding arena.

A dedicated service of the European Commission in DG RTD has an overall coordinating role regarding widening participation in general, being responsible for the synergies between Horizon 2020 and ESIF as well as for the implementation of the SEWP specific objective. Furthermore, since 2014, it chairs the **RTD-ESIF contact group** that is responsible to follow the implementation of synergies between Horizon 2020 and ESIF across the different DG RTD Directorates. In late 2016 it was decided that the mandate of the group will be extended to cover the issue of widening participation in Horizon 2020.

One of the new tasks of the **RTD-ESIF contact group** would be to put in place a more structured monitoring system (both quantitative and qualitative) across the thematic directorates of DG RTD and other DGs and to keep track of the different widening-related measures being adopted and their effectiveness.

H.10.4.Achievements so far

Achievements in SEWP

Widening actions led to a high level of participation in all calls under SEWP so far.[53] Especially the Teaming action has attracted a lot of attention at political level, with submitted proposals either coordinated or supported financially by national or regional authorities. In several countries (e.g. Poland), national competitions were held by relevant Ministries in order to identify the best proposals for facing the intense competition at the European level – a first in the history of Framework Programmes. Equally, because of the link (Teaming in particular) with Smart Specialisation Strategies for Research and Innovation, countries took

[52] https://eli-laser.eu/
[53] 169, 88 and 553 proposals submitted respectively under the 2014-15 Teaming, ERA Chairs and Twinning calls.

the initiative to link the actions with their Operational Programmes in ESIF (e.g. Poland, Czech Republic).

Under Horizon 2020 so far, 31 Teaming Phase 1, 10 Teaming Phase 2, 67 Twinning and 14 ERA Chairs projects have been funded. Out of a total of EUR 254 million allocated, 73% of the funding went to partners from low R&I performing countries. In terms of the achievements of the individual projects of Teaming, Twinning and ERA Chairs, these are not yet measurable as all projects have started at the earliest in mid-2015 and are still running. More details can be found under the SEWP thematic annex of the Staff Working Document to the Horizon 2020 interim evaluation.

Achievements in other parts of Horizon 2020

For the different initiatives undertaken to widen participation across Horizon 2020 mentioned in Box 2 above, the actions have successfully managed to raise awareness and bring EU-13 stakeholders closer to Horizon 2020, through networking, information sharing and exchange of best practices. The table below presents the relevant data per country group for FP7 and Horizon 2020.

Table 41 Key data on participation per country group, FP7 and Horizon 2020

		Horizon 2020			
	FP7, EU-13	EU-13	EU-15	EU-28	Overall
Share of EC contribution	4.2%	4.4%	88.5%	92.9%	100%
Average EC Contribution per year (EUR million)	272	302	6,015	6,318	6,800
Annual EC contribution per inhabitant (in EUR)	*3*	3	15	12	n.a
Annual EC Contribution per researcher FTE (in EUR)	*1,321*	1,271	3,808	3,475	n.a
EC Contribution per EUR million spent on R&D (public and private, GERD)	N/A	67,524	63,277	63,429	n.a
Share of participations	7.9%	8.5%	82.6%	91.1%	100%
Share of SME participation	9.3%	21.8%	21.2%	21.3%	20.7%
Share of newcomers participations	N/A	31.2%	19.7%	20.8%	21.1%
Share of private sector participation	28.7%	31.1%	34.2%	33.9%	33.2%
Share of unique participants	10.9%	11.7%	76.9%	88.6%	100%
Success rate of applications	18.0%	11.1%	14.4%	14.0%	14.1%
Share of Projects Coordinators in Signed Grants	9.7%	5.1%	87.6%	92.7%	100%

Source: European Commission, cut-off data 1 January 2017, and HLEG report on FP7 ex-post evaluation

In spite of the bulk of the newcomers having origin in EU-15, **EU-13 has a significantly larger (31.2%)** share of participations of newcomers compared to EU-15 (19.7%).

Some programme parts register however a better EU-13 participation than others, and better than in FP7, but still quite low. The picture is therefore diversified and a causality link between measures in place and participation/success rates cannot be defined. **Participants from EU-13 Member States represent 8.5% of the participations in Horizon 2020 and receive 4.4% of the overall funding, which is slightly more than under FP7 (respectively 7.9% and 4.2%).** Overall the EC contribution to participants from EU-13 countries increased from approximately EUR 270 million per year in FP7 to EUR 300 million per year under Horizon 2020.

Again, presenting the Member States in terms of EU-13 and EU-15 hides the fact that within each group performance is far from homogenous. The analysis at country level performed in

the table 42 clearly shows that some **EU-13 countries** are in spite of overall lower Horizon 2020 contribution **outperforming the EU-15 average**. E.g. **Slovenia, Cyprus and Estonia** outperform the EU-15 averages, taking into account the size of the population, the number of researchers and national investments in R&D.

Furthermore taking **national investments in R&D into account, EU-13 Member States on average outperform EU-15 Member States by 6.7%.** The variations in Horizon 2020 funding to a large extent can thus be explained by differences in national investments in R&I. Overall applications from EU-15 Member States (14.4%) have a higher success rate than applications from EU-13 (11.6%). Noticeably, **EU-13 countries record a higher share of SME participation that under FP7** (from 18.2% to 21.8%) which is above the performance of EU-15 countries. The private sector participation also increased compared to FP7 (from 28.7% to 31.1%). **There are however big differences between countries as regards the shares of SME participation -** with Hungary, Estonia and Cyprus having the largest share of around 30% of SME participation.

Table 42 Horizon 2020 contribution normalised by inhabitant, researcher and R&I investment nationally

Country	H2020 contribution (EUR million)	Horizon 2020 contribution		
		Per inhabitant	Per researcher FTE	Per EUR million spend on R&D
Malta	16	36	19,094	230,759
Lithuania	21	7	2,585	54,264
Latvia	22	11	5,978	141,825
Bulgaria	30	4	2,095	68,791
Croatia	32	8	5,042	85,644
Slovakia	50	9	3,492	54,245
Luxembourg	54	94	18,892	80,767
Cyprus	62	73	71,860	768,657
Estonia	66	50	15,767	217,990
Romania	77	4	4,422	98,703
Hungary	109	11	4,298	72,008
Slovenia	109	53	13,848	128,243
Czech Republ	129	12	3,393	39,751
Poland	185	5	1,908	42,743
Portugal	343	33	8,663	149,794
Ireland	356	75	16,610	121,962
Finland	430	78	11,470	70,879
Greece	435	40	12,396	258,158
Denmark	497	87	11,887	61,706
Austria	576	66	13,609	55,170
Sweden	704	71	10,249	48,267
Belgium	965	85	17,518	95,806
Netherlands	1,566	92	20,337	114,857
Italy	1,664	27	13,786	75,991
Spain	1,813	39	14,806	137,627
France	2,097	31	7,812	43,110
United Kingd	3,083	47	10,654	70,251
Germany	3,464	42	9,690	39,735
EU-28	**18,953**	**37**	**10,426**	**63,429**
EU-13	**907**	**9**	**3,812**	**67,524**
EU-15	**18,046**	**44**	**11,423**	**63,277**

Source: European Commission, CORDA data, cut-off date 1 January 2017

H.10.5.Lessons learnt/Areas for improvement

The **EU funding from Horizon** 2020 to EU-13 countries has a slow increasing trend (4.2% in FP7 to 4.4% in Horizon 2020)[54]. It is to be noted that some programme parts register however a better EU-13 participation that others, and better than in FP7, but still quite low. The picture is therefore diversified and a causality link between measures in place and participation/success rates cannot be defined. **Presenting the Member States in terms of EU-13 and EU-15 hides the fact that within each group performance is far from homogenous.** The analysis at country level clearly shows that some EU-13 countries are in spite of overall lower Horizon 2020 contribution outperforming the EU-15 average. E.g. Slovenia, Cyprus and Estonia outperform the EU-15 averages, taking into account the size of the population, the number of researchers and national investments in R&D.

Raising participation of low performing countries in Horizon 2020 is a complex and multi-faceted issue. The measures currently in place have a long term impact and do not result in an immediate increase of the participation rates of low performing countries.

Widening participation is a shared responsibility, which needs to be addressed both nationally and at EU level in a complementary way whilst respecting the principles and role of each level and instrument used. Horizon 2020 can stimulate reforms and leverage higher and better R&I investments across Europe, but always maintaining R&I excellence as the cornerstone objective and evaluation criterion, if Europe wants to be able to compete worldwide and deploy measures that mutually benefit all parties involved.

H.11. International networks for excellent researchers and innovators such as European Cooperation in Science and Technology (COST)

H.11.1.Overview

COST (Cooperation in Science and Technology) is a European intergovernmental framework to support the networking of nationally funded research activities. It provides means to jointly develop ideas and new initiatives across all fields in science and technology, including social sciences and humanities, through pan-European networking of nationally funded research. COST receives funding from Horizon 2020 and complements the activities of the programme itself, in particular by serving as a bridge to the less connected and less supported research communities of the COST Member States[55].

COST is an integral part of European Research Area (ERA) and contributes to the delivery of the Europe 2020 agenda and the Innovation Union goals. It aims to increase participation of researchers from Widening countries[56] in European networks, to support the involvement of early stage researchers and to ensure a gender balance in research. By involving institutions from Near Neighbour Countries (i.e. the non-COST members Albania, Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Jordan, Lebanon, Libya, Moldova, Morocco, the Palestinian Authority, Russia, Syria, Tunisia and Ukraine) and International Partner

[54] *Source: European Commission, CORDA data, cut-off date 1 January 2017*

[55] COST has currently 36 Member Countries (28 EU Member States, Bosnia-Herzegovina, Former Yugoslav Republic of Macedonia, Iceland, Montenegro, Norway, Serbia, Switzerland and Turkey) and one Cooperating State (Israel).

[56] Countries eligible for funding under SEWP (EU-15 + Luxembourg + Portugal, Former Yugoslav Republic of Macedonia, Montenegro, Serbia and Turkey)

Countries, COST supports European neighbourhood policy and contributes to the "Open to the World" objective of Commissioner Moedas[57].

H.11.1.Rationale

COST was set up as the first intergovernmental framework to promote cooperation among researchers across Europe in 1971, at a time when there was no such research collaboration at the European level. Since then, COST has become one of the widest frameworks for research and technology cooperation. For this reason, COST is one of the cross-cutting issues in Horizon 2020 as specified in Regulation 1291/2013:

"{...} linkages and interfaces shall be implemented across and within the priorities of Horizon 2020. Particular attention shall be paid in this respect to {...} ***international networks for excellent researchers and innovators such as European Cooperation in Science and Technology (COST).*** *{...} The cross-cutting issues will be supported by a number of horizontal support measures, including support to {...} administration and coordination of international networks for excellent researchers and innovators, such as COST."*

COST is an independent organisation. Its objective is not to fund research itself, but to fund research networks among R&I stakeholders (academia, public institutions, SME/industry, NGOs, European/International organisations) through a set of tools such as short term scientific missions, workshops, conferences, training schools, dissemination activities. These networks, i.e. COST Actions, are financed via cascade funding based on a competitive evaluation and selection of proposals. COST organises open calls for the submission of proposals with collection dates every 6 to 9 months. COST Actions are open to researchers from universities, public private institutions, NGOs, industry and SMEs regardless of their scientific disciplines. The average size of a COST action is 50 participants with an annual budget of EUR 130 000 and a total duration of 4 years.

As the very nature of research environment has become more international and challenge-oriented over the years, today such networks which facilitate trans-disciplinary collaboration among researchers and different stakeholders are crucial. Furthermore, COST is facing a large degree of oversubscription, e.g. 516 proposals were received for the last proposal deadline date with less than 40 to be funded. Even though oversubscription is considered usual for programmes with a bottom-up profile, these numbers show the high interest which COST has created among researchers.

As set out in the Horizon 2020 Work Programme 2016-2017 'Spreading Excellence and Widening Participation'[58], COST is an integral part of the Innovation Union and the European Research Area (ERA) and contributes to the delivery of the Europe 2020 agenda and the Innovation Union commitments[59], notably on business academia collaboration (commitment 2), mobility and trans-national collaboration (commitment 4), SME involvement (commitment 7) and knowledge transfer (commitment 21) through efficient implementation of the COST networking. COST strategic objectives (see table below) are closely aligned with

[57] https://ec.europa.eu/digital-single-market/en/news/open-innovation-open-science-open-world-vision-europe
[58] Horizon 2020 Work Programme 2016-2017 'Spreading Excellence and Widening Participation' http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-sewp_en.pdf
[59] Europe 2020 Flagship Initiative Innovation Union, SEC(2010) 1161 https://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication_en.pdf

the priorities of ERA and the objectives of the Widening pillar under Horizon 2020. Through its "Excellence and Inclusiveness Policy", COST aims to increase participation of researchers from Widening countries, to support the involvement of early stage researchers and to ensure a gender-balance.

By their very nature, a large proportion of COST actions are multidisciplinary and focus on cutting-edge research problems. There are currently about 300 ongoing COST networking actions covering a wide range of scientific fields. Furthermore, in its recently published strategy paper, COST has made clear that it aims to respond to future 'megatrends' in the science system such as digitisation, cross disciplinary research, pooling of resources, changing relations between science and society.[60]

Table 40 Objectives of COST

1. Joining research efforts and developing common S&T programmes through coordination of nationally funded research activities led by pan-European, high quality, collaborative S&T networks
2. Capacity building by providing networking and leadership opportunities for new talents and thereby contributing to strengthen and build up excellent S&T communities
3. Addressing Societal Questions by promoting trans-disciplinary, new approaches and topics and identifying early warning signals of unforeseen societal problems aiming at contributing to Societal Challenges
4. Strengthening COST Inclusiveness Policy by fostering better access and integration of less research intensive countries' researchers to the knowledge hubs of the European Research Area with the aim of contributing to the Widening Pillar of Horizon 2020

H.11.2.Implementation

The implementation of COST as a programme in support of the networking of nationally funded research activities is under the direct governance of the Committee of Senior Officials (CSO), the supreme governance body of COST. Each of the 36 Member States is represented by a delegate in the CSO. The CSO is chaired by a President and a Vice-President, and is supported by Executive Body (EB), various sub-committees and ad-hoc working groups. Furthermore, the day-to-day programme implementation falls under the immediate responsibility of the COST Association which is an international non-profit organisation under Belgian law.

COST Actions are funded by the European Commission, mainly DG RTD with a total of EUR 300 million provided equally by two different programme lines (Societal Challenge 6 'Europe in a changing world - inclusive, innovative and reflective Societies'; and 'Spreading Excellence and Widening Participation'). This financial support is based on Specific Grant Agreements (SGAs) between the Commission and the COST Association. Even though COST receives EU funding from two different work programmes under Horizon 2020, the overall budget is used in an integrated manner. In line with Horizon 2020 Spreading Excellence and Widening Participation's objectives, COST has developed an inclusiveness policy, which commits the programme to spend at least 50% of its budget on actions which benefit research communities in Widening countries.

[60] COST, Inspiring researchers, strengthening Europe - Vision and strategic goals for COST, COST 094/16, 1 July 2016, Brussels.

The Commission has only observer status in the Committee of Senior Officials as well as in the Executive Board. DG Research and Innovation Unit B5 'Spreading Excellence and Widening Participation' is in charge of the policy and operational management of the Grant Agreement of COST. In order to explore potential synergies and complementarities between COST and research and innovation projects under Horizon 2020, a network of correspondents in 8 thematic directorates including DG CONNECT was established in early 2016. This also shows in practice how COST functions as a cross-cutting issue in Horizon 2020.

In order to track the progress in implementation, two kinds of internal assessments are done by the European Commission. The first one is the assessment of periodic and final reports of SGAs. Secondly, the European Commission carries out midterm and final review of the COST activities with the help of independent experts. The midterm review will take place in 2017. The COST Association also monitors COST activities via Impact Analysis Studies and Customer Satisfaction Survey[61]. In this way, the COST Association evaluates COST activities in terms of the overall outcome and impact achieved and assesses stakeholders' satisfaction with COST activities. The Scientific Committee (SC), composed of independent, high level scientists from all COST Member States, is responsible for the overall supervision and quality control of procedures related to the submission, evaluation and selection of proposals, and the monitoring and final assessment of COST actions. In addition, for each individual COST networking action, an action rapporteur – i.e. external expert - is assigned in order to assess the outputs and impacts of the Action. Last but not least, every five years, the COST CSO President reports to the COST Ministerial Conference on progress achieved by COST.

H.11.3.Achievements so far

At the start of Horizon 2020 in 2014, the COST Association, as an independent, non-profit organisation, took over the implementation of the COST actions from the European Science Foundation (ESF). The COST Scientific Committee was renewed. Three open calls were already published and evaluated and 66 excellent proposals were selected and approved. In December 2016, according to the information received from the COST Association, there are about 300 networking actions run by more than 45000 researchers.

International Cooperation continued to be implemented on the basis of mutual benefit, as defined by COST and confirmed by the candidate international cooperation partner on the participation of researchers, engineers and scholars from outside Europe. Montenegro formally became a COST Member in May 2015. There are currently 276 Near Neighbour Countries participations in COST Actions from 16 countries and 546 International Partner Countries participations in COST Actions from 38 countries.

The expected impacts of COST are grouped into four objectives: "Joining research efforts and developing common S&T programmes", "Capacity building", "Addressing Societal Questions" and "Strengthening COST Inclusiveness Policy". Key Performance Indicators, KPIs, developed in order to monitor the progress towards achieving the objectives and their progress are given in the table below.

[61] See: http://www.cost.eu/media/newsroom/2014_IA_CSS

Table 41 Status of the Key Performance Indicators of COST (Status by April 2016[62])

Objective	KPI	Target	Current result	Remarks
1. Joining research efforts and developing common S&T programmes through coordination of nationally funded research activities led by pan-European, high quality, collaborative S&T networks	a) Average increase in size of the COST Action network (Openness indicator)	on average 30% increase at the end of the Action	50%	Above the target
	b) Average number of reimbursed participants per Action per year	around 100 reimbursed participants per Action per year	80	Slightly below target
2. Capacity building by providing networking and leadership opportunities for new talents and thereby contributing to strengthen and build up excellent S&T communities	a) Share of Early Career Investigators (ECI) among reimbursed participants in COST Actions	20% to 50%	36%	Within the target
	b) Share of Early Career Investigators acting as Action Chairs or Vice-Chairs	10% to 30%	Chair: 13% Vice-Chair: 10%	Within the target
3. Addressing Societal Questions by promoting trans-disciplinary, new approaches and topics and identifying early warning signals of unforeseen societal problems aiming at contributing to Societal Challenges	a) Number of trans-disciplinary Actions	Increasing trend	83%	Within the target
	b) Share of Actions in the area of different societal challenges	Between 20% and 50%	56%	Above the target
	c) Share of Actions involving business enterprises	10 to 50 % of all Actions	59%	Above the target
	d) Share of Actions involving government organisations	5% to 20 % of all Actions	23%	Above the target
4. Strengthening COST Inclusiveness Policy by fostering better access and integration of less research intensive countries' researchers to the knowledge hubs of the European Research Area with the aim of contributing to the Widening Pillar of Horizon 2020	a) Share of Actions' S&T budget benefiting Inclusiveness Target Countries[63]	50%	32%	Below the target
	b) Share of reimbursed researchers[64] from Inclusiveness Target Countries	between 35% to 50%	32%	Slightly below target
	c) Average share of Inclusiveness Target Countries per Action[65]	between 40% and 50%	43%	Within the target

Source: COST (status 30/4/2016, periodic report SGA 68146)

With reference to the inclusiveness policy, COST has adopted a list of Inclusiveness Target Countries (ITC), which corresponds to the Horizon 2020 Widening countries, and has committed to spend 50% of its budget at the benefit of the research communities in those countries. Such objective however has not been fully attained. By the end of 2016, the fulfilment of the target was 40%. A specific task force was launched in July 2016 with participation of European Commission DG RTD Unit B5 to boost participation and fully fulfil the KPI. The Task Force came up with a package of measures for Widening countries including: 1) minimum condition for the inclusion of those countries already at proposal stage (based on a fixed ratio); 2) the obligation to fill at least one key position of the management

[62] This table is established once a year with periodical report due end of April.
[63] It was the most conservative calculation used when providing the data. The conservative way meant exclusively the direct reimbursement to ITC participants at COST Actions' activities. It does not consider strategic, communication efforts and indirect capacity building effects.
[64] Researchers here cover all participants receiving a reimbursement.
[65] The KPI looks into the proportion of COST Member Countries within the MC members of an Action.

committee (chair, vice chair, working group leaders); 3) a new conference grant for young researchers, 4) the development of a mentoring scheme for improving payment modalities. This package of measures was adopted by the CSO in November 2016 for implementation in 2017. Regarding the participation of early career investigators in COST actions, the KPI was fully attained (36% versus minimum requirement of 20%).

Societal impacts are mainly achieved indirectly at the level of the individual networking actions. 83% of these actions are trans-disciplinary. 56% of these actions are addressing all societal challenges tackled by Horizon 2020 and 59% include business entities and %23 government organisations. Further to that, there is an active participation of SMEs in 59% of all networking actions.

H.11.4.Lessons learnt/Areas for Improvement

When evaluating the potential of COST to contribute to the Innovation Union there is still some potential for improvement. As a generic broad KPI the participation of business enterprises has already attained the level of 59 % but could still be strengthened. In addition COST could elaborate more on its contribution to some concrete commitments of the Innovation Union.

With reference to the overall Widening expenditure indicator, the 50% spending target has not yet been fully attained. In order to boost participation, the set of measures proposed by the task force on Widening and inclusiveness need to be further implemented.

COST networking actions are in general relatively specialized which might impact the visibility and policy impact of COST actions. Finally, as stated in the COST new strategy paper, which looks at some 'megatrends' in the science system, innovative networking tools incorporating new digital technologies need to be developed.

H.12. International cooperation - Cooperation with third countries

H.12.1.Overview

The Horizon 2020 Regulation states that international cooperation shall be promoted and integrated into the programme to achieve, in particular, the objectives of strengthening the Union's excellence and attractiveness in research and innovation as well as its economic and industrial competitiveness, effectively tackling common societal challenges, and supporting the Union's external and development policy objectives. Targeted international cooperation actions shall be implemented on the basis of common priorities and mutual benefits, taking account of scientific and technological capabilities, market opportunities and expected impact.

H.12.2.Rationale

Although certain fields of research have been broadly international since several decades, in recent years the worldwide landscape of research and innovation (R&I) has undergone substantial transformations, shifting towards an increasingly globalised and multipolar network of science and technology actors. In this context, the European Union's political priority to remain a major global actor through an R&I system that is open to the world requires cooperating more closely with international partner countries.

International cooperation strengthens the Union's R&I excellence, attractiveness and competitiveness by enabling European R&I access to the global state of the art knowledge,

research test beds and innovation advances in fields where Europe is less specialised. It is attracting the best minds to perform R&I in Europe, facilitating European researchers to pursue an international career and giving access to European researchers to systems and resources that are not found in Europe. Indeed, bibliographic studies indicate a relatively higher scientific impact of researchers with international experience while international co-publications tend to be more often cited[66].

The need for international cooperation in order to strengthen the Union's competitiveness in R&I is more pressing now than ever as more R&I is performed outside Europe[67]. There has been a significant drop in the EU's share of the world's gross expenditures in R&D, from around one fourth in 2000 to around one fifth in 2013, in the output of scientific publications, from around one third in 2000 to slightly more than one fourth in 2013 and in patent applications, from more than one third in 2000 to less than one fourth in 2013[68].

Global challenges call for global mobilisation of resources and coordination of activities. For example, international cooperation allows research on treatments for infectious diseases or on climate change to be performed more efficiently and to maximize impact. Furthermore, an increasing number of research fields require infrastructures which are so sophisticated or costly that they exceed the capabilities of a single country, thereby leading to major multinational collaborations.

The objectives of international cooperation under Horizon 2020 apply in different ways depending on the international partner country or region, while areas for cooperation are identified on the basis of R&I capacities, market access opportunities, the contribution to international commitments, and the R&I framework conditions in place. For EEA, EFTA and EU enlargement countries, the focus is on fostering integration into the European Research Area. For European Neighbourhood Policy countries, the objective is to support a Common Knowledge and Innovation Space, including mobility for academics and capacity building. For industrialised countries and emerging economies, the focus is on increasing competitiveness, joint tackling of global challenges and increasing participation in international value chains. For developing countries, the emphasis is on promoting their sustainable development and addressing global societal challenges.

H.12.3.Implementation

The objectives for international cooperation are implemented by opening up Horizon 2020 to researchers and innovators from across the world and supporting targeted activities on the basis of priority areas for cooperation with international partner countries and regions. The political ambition in Horizon 2020 is to maintain international cooperation activities at least at the level of FP7.

Participation of third-country entities in Horizon 2020 can lead to different types and levels of cooperation. Entities from associated countries (AC) enjoy the highest level of cooperation as they can participate and be funded under the same rules that apply for EU Member States.

[66] See Fig. I-2-37 and I-2-44 of "Science, Research and Innovation Performance of the EU", European Commission (2016).
[67] See e.g. "Science, Research and Innovation Performance of the EU", European Commission (2016), or "Study on EU positioning: An analysis of the international positioning of the EU using revealed comparative advantages and the control of key technologies", Fraunhofer, IDEA Consult, DG RTD A.6 (2016).
[68] See Fig. I-2-5, I-3-1 and I-3-15 of "Science, Research and Innovation Performance of the EU", European Commission (2016).

International cooperation with third-country[69] entities is primarily achieved through their participation in grant agreements of collaborative[70] projects of Horizon 2020, where entities from EU or associated countries and third-countries submit together a proposal under a Horizon 2020 call. Depending on the eligibility for funding of the third-country participants, they can either receive funds from Horizon 2020 or not[71].

Furthermore, in projects of "joint" and "coordinated" calls, Horizon 2020 and third-country R&I programmes coordinate calls under which EU and/or AC participants collaborate with third-country participants, each side being funded by the respective programme. In projects under "twinning" calls, cooperation is achieved mainly through the co-organisation of activities such as workshops, exchange of results etc.

Several calls of the Horizon 2020 work programmes contribute to the objectives of various multilateral initiatives tackling societal challenges with the participation of the EC, national and regional funding agencies. Even if participants of projects under these calls do not necessarily directly collaborate with third-country entities, they contribute to the shared scope and priorities of the multilateral initiative.

International cooperation through promoting R&I staff mobility at an international level is achieved by participation of third-countries in projects under the Marie Skłodowska Curie actions (MSCA).

Funding bodies of EU or AC and third-countries can also join to issue calls under joint programming such as the ERA-NETs and the Article 185 initiatives. Depending on the specific rules for participation, third-country participants can then collaborate in projects funded under these calls.

The international dimension of Horizon 2020 is also reflected by the number of ERC grant holders and researchers funded under MSCA grants that are non EU nationals, since Horizon 2020 is open to participation and funding of people of any nationality.

While Horizon 2020 is generally open to third-countries, certain topics of the Horizon 2020 Work Programmes (WP) have been flagged as particularly relevant for international cooperation. This helps identify the extent of WP topics that have a strong international dimension and encourage international cooperation, but also as a service provided in the Horizon 2020 participant portal in order to better guide potential applicants.

A set of key indicators have been identified to measure achievements towards international cooperation within Horizon 2020. They relate to the share of third-country participations in Horizon 2020 and the EU financial contribution attributed to them, as well as the share of budget of topics in the WPs that are flagged as particularly relevant for international cooperation. Further indicators that are more connected to research results and the international impact of Horizon 2020 (such as Horizon 2020-funded international co-publications and co-patents) will become more trustworthy in the coming years, as more projects deliver results.

[69] Here referring to all countries that are neither EU Member States nor associated to Horizon 2020.
[70] As "collaborative" we refer to projects under non bottom-up, internationally open calls of Horizon 2020, i.e. all parts except for the ERC, Marie Skłodowska-Curie Actions, the SME instrument and the "Access to Risk Finance".
[71] The list of countries that are automatically eligible of funding from Horizon 2020 can be found in Appendix A of the Horizon 2020 Main Work Programmes.

The EU international cooperation policy also includes improving the framework conditions that underpin international cooperation. Such conditions may refer to reciprocity in accessing public funding, research data or infrastructures, to standards for research integrity, or to the ability to fund a single Horizon 2020 project from third country sources in addition to the EU funding. Today, nine industrialised countries and emerging economies provide support for funding the participation of their researchers in Horizon 2020[72].

Another area of action under the EU international cooperation policy deals with exploiting synergies between Horizon 2020 actions and activities of other EU programmes and policies. For instance, synergies are exploited with the 'EU Macro-regional Strategy for the Danube Region' and the Instrument for Pre-Accession Assistance, aiming to increase the effectiveness of investments into R&I, enhance the regional research and education capacity and develop smart specialisation strategies for R&I. Complementarities have also been developed with the programme for S&T Innovation and capacity building in African, Caribbean and Pacific countries of the European Development Fund, the European Neighbourhood Instrument, the R&I pillar of the Cross Border Cooperation Programme for the southern Mediterranean countries, and the African Union Research Grants.

H.12.4.Achievements

Key indicators

The main indicators for monitoring the implementation of international participation in Horizon 2020 are i) the share of third-country participations[73] in collaborative projects; ii) the share of EU contribution to participants from third-countries and iii) the share of budget of topics in the WP that are flagged as particularly relevant for international cooperation. Since the rules for participation are different for countries that are either associated or non-associated (third countries) to Horizon 2020, different figures are computed for each of these cases[74].

As of January 2017, the share of third-country participation in collaborative projects is 2.5% in Horizon 2020[75] as compared to 4.3% in FP7[76] (see Table below). The same share is 6.7% for associated countries including Switzerland and 4.3% excluding Switzerland.

Table 42 Share of non-EU participations in the number of total participations to Horizon 2020, for signed contracts in collaborative projects

Indicators	Horizon 2020	FP7 Baseline*	Target
Third countries (excluding Switzerland)	2.5%	4.3%	4.3%
Associated countries (including Switzerland)	6.7%	N/A	N/A
Associated countries (excluding Switzerland)	4.3%	N/A	N/A

[72] Australia, China, India, Japan, Mexico, Russia, South Korea and regions of Brazil and Canada.
[73] For sake of brevity, in the following we will occasionally refer to "entities from third countries" as "third countries" (e.g. "participation of South Africa in Horizon 2020" is meant to abridge "participation of entities from South Africa in Horizon 2020").
[74] Following the International Agreement of 5 December 2014 associating Switzerland to parts of Horizon 2020, Switzerland has an associated country status for actions under these parts, while it remains a non-associated country for the rest. For this reason, the values of the indicators for associated countries are presented both with and without Switzerland.
[75] 2.5% (2.6%) including (excluding) projects under Joint Technology Initiatives.
[76] 4.3% (4.6%) for the same countries as in Horizon 2020 and including (excluding) projects under Joint Technology Initiatives (JTI). 4.9% for third countries non-associated to FP7, excluding JTIs.

Source: CORDA; Signed grants cut-off date by 1/1/2017
**FP7 figures are presented for the same countries as for Horizon 2020.*

Regarding the EU contribution to third-country participants in collaborative projects, as shown in the table below, it has dropped from 1.8% in FP7 to 0.8% in Horizon 2020.

Table 43 Share of EU financial contribution to non-EU participants in total Horizon 2020 EU contribution, for signed contracts in collaborative projects

Indicators	Horizon 2020	FP7 Baseline*
Third countries (excluding Switzerland)	0.8%	1.8%
Associated countries (including Switzerland)	4.8%	N/A
Associated countries (excluding Switzerland)	4.1%	N/A

Source: CORDA; Signed grants cut-off date by 1/1/2017
**FP7 figures are presented for the same countries as for Horizon 2020.*

Four significant reasons can be identified behind the drop of third-country participations and EU contribution[77]: 1) the change in the eligibility conditions for funding of BRICM[78] countries in Horizon 2020 with respect to FP7, 2) the effects of mainstreaming international cooperation in Horizon 2020 as opposed to the dedicated "Activities of International Cooperation" theme of FP7, 3) the absence of a funding scheme that mandates international participation in Horizon 2020 as opposed to the 'Specific International Cooperation Actions' (SICA) scheme of FP7 and 4) to a lesser extent, because of a significant drop in the EU neighbourhood, supposedly due to recent conflicts and socio-political developments in the region.

On the other hand, the share of budget allocated to topics of the WPs that are flagged as particularly relevant for international cooperation[79] has increased, from 12% in FP7 to around 23% in Horizon 2020. As shown in the table below, a total of EUR 3 175.8 million are allocated by the EC to international cooperation topics, with the biggest share coming from LEIT-ICT, Research Infrastructures, SC4 "Smart, green and integrated transport", SC1 "Health, demographic change and well-being" and SC2 "Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy" and SC4 "Smart, green and integrated transport".

Table 44 Percentage of budget of topics in the Horizon 2020 Work Programme 2014-2015 that are particularly relevant for international cooperation

Programme part*	Allocated EU budget to International Cooperation topics (EUR million)	Share of EC contribution to International Cooperation topics
FET - Future and Emerging Technologies	94.5	19.8%
RI - Research Infrastructures	551.0	63.3%
LEIT-ICT	585.0	23.8%

[77] For more details, see "Performance Analysis of International Participation in Horizon 2020", October 2016, European Commission, DG RTD-C.
[78] Brazil, Russia, India, China and Mexico
[79] These are topics that mention at least one third country or region or encourage third-country entities to apply.

LEIT-NMBP	267.6	18.8%
LEIT-SPACE	31.2	9.3%
SC1 - Health, demographic change and well-being	364.5	23.4%
SC2 - Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy	287.0	37.6%
SC3 - Secure, clean and efficient energy	179.8	11.0%
SC4 - Smart, green and integrated transports	365.5	29.0%
SC5 - Climate action, environment, resource efficiency and raw materials	223.3	26.0%
SC6 - Europe in a changing world - Inclusive, innovative and reflecting societies	69.2	21.6%
SC7 - Secure societies - Protecting freedom and security of Europe and its citizens	77.0	18.3%
SEWP - Spreading excellence and widening participation	0.1	0.1%
SWAFS - Science with and for society	14.1	13.0%
Euratom	63.9	12.4%
Total Horizon 2020	3 175.8	23.3%

Source: CORDA data; extraction on 1/1/2017
**Bottom-up/not internationally open parts (FTI, ERC, MSCA, "Access to Risk Finance" and "Innovation in SMEs") not shown.*

In the following, a more detailed analysis of the participation of the third and associated countries as well as international participation in the different programme parts, types of action and how they compare to FP7[80] is provided.

Performance of entities from associated or third countries

Regarding countries that are not automatically eligible for funding from Horizon 2020, the most active up to January 2017 in terms of participations are the USA, China, Canada, Brazil and Australia as compared to USA, Russia, China, Brazil and Australia in FP7. The change in the eligibility conditions for automatic funding in Horizon 2020 has affected the BRICM countries apart from China and to a lesser extent, Brazil. In particular, the participation share of the non-BRICM third countries has dropped by around 40% from FP7 to Horizon 2020. A drop is also registered for China (around 25%) Brazil (30%), Mexico (40%), Russia (75%) and India with a drop of close to 85%.

The participation share of third countries that are automatically eligible for funding from Horizon 2020 has dropped by around 30% with respect to FP7. The most active country in Horizon 2020 is South Africa, followed by Argentina, Chile, Kenya and Egypt, as compared to FP7, where the most active countries were South Africa, Argentina, Morocco, Egypt and Chile. The overall drop is partly attributed to the absence in Horizon 2020 of the FP7 SICA scheme and the "Activities of International Cooperation" theme. The first accounted for around 25% and the second for around 11% of the participations from developing counties in FP7, more than three times the corresponding 7% and 3% share for industrialised countries. Therefore, their absence in Horizon 2020 affected more the developing than the industrialised countries. Also, the participation share of developing countries from the Southern Neighbourhood region has fallen by almost 55% in Horizon 2020 with respect to FP7 while for countries outside this region the fall is around 25%. It is reasonable to conclude that the

[80] Results not emanating from the tables included are taken from "Performance Analysis of International Participation in Horizon 2020", October 2016, RTD-C.

recent socio-political turmoil in some of these countries has affected their participation in the Framework Programme.

Table 45 Participations and EU financial contribution to signed grants of collaborative projects of the 10 most active third countries

Third countries	Number of participations in signed grants		EU contribution to participants of signed grants (EUR million)	
	Horizon 2020 (up to Jan '17)	FP7	Horizon 2020 (up to Jan '17)	FP7
United States	116	509	19.2	79.0
China	81	334	2.2	32.8
South Africa	75	233	16.5	33.1
Canada	50	198	3.1	11.2
Brazil	50	217	7.6	31.3
Australia	45	199	3.7	12.0
Russian Federation	43	520	1.7	69.5
Kenya	27	72	4.7	12.1
South Korea	26	67	0.2	1.94
Mexico	24	118	0.0	17.4
Third countries*	**897**	**4 721**	**108.4**	**575.8**
All countries	**36 149**	**111 316**	**13 621**	**32 833**

Source: CORDA, extraction date 1/1/2017
Note: Data for Beneficiaries only (third-parties are not included).
**FP7 figures are presented for the same countries as for Horizon 2020.*

The participation of third countries in MSCA and ERC grants is presented in the following table[81]. Participations in MSCA account for more than half of all participations of third countries in Horizon 2020. The drop in the share of participations from FP7 to Horizon 2020 (10.4% in Horizon 2020 compared to 11.8% in FP7) is not as significant as that among projects in the rest of the programme. As for participations in the SME instrument, there are two exceptional participations with EU contribution of EUR 0.37 million.

Table 46 Participations and EU financial contribution to MSCA and ERC signed grants of the 10 most active third countries

Third countries	MSCA		Third countries	ERC	
	Participations*	EU contribution (MEUR)		Participations	EU contribution (MEUR)
United States	468	0.25	**United States**	8	1.51
China	96	0.00	**Brazil**	2	1.07
Australia	78	0.26	**New Zealand**	2	0.33
Canada	75	0.00	**Chile**	1	0.51
Argentina	57	0.20	**South Korea**	1	0.49
Brazil	47	0.00	**Colombia**	1	0.42
Japan	45	0.05	**Australia**	1	0.16

[81] For MSCA actions, both beneficiaries and "partner organisation" participants are included.

Chile	40	0.21	**Singapore**	1	0.15
South Africa	31	0.00	**Guatemala**	1	0.09
Russian Federation	27	0.00	**Canada**	1	0.06
Third countries	**1241**	**0.98**	**Third countries**	**22**	**4.90**
All countries	**11 892**	**2 097**	**All countries**	**2 711**	**3 871**

Source: CORDA, extraction date 1/1/2017
**Participations include beneficiaries and partner-organizations*

Including collaborative, MSCA, ERC and SME instrument actions, the EU contribution to participants from third countries is EUR 114.65 million, which amounts to 0.56% of the EUR 20 400 million total EU contribution.

Regarding associated countries, the most active in terms of participations are Switzerland, Norway and Israel, followed by Turkey and Serbia. There is a slight drop in participation shares from FP7 to Horizon 2020 for the most active countries, with the exception of Serbia whose share has increased by around 50%. If Switzerland - that was not associated to all parts of Horizon 2020 until 2017 - is excluded, the share of EU financial contribution to beneficiaries has remained stable: 4.1% in Horizon 2020 compared to 4.0% in FP7. The biggest recipient of EU contribution for collaborative projects is Norway while more than half of the EU contribution to Israel is given via ERC grants. The change from 2014 to 2015 is generally positive both for participations and EU contribution shares.

Table 47 Participations and EU financial contribution to signed grants of collaborative projects of associated countries

Associated countries	Participations from Associated Countries		EU contribution to participants in signed grants (EUR million)	
	Horizon 2020 (up to Jan '17)	FP7	Horizon 2020 (up to Jan '17)	FP7
Switzerland	889	3 327	91.2	1 140.2
Norway	632	1 980	299.4	608.2
Israel	288	1 093	126.1	381.7
Turkey	249	888	58.1	148.0
Serbia	125	264	24.0	59.5
Iceland	73	224	31.7	53.0
Ukraine	52	201	5.7	23.0
FYROM	28	83	2.0	10.9
Moldova	21	41	1.7	3.1
Tunisia	15	39	1.9	2.7
Bosnia & Herzegovina	14	103	1.6	12.1
Georgia	14	60	0.7	4.6
Montenegro	10	37	0.2	3.8
Armenia	9	40	0.3	3.1
Faroe Islands	8	37	1.4	2.1
Albania	7	14	2.2	2.4
Associated countries*	**2434**	**8431**	**648.3**	**2 458.2**
All countries	**36 149**	**111 316**	**13 621**	**32 833**

Source: Corda, extraction date 1/1/2017
Note: Data for Beneficiaries only (third-parties are not included).
**FP7 figures are presented for the same countries as for Horizon 2020.*

Entities from associated countries enjoy the same level of participation in Horizon 2020 as Member States. Therefore, they are eligible to participate in mono-beneficiary calls such as the ERC and those under the SME instrument, as well as in calls that are not open to third countries such as the "Access to Risk Finance" part. The table below shows the participations and EU contribution to associated countries for ERC, MSCA and the SME Instrument actions. Almost half of participations to MSCA are from Switzerland, while Israel is first in ERC grants and grants under the SME Instrument. Also, there is one (Swiss) participation in a signed grant under "Access to Risk Finance", with no EU contribution.

Table 48 Participations of and EU financial contribution to associated countries for signed grants of MSCA, ERC and the SME Instrument

Countries	MSCA		ERC		SME Instrument	
	Partici-pations*	EU contribu-tion (MEUR)	Partici-pations	EU contribu-tion (MEUR)	Partici-pations	EU contribu-tion (MEUR)
Switzerland	327	61.6	162	264.6	0	0.00
Israel	110	16.2	145	187.9	66	28.0
Norway	105	25.2	22	38.3	47	13.6
Turkey	67	6.8	14	14.3	15	4.6
Serbia	38	1.7	1	1.7	5	1.8
Ukraine	36	2.9	0	0.00	2	1.3
Iceland	20	3.7	2	0.00	13	2.6
Tunisia	10	0.41	0	0.00	0	0.00
Bos. & Herz.	8	0.35	0	0.00	0	0.00
Armenia	6	0.00	0	0.00	0	0.00
Moldova	5	0.46	0	0.00	0	0.00
Georgia	4	0.52	0	0.00	0	0.00
Albania	3	0.08	0	0.00	0	0.00
Montenegro	3	0.00	0	0.00	0	0.00
FYROM	2	0.13	0	0.00	0	0.00
Faroe Islands	0	0.00	0	0.00	1	0.05
Associated countries*	**687**	**120.1**	**346**	**509.0**	**149**	**51.9**
All countries	**11 892**	**2 097**	**2 711**	**3 871**	**2333**	**781.7**

Source: CORDA, extraction date 1/1/2017
**Participations include beneficiaries and partner-organizations*

Including collaborative, MSCA, ERC and SME instrument actions, the EU contribution to participants from associated countries is EUR 1329.3 million, which is 6.5% of the EUR 20 400 million total EU contribution.

Performance of the different programme parts and types of action

MSCA have the highest number and share of third-country participations. The other parts that perform above average are Societal Challenges 6 – "Europe in a changing World – Inclusive,

innovative and reflecting societies", 5 – "Climate action, environment, resource efficiency and raw materials" and 2 – "Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy". The parts with the least international participation are the Future and Emerging Technologies, LEIT-ICT, LEIT-NMBP (Nanotechnology – Materials – Biotechnology – Primary metals) as well as Societal Challenges 3 – "Secure, clean and efficient energy", 4 – "Smart, green and integrated transports" and 7 – "Secure societies – Protecting freedom and security of Europe and its citizens" . In terms of EU contribution to third-country participants, the highest and lowest performing parts are the same as before, except for Research Infrastructures and the Societal Challenge 1 – "Health, demographic change and well-being", with a relatively high EU contribution to third country participants, but also the MSCA, where the EU contribution is relatively low as there are only exceptional third-country beneficiaries[82].

Apart from the MSCA mentioned above, other types of action with significant international participation are the Coordination and Support Actions (CSA) and the Research and Innovation Actions (RIA). In terms of EU contribution, third-country beneficiaries receive EU funds mostly under the RIA, followed by the CSA (although with a higher share among recipients).

The strong international performance of the MSCA is expected since all its four main actions support the international mobility of researchers, in particular MSCA-RISE and the Global Fellowships of the MSCA-IF schemes. On the other hand, the SME instrument has only two and the ERC eighteen exceptional participations since these mono-beneficiary types of action are, up to exceptions, restricted to entities from EU or associated countries.

Innovation actions (IA) include significantly less international participation than RIA. Indeed, more than 35% of all participations of Horizon 2020 are of private for-profit entities (PRC), while the same number among third-country participations is only 22%. This is even more manifest within IA, where the figures are 52% of PRC against only 29% within non-AC participations.

Projects of Public-Private Partnerships (the contractual PPP and the JTIs) have either no or very few international participants, except for the JTI “Innovative Medicines Initiative” (IMI2). Regarding Public-Public Partnerships, the ERA-NET-Cofund actions are among the most international types of action with a third-country participation share at around 5%. Also, three out of the four Horizon 2020 Article 185 Initiatives cooperate with non-Associated Countries (which are not participating states in the sense of the basic act): the EDCTP2 programme has a very strong international dimension via participation of 14 sub-Saharan countries, while Canada cooperates in AAL2 and South Korea in Eurostars2[83]. On the other hand, 'European Joint Programme' (EJP) projects have no international participants.

Regarding the EU's investment in topics directly related to the objectives of multilateral initiatives:

- In health-related initiatives (IRDiRC, IHEC, IHMC, IKMC, ICGC, InTBIR, GACD, GloPID-R, GTBVP) during 2014-2015 the EU's investment has been around EUR 114 million, leveraging around EUR 532 million, while the EU investment for 2016-2017 is

[82] In the MSCA-RISE program, third-country partner-organisation participants from countries that are eligible for automatic funding can receive indirect EU contribution.
[83] For more details, see the dedicated Staff Working Documents for the art. 185 and 187 initiatives.

expected to be higher than EUR 120 million, leveraging around three times more non-EU funding.

- In activities related to climate action and the environment such as the 'Belmont Forum', the Group on Earth Observation (GEO) and the Intergovernmental Panel on Climate Change (IPCC), the total Horizon 2020 budget for these topics is close to EUR 200 million, while the total investment by all partners is estimated to be around three to four times this amount.

The key indicators presented above do not capture cooperation through projects under joint or coordinated calls, where the third-country partners are not beneficiaries of an EU grant. The Work Programmes of Horizon 2020 for 2014-15 and 2016-17 contain 21 joint/coordinated calls that have so far led to more than 30 projects of around 220 participations from EU or associated countries, receiving EUR 55 million from the EU. With a roughly equal number of third-country participants, this corresponds to around 25% of the total third-country participations to collaborative projects.

In FP7 there were 31 coordinated calls, leading to 91 projects of around 790 participations that received close to EUR 153 million from the EU, which is roughly three times more than the current Horizon 2020 figures. Assuming that there will not be a large change in the number of signed projects under joint/coordinated calls in the rest two thirds of Horizon 2020, it can be concluded that joint/coordinated projects of Horizon 2020 and FP7 have similar participations and EU contribution.

H.12.5.Lessons learnt/Areas for improvement

The discontinuation in Horizon 2020 of the dedicated international cooperation theme and specific international cooperation actions of FP7 has not been accompanied by a transversal increase of international participation across the different parts of Horizon 2020, while the change in the funding eligibility conditions for certain third countries has negatively affected their participation to the programme.

Furthermore, Horizon 2020 attracts third-country research organisations more than private for-profit entities, with Innovation Actions being among the least international of the programme. The programme's increased focus on closer-to-market activities has required finding an appropriate balance between engaging in international cooperation and safeguarding the interests of the EU's companies.

Corrective actions have been taken to improve international participation in Horizon 2020, including increasing the number of work programme topics that are specifically relevant for international cooperation, improving the framework conditions for international collaboration, and refining the communication strategy to ensure global awareness of EU's strengths and of the international openness of Horizon 2020.

In particular, the budget allocated to Horizon 2020 WP topics flagged as particularly relevant for international cooperation has increased, from 12% in FP7 to over 22%. It should be noted though that there are only very few topics for which international participation is mandatory.

Regarding framework conditions, a priority has been to stimulate and assist industrialised countries and emerging economies in setting up mechanisms to fund the participation of their researchers in Horizon 2020 actions. So far, mechanisms exist in several countries – including

Australia, China, India, Japan, Mexico, Russia, South Korea and regions of Brazil and Canada, and efforts are continuing to broaden their scope of application. Furthermore, global multilateral fora in different thematic fields have addressed framework conditions such as open access to research data and infrastructures in their respective fields.

Regarding collaboration with developing countries, the priority has been to enhance the synergies with the external instruments and ensure that science, technology and innovation are taken on board in the planning of the national and regional programmes. This is in line with the Sustainable Development Goals' strategy which encompasses science, technology and innovation as an effective engine for sustainable development.

Regarding the communication strategy, the EC has continued its 'Horizon 2020 – Open to the World' communication campaign to ensure that the programme is known worldwide. It has also improved visibility and guidance on the Participant Portal and the international cooperation website. The EU delegations have contributed to promote the EU strategy, and Horizon 2020 National Contact Points have continued to provide guidance and advice to researchers and assisting in partner search. Furthermore, a series of bilateral policy support projects with partner countries and regions have carried on with awareness raising, while the EC is setting up a facility to provide services in support of further policy development, priority-setting and implementation of international cooperation.

Moreover, the updating of the roadmaps for international cooperation has been synchronised with the Horizon 2020 strategic programming cycle such that science and technology policy dialogues and cooperation roadmaps can effectively serve as a basis for priority setting in programming.

H.13. Science and Society: Responsible Research and Innovation

H.13.1. Overview

Responsible Research and Innovation (RRI) is a cross-cutting issue in Horizon 2020 that encourages societal actors (researchers, citizens, policy makers, businesses, third sector organisations, etc.) to work together during the whole research and innovation (R&I) process to better align R&I and its outcomes with the values, needs and expectations of society. In practice, it means taking action in the five following dimensions: public engagement, science education, gender equality, ethics, and open access/data. Where relevant, it also involves institutional changes to governance frameworks[84].

H.13.1. Rationale

Regulation (EU) No 1291/2013 refers to Responsible Research and Innovation (RRI) on several instances, outlining the rationale for this cross-cutting issue (CCI). For instance, Recital 22 states that "*Horizon 2020 should foster the informed engagement of citizens and civil society in research and innovation matters by promoting science education, by making scientific knowledge more accessible, by developing responsible research and innovation agendas that meet citizens' and civil society's concerns and expectations and by facilitating their participation in Horizon 2020 activities. The engagement of citizens and civil society should be coupled with public outreach activities to generate and sustain public support for Horizon 2020*". These activities are to be carried out with the aim of ensuring that R&I deliver

[84] http://ec.europa.eu/research/swafs/index.cfm?pg=about.

smart, inclusive and sustainable solutions to societal challenges by engaging new perspectives, new innovators and new talent[85].

In the 'real world' these aspirations are leading to the emergence of different kinds of R&I infrastructures and modes of R&I, such as citizen science, open innovation platforms[86], Living Labs[87] and programmes dedicated to RRI launched by research institutes. These engage and open up R&I to stakeholders including SMEs, third sector organisations, policy makers, citizens, end-users and students. In this way, the beneficiaries of R&I contribute to research (e.g. agenda setting, scientific research, analysis of results and policy development) and innovation (e.g. ideation, concept design, rapid prototyping and verification of results).

The accelerating pace of the co-evolution of science and society makes new ways of conducting R&I ever more important at all levels of governance, as exemplified by Commission Moedas' 3Os Strategy. As underlined by Commissioner Moedas, "*an invention becomes an innovation only if users become a part of the value creation process. Notions such as 'user innovation'... emphasize the role of citizens and users in the innovation processes as 'distributed' sources of knowledge. This kind of public engagement is one of the aims of the Responsible Research and Innovation programme in Horizon 2020*"[88]. Citizen science aims to encourage citizens to become involved in the science itself: "*Citizen Science can contribute to the Commission's goal of Responsible Research and Innovation, as it reinforces public engagement and can re-direct research agendas towards issues of concern to citizens*"[89].

The 2014 Rome Declaration on RRI in Europe[90] argued that good marketing cannot be relied upon for R&I acceptability, that diversity in R&I is "*vital for enhancing creativity and improving scientific quality*", and that "*early and continuous engagement of all stakeholders is essential for sustainable, desirable and acceptable innovation*". Building on the Lund Declaration of 2009 (which called for an emphasis on tackling societal challenges) and the Vilnius Declaration of 2013 (which underlined the need for resilient partnerships with all relevant actors for research to serve society)[91], the Rome Declaration called on "*European Institutions, EU Member States and their R&I Funding and Performing Organisations, business and civil society to make Responsible Research and Innovation a central objective across all relevant policies and activities, including in shaping the European Research Area and the Innovation Union*". The R&I Commissioners' meeting on 25 May 2016 re-iterated the need to promote RRI throughout the Horizon 2020 Work Programme; all parts of Horizon 2020 are therefore expected to make efforts to embed RRI to bring science closer to society and *vice versa*. As part of interim evaluation activities of Horizon 2020, the European Economic and Social Committee found very strong support for the involvement of civil

[85] http://ec.europa.eu/research/participants/data/ref/h2020/legal_basis/fp/h2020-eu-establact_en.pdf.
[86] See for instance https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/support-measure/manner-suomi/six-city-programme-6aika-open-innovation-platforms-spearhead-project.
[87] See for instance, http://www.enoll.org/ and http://www.iemed.org/llista_activitats-en/the-mediterranean-as-an-open-living-lab?set_language=en.
[88] https://ec.europa.eu/digital-single-market/en/news/open-innovation-open-science-open-world-vision-europe
[89] *Ibid*.
[90] Made under the Italian Presidency of the Council of the European Union. See https://ec.europa.eu/research/swafs/pdf/rome_declaration_RRI_final_21_November.pdf.
[91] See The Lund Declaration (2009), http://www.vr.se/download/18.7dac901212646d84fd38000336/ made under the Swedish Presidency of the Council of the European Union, and The Lund Declaration (2015), http://www.vr.se/download/18.43a2830b15168a067b9dac74/1454326776513/The+Lund+Declaration+2015.pdf made as part of the high-level conference "Lund Revisited: Next steps in tackling societal challenges" and organised by the European University Association.

society organisations in Horizon 2020 project consortia (81% of those who responded to a targeted survey)[92]. In addition, the open public online consultation on the Science with and for Society (SWAFS) Work Programme 2018-2020 received 104 contributions representing more than 6,500 organisations from a wide range of stakeholder groups (e.g. industry, academia, civil society) and found a very high degree of support for integrating RRI across Horizon 2020[93].

H.13.2.Implementation

The Key Performance Indicator (KPI) for RRI in Horizon 2020 is "*instances where citizens, Civil Society Organisations (CSOs) and other societal actors contribute to the co-creation of scientific agendas and scientific contents*"[94]. It is a proxy for actions across the five dimensions of RRI, though like most KPIs it imperfectly captures the concept.

Mainstreaming/embedding RRI across Horizon 2020 is the responsibility of a dedicated service with the European Commission, DG RTD which is also responsible for the Science with and for Society (SWAFS) programme part. This service regularly screens Scoping Papers and Work Programmes to monitor how RRI is being embedded in Horizon 2020. Meetings are held with EC services responsible for other parts of Horizon 2020 on an *ad hoc* basis, and briefings are written to support other EC services to embed RRI. Recently, a training package developed by the RRI Tools project[95] was used to train RRI stakeholders across Europe, including EC civil servants.

The Common Research Datawarehouse (CORDA) allows identification of RRI-relevant funded projects through a system called 'flagging'. Flagging is the process by which projects that fit the criteria for being RRI-relevant are attributed a 'flag'; these flags are attributed by project officers from the EC and executive agencies responsible for managing different parts of Horizon 2020. In this way CORDA allows quick identification of projects that are flagged as RRI relevant, those that are not relevant, and also those that are missing flags (for whatever reason that may be). The flagging system does not hold any other data – such as information about why projects are attributed a flag.

A potential additional source of information on the prevalence of RRI in Horizon 2020 is the participation of civil society organisations (CSO). The "*Study on network analysis of civil society organisations' participation in research framework programmes*" examined this using CORDA data. It had to clean the data carefully and developed a four-fold typology of CSO participants in Framework Programmes to analyse CSO participation: 1) Core CSOs (e.g. individuals and non-profits), 2) organisations that are publicly financed and oriented to society, 3) organisations that are financed by business and oriented to society, 4) organisations that are financed by and oriented towards business. It found (using data up to April 2015) that in Horizon 2020 CSO types 1 and 2 made up 2.7% of project participants receiving just 0.7% of total funding; by contrast, 5.3% of participants receiving 1.6% of funding were CSO types 3 & 4[96]. Overall, this study suggested that CORDA cannot currently be used to assess CSO

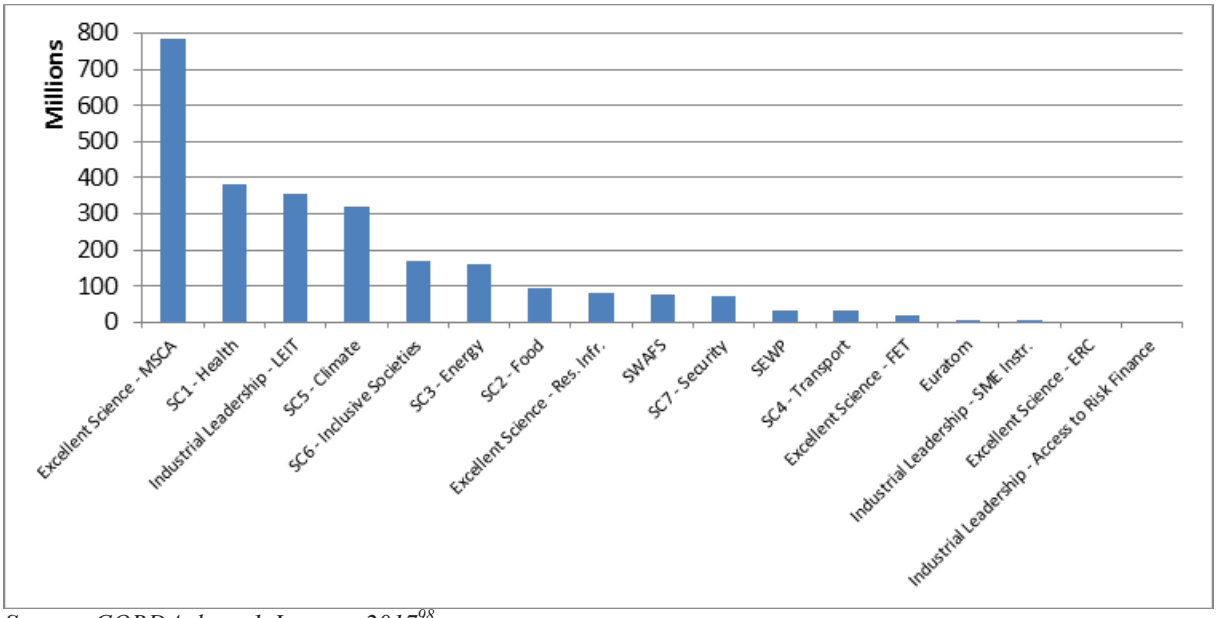
[92] Draft Information Report – Section for the Single Market, Production, and Consumption: Interim evaluation of Horizon 2020); European Economic and Social Committee. INT/807.
[93] http://ec.europa.eu/research/consultations/swafs-wp2018-2020/consultation_en.htm.
[94] https://ec.europa.eu/programmes/horizon2020/en/news/horizon-2020-indicators-assessing-results-and-impact-horizon.
[95] http://www.rri-tools.eu/.
[96] Study on network analysis of civil society organisations' participation in research framework programmes (CONTRACT NO. RTD-B6-2014-SI2.687781) - D5: Draft final report.

involvement in consortia, and that the level of involvement of 'true' CSO in consortia is very low, of peripheral importance, and of a potentially poor quality given the low funding.

H.13.3.Achievements so far

As of 1 January 2017, CORDA data show that 11.0% of Horizon 2020 projects, *for which data are available (i.e. not missing)*, are RRI relevant. The EC contribution to these flagged projects is EUR 2.7 billion this equates to 13.95% of the Horizon 2020 budget[97]. Excluding *ad hoc* calls and joint undertakings, more than two-thirds of the RRI-flagged EC contribution goes to MSCA (30.4%), SC1 – Health (14.8%), Industrial Leadership – LEIT (13.7%), and SC5 – Climate (12.4%).

Figure 54 EC contribution (EUR million) to RRI-flagged projects in Horizon 2020 programme parts



Source: CORDA data, 1 January 2017[98]

These figures do not take into account the 33.8% of Horizon 2020 projects that current lack RRI flags altogether. Indeed, RRI flags are almost completely missing from some lines of Horizon 2020, for instance ERC (99.9%), Euratom (83.3%), and Innovation in SMEs (82.3%). This suggests that the EC contribution to RRI-flagged projects could be considerably higher than indicated above.

The patterns suggested by CORDA data are backed up to some extent by text screening exercises. In the 2014-2015 Work Programme, RRI was explicitly addressed in six programme parts and the translation of RRI into topics was not extensive. Nevertheless, some parts of Horizon 2020 did demonstrate a good level of appropriation, for instance, Industrial Leadership – LEIT (which has 7.6% of projects flagged as RRI relevant in CORDA for which data are available). Progress was made in the Work Programme 2016-2017, where RRI was addressed in almost all parts, either by mentioning RRI explicitly or by demonstrating a

[97] Where EUR 19,361,213,441 EU contribution (eCorda data extraction 19/01/2017) are allocated to Horizon 2020 projects and 784 projects have an RRI flag (eCorda data extraction 19/01/2017).
[98] Where EUR 2,586,774,344 are allocated to 751 RRI-flagged projects excluding joint actions and grants to identified beneficiaries (eCorda data extraction 19/01/2017).

greater understanding of it. The increased emphasis on RRI suggests that a higher proportion of projects should be attributed an RRI flag as increasing numbers of grants from the Work Programme 2016-2017 are signed.

Screening of the draft 2018-2020 Work Programme scoping papers[99] provides preliminary cause for concern: just two mentioned RRI explicitly (Excellent Science – MSCA & SC2 – Food) and in some lines no keywords associated with RRI were mentioned at all (Industrial Leadership – Innovation in SMEs, Industrial Leadership – Access to Risk Finance). Nevertheless, some dimensions of RRI were mentioned more frequently than others (e.g. public engagement and gender) and in some scoping papers keywords were mentioned several times across the context and strategic orientations, pointing to a fuller treatment and embedding of the concept; these include SC5 – Climate (which currently has 22.5% of projects flagged as RRI relevant in CORDA for which data are available) and SC6 – Inclusive Societies (which currently has 41.5% of projects flagged as RRI relevant in CORDA for which data are available).

Unfortunately, the figures suggested by CORDA data and text screening exercises do not make it possible to conclude that RRI is well embedded in Horizon 2020, as this would require in-depth analysis of what the attribution, non-attribution or even omission of the RRI flag represents in practice.

H.13.4.Lessons learnt/Areas for improvement

RRI is a cross-cutting issue that is relatively new to Horizon 2020. CORDA data suggest it is now integrated in around 11% of total Horizon 2020 projects, and this has a significant budget associated with it. The prevalence and distribution of RRI across Horizon 2020 varies greatly between programme parts; this pattern of distribution is backed by the RRI text screenings of Work Programmes. RRI is highly policy relevant and there is widespread support for involving citizens and CSOs in Horizon 2020. However, CSO involvement in Horizon 2020 is very low, and CSOs are generally “hangers on” in projects and rarely co-ordinate them[100].

It is therefore important to understand what RRI flags in CORDA represent and whether and how RRI-flagged projects are really "*instances where citizens, Civil Society Organisations (CSOs) and other societal actors contribute to the co-creation of scientific agendas and scientific contents*". It is also important to increase the involvement of CSOs in Horizon 2020. RRI cannot be well implemented without involving representatives of citizens and civil society in the programme itself. This would likely involve improving the collection of data about CSO participation.

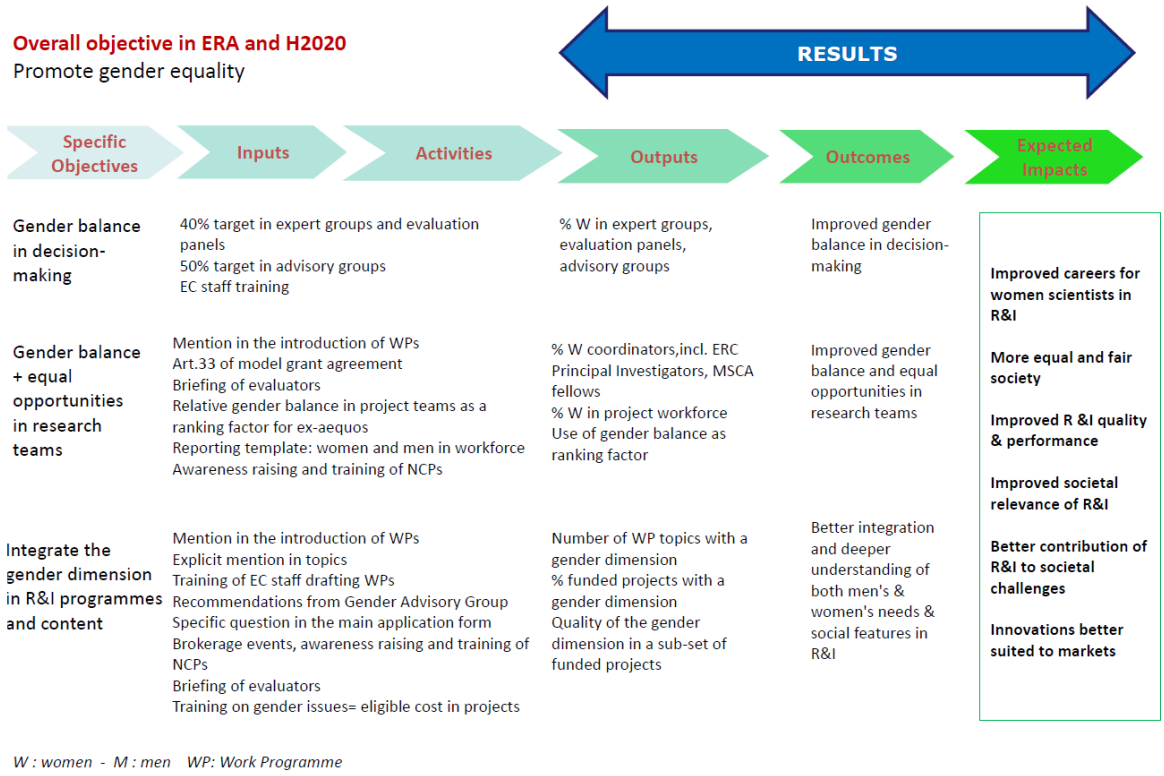
[99] RTD B7 - Screening of "Responsible Research & Innovation" in Horizon 2020 Work Programme 2018-2020 Scoping Papers.
[100] "Study on network analysis of civil society organisations’ participation in research framework programmes" (CONTRACT NO. RTD-B6-2014-SI2.687781) - D5: Draft final report.

H.14. Gender equality

H.14.1. Overview

Gender equality is implemented as a cross-cutting issue in Horizon 2020 with three objectives and according to the following intervention logic.

Figure 55 Gender equality in Horizon 2020 - Intervention logic



Source: European Commission, DG RTD

H.14.2. Rationale

The EU has developed over the years a well-established regulatory framework on gender equality, with binding directives, which apply across the labour market including the research sector. The European Commission has defined for the period 2016-2019 a Strategic engagement for gender equality[101] in all EU policies. Gender equality in research and innovation is part of this strategic engagement. The EC gender equality policy is also in line with international priorities such as the Beijing Platform of Action[102], the UN Sustainable Development Goals[103], and the G7 Guiding Principles for Capacity Building of Women & Girls[104], included in the Ise-Shima Declaration

Gender equality is one of the priorities of a "Reinforced European Research Area Partnership for Excellence and Growth[105]" (ERA). In its 2015 Conclusions on Advancing Gender

[101] http://ec.europa.eu/justice/gender-equality/files/documents/160111_strategic_engagement_en.pdf
[102] http://www.un.org/womenwatch/daw/beijing/platform/
[103] http://www.un.org/sustainabledevelopment/gender-equality/
[104] http://www.mofa.go.jp/files/000160274.pdf
[105] http://ec.europa.eu/research/era/era_communication_en.htm

Equality in the ERA[106], the Council invites the Commission to continue to strengthen the implementation, monitoring and evaluation of all Horizon 2020 objectives related to gender equality.

Achieving gender equality is not only a matter of social justice but also of economic growth and research performance. Including sex and gender analysis[107]enhances research quality and the societal relevance of the produced knowledge, technologies and innovations. It also contributes to the production of goods and services better suited to potential markets. Gender equality calls for more transparency and a wider access of women scientists to research, thereby enlarging the pool of talents and the innovation potential. It therefore contributes to Commissioner Moedas Three O's priorities[108] and to President Juncker's priorities[109] for the European Union.

The FP7 ex-post evaluation[110] showed that gender equality in R&I is advancing very slowly. In FP7, women represented 38%[111] of the total reported workforce of the projects, but only 28.5 % of projects coordinators[112], 35% of the experienced researchers[113] and 29% of Work Packages leaders[114]. This vertical segregation is also combined with a horizontal one, depending on the scientific fields. Similar gaps are reflected across the EU as shown by the latest She Figures[115].

Given the challenges to address, the original three objectives set for gender equality in Horizon 2020 continue to be highly relevant, and aligned with international and EU policies.

H.14.3.Implementation

Major changes were introduced in Horizon 2020 compared to FP7 in the way gender equality is mainstreamed as a cross-cutting issue. The objectives stated in Article 16 of Horizon 2020 Framework Regulation are implemented at several levels in the funding process, starting with the work programmes and topic description, through the application and proposal evaluation, the granting phase to the projects monitoring and reporting. More specifically:

- Gender balance in research teams: The relative gender balance in teams is one of the factors used to rank proposals with the same evaluation scores[116]. By signing their grant agreement, beneficiaries commit to promote equal opportunities and gender balance at all levels of personnel assigned to the action including at supervisory and managerial level[117].

[106] http://data.consilium.europa.eu/doc/document/ST-14846-2015-INIT/en/pdf
[107] taking into account both men and women biological characteristics and social / cultural features
[108] https://ec.europa.eu/research/openvision/index.cfm
[109] https://ec.europa.eu/priorities/index_en
[110] https://ec.europa.eu/research/evaluations/index_en.cfm?pg=fp7
[111] Table 45, FP7 Monitoring Report 2013
[112] Computed from data of Table 9, FP7 Monitoring Report 2013
[113] Table 46 – FP7 Monitoring Report 2013
[114] CORDA / RESPIR- 04-02-2016
[115] https://ec.europa.eu/research/swafs/pdf/pub_gender_equality/she_figures_2015-final.pdf
[116] Applicants are asked to indicate in their proposal the gender of the persons primarily responsible for carrying out the project's activities. Annexe H - WP General Annexes - Horizon 2020 Participant Portal
[117] Art. 33.1 of the mono and multi-beneficiaries Model Grant Agreement.

- Gender balance in decision-making: the EC set two targets: one of 40% of the underrepresented sex in expert groups and evaluation panels[118] and one of 50% of the underrepresented sex in advisory groups.

- Gender dimension in the content of research and innovation: gender issues are explicitly mentioned in a number of topics of Horizon 2020 work programme. Topics with a gender dimension are flagged[119] on the Participant Portal. When drafting their proposal, under the chapter "Excellence", applicants are invited to describe, "where relevant, to which extent and how their planned research takes into account sex and/or gender analysis". In the evaluation process, the gender dimension is mentioned in the briefing given to evaluators.

An Advisory Group "gender" formulated recommendations to better integrate the gender dimension in work programmes[120] and to identify gender expertise. Training sessions were organised for Commission and Agency staff and for National Contact Points (NCPs). Awareness raising on gender as a cross-cutting issues was done in NCPs meetings and brokerage events.

The implementation of gender equality as a cross-cutting issue is monitored through four Key Performance Indicators (KPI)[121]:

- KPI 1: % women participants in Horizon 2020 projects (total workforce)
- KPI 2: % women project coordinators in Horizon 2020 projects, i.e. Marie Skłodowska-Curie Actions (MSCA) fellows, European Research Council (ERC) principal investigators and scientific coordinators in other Horizon 2020 activities[122]
- KPI 3: % women in EC advisory groups, evaluation panels, expert groups, individual experts, etc;
- KPI 4: % projects taking into account the gender dimension in R&I content.

H.14.4.Achievements so far

An expert group[123] helped the EC assess gender equality as a cross-cutting issue using the following quantitative and qualitative methods:

- A quantitative analysis based on a set of data extracted from CORDA (cut-off date 01-01-2017)
- An analysis, both qualitative and quantitative, of a sub-set of 111 projects out of the 263 funded projects that correspond to 35 gender-flagged topics[124],from the seven Societal Challenges, LEIT-ICT, LEIT-NMBP and SWAFS.
- A qualitative analysis of various key documents and information, such as parts of work programmes, topic descriptions, etc.

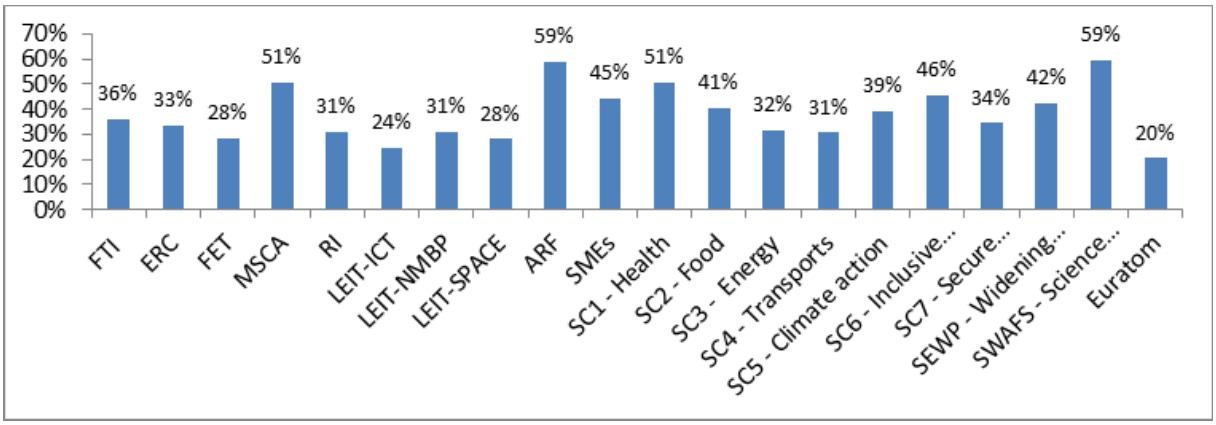
[118] P.4, 2013 call for interest to independent experts to assist the Commission in implementing Horizon 2020 http://ec.europa.eu/research/participants/data/support/h2020_call-individual_experts_oj_c342_03.pdf Art 10.6 - EC Decision C(2016) 3301 final http://ec.europa.eu/transparency/regexpert/PDF/C_2016_3301_F1_COMMISSION_DECISION_EN.pdf
[119] Topics are flagged when they include one or more of the following words: gender, sex, woman /women, man/men, boy(s), girl(s)
[120] http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=18892&no=1
[121] https://ec.europa.eu/programmes/horizon2020/en/news/horizon-2020-indicators-assessing-results-and-impact-horizon
[122] corresponding to the Principal Contact Person in the organisation having the role of Coordinator
[123] http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=3470&NewSearch=1&NewSearch=1
[124] as indicated on the Participant Portal; only RIA and IA funding schemes; Work Programme 2014-2015

Objective 1: Gender balance and equal opportunities in research teams

Concerning the **first Key Performance Indicator**, **the proportion of women in projects workforce is 40.3%**. This proportion falls down to 33.6 % if the projects relating to ERC, MSCA and ICT are excluded. The latter represents a decrease compared with FP7 where this proportion reached 38%[125]. Only preliminary figures are however available as this indicator is collected from projects periodic reports. When looking at the subset of 111 projects, the expert group found that women represented 36 % of the key staff named in the Description of Activities.[126]

It should be noted that the detailed workforce data gathered in FP7 is not collected under Horizon 2020. This does not allow to monitor the gender balance at different levels (vertical segregation). Data on researchers will however be included in the projects periodic reporting from 2017.

Figure 56 Share of women in total workforce by Horizon 2020 programme parts



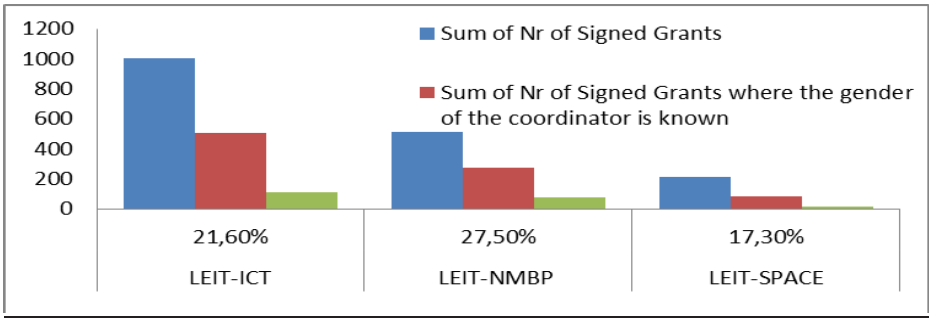
Source: Corda – Projects' periodic reports– cut-off date 01-01-2017

Concerning the **second Key Performance Indicator**, **women represent 31% of projects' coordinators**, including 24.5% of ERC Principal Investigators, 42.2% of MSCA Fellows and 26.9% of scientific coordinators[127] in other Horizon 2020 activities.[128]This represents an increase compared to FP7, where women represented overall 28.5% of projects coordinators, including 20% of ERC Principal Investigators, 36.5% of MSCA Fellows and 20% of contact persons for scientific Aspects in other F7 activities[129]. In the subset of 111 projects, the expert group found that 25% of projects coordinators are women, a result close to the proportion of women among scientific coordinators in other Horizon 2020 activities.

It should be noted that data on the gender of scientific coordinators in other Horizon 2020 activities was not collected in case of grants' amendments, which represents a quite high proportion of the signed grants (47.3%). It will be corrected in 2017 and all grants will be taken into account.

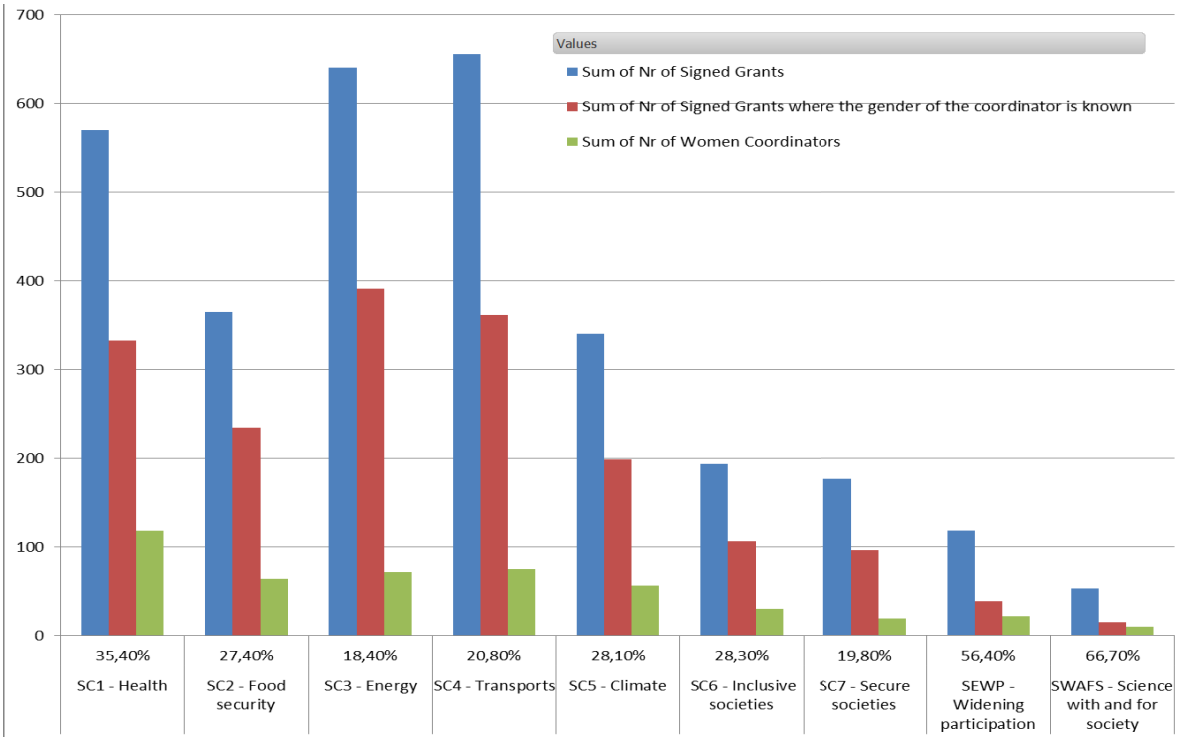
[125] Table 45: Cooperation – Projects' Workforce by gender (excluding PEOPLE), FP7 Monitoring Report 2013
[126] 2398 men and 1409 women and 28 names for which is was not possible to retrieve the gender. The expert group noted that a significant proportion of projects did not indicate the gender of the consortium members, even though it is requested in the proposal template.
[127] Principal contact person in the organisation having the role of Coordinator
[128] These data refer to the ongoing grant agreements where the gender of projects coordinators is known.
[129] Table 9 , FP7 Monitoring Report 2013-
http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf

Figure 57 Share of women coordinators by Horizon 2020 parts – LEIT



***Source**: Corda – projects at grant agreement level. – cut-off date 01-01-2017*

Figure 58 Share of women coordinators by Horizon 2020 Societal Challenges



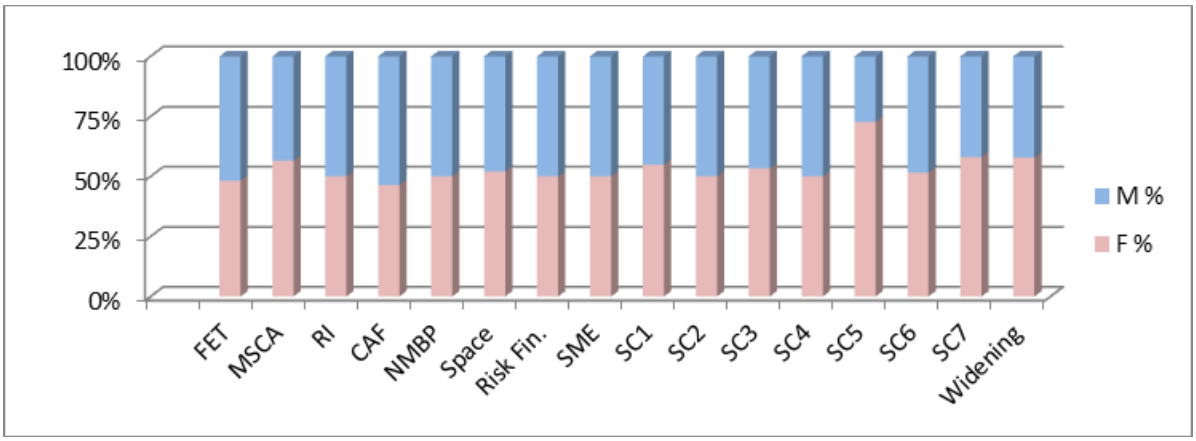
***Source:** Corda – projects at grant agreement level. – cut-off date 01-01-2017*

Objective 2: Gender balance in decision-making

This objective is close to being achieved. 53% of advisory groups members are women, while the target was set at 50 % of the under-represented sex. **It is higher than in FP7 where 33% of the members of the advisory groups were women**[130]. 36.7% of contracts were signed with women experts participating in evaluation panels[131], while the target was set at 40%.

[130] Table 10- FP7 Monitoring Report 2013
[131] Horizon 2020 monitoring report 2015

Figure 59 Gender distribution per thematic Advisory Group [132]



Source: *European Commissio,n latest update: December 2016*

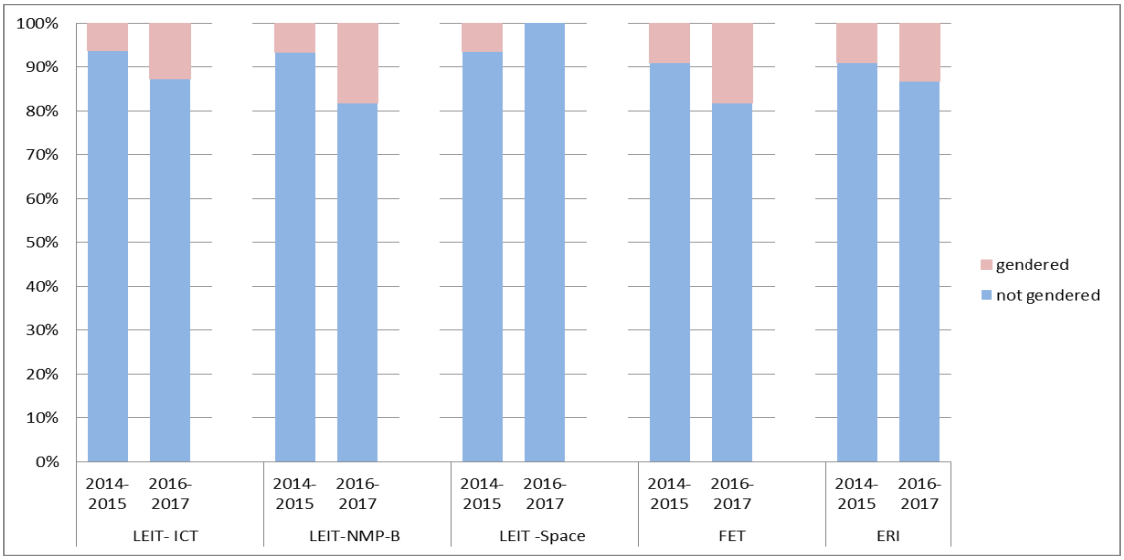
In the EC expert database, 29,9 % of experts registered with a full profile in December 2015 were women and 30,5% in December 2016. In December 2016, among them 6,022 experts, 3,904 women and 2,118 men declared having a gender expertise, which represented an increase of 27 % for women and 28 % for men compared with December 2015.

Objective 3: Integration of the gender dimension in research content

The assessment was done by the expert group, at the levels of topics and funded projects, with a qualitative analysis of the subset of 111 projects from 35 gender-flagged topics.

The number of topics in which gender issues were explicitly mentioned, increased from 99 out of 610 topics in WP 2014-2015 to 108 out of 568 in WP 2016-2017[133]. The wording relating to gender was often vague. However, the expert group noted improvement in the wording in some parts of the WP 2016-2017.

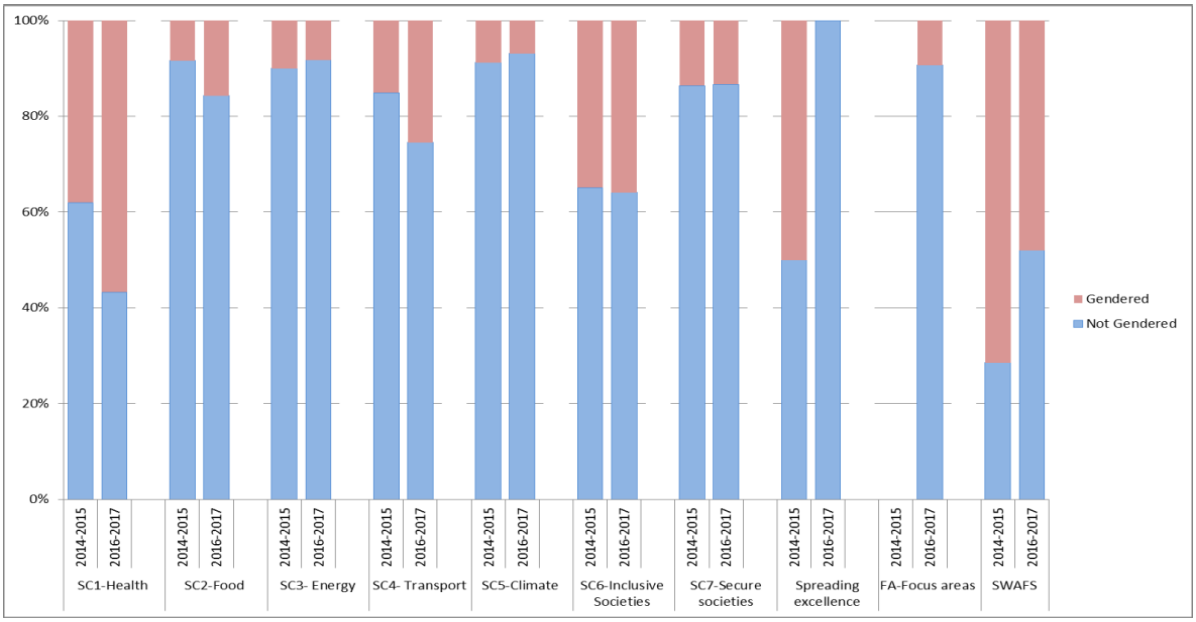
Figure 60 Topics with and without an explicit gender dimension- Industrial Leadership



Source: European Commission, DG RTD- 2015

[132] Latest update December 2016
[133] At the level of the adoption of the work programmes – not taking into account the possible amendments

Figure 61 Comparison of topics with and without an explicit gender dimension - Societal Challenges



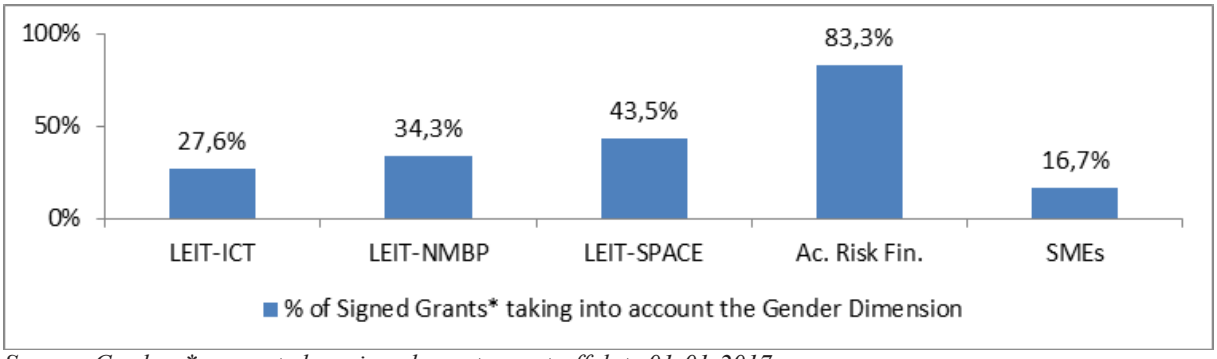
Source: European Commission, DG RTD- 2015

The expert group noted that in their subset of 35 topics from the WP 2014-2015, gender-flagged on the Participant Portal, 20% of the topics did not have an explicit gender dimension[134]: in other words, the WP scribes overstated the number of topics with a gender dimension as presented to the potential applicants. The additional topics referred to people in general without mentioning gender, women or sex.

Concerning the fourth Key Performance Indicator, 32.4 % of the projects[135] were "ticked" as having a gender dimension by projects officers when preparing the grant agreement, 31.4% in LEIT and 30.0% in Societal Challenges. The identification of a gender dimension in projects was done at the level of the Description of Activities annexed to the grant agreement. Project officers answered a "yes/no" question[136] in SyGMA[137] when preparing the grant agreement. In comparison with Societal Challenges, **in FP7 17% of the projects[138] under Cooperation, Science in Society and Regions of Knowledge declared having a gender dimension in their content.**

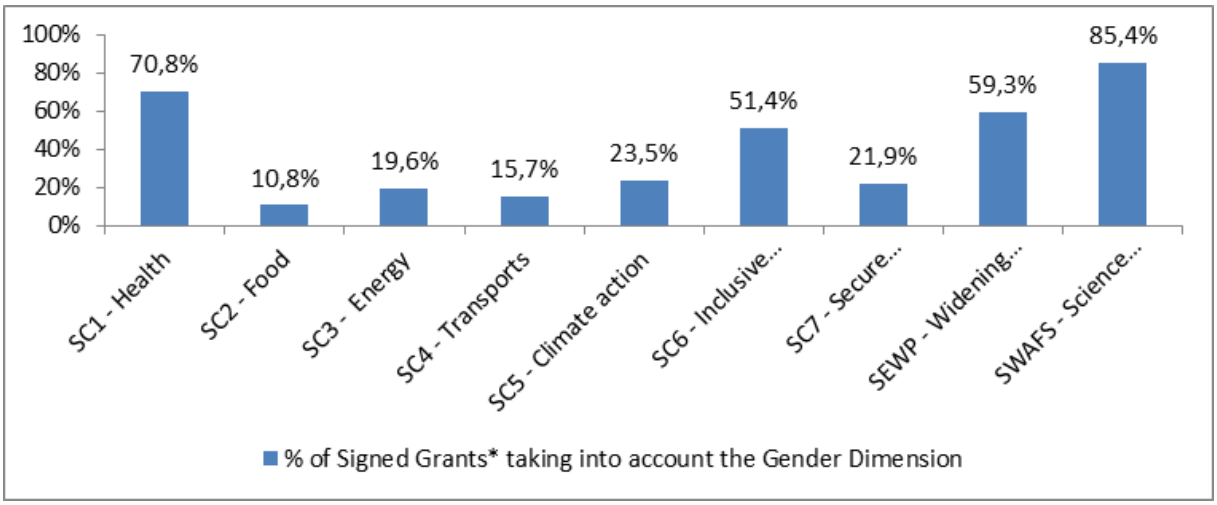
[134] They did not include the words gender or women or sex
[135] The indicator do not include MSCA and ERC
[136] The question was not compulsory. Its status is currently being modified to ensure data completeness.
[137] System Grant Management
[138] Table 12 FP7 Monitoring report 2013- Self-declaration of beneficiaries at the end of their projects

Figure 62 Integration of the Gender Dimension in funded projects – Industrial Leadership



*Source: Corda - * computed on signed grants – cut-off date 01-01-2017*

Figure 63 Integration of the Gender Dimension in funded projects – Societal Challenges, SEWP and SWAFS



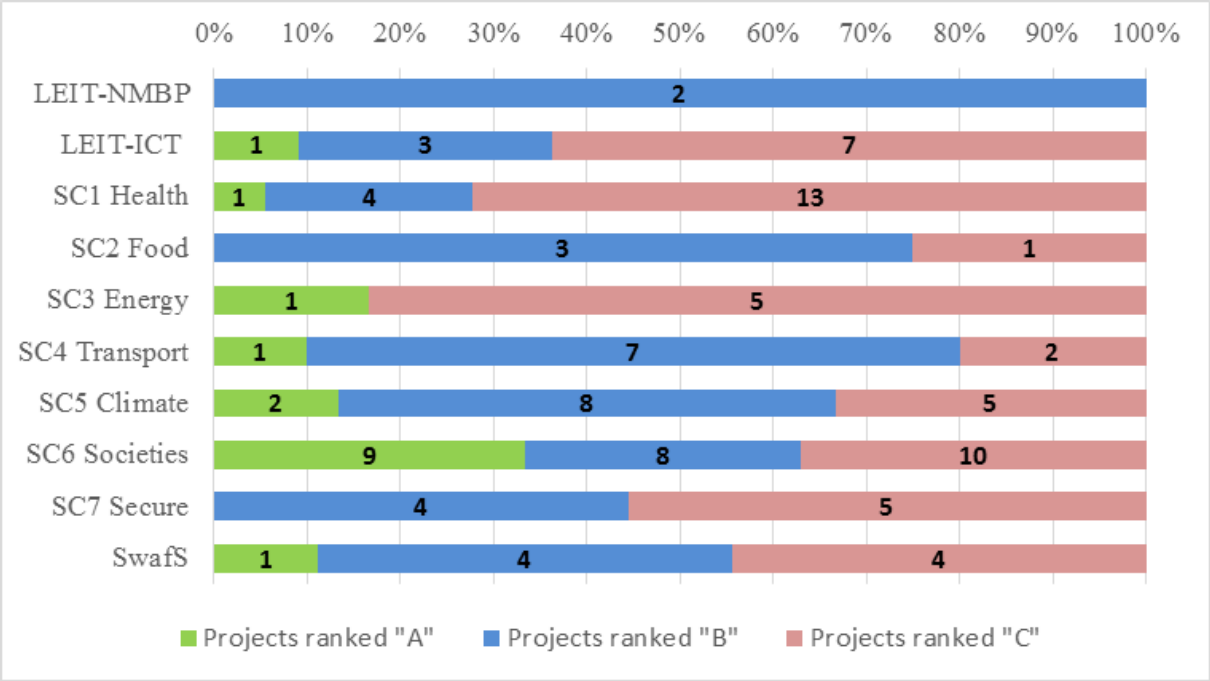
*Source: Corda - * computed on signed grants – cut off date 01-01-2017*

The expert group compared the identification done in SyGMA with their own assessment for the subset of 111 projects. Among the 61 projects considered with a gender dimension in SyGMA, only 35 projects actually included it and 12 out of the 17 projects considered by the expert group as having a gender dimension were retained as such in SyGMA. The gaps cast doubt on the reliability of the data obtained from this database.

The expert group also assessed the degree of integration of the gender dimension in the 111 projects from gender-flagged topics. It, found that 53% of the projects included a gender dimension, 14 % well and 39 % in part. The notion did not seem to be well understood yet and was often confused with gender balance in research teams. Furthermore it was not always well evaluated. Some ESRs[139] were inconsistent with the expert group assessment of the projects.

[139] Evaluation Summary Report

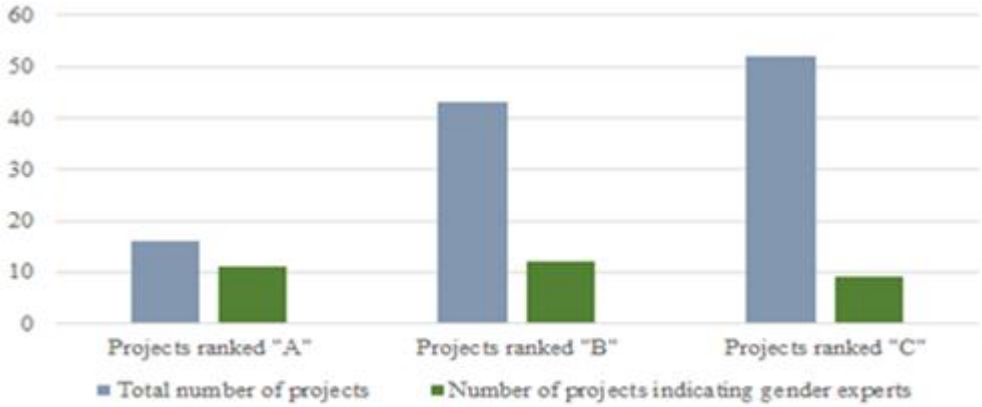
Figure 64 Degree of integration of the gender dimension in the sub-set of 111 funded projects



Projects ranked A: Projects take the gender perspective seriously into account and integrate the gender dimension into a significant part of their activities, at various levels, such as in theoretical background, methodology, the impact and dissemination sections. The result is a clear vision of how gender will be integrated into the research content, with a good internal coherence within the project.
Projects ranked B: Projects discuss gender dimension in a few lines, with no further development.
Projects ranked C: Projects only mention (generally rapidly) gender balance in the team and completely miss any gender dimension in their research.
Source: EC Expert Group on the interim evaluation of gender as a cross-cutting issue in Horizon 2020

The expert group checked the presence of researchers with gender expertise in the consortium as presented in the Description of Activities. It found a high frequency of researchers with gender expertise in projects ranked A. However none of the 111 projects included gender training (eligible for funding in Horizon 2020).

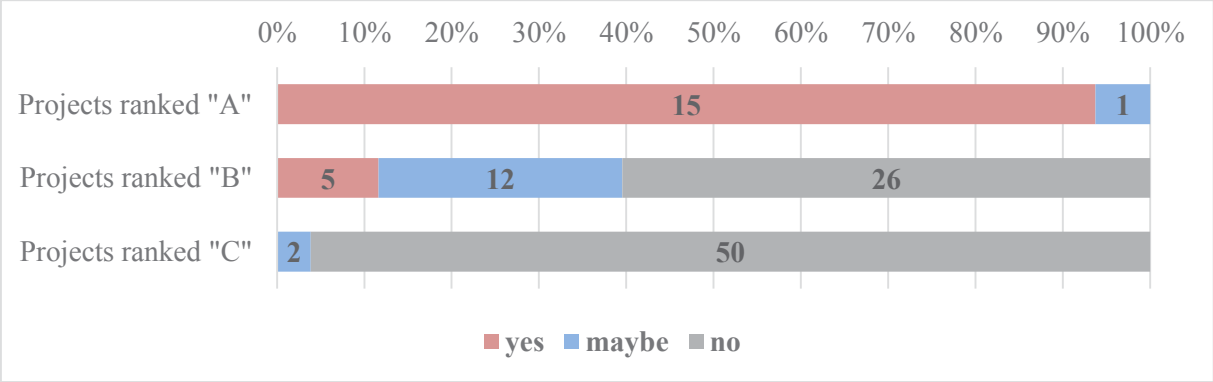
Figure 65 Researchers with gender expertise in the consortium



Source: EC Expert Group on the interim evaluation of gender as a cross-cutting issue in Horizon 2020

The expert group also evaluated whether the projects were likely to increase gender knowledge and found that it was the case for most of the projects ranked A.

Figure 66 Gender knowledge produced



Source: EC Expert Group on the interim evaluation of gender as a cross-cutting issue in Horizon 2020

Examples of ranked A projects are presented below:

- **Pan-European web entrepreneurship and start-up ecosystem (WELCOME) LEIT -** Topic ICT-13-2014

The project aims to connect four major EU entrepreneur ecosystems, identifying and engaging through local partners their most relevant players (investors, corporates, media, and web entrepreneurs) with prospective, emerging and successful start-ups. The final goal is to create a Pan-European startup ecosystem in which every entrepreneur in each of the local ecosystems feels at home and interconnected. The project deals with gender issues by promoting affirmative action at institutional level and developing an action plan with activities to promote gender equality in all forms within the project.

- **Ageing Trajectories of Health: Longitudinal Opportunities and Synergies (ATHLOS) – Societal Challenge 1-** Topic PHC-2014-two-stage

The objective of ATHLOS is to achieve a better understanding of ageing by identifying patterns of healthy ageing, the determinants of those patterns and the critical points when changes in trajectories are produced, and to propose timely clinical and public health interventions to optimize healthy ageing. One of the aims is to understand differentials in ageing trajectories between men and women. Although gender is not the main focus of the project, gender considerations are well included in the methodology, work packages and policy recommendations.

- **Energy System Transition Through Stakeholder Activation, Education and Skills Development (ENTRUST) Societal Challenge 3 -**Topic LCE-20-2014

The project aims to analyse Europe's energy system and understand how human behaviour around energy is shaped by both technological systems and socio-demographic factors (especially gender, age and socio-economic status). Gender appears in the theoretical framework, the methodology, the impact and in the dissemination planning. It is part of a socio-economic WP and has a specific deliverable.

- **Congestion Reduction in Europe: Advancing Transport Efficiency (CREATE) Societal Challenge 4-** Topic MG-5.3-2014

CREATE examines the full range of urban passenger and freight/servicing movements in urban, suburban and peri-urban areas, and the evolving ways in which urban streets are used. It identifies and quantifies the main impacts (economic, social and environmental) of policy measures introduced at different stages in the Transport Policy Evolution Cycle.

It assesses the effectiveness of different measures, their distributional consequences by gender and for residents and mobility disadvantaged groups of travellers. It identifies gender-specific travel behaviour and transport requirements, and the gender implications of different technologies and transport policy measures. It monitors quality control and adherence to the gender dimension of the work.

- **Development of water supply & sanitation technology, systems & tools, and/or methodologies-Waterspoutt- Societal Challenge 5**-Topic WATER-5-2014c

The project aims to design and field-test solar disinfection technologies to provide affordable access to safe water to remote and vulnerable communities in Africa. Gender is presented as a basis issue for the project. It has a Social Science work package (the rest is more technical) where gender appears at all levels (theory, methodology, impact, dissemination, in a deliverable). There is good gender expertise in the project and in particular with the Social Science work package leader.

- **Revisioning the 'Fiscal EU': Fair, Sustainable, and Coordinated Tax and Social Policies (FairTax) Societal Challenge 6** – Topic EURO-1-2014

The project aims to research ways of harmonizing of EU Member States tax and social policies to produce fairer, more stable, and more sustainable tax and social policy regimes. The topic was well worded and the project covers gender very extensively, including it in its objectives, its theoretical framework, its methodology and impact. It has a specific gender Work Package and refers to gender in several other parts. The coordinator has good gender expertise.

- **Innovative Social Investment: Strengthening communities in Europe (InnoSI) Societal Challenge 6** - Topic Euro-3-2014

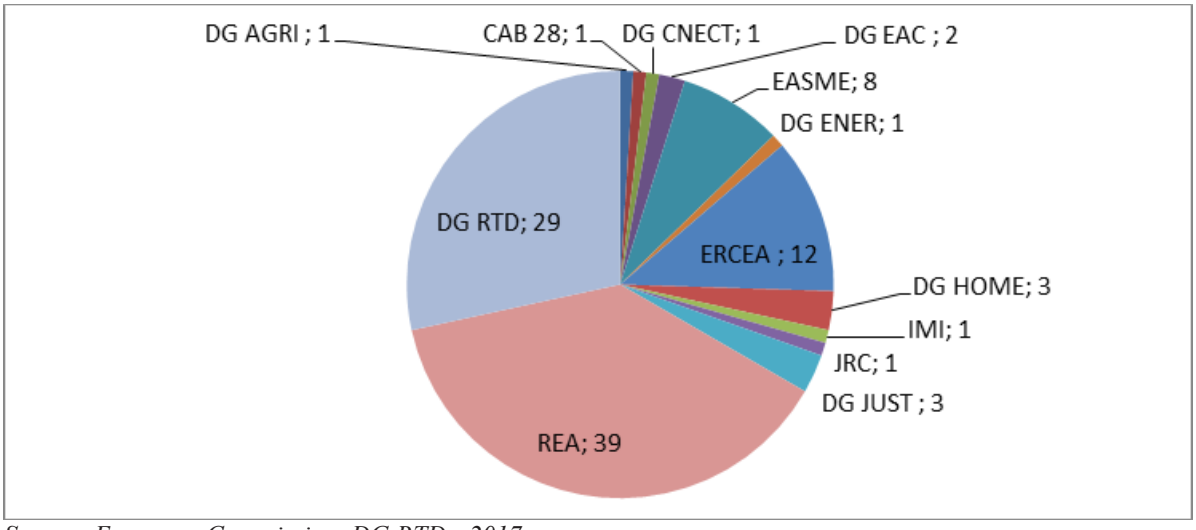
One of the main objectives of InnoSI is to understand better, from the perspective of recipients, the social and psychological impact of innovative and strategic approaches to social welfare reform with a particular focus on gender and generational issues. Gender analysis is a key dimension in the project and runs through all the work packages. The project is likely to provide new knowledge on how the gender dimension is and could be integrated in welfare reforms.

- **Mapping mobility – pathways, institutions and structural effects of youth mobility in Europe (MOVE) – Societal Challenge 6** - Topic YOUNG-2-2014

MOVE aims to provide a research-informed contribution to improving the conditions of young people mobility in Europe and a reduction of its negative impacts through the identification of good practice thus fostering sustainable development and wellbeing. It is based on a multilevel research design, including case studies on six types of mobility (higher education, voluntary work, employment, vocational training, pupil's exchange and entrepreneurship), a survey and secondary data analysis, taking into consideration social inequality. Gender is a central category within a broader perspective on social inequality and young people disadvantages.

Finally, to help implement the gender equality objectives at each stage of the research cycle and across Horizon 2020, **awareness raising and specific training** are a valuable support to improve the understanding and take up. Gender equality was included in 12 awareness raising sessions organised by NCPs at EU level for potential applicants in the period 2014-2016. Seven training sessions were organised for the EC staff and two for the NCPs academy. The attendance was limited and largely female with 102 participants for the EC and around 40 participants for the NCP Academy.

Figure 67 Participants in DG RTD gender trainings 2014-2016



Source: European Commission, DG RTD - 2017

H.14.5.Lessons learnt/Areas for improvement

The comprehensive approach developed to implement gender equality as a cross-cutting issue in Horizon 2020 is wider in its coverage and more specific than in FP7. Compared with FP7, the interim evaluation showed that:

- Some progress was made on gender balance in research teams involved in funded projects, although, considering the current weaknesses in the monitoring system, these results remain to be confirmed;
- The targets are closed to be achieved for the advisory groups and, to a lesser extent for the evaluation panels, but the involvement of experts with gender expertise is still low;
- The gender dimension in R&I content carries a great potential to improve R&I quality and relevance to society, but it requires more investment to be achieved. The actors involved should acquire a better knowledge of what the gender dimension entails in the various fields of R&I and the monitoring system needs to be substantially improved.

Areas of improvements should therefore be of two main types:

- Enhancing the culture of gender equality in R&I through awareness raising and training. Evaluators and moderators should acquire a better knowledge of the gender dimension in R&I content and of implicit biases in assessing men and women applicants.
- Adapting the mainstreaming of the gender equality inputs in the Horizon 2020 implementation system to improve efficiency.

H.15. SME involvement in research and innovation and broader private sector participation

H.15.1.Overview

Economic enterprises strongly participate in all the Horizon 2020 Programme's parts, in particular when addressing challenges in society by helping to bridge the gap between research and the market, and through the support of innovative enterprises to develop their

technological breakthroughs into a viable commercial potential. The market-driven approach of the innovation part of Horizon 2020 proposes a variety of actions/instruments to the enterprises, notably the SME Instrument and the financial instruments, with the aim of a better uptake by companies, in particular SMEs.

H.15.1.Rationale

SMEs play a key role in fostering innovation and have the ability to market new products quickly. FP7 strengthened the innovation capacity of European SMEs and their contribution to the development of new technology based products and markets by helping them outsource research and acquire technological know-how, increase their research efforts and extend their networks. This with around EUR 1.3 billion for the *'Research for the Benefit of SMEs*' under the FP7 Capacity programme and also, with the target budget of more than 15% under the FP7 Cooperation programme.

In line with the recommendation of the High level group of the FP7 ex-post evaluation [140] considering that SMEs have an important and needed role in the "innovation pipeline/innovation value chain", specific rules were established under Horizon 2020 to better engage SMEs in all sectors and activities. Also, Horizon 2020 focuses on durable benefits by providing more favourable conditions to SMEs carrying business innovation and bringing it to the markets. The competitive grants as the ones put in place through the SME Instrument are therefore shaped to the needs of innovative firms to get successfully into the market with a targeted objective to impact European society in terms of growth and sustainable employment on the widest range of thematic sectors.

Also, in order to support SMEs to invest more in innovation, the European Commission proposed on one hand a dedicated instrument providing grants for R&D projects driven specifically by SMEs whereas - on the other hand - it gives access to debt facilities (e.g. loans and guarantees) and to equity (finance for early and growth-stage investment). On debt finance, Horizon 2020 InnovFin – EU Finance for Innovators, with support of the European Fund for Strategic Investments (ESFI), provides guarantees to banks and other lenders providing loans to innovative companies. On equity finance, together with the European Investment Fund (EIF), the Commission is setting up a Fund-of-Funds to invest in venture capital funds, with most funding coming from the private sector and with independent fund management.

The overall idea is to seize innovation's potential, actually turning it into growth and jobs, by addressing the issue of insufficient financial availability, in particular of SMEs, aiming at fostering more innovative, productive and prosperous enterprises in Europe.

H.15.2.Implementation

In Horizon 2020, access to grants for SMEs - either as a single beneficiary as for SME Instrument, or as a member of consortium as for the Fast Track to Innovation (FTI) or collaborative grants - is encouraged by a simplification of conditions to apply[141] and by a

[140] "Commitment and Coherence – Ex-Post Evaluation of the 7th EU Framework Programme" (p65). http://ec.europa.eu/research/evaluations/pdf/fp7_final_evaluation_expert_group_report.pdf#view=fit&pagemode=none

[141] For e.g. no provision of financial capacity documents for SME applying to SME Instrument Phase 1, less administrative burden during the application phase.

shorter time-to-grant. In addition, under the SME Instrument, proposals can be submitted by single SMEs (mono-partner grants).

Around EUR 9 billion of the Horizon 2020 budget shall support SME innovation through grants. Its bulk is allocated to SMEs participating as partners in consortia conducting collaborative research and innovation projects. The SME Instrument, in parallel, encourages early-stage for-profit SMEs to put forward their innovative ideas with an EU dimension into the market. The Better regulation package[142] has also influenced the level of attractiveness of such tools, by ensuring an easy access with simple rules and procedures in all three stages[143] of the innovation cycle.

The co-legislators established that within the target of ensuring a minimum of 20% of SMEs' participation, a minimum of 5% of those combined Societal Challenges and LEIT's budgets will be initially allocated to the dedicated SME instrument for the transitional two-first years of the Programme (2014-2015). This target is set to 7% averaged over the duration of Horizon 2020.

The Fast Track to Innovation (FTI) pilot supports innovation actions under LEITs and Societal Challenges, conducted by industry-intensive consortia with a minimum of 3 and a maximum of 5 participants. The EU contribution is EUR 2.5 million per project with a Time-to-Contract of 6 months.

The Second Eurostars Joint Programme (2014-2020)[144] promotes market-oriented transnational research of research performing SMEs in any field. It is undertaken by at least two Member States and/or Associated countries, with the financial contribution of the EU (EUR 287 million). By pooling together national resources, Eurostars also aims at strengthening integration and synchronisation of national research programmes contributing to the achievement of the European Research Area.

In addition, the new generation of debt and equity Financial Instruments – InnovFin - EU Finance for Innovators – shall generate direct investments of more than EUR 24 billion and total final investment of more than EUR 50 billion into research and innovation activities. Of that amount, at least a third is likely to be absorbed by SMEs and small midcaps below 500 employees[145].

H.15.3.Achievements so far

Through all its actions, Horizon 2020 is contributing significantly to increase private firms' participation in research and innovation. The trend established under FP7, where private for profit organisations accounted for a quarter of the total number of applicants and a third of the total amount of requested EU contribution in retained proposals[146], is confirmed. Private-for-Profit entities (PRC) represent 33.2% (16,298 participations) of the total (49,090).

Under Societal Challenges and Leadership in Enabling and Industrial Technologies, 8,637 SMEs have already participated to Horizon 2020, for an overall EU financial contribution of EUR 2,828.4 million. This participation represents 23.9% of budget allocation, which exceeds

[142] http://ec.europa.eu/smart-regulation/guidelines/toc_guide_en.htm
[143] Innovation cycle phases are: creation/start-up phase, early stage and expansion.
[144] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/eurostars-programme
[145] See eligibility conditions – InnovFin - http://www.eib.org/products/blending/innovfin/
[146] 7th FP7 Annual Monitoring Report 2013.

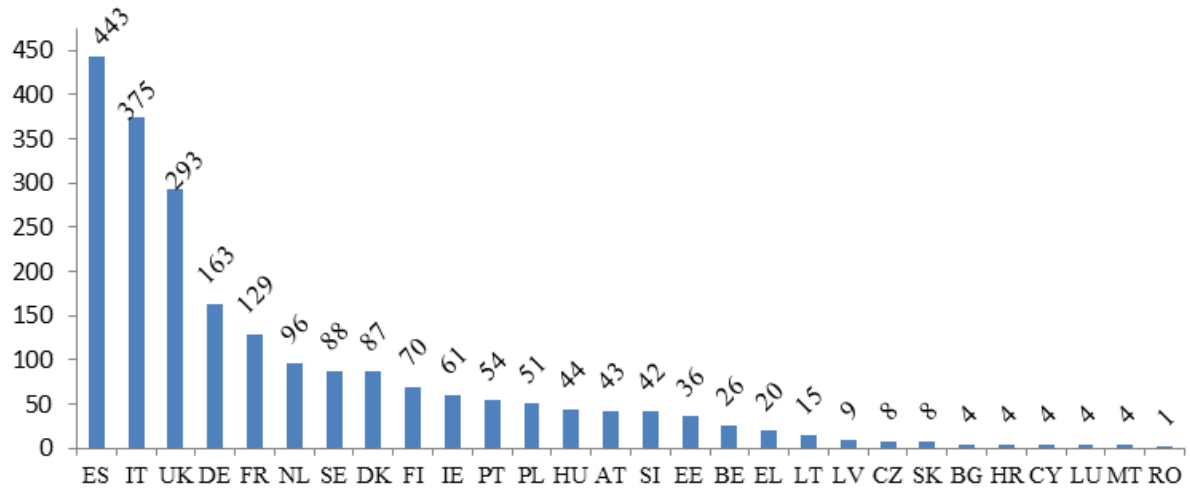
by 3.9 percentage points, the 20% budgetary target set by EU Council and Parliament. At the end of Horizon 2020, direct support to SMEs would reach EUR 8.33 billion (post-EFSI) of which about EUR 3 billion devoted to innovative projects through the SME instrument[147].

Industry participation – both in terms of involvement in submitted proposals and in selected projects – has taken a very encouraging trend over the past two years. Already, 5,399 grants with at least one participant from the private sector have been signed[148] representing an EU financial contribution of EUR 5,653 million.

Under the Fast Track to Innovation pilot, five cut-off dates in 2015 and 2016 have received a positive response from the industry, with 75 projects and 342 entities selected for funding with an EU contribution of EUR 161.2 million. 73% of the entities selected were from the industrial sector, among which 63.2% were SMEs.

The share of EC funding allocated through the SME instrument between 2014 and 2016 is 5.6% of the total budgets of the specific objectives LEIT and the priority Societal Challenges and it represents EUR 881.7 million. This share is increasing from 5% in 2014 and 5.1% in 2015 to 5.6% in 2016: the favourable trend is in line with the minimum target of 7%.[149] Spain, Italy and the UK have the largest share of participation funding from the SME Instrument.

Table 49 Number of Member States participation in the SME Instrument

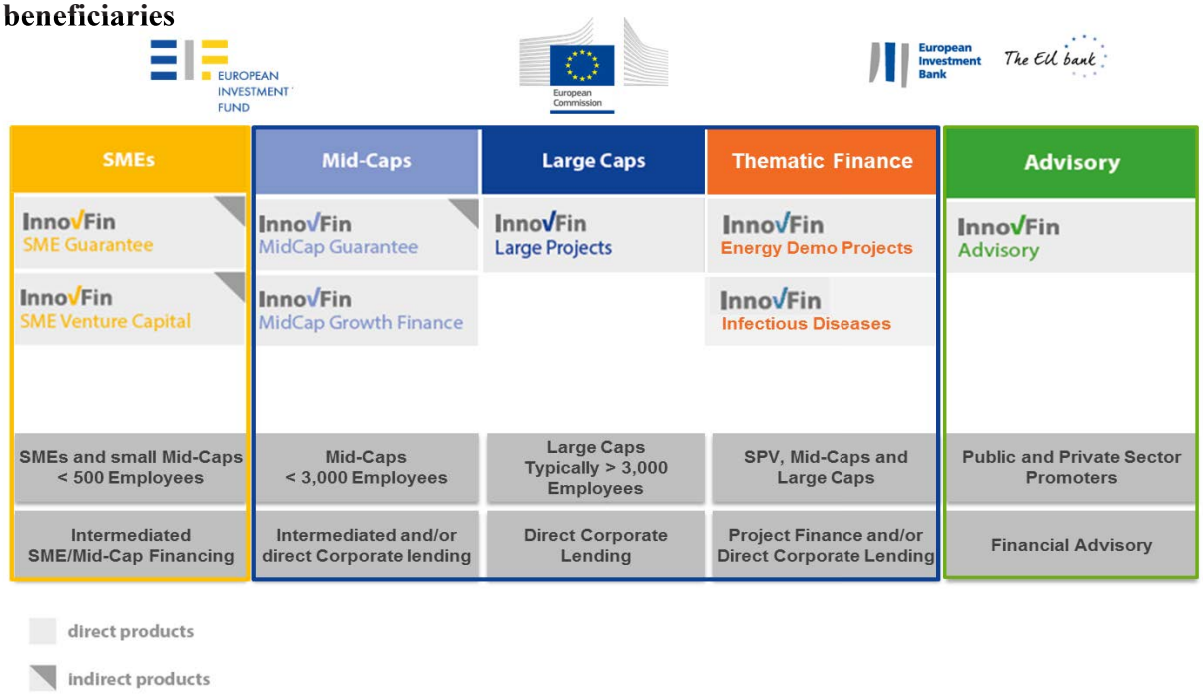


Source: Corda. Cut-off date: 1 January 2017.

Finally, the role of **financial instruments** has already grown due to their leverage effect on public investment resources, their capacity to combine different forms of public and private resources, and their longer-term financial sustainability.

[147] For the overall period of Horizon 2020.
[148] Source: Corda. Cut-off date: 1 January 2017.
[149] Source: Horizon 2020 Work Programmes. These data are not based on Corda, but consider the budget earmarked to the SME instrument in the Work Programmes. The 7% target is set in Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020, Annex II.

Figure 68: Financial instruments per targeted beneficiaries



Source: European Commission

Financial support to SMEs and to private sector as a whole through the financial instruments of for the entire implementation period of Horizon 2020, **InnovFin** – EU Finance for Innovators' will make available more than EUR 24 billion of financing for investments in research and innovation by companies, small to large, young to well-established. The suite of tailored-made financial instruments, whatever the size and stage of projects, provides specific support to SMEs and mid-caps with on one hand equity investments, and debt financing of EUR 25,000 to EUR 7.5 million via local financial intermediaries through the **InnovFin SME Guarantee** on the other hand.

In the first three years of Horizon 2020[150], already more than 5700 SMEs have been funded thanks to InnovFin which exceed the provisional target of 5,000. This 3-years achievement covers 29 countries, for a total guarantee amount of EUR 4 billion of which EUR 0.32 billion issued as counter-guarantees. It enables up to EUR 8.65 billion of loans/leases to innovative SMEs and Small Mid-caps, mobilising up to EUR 12,53 billion of investments.

Also, 30 InnovFin SIUGI agreements have been signed in Spain, 10 in Bulgaria and 2 in Malta with financial intermediaries for a maximum portfolio volume of EUR 279 million. The main aim of this initiative is to facilitate access to finance for SMEs by lowering the interest rates charged by banks on their loans. At the same time, intermediary banks will considerably reduce the risk on each SME loan, and the relevant cost of capital, by benefiting from a financial guarantee issued by the EIB Group.

In terms of estimated mobilised investments, EUR 73.77 billion out of the EUR 82.5 billion target for the **EFSI SME Window** are expected to be supported through the transactions signed by the end of May 2017. This total includes 73 transactions signed with funds for the Risk Capital Resources (RCR) EIF mandate for EUR 3.2 billion.

[150] Source: European Investment Fund. A full assessment of the performance of the Financial Instruments of Horizon 2020 can be found in Annex 2 Part H.

With regards to **InnovFin Debt – EIB,** 40 loans have been granted to Mid-Caps for EUR 1651 million, and 22 loans to SMEs for EUR 330 million.

InnovFin Equity– EIF – IFE aims at providing equity investments and co-investments to support companies in their pre-seed, seed, and start-up phases operating in innovative sectors covered by Horizon 2020, including life sciences, clean energy and high-tech. As of 31/12/2016, 10 IFE Operations have been signed in 6 Member States including 7 early stage and 3 multi stage for an amount of EUR 164.5 million. Also, 5 investments made into Eligible IFE Final Recipients for EUR 15 million in 4 Member States.

Finally, this overview of this 3-years implementation is also positive with regards to private sector as a whole. Large companies benefited from specific funding; with in particular 28 loans granted for EUR 2515 million and 5 loans to R&I infrastructures for EUR 527 million under InnovFin Debt – EIB.

H.15.4.Lessons learnt/Areas for improvement

This state of play of Horizon 2020 so far shows that the objective to increase participation of innovative SMEs is confirming its positive trajectory. The budget allocated to innovative and research-performing SMEs is above the target objective of 20% of the combined budgets for LEITs and the Societal Challenges. These Instruments combined with complementary support schemes, such as the SME Instrument, adequately respond to the specific financing needs of SMEs, covering all stages of the innovation cycle of SMEs' projects. Such global approach shows that Horizon 2020 respond well to innovative SMEs desiring to succeed their market positioning.

Objectives set under Horizon 2020 as far as financial instruments and their use are concerned and agreed with the European Investment Bank Group have been achieved in 2016[2]. This is a clear demonstration of the attractiveness of such products on the market.

The combination of financial instruments and grants (including the SME Instrument) provides benefits to reinforce the participation of SMEs and the broader private sector acting as a driving force of innovation in Europe. This overall combination of instruments offers better structural conditions to drive their high-risk projects into the market.

[2] SME Guarantee product.