RISIS

RESEARCH INFRASTRUCTURE FOR SCIENCE AND INNOVATION POLICY STUDIES

DOCUMENTATION OF RISIS DATASETS

EUPRO

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Outline

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1 Basic Characteristics

Name and short description of the infrastructure

The development of the EUPRO database has been started by AIT back in 2005 comprising information on R&D projects and all participating organizations funded by the European Framework Programmes (FP). Within RISIS I, EUPRO has been extended significantly by including data of other European funding initiatives.

Currently EUPRO consists of the following four programme modules:

- data on FP projects (1984-2018), including H2020 as the main update to the prae-RISIS version of EUPRO,
- data on R&D projects funded by EUREKA (1985-2016), an intergovernmental network supporting market-oriented R&D and innovation projects across all technological sectors,
- data on R&D projects funded through the Joint Technology Initiatives ARTEMIS, ENIAC and ECSEL (JTI) (2008-2014), long-term public-private partnerships, which support large-scale multinational research activities in areas of major interest to European industrial competitiveness and issues of high societal relevance, and
- data on R&D actions funded by the European Cooperation in Science and Technology (COST) (1971-2014), a pan-European networking initiative supporting transnational cooperation among researchers, engineers and scholars across Europe.

Aim of the database

The EUPRO database is a significant asset of the Center for Innovation Systems & Policy of AIT used for basic oriented research projects and contract research for national and international customers, such as the European Commission. It facilitates the analysis of participation patterns of organisations in and across different European funding initiatives and the investigation of collaborative network structures, including their evolution over time and the development of the European Research Area (ERA).

Legal name of operating organization

The database is operated and maintained by AIT Austrian Institute of Technology GmbH, located at Giefinggasse 4, 1210 Vienna, Austria.

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2 Database content

2.1 Definition and description of observations

Units and definition of observations

Basically, EUPRO covers information on **projects** (such as project objectives and achievements, project costs, total funding, start and end date, contract type, information on the call), and **participants** (standardized name of the participating organisation, organisation type, and geographical location).

According to different funding principles, the four individual EUPRO programme modules differ slightly in structure and content and comprise the following information:

FP

- *programmes*: start and end date, previous and successor programmes, programme funding and objectives
- *projects*: project objectives and achievements, project costs, total funding, start and end date, contract type, information on the call
- *organisations*: names of the participating organisations, organization type and OrgReg_ID
- *participations*: address of the participation entity of the organisation, and geographical location, project funding on the participants level
- *project output*: title, year, authors and URLs of reports summaries, results in brief and (open access) publications for FP1 to FP7; for H2020 individual tables for reports, deliverables and publications are available

EUREKA

- *projects*: title, objectives, technology and market area, start and end date, duration, project costs
- *participations*: name, organisation type, role in project, address, website
- *funding countries*: involvement in EUREKA, description of national EUREKA funding framework and conditions
- *national funding schemes*: instrument name, name of RFO, description of general procedures, funding eligibility, restrictions, share of funding by type of participating organisation

JTIs

- *programmes*: name and call of JTI, JoREP link (programme ID and call ID) for further information on JTI
- *projects*: project title, start date, duration, eligible project costs, European and national funding
- *participations*: name, country of origin, eligible costs, European and national funding on the participants level

COST

- *actions*: title and objective, science fields, start and end date
- *parties*: participating eligible countries and non-COST institutions
- *management structure*: organisation name, title, address and type of membership in the management committee

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Number of observations

EUPRO comprises information on ***105,435 projects*** and ***570,772 participations***.
Table 1 disaggregates the units of observation by different FPs and other European funding initiatives.

Table 1: EUPRO database - number of projects and participations

Programme	Period	Projects	Participations
FP1	1984 - 1987	3,348	7,972
FP2	1987 - 1991	3,987	19,184
FP3	1990 - 1994	5,474	30,768
FP4	1994 - 1998	14,524	67,831
FP5	1998 - 2002	16,026	78,562
FP6	2002 - 2006	10,100	75,356
FP7	2007 - 2013	25,778	139,682
H2020*	2014 - 2018	20,080	92,484
EUREKA	1985 - 2016	4,853	20,778
JTIs**	2008 - 2014	133	2,612
COST	1971 - 2014	1,132	35,543
Total	**1971 - 2018**	**105,435**	**570,772**

Note: *until December 2018, **Including ARTEMIS (calls 2009-2013), ENIAC (calls 2008-2013), ECSEL (2014)

2.2 Data acquisition and processing (e.g. data cleaning)

Where the data are retrieved from

The data on FP projects, EUREKA, JTIs and COST actions are publicly available. Besides available downloadable open data for FP7 and H2020 as excel files, we used a wrapper – a kind of web scraping program – to extract and structure the information from the different XML-Files in an automated way. The program was written in Python, using the Beautiful Soup library which is used for parsing structured data. In order to do this, the wrapper opens each project pre-downloaded XML files and parses the XML content. As mostly of the files have the same structure it is easy to guide the wrapper to the relevant information, which is then stored in a relational form.

The core data sources for the construction of the four components of EUPRO are:

- CORDIS projects database (http://cordis.europa.eu/) for **FP** projects. Basic raw data on FP7 and H2020 projects, participants, and project outcomes of the current version (FP_2020) was downloaded in March 2020 in CSV-format. Additional available data, like e.g. the Fields of Science categories assigned to FP projects and the geolocation of the participants, were extracted from the downloadable XML-files, available for FP7 and H2020, which hold the complete project information as accessible on the CORDIS project websites.
- Project level data for EUREKA has been retrieved from the **EUREKA** website (http://www.eurekanetwork.org/eureka-projects). Raw data of the current version (EUREKA 2.0) was downloaded via web scraping in January 2017.
- Project level data for the three **JTI** ARTEMIS, ENIAC and ECSEL has been retrieved from the respective programme websites (https://www.artemis-ju.eu; http://www.eniac.eu;

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https://www.ecsel.eu). Raw data of the current version (JTI 1.0) was available in PDF-format and was downloaded in May 2017.

- Project level data for **COST** actions has been retrieved from the COST website (https://www.cost.eu). Raw data of the current version (COST 1.0) was via web scraping in May 2014.

How the data are processed in terms of data cleaning

The quality of the raw data extracted from the different programmes websites is not generally sufficient for policy-relevant analyses. AIT has undertaken substantial efforts to improve quality and the level of standardisation of the data and to retrieve and add missing data. Data quality was improved by harmonizing different spelling and language variants of organization names and by extending, cleaning and harmonizing the type of participating organizations.

Data cleaning and standardisation includes three major steps:

- identification of unique organisation name,
- identification of unique organisation type, and
- regionalisation (i.e. geocoding of addresses and assignment to (adapted) European NUTS regions).

The harmonisation of organisation names and the integration of new data is ultimately manual, but supported by applying specific matching algorithms developed by AIT. These algorithms are based on statistical properties such as the frequency of adjacent characters in the organisation names and are used to identify similar organisation names that can be attributed to the same organisation. All algorithmically identified name matches are manually checked for accuracy.

For the data regionalisation we used RISIS developed geolocalisation tools, specifying their geographical locations by giving their latitude and longitude coordination. This facilitates all kind of spatial analyses of project based R&D networks, e.g. the investigation of the network at the level of functional urban areas.

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2.3 Information on all variables/indicators

2.3.1 FP_2020

Programme tables

Table 2: Description of variables providing information about programmes (FP)

Variable	Description
PrgType	code (1-8) for the names of the specific framework programme types FP1 to FP7 and H2020 in which the subprogrammes were funded[1]
PrgName	full name of subprogramme areas in each of the framework programmes (e.g., FP7-HEALTH - Specific Programme "Cooperation": Health)[2]
PrgAcr	subprogramme acronym (e.g., FP7-HEALTH)[1]
PrgURL	official website of the subprogramme[1]
PrgStartDate, PrgEndDate	day, month and year of subprogramme start and end[1]
PrevPrg	acronym of the predecessor subprogramme[1]
SuccPrg	acronym of the successor subprogramme[1]
PrgFunding_inMill	financing contribution of the European Union to the complete subprogramme[1]
OfficialJournalReference	reference to the Official Journal of the EU, the main source of the EUR-Lex content[1]
OfficialJournalReference_Date	date of Reference[1]
LegislativeReference	reference to EUR-Lex (eur-lex.europa.eu)[1]
LegislativeReference_Date	date of reference[1]
Objective, Abstract, Subdivision, Implementation, Remarks	detailed description of the subprogramme, its objectives, subdivisions and implementation (only available for FP1-FP6)[1]
Subjects	one or more of 52 standardized keywords (see Table 26) characterizing the conceptual orientation of the subprogramme (only available for FP1-FP6)[1]

Table 3: Description of variables providing information about topics (FP)

Variable	Description
PrgAcr	subprogramme acronym (e.g., FP7-HEALTH)[1]
TopicsCode	non-unique topic identifier within subprogrammes[1]
TopicsName	name of topic within subprogrammes[1]
TopicsObjective	conceptual orientation of the topic; only available for some H2020 topics[1]
KeywordCode	unique CORDIS code for keywords assigned to topics[1]
KeywordTitle	(multiple) keywords assigned to topics[1]

[1] introduced and/or processed by AIT

[2] provided by source data set (e.g. CORDIS, unchanged)

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Project tables

Table 4: Description of variables providing information about projects (FP)

Variable	Description
RecCtrNr	unique identifier (record control number) for each project in the database, identical with unique identifier of all projects in the CORDIS projects database[1]
ProjectReference	(not-unique) project index, for internal use in the European Commission (matches with Project Id in CORDA)[1]
Title	Full title of the project[1]
ProjAcr	(non-unique) project acronym or abbreviation of the project title[1]
Start Date, End Date	day, month and year of project start and end[1]
TotalProjectCosts	official project costs as indicated in the project proposal[1]
ProjectEUFunding	financing contribution of the EU; since not all projects are financed completely, figures in "Project Funding" are equal to or smaller than figures in "Project Cost".[1]
TopicsCodes	non-unique topic identifier(s) within subprogrammes (corresponding topic name and topic keywords see Table 3)[1]
Call	call identifier from FP6 onwards[1]
FundingSchemeCode	abbreviation of Funding Scheme (corresponding funding scheme name see Table 5)[1]
Objective	conceptual orientation of the project[1]
Subjects	one or more of 69 standardized keywords; in the first three FPs distinct combinations of subject indices were allocated by the EC to projects of the same subprogram; after FP4 the allocation of subject indices to specific subprogrammes is more ambiguous (only available for FP1-FP6) Caution: allocation of subject indices seems sometimes arbitrary – check reliability of contents of this variable before usage[1]
ProjectURL	official website of the project[1]

Table 5: Description of variables providing information about funding_schemes (FP)

Variable	Description
FundingSchemeCode	abbreviation of Funding Scheme[1]
FundingSchemeName	different types of contracts which regulate size, financing and funding of the research projects (e.g., STREP - Specific Targeted Research Project, CA – Coordination action)[1]

Table 6: Description of variables providing information about the thematic orientation of the projects (FP)

Variable	Description
RecCtrNr	unique identifier (record control number) for each project in the database, identical with unique identifier of all projects in the CORDIS projects database; corresponds with the entries in the field RecCtrNr in the projects table (Table 4)[1]
ProjectReference	(not-unique) project index, for internal use in the European Commission (matches with Project Id in CORDA); corresponds with the entries in the field ProjectReference in the projects table (Table 4)[1]
fos_term	(multiple) Fields of Science (FoS)[3] assigned to the project[1]
fos_hierarchy_code	representation of fos_term in the FoS Taxonomy[4] in numeric form[1]
fos_hierarchy_text	representation of fos_term in the FoS Taxonomy in text form[1]

[3] based on "European Science Vocabulary" (EuroSciVoc), a multilingual taxonomy that represents all the main fields of science that were discovered from CORDIS content. https://op.europa.eu/en/web/eu-vocabularies/th-concept-scheme/-/resource/authority/euroscivoc/?target=Browse

[4] for a complete representation of the EuroSciVoc Taxonomy see Table A 1 in the Appendix

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Participation tables

Table 7: Description of variables providing information about participations (FP)

Variable	Description
RecCtrNr	unique identifier (record control number) for each project in the database, identical with unique identifier of all projects in the CORDIS projects database; corresponds with the entries in the field RecCtrNr in the projects table (Table 4)[1]
Cnr	not unique identifier (control number) assigned internally by AIT, all project-relevant information is indicated with "1", prime contractor with "2", and remaining participants with "3", "4", etc.[2]
Role	Role of participant in the project; differentiates between "Coordinator", "Coordinator contact", "Participant" and "Partner" (in MSC-Actions); note that for some projects in FP6-IST and FP7-ICT also the role "Coordinator Contact is specified[1]
OrgID	internal unique identifier for each organisation; corresponds with the entries in the field OrgID in the organisations table (Table 8)[2]
PIC	9-digit Participant Identification Code used for all FP participants in EU programmes[1]
stApplicant	standardised EUPRO organisation name; the FP database currently covers a period of more than 30 years during which organisations have changed to mergers, acquisitions and divestitures. At the moment organisations are labelled by the name valid at the moment of the grant agreement. [2]
sAcronym	abbreviation of the organisation name (available only for FP7 and H2020 projects)[1]
stOrgtyp	standardised EUPRO organisation type[2]
endofParticipation	"true", if participation ended before project end, otherwise "false"[1]
sAddress, sPostcode, sCity, sCountry	street level address information[1]
ECcontribution	amount of EU funding on participant level[1]
organizationUrl	link to the organisation's website[1]
vatNumber	Value Added Tax Registration Number; unique number that identifies a taxable person (business) or non-taxable legal entity that is registered for VAT[1]
stCtry-2	standardised country codes of the participating organisational units; country abbreviations are given as ISO 3166-1 Alpha-2 codes[5,2]

Table 8: Description of variables providing information about organisations (FP)

Variable	Description
OrgID	internal unique identifier for each organisation; corresponds with the entries in the field OrgID in the participations table (Table 7)[2]
stCtry-2	standardised country codes of the participating organisational units; abbreviations are given ISO 3166-1 Alpha-2 country codes; in the case of multinational organisations the participating national branches are listed[2]
stApplicant	standardised EUPRO organisation name; the FP database currently covers a period of more than 30 years during which organisations have changed due to mergers, acquisitions and divestitures. Currently, organisations are labelled by the name valid at the moment of the grant agreement[2]
stOrgtyp	standardised EUPRO organisation type (see Table 25)[2]
OrgReg_EntityID	unique identifier for public sector research organisations; corresponds with the entries in RISIS-OrgReg, the Register of European Public Research and Higher Education Actors[2]

[5] https://www.iso.org/obp/ui/#search/code/

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Table 9: Description of variables providing information about localisation of participants (FP)

Variable	Description
RecCtrNr	unique identifier (record control number) for each project in the database, identical with unique identifier of all projects in the CORDIS projects database; corresponds with the entries in the field RecCtrNr in the participations table (Table 7)[1]
Cnr	not unique identifier (control number) assigned internally by AIT, all project-relevant information is indicated with "1", prime contractor with "2", and remaining participants with "3", "4", etc. corresponds with the entries in field Cnr in the participations table (Table 7)[2]
sCity	name of the city, where the participating organisational unit is localised[1]
stCtry-2	standardised country codes; country abbreviations are given as ISO 3166-1 Alpha-2 codes[2]
OrgID	internal unique identifier for each organisation; corresponds with the entries in the field OrgID in the participations table (Table 7)[2]
latitude_city, longitude_city	geographic coordinates of sCity[2]
latitude_org, longitude_org	geographic coordinates of the address of the participating organisational units on street level[1]
NUTS3	regional EUROSTAT classification referencing the subdivisions of countries, where sCity is localised[2]

Project outputs

Table 10: Description of variables providing information about project output from F1 to FP7 (FP)

Variable	Description
RecCtrNr	unique identifier (record control number) for each project in the database, identical with unique identifier of all projects in the CORDIS projects database; corresponds with the entries in the field RecCtrNr in the projects table (Table 4)[1]
stDocType	standardised type of project output (open access publications, report summaries, results in brief, deliverables, etc.)[6]
Title	title of project output[1]
Authors, Publisher, Journal, Year, DOI	bibliographic information in the case of open access publications[1]
Link	Link to the results page on CORDIS[1]

Table 11: Description of variables providing information about H2020 deliverables (FP)

Variable	Description
RecCtrNr	unique identifier (record control number) for each project in the database, identical with unique identifier of all projects in the CORDIS projects database; corresponds with the entries in the field RecCtrNr in the projects table (Table 4)[1]
title	deliverable title[1]
description	short description of the content[1]
deliverableType	Documents, reports; open data; Websites, patent fillings, videos etc. [1]
url	direct link to download the document[1]

[6] *Report Summaries* come from the publishable summaries of periodic and final reports submitted by the project participants and approved by the European Commission's project officer. *Results in Brief* are written by CORDIS science editors based on each Report Summary. Results in Brief provide a multilingual summary of each project's outcomes in a more accessible language and aimed at supporting the exploitation of the research results (CORDIS, Projects and results, available at https://cordis.europa.eu/guidance/about-projects_en.html, last accessed on 20 June 2019).

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Table 12: Description of variables providing information about H2020 publications (FP)

Variable	Description
RecCtrNr	unique identifier (record control number) for each project in the database, identical with unique identifier of all projects in the CORDIS projects database; corresponds with the entries in the field RecCtrNr in the projects table (Table 4)[1]
title	publication title[1]
authors, journalTitle, journalNumber, publishedYear, publishedPages, issn, doi	bibliographic information in the case of open access publications[1]
isPublished	type of publication (Peer reviewed articles, Conference proceedings, Thesis dissertations, etc.)[1]

Table 13: Description of variables providing information about H2020 reports (FP)

Variable	Description
RecCtrNr	unique identifier (record control number) for each project in the database, identical with unique identifier of all projects in the CORDIS projects database; corresponds with the entries in the field RecCtrNr in the projects table (Table 4)[1]
title	report title[1]
teaser	short description of the report[1]
summary	extended description[1]
workPerformed	description of the main tasks in the project[1]
finalResults	description of the main achievements[1]
relatedFile	link to related illustrations, images, announcements, etc.[1]
url	link to the project website or further information[1]

2.3.2 EUREKA 2.1

Table 14: Description of variables providing information about projects (EUREKA)

Variable	Description
projectNr	unique identifier (record control number) for each project in the database; corresponds with the entries in the field projectNr in the participation table (Table 15)[1]
projectType	type of funding instrument (EUREKA projects, umbrellas, clusters; Eurostars)[1]
status, status_date	current status of the project (e.g., announced, finished, approved) given in the EUREKA projects database in January 2017[1]
acronym	(non-unique) project acronym[1]
title	full title of the project[1]
description_short, description_long	conceptual orientation of the project[1]
technologyArea	thematic field of research (see Appendix Table 28 for the complete list of technology areas on three levels)[1]
marketArea	target market area[1]
startDate, endDate	day, month and year of project start and end[1]
duration_months	duration of the project in months[1]
actualCost_m_euro	official project costs[1]

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Table 15: Description of variables providing information about participations (EUREKA)

Variable	Description
projectNr	unique identifier for each project in the database; corresponds with the entries in the field projectNr in the projects table (Table 14)[1]
cnr	unique identifier (control number) assigned internally by AIT, as project participants are not uniquely indexed in the EUREKA projects database; all project-relevant information is indicated with "1", prime contractor with "2", and remaining participants with "3", "4", etc. [1]
role	role of participant in the project (as given); differentiates between "Partner", "Interested", "Main", "Main under Reserve" and "Observer"[1]
stApplicant	standardised EUPRO organisation name[2]
stOrgtyp_EUREKA	standardised EUREKA organisation type; distinguishes between Large company, SME, R&D Performing SME, Research Institute, University, Government and Other[1]
stOrgtyp	standardised EUPRO organisation type[2]
sAddress, sPostcode, sCity	street level address information[1]
stCountry	standardised country name; correlates with the entries in field stCountry in countries table (Table 16)[2]
stCtry	standardised country codes; country abbreviations as ISO 3166-1 Alpha-3[7] codes[2]
Website	URL of participant[1]

Table 16: Description of variables providing information about participating countries (EUREKA)

Variable	Description
stCountry_ID	unique identifier for each country in the database; corresponds with the entries in the field stCountry_ID in the funding source table (Table 17)[2]
stCountry	standardised country name; correlates with the entries in field stCountry in participation table (Table 15)[2]
affiliation_type	type of affiliation to EUREKA (member, associated country, etc.)[1]
affiliation_year	year since type of affiliation is valid[1]
ctry_description	description of the R&D activities of the country within EUREKA[1]
funding_description	general description of the national funding principles[1]

Table 17: Description of variables providing information about funding sources (EUREKA)

Variable	Description
stCountry_ID	unique identifier for each country in the database; corresponds with the entries in the field stCountry_ID in the country table (Table 16) and the funding by type of organisation table (Table 18)[2]
fs_id	unique identifier for each founding source in the database; corresponds with the entries in the field fs_id in the funding by type of organisation table (Table 18)[2]
fs_name	name and type of national funding source[1]
fc_institution	name of responsible agency or ministry[1]
fc_adress, fc_postal code, fc_city	street level address information[1]
fs_link	URL of national funding source[1]
fs_description	description of the general procedure, restrictions, target groups, eligibility criteria, etc. of the funding source[1]

[7] https://www.iso.org/obp/ui/#search/code/

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Table 18: Description of variables providing information about funding by type of organisation (EUREKA)

Variable	Description
stCountry_ID	unique identifier for each country in the database; corresponds with the entries in the field stCountry_ID in the funding source table (Table 17)[2]
fs_id	unique identifier for each founding source in the database; corresponds with the entries in the field fs_id in the funding by type of organisation table (Table 18)[2]
elig_org_type	eligible organisation type[1]
fund_elig_cost	funding rate for each organisation type[1]
max_cost	maximal funding per organisation type[1]
add_infromation	additional information[1]

2.3.3 JTI 1.0

Table 19: Description of variables providing information about programmes (JTI)

Variable	Description
JU_name	unique JTI acronym (ARTEMIS, ENIAC, ECSEL); corresponds with entries in the field JU_name in the projects table (Table 20)[1]
JU_call	call ID; corresponds with entries in the field JU_call in the projects table (Table 20)[1]
JoREP_prog_id	link to programme ID in JoREP database[2]
JoREP_call_id	link to call ID in JoREP database[2]
Proj_info_source	URL, where project level data was retrieved[2]
Benefic_info_source	URL, where beneficiary level data was retrieved[2]
Last accessed	date of data retrieval[2]
Comments	comments on missing or divergent data[2]

Table 20: Description of variables providing information about projects (JTI)

Variable	Description
JU_name	unique JTI acronym (ARTEMIS, ENIAC, ECSEL); corresponds with entries in the field JU_name in the programme table (Table 19) and the beneficiaries table (Table 21)[1]
JU_call	call ID; corresponds with entries in the field JU_call in the programme table (Table 19) and the beneficiaries table (Table 21)[2]
Proj_acronym	(non-unique) project acronym or abbreviation of the project title; corresponds with entries in the field Proj_acronym in the beneficiaries table (Table 21)[1]
Proj_title	Full title of the project[1]
Proj_start date	day, month and year of project start[1]
Duration	duration of the project in months[1]
Proj_eligible_cost, Proj_eligible_cost_remarks	eligible project costs[1]
Proj_JU_funding	JU project funding[1]
Proj_national_funding, Proj_national_funding_flag	national project funding[1]; flag indicates estimated data[2]
Comment	Comments on data retrieval and the calculation of project costs and funding[2]

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Table 21: Description of variables providing information about beneficiaries (JTI)

Variable	Description
JU_name	unique JTI acronym (ARTEMIS, ENIAC, ECSEL); corresponds with entries in the field JU_name in the projects table (Table 20)[1]
JU_call	call ID; corresponds with entries in the field JU_call projects table (Table 20)[2]
Proj_acronym	(non-unique) project acronym or abbreviation of the project title; corresponds with entries in the field JU_call projects table (Table 20)[1]
stApplicant	standardised EUPRO organisation name[2]
benefic_country	standardised country codes given as ISO 3166-1 Alpha-2 country codes[8,2]
benefic_eligible_cost, benefic_eligible_cost_remarks	eligible project costs on the beneficiary level[1]
benefic_JU_funding	JU project funding on the beneficiary level[1]
benefic_national_funding	national funding on the beneficiary level[1]; flag indicates estimated data[2]
Comment	Comments on data retrieval and the calculation of project costs and funding on the beneficiary level[2]

2.3.4 COST 1.0

Table 22: Description of variables providing information about actions (COST)

Variable	Description
ActionNo	unique identifier for each project in the database, corresponds with the entries in the field ActionNo in the parties table (Table 23), the management structure table (Table 24)[1]
Science Field	COST science fields[1]
Title	Full title of the project[1]
Description	conceptual orientation of the project[1]
LastUpdated	date of last update of project information[1]
Start Date, End Date	day, month and year of action start and end[1]
mcChair, mcViceChair	name of management committee chair and vice chair[1]

Table 23: Description of variables providing information about parties (COST)

Variable	Description
ActionNo	unique identifier for each project in the database, corresponds with the entries in the field ActionNo in the actions table (Table 22)
StartDate	start date of participation
Type	type of participation (COST or non-COST countries, institutions, bodies, etc.)
Country	name of participating country
InstitutionName	Institution name (not standardised) in the case of COST Near Neighbour Countries, COST International Partner Countries or non-COST Institutions
OrganisationName	name of organisation in the case of Specific Organisations (e.g. public bodies)

[8] https://www.iso.org/obp/ui/#search/code/

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Table 24: Description of variables providing information about management structure (COST)

Variable	Description
ActionNo	unique identifier for each project in the database, corresponds with the entries in the field ActionNo in the actions table (Table 22)[1]
Type	type of participation (COST or non COST countries, institutions, bodies, etc.)[1]
mcCountry, mcInstitution, mcOrganisation	name of participating country, institution or organisation[1]
mcType	management committee member, observer or substitute[1]
personInstitution, personStreetCity	Institution and address of the management committee member, observer or substitute[1]

2.4 Sectorial, temporal and geographical coverage

Information on the sectorial classifications used

Table 25: Organisation type[9]

stOrgtyp	Description
EDU	universities and other educational institutions
ROR	public and private research organisations
IND	industry
GOV	governmental institutions
OTH	special interest groups, like unions, chambers, inter-trade organisations, etc
	not available

Table 26: Subjects (FP1-FP6)

Subjects
Aerospace Technology
Agriculture
Biotechnology
Business aspects
Construction Technology
Coordination and Cooperation
Earth Sciences
Economic Aspects
Education and Training
Electronics and Microelectronics
Energy Saving
Energy Storage and Energy Transport
Environmental Protection
Evaluation
Food
Forecasting
Fossil Fuels
Industrial Manufacture

[9] used in FP and EUREKA

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Information and communication technology applications
Information and Media
Information Processing and Information Systems
Innovation and Technology Transfer
Intellectual property rights
Legislation and Regulations
Life Sciences
Materials Technology
Mathematics and Statistics
Measurement Methods
Medical biotechnology
Medicine and Health
Meteorology
Nuclear Fission
Nuclear Fusion
Other Energy Topics
Other Technology
Policies
Radiation Protection
Radioactive Waste
Reference Materials
Regional Development
Renewable Sources of Energy
Research ethics
Resources of the Sea and Fisheries
Safety
Scientific Research
Social sciences and humanities
Standards
Sustainable development
Telecommunications
Transport
Waste Management

Table 27: Fields of Science (EuroSciVoc) taxonomy (FP7-H2020)[10]

level 0	**level 1**	**level 2**
agricultural sciences	agricultural biotechnology	agricultural genetics
		biomass
		marker assisted selection
	agriculture, forestry, and fisheries	agriculture
		fisheries
		forestry
	animal and dairy science	animal husbandry
		apiculture
		dairy

[10] for the complete 5-level table see Table A 1

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		pets
	other agricultural sciences	
	veterinary science	
engineering and technology	chemical engineering	biochemical engineering
		chemical engineering software
		chemical process engineering
	civil engineering	architecture engineering
		construction engineering
		structural engineering
		transportation engineering
	electrical engineering, electronic engineering, information engineering	electrical engineering
		electronic engineering
		information engineering
	environmental biotechnology	bioremediation
		biosensing
	environmental engineering	energy and fuels
		geological engineering
		geotechnics
		mining and mineral processing
		natural resource management
		remote sensing
		waste management
		water management
	industrial biotechnology	biomaterials
		bioprocessing technologies
		metabolic engineering
	materials engineering	ceramics
		coating and films
		colors
		composites
		crystals
		fibers
		liquid crystal
		metallurgy
		nanocomposites
		paper and wood
		synthetic dyes
		textiles
	mechanical engineering	applied mechanics
		manufacturing engineering
		mechatronics
		thermodynamic engineering
		tribology
		vehicle engineering
	medical engineering	medical laboratory technology
	nanotechnology	nano-materials
		nano-processes
		nanoelectromechanical systems
		nanoelectronics
		nanophotonics
	other engineering and technologies	food and beverages
		microtechnology

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humanities	arts	architectural design
		art history
		modern and contemporary art
		performing arts
		visual arts
	history and archaeology	archaeology
		history
	languages and literature	languages - general
		linguistics
		literary genres
		literature - general
	other humanities	
	philosophy, ethics and religion	ethics
		philosophy
		religion
medical and health sciences	basic medicine	anatomy and morphology
		immunology
		medical genetics
		medicinal chemistry
		neurology
		pathology
		pharmacology and pharmacy
		physiology
		toxicology
	clinical medicine	allergology
		anaesthesiology
		andrology
		angiology
		cardiology
		clinical microbiology
		clinical neurology
		critical care medicine
		dentistry
		dermatology
		embryology
		emergency medicine
		endocrinology
		gastroenterology
		general medicine
		gerontology
		hematology
		hepatology
		integrative and complementary medicine
		internal medicine
		nephrology
		obstetrics and gynaecology
		odontology
		oncology
		ophthalmology
		orthopaedics
		otorhinolaryngology

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		paediatrics
		physiotherapy
		pneumology
		psychiatry
		radiology
		rheumatology
		surgery
		transplantation
		urology
	health sciences	dietetics
		epidemiology
		health care sciences
		health care services
		infectious diseases
		inflammatory diseases
		medical ethics
		nursing
		nutrition
		parasitology
		public and environmental health
		social biomedical sciences
		sport and fitness sciences
		substance abuse
		tropical medicine
	medical biotechnology	cells technologies
		genetic engineering
		medical bioproducts
		nanomedicine
		prosthetics
		tissue engineering
	other medical sciences	forensic science
		history of medicine
natural sciences	biological sciences	biochemistry
		biodiversity conservation
		behavioural sciences biology
		biological morphology
		biology
		biophysics
		botany
		cell biology
		developmental biology
		ecology
		evolutionary biology
		freshwater biology
		genetics and heredity
		marine biology
		microbiology
		molecular biology
		morphology
		neurobiology
		reproductive biology
		synthetic biology

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		zoology
	chemical sciences	analytical chemistry
		electrochemistry
		inorganic chemistry
		nuclear chemistry
		organic chemistry
		physical chemistry
		polymer science
	computer and information sciences	artificial intelligence
		computational science
		computer security
		data science
		databases
		internet
		software
	earth and related environmental sciences	atmospheric sciences
		environmental sciences
		geochemistry
		geology
		geophysics
		hydrology
		oceanography
		palaeontology
		physical geography
		soil science
	mathematics	applied mathematics
		pure mathematics
	other natural sciences	
	physical sciences	acoustics
		astronomy
		atomic physics
		classical mechanics
		condensed matter physics
		electromagnetism and electronics
		molecular and chemical physics
		nuclear physics
		optics
		plasma physics
		quantum field theory
		quantum mechanics
		relativistic mechanics
		string theory
		theoretical physics
		thermodynamics
social sciences	economics and business	business and management
		economics
	educational sciences	didactics
		inclusive education
		pedagogy
		special education
	law	admiralty law

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		constitutional law
		criminology
		human rights
		international law
		law enforcement agencies
		penology
	media and communications	information science
		journalism
		library science
	other social sciences	social sciences interdisciplinary
	political science	government systems
		political communication
		public administration
		public policy
	psychology	behavioural psychology
		cognitive psychology
		psycholinguistics
		psychotherapy
		social psychology
	social and economic geography	cultural and economic geography
		transport
		sociology

Table 28: EUREKA concordance table Technology Areas (Level 1 and 2)[11]

Technology Area (Level 1)	**Technology Area (Level 2)**
1 ELECTRONICS, IT AND TELECOMS TECHNOLOGY	1.1 Information Processing, Information System
	1.2 Electronics, Microelectronics
	1.3 Telecommunications
	1.4 Multimedia
	1.5 IT and Telematics technology
2 INDUSTRIAL MANUFACTURING, MATERIAL AND TRANSPORT	2.1 Materials Technology
	2.2 Industrial Manufacture
	2.3 Construction Technology
	2.4 Transport and Shipping Technologies
	2.5 Transport Infrastructure
	2.6 Design and Modeling / Prototypes
	2.7 Process control and logistics
	2.8 Signal Processing
	2.9 Aerospace Technology
3 BIOLOGICAL SCIENCES / TECHNOLOGIES	3.1 Medical technology
	3.2 Biology / Biotechnology
	3.3 Micro- and Nanotechnology related to Biological sciences
	3.4 Genome Research
4 ENERGY TECHNOLOGY	4.1 Renewable Sources of Energy
	4.2 Rational use of energy
	4.3 Energy production, transmission and conversion
	4.4 Energy Storage and Transport
	4.5 Other Energy Topics

[11] for the complete 3-level table see Table A 3.

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	4.6 Printing
	4.7 Fossil Energy Sources
	4.8 Mining Technologies
5 TECHNOLOGY FOR PROTECTING MAN AND THE ENVIRONMENT	5.1 Environment technology
	5.2 Waste Management technology
	5.3 Safety technology
6 OTHER INDUSTRIAL TECHNOLOGIES	6.1 Textiles Technology
	6.2 Chemical Technology and Engineering
	6.3 Other Industrial Technologies_subgroup
	6.4 Apparatus Engineering
	6.5 Footwear / Leather Technology
	6.6 Process Plant Engineering
	6.7 Sound Engineering/Technology
7 AGRICULTURE AND MARINE RESOURCES	7.1 Agricultural technology
	7.2 Animal Selection/Production / Husbandry technology
	7.3 Resources of the Sea, Fisheries
	7.4 Biocontrol
8 CHEMISTRY, PHYSICAL AND EXACT SCIENCES	8.1 Micro- and Nanotechnology related to physical and exact sciences
	8.2 Meteorology / Climatology
	8.3 Chemistry
	8.4 Membrane / Filtration technology
	8.5 Analytical Chemistry
	8.6 Mathematics, Statistics
	8.7 Earth Sciences
	8.8 Hydraulics
9 MEASUREMENTS AND STANDARDS	9.1 Measurement Tools
	9.2 Electronic measurement systems
	9.3 Reference Materials
	9.4 Standards
	9.5 Recording Devices
10 AGROFOOD TECHNOLOGY	10.1 Technologies for the food industry
	10.2 Food quality and safety
	10.3 Nutrition and Health

Table 29: COST science Fields

Science Field	Science Field Full Name
ICT	Information and Communication Technologies
MPNS	Materials, Physical and Nanosciences
ESSEM	Earth System Science and Environmental Management
TUD	Transport and Urban Development
FA	Food and Agriculture
ISCH	Individuals, Societies, Cultures and Health
BMBS	Biomedicine and Molecular Biosciences
CMST	Chemistry and Molecular Sciences and Technologies
FPS	Forests, their Products and Services

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Information on the temporal coverage used

EUPRO module	First call year	Last call year
FP 2020	1984	2018
EUREKA 2.1	1985	2016
JTI 1.0	2008	2014
COST 1.0	1971	2014

Information on the geographical coverage and classifications used

Since we have information on the geographical location of the project participants in the EUPRO database, we can analyse their geographical distribution across Europe at the country-level as well as on the regional level by assigning organisation to European NUTS regions[12] using NUTS classification revision 2010[13].
EUPRO covers participations from the following countries:

- *EU 27 Member States*
- *Associated countries* (with science and technology cooperation agreements that involved contributing to the framework programme budget)[14]:
  UK; Switzerland; Israel; Norway, Iceland and Liechtenstein; Turkey, Croatia, the Former Yugoslav Republic of Macedonia and Serbia; Albania and Montenegro; Bosnia & Herzegovina; Faroe Islands; Republic of Moldova
- *Third Countries* (countries that are not Member States, nor associated countries)[15]
  - *International Cooperation Partner Countries* (ICPC)[16]: Countries eligible for EU funding from Africa, Asia, Carribean, Pacific, Eastern Europa and Central Asia (EECA), Latin America, Mediterreanean Partner Countries (MPC) and Western Balkan Countries (WBC) (for the total list see Annex, Table A 2)
  - *High-income countries* (normally not eligible for EU funding): United States of America, Canada, Japan, the Republic of Korea, Singapore, Australia and New Zealand, Taiwan, Hong Kong and Macao, Vatican, San Marino, Monaco and Andorra.

[12] including the analogous territorial descriptions for Switzerland and Norway

[13] History of NUTS, http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/history_nuts (accessed: 24/04/2014)

[14] FP7 Third Country Agreements, http://ec.europa.eu/research/participants/data/ref/fp7/116018/fp7-third-country-agreements_en.pdf (accessed: 24/04/2014)

[15] Cooperation with Third Country Participants in an EC funded FP7 multi-partner research project, http://ec.europa.eu/research/participants/data/ref/fp7/90400/guideline-third-country-participants_en.pdf

[16] List of International Cooperation Partner Countries (ICPC) - Annex 1 of Work Programme 2013 Cooperation, http://ec.europa.eu/research/participants/data/ref/fp7/206006/wp-2013-annex-1-icpc-list_en.pdf, (accessed: 24/04/2014)

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2.5 Quality and accuracy of data

Information on the number of missing values[17]

Table 30: Number and ratio of missing values of FP project data

Variable	Missing values	
	Count	Ratio
RecCtrNr	-	
ProjectReference	-	
Title	1	0%
ProjAcr	2	0%
Start Date	2,176	2%
End Date	2,999	3%
TotalProjectCosts	24,089	24%
ProjectEUFunding	22,626	23%
TopicsCodes	15,415	16%
Call	43,817	44%
FundingSchemeCode	5,209	5%
Objective	9,534	10%
Subjects (FP1-FP6)	24,113	24%
Fields of Science (FP7-H2020)	3,097	7%
ProjectURL	75,478	76%

Table 31: Number and ratio of missing values of FP participation data

Variable	Missing values	
	Count	Ratio
RecCtrNr	-	
Cnr	-	
Role	-	
OrgID	3,940	1%
PIC	297,670	58%
stApplicant	3,829	1%
sAcronym	281,004	55%
stOrgtyp	4,295	1%
endofParticipation	281,721	55%
sAddress	2,877	1%
sPostcode	88,564	17%
sCity	14,439	3%
sCountry	1,622	0%
ECcontribution	297,479	58%
organizationUrl	329,122	64%
vatNumber	327,898	64%
stCtry-2	1,028	0%

[17] This section covers information on the variables of the two main tables in each of the data sets, projects and participations. Information on variables of the remaining tables can be provided upon request.

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Table 32: Number and ratio of missing values of EUREKA project data

Variable	Missing values	
	Count	Ratio
projectNr	_	
projectType	_	
status, status_date	_	
acronym	_	
title	_	
description_short, description_long	_	
technologyArea	1,779	37%
marketArea	2,157	44%
startDate, endDate	4	0%
duration_months	1	0%
actualCost_m_euro	34	1%

Table 33: Number and ratio of missing values of EUREKA participation data

Variable	Missing values	
	Count	Ratio
projectNr	_	
Cnr	_	
Role	7,483	36%
stApplicant	_	
stOrgtyp_EUREKA	16,906	81%
stOrgtyp	171	1%
sAddress	4,450	21%
sPostcode	17,907	86%
sCity	3,898	19%
stCountry	_	
stCtry	_	
Website	17,014	82%

Table 34: Number and ratio of missing values of JTI project data

Variable	Missing values	
	Count	Ratio
JU_name	-	
JU_call	-	
Proj_acronym	-	
Proj_title	1	1%
Proj_start date	-	
Duration	-	
Proj_eligible_cost	1	1%
Proj_JU_funding	1	1%
Proj_national_funding	25	19%

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Table 35: Number and ratio of missing values of JTI beneficiaries' data

Variable	Missing values	
	Count	Ratio
JU_name	-	
JU_call	-	
Proj_acronym	-	
stApplicant	119	4%
benefic_country	-	
benefic_eligible_cost	55	2%
benefic_JU_funding	39	1%
benefic_national_funding	549	19%

Table 36: Number and ratio of missing values of COST action data

Variable	Missing values	
	Count	Ratio
ActionNo	-	
Science Field	-	
Title	-	
Description	307	27%
LastUpdated	-	
Start Date, End Date	-	

Table 37: Number and ratio of missing values of COST parties' data

Variable	Missing values	
	Count	Ratio
ActionNo	-	
StartDate	1572	7%
Type	-	
Country	50	0%
InstitutionName	-	
Organisation name	-	

Estimation of data quality issues with respect to data acquisition, reliability of retrieving system

In general, the original databases of the four funding instruments (FP, EUREKA, JTI, COST) constitute reliable resources on all R&D projects and participations. However, in some few cases information is incomplete or inconsistent, as for instance the address data, project costs, project funding and funding on the participants' level, in particular for earlier FPs.

With regard to the data acquisition and retrieving system the data is sound and complete. The retrieving system used was a wrapper – a type of web scraping program.

- *Soundness*: The raw data which is extracted from the websites is copied one-on-one and simply restructured in a relational form.
- *Completeness*: The wrapper parses the HTML content of all project webpages and is guided to the relevant information. Each webpage follows a given structure. Hence, each piece of information is located in the same place and information won't be missed by the wrapper.

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3 Technical Specifications

3.1 Information on the data base system

Current data base system used

The four modules of the EUPRO database are realised as Microsoft Access 2016 database.

Planned future technical changes concerning data base system

As part of the RCF Platform, EUPRO is one of the datasets to be incorporated. For that purpose, an API – Application Programming Interface will be developed for the transfer of the data to the Platform. While having a MS Access version of the EUPRO database has its benefits, for server-side web programming, an appropriate relational database management system (RDBMS) and a database server needs to be used. Therefore, a MySQL version for the four modules of the EUPRO database will be provided as well.

3.2 Technical variable definition

Labelling and data type of all variables[18]

Table 38: Data type of variables providing information about projects (FP)

Variable	Data type
RecCtrNr	Number
ProjectReference	Text
Title	Text
ProjAcr	Text
Start Date	Date
End Date	Date
TotalProjectCosts	Number
ProjectEUFunding	Number
TopicsCodes	Text
Call	Text
FundingSchemeCode	Text
Objective	Long Text
Subjects (FP1-FP6)	Text
Fields of Science (FP7-H2020)	Text
ProjectURL	Text

Table 39: Data type of variables providing information about participations (FP)

Variable	Data type
RecCtrNr	Number
Cnr	Number
Role	Text
OrgID	Number
PIC	Number
stApplicant	Text

[18] This section covers information on the variables of the two main tables in each of the data sets, projects and participations. Information on variables of the remaining tables can be provided upon request.

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sAcronym	Text
stOrgtyp	Text
endofParticipation	Text
sAddress, sPostcode, sCity, sCountry	Text
organizationUrl	Text
vatNumber	Text
EUcontribution	Number
stCtry-2	Text

Table 40: Data type of variables providing information about projects (EUREKA)

Variable	Data type
projectNr	Number
projectType	Text
status	Text
status_date	Date
acronym	Text
title	Text
description_short, description_long	Long Text
technologyArea	Text
marketArea	Text
startDate, endDate	Date
duration_months	Number
actualCost_m_euro	Number

Table 41: Data type of variables providing information about participations (EUREKA)

Variable	Data type
projectNr	Number
Cnr	Number
Role	Text
stApplicant	Text
stOrgtyp_EUREKA	Text
stOrgtyp	Text
sAddress, sPostcode, sCity	Text
stCountry	Text
stCtry	Text
Website	Text

Table 42: Data type of variables providing information about projects (JTI)

Variable	Data type
JU_name	Text
JU_call	Text
Proj_acronym	Text
Proj_title	Text
Proj_start date	Date
Duration	Number

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Proj_eligible_cost, Proj_eligible_cost_remarks	Number
Proj_JU_funding	Number
Proj_national_funding,	Number
Proj_national_funding_flag	Text
Comment	Long Text

Table 43: Data type of variables providing information about beneficiaries (JTI)

Variable	Data type
JU_name	Text
JU_call	Text
Proj_acronym	Text
stApplicant	Text
benefic_country	Text
benefic_eligible_cost, benefic_eligible_cost_remarks	Number
benefic_JU_funding	Number
benefic_national_funding	Number
Comment	Long Text

Table 44: Data type of variables providing information about actions (COST)

Variable	Data type
ActionNo	Text
Science Field	Text
Title	Text
Description	Long Text
GeneralInfo	Long Text
LastUpdated	Date
Start Date, End Date	Date
mcChair, mcViceChair	Text

Table 45: Data type of variables providing information about parties (COST)

Variable	Data type
ActionNo	Text
StartDate	Date
Type	Text
Country	Text
InstitutionName	Text
OrganisationName	Text

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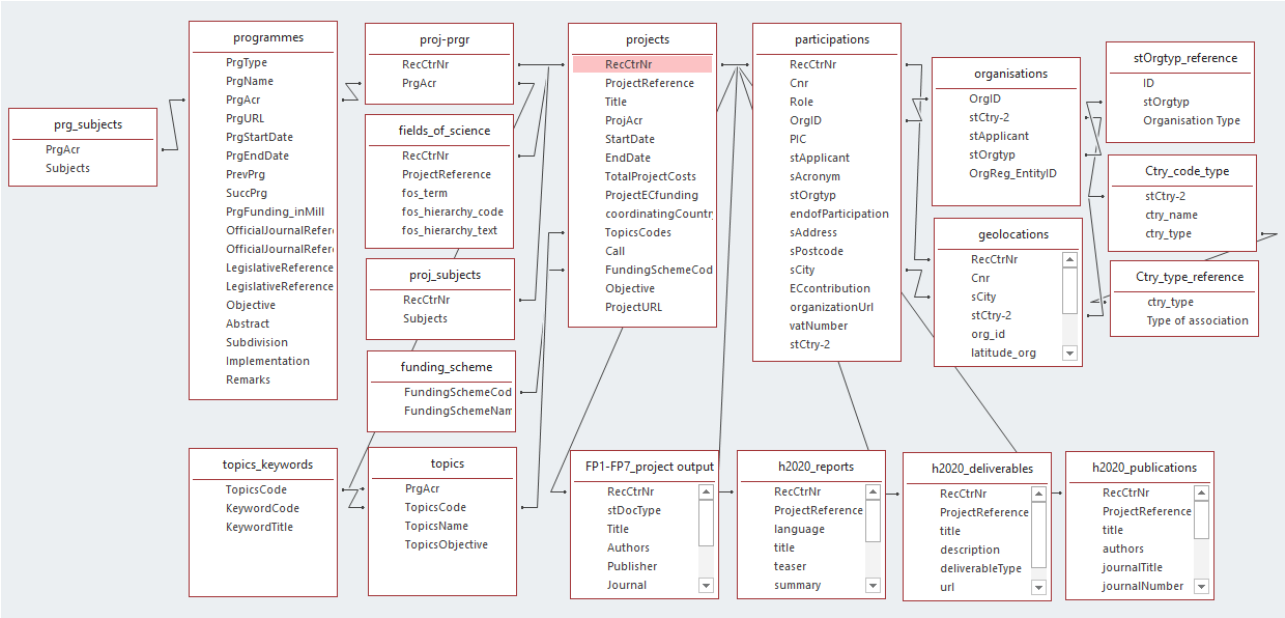
3.3 Description of the Entity Relationship Model

FP 2020 currently consists of 19 tables (Figure 1). The relation between *projects*, *programmes*, *participations* and project outputs (*FP1-FP7_project output*, *h2020_reports*, *h2020_deliverables*, *h2020_publications*) is realised via RecCtrNr (record control number), which is a unique identifier for each project in the database and identical to the unique identifier for the project in the CORDIS projects database. Detailed information about individual programmes is accessible by PrgAcr (Programme Acronym) in *programmes*, further information on FP *topics* are linked by TopicCodes to the *projects* table. Thematic classifications (*Subjects*) used for FP1-FP6 programmes and projects are given in the *prg_subjects* table (linked via PrgAcr to *programmes*) and the *proj_subjects* table (linked via RecCtrNr to *projects*). The thematic classification of FP7 and H2020 projects is provided in the *fields_of_science* table, linked via RecCtrNr to the *projects* table.
The *participations* table is linked by RecCtrNr and sCity to the *geolocations* table, which holds the geocoded data of the participants on city level. Every stApplicant is linked via OrgID to the *organisations* table, which provides the link to RISIS-OrgReg, the Register of European Public Research and Higher Education Actors. The three remaining tables – *stOrgtype_reference*, *Ctry_code_type*, and *Ctry_type_reference* explain abbreviations used in the respective variables. Data of the scientific output of each project is comprised in *FP1-FP7 project output*, *h2020_reports*, *h2020_deliverables*, and *h2020 publications*.

Figure 1: FP Entity Relationship Model (main table)



The logic of the **EUREKA** database structure is similar (Figure 2). Projects and participations are linked by projectNr. The table *TechnologyArea_code* structures the entities in technologyArea in the *projects table* in three different aggregation levels. Specific information about the EUREKA funding conditions and funding schemes in each country are linked to the *participation* table via stCountry.

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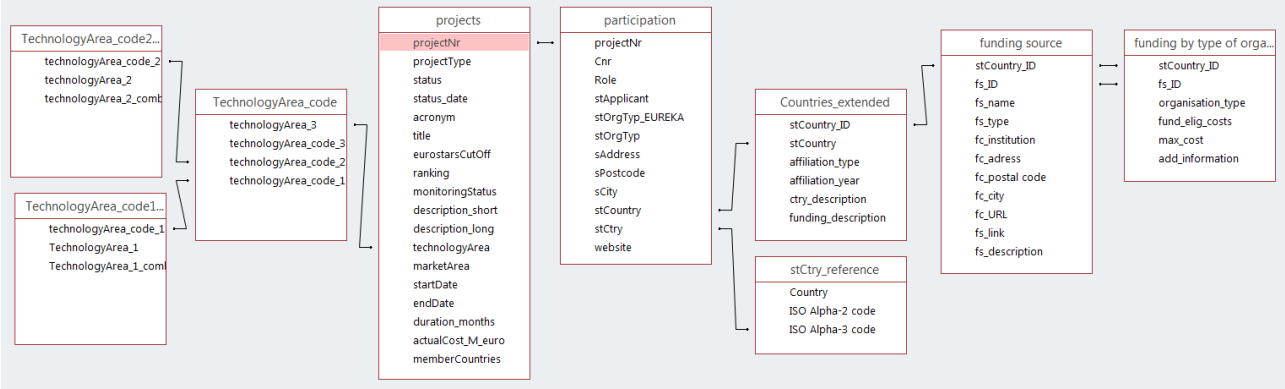
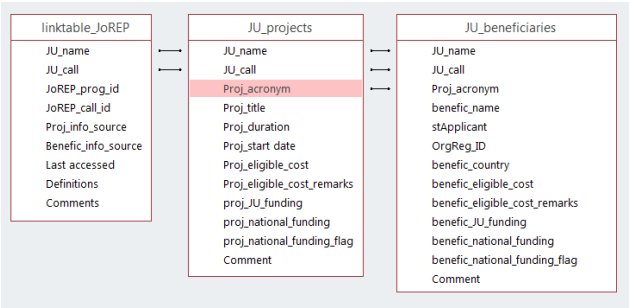
Figure 2: EUREKA Entity Relationship Model



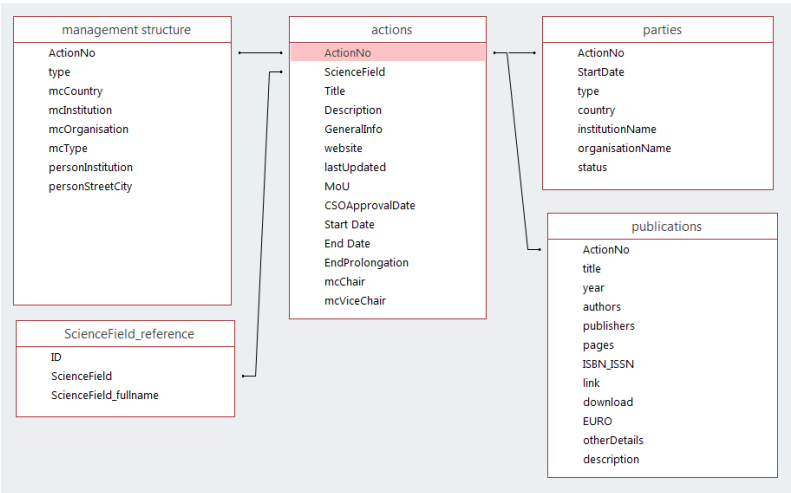
The structure of the **JTI** database is very simple (Figure 3). Data on programmes and the resulting projects are linked via JU_name (JTI name) and JU_call (specific call name). Beneficiaries are connected to their specific projects via Proj_acronym (project acronym).

Figure 3: JTI Entity Relationship Model



In the **COST** database (Figure 4) ActionNo connects the tables about the underlying management structure of the COST action, the participating parties and the resulting publications.

Figure 4: COST Entity Relationship Model



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3.4 Interfaces for access and to other infrastructures

Technical information on interfaces with other infrastructures

Integration of EUPRO within RISIS has been core in order to increase the scientific value of EUPRO for cross-dataset empirical analyses, on the one hand, and to be able to gain from RISIS developed facilities, such as geolocalisation tools, for the further advancement of EUPRO, on the other hand. Inter-operability with other datasets is considered as a key element for the further establishment and sustainable attractivity of EUPRO for new research endeavours, in particular those relating to the investigation of impacts of publicly funded R&D networks.

The following integration activities has been conducted during RISIS II:

- The link to **RISIS-OrgReg** enables the direct inter-linking with other RISIS core datasets featuring public research organisation, in particular LeidenRank and RISIS-ETER. At the moment, stApplicants included in FP_2020 are linked to RISIS-OrgReg via OrgReg_EntityID in the *organisations* table. Likewise, the link to companies listed in **RISIS-FirmReg** will be established as soon as the first release of the register is available.
- With the application of the new geolocalisation tools developed in RISIS to EUPRO, we have been able to analyse the spatio-temporal development of FP networks in much more flexible manner and integrate it in geographical terms with other RISIS datasets. One promising example in this context has been a combination of EUPRO with the **Nano S&T dataset**, investing Nanoscience and -technology networks in publications and patents (coming from Nano S&T dataset) with Nanoscience and –technology FP networks (coming from EUPRO) (see Villard et al. 2017).
- EUPRO has been inter-linked directly at the organisational level with **RISIS-ETER** in order to analyse the relationships between several characteristics of European Higher Education Institutions (HEIs) coming from RISIS-ETER, and their participation patterns in the EU FP coming from EUPRO. First research endeavors in this direction have been conducted within in RISIS (see Lepori et al. 2015), further research projects in this direction are currently under way.
- **JoREP** has – in contrast to EUPRO – a programme perspective on joint transnational research programmes, i.e. it gathers systematic information on a series of transnational programmes from 2000 to 2014. In EUPRO we have established a direct link (programme identifier) of programmes available in EUPRO and also in JoREP. These are at the current stage EUREKA and JTIs, and enables the relational investigation of networks of performers in these programmes (coming from EUPRO), and programme characteristics (coming from JoREP).
- **RISIS-KNOWMAK** draws upon project data from the EUPRO FP module to compute and visual indicators of knowledge creation in the European Research Area (see Lepori et al. 2017). Projects are annotated[19] with topical classes relevant for Key Enabling Technologies (KET) and Societal Grand Challenges (SGC), include detailed subclasses. The link to RISIS-KNOWMAK has been further extended to include annotation of all projects based on their descriptions, including FP projects outside the scope of RISIS-KNOWMAK as well as EUREKA

[19] https://gate.ac.uk/projects/knowmak

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projects. With the full annotation, alternative indicator definitions may be used, and specific projects may be associated with KETs and SGCs.

Integration with RCF

The EUPRO version that is made available for access to researchers in RISIS is foreseen to be fully incorporated in RCF, under the condition of controlled access and that security of usage is given (i.e. access for selected users with a concrete research project to the parts of the dataset needed for the research). Note that underlying cleaning and standardisation data (e.g. name variants) will not be made available via RCF. Linking to other datasets in the RCF will be realized via the RISIS registers (providing the respective identifiers to the registers in EUPRO). Most probably, as mentioned above in the planned future technical changes section, there will be an API (Application Programming Interface) developed for the transfer of the EUPRO data to the RCF Platform. Anyhow, the technical issues for incorporation of EUPRO into RCF (e.g. database system, how can a user access which parts of the dataset, etc.) are to be defined in more details in close cooperation with WP4 beginning with autumn.

4 Scientific use cases and main references

Summarizing the research activities of external researchers accessing EUPRO via RISIS, we can distinguish the following main research directions for which EUPRO has been mobilized:

- Observing and characterizing **structure and dynamics of knowledge creation** and networks, disaggregated across different topics and/or geographical spaces (e.g. for climate change, biodiversity, Nanoscience; done by researchers from University of Coimbra, Université Paris-Est Marne-la-Vallée)
- Observing **FP participation patterns and networking of firms** in specific industries (e.g. pharmaceutical and chemical industries, done by researcher from Université Paris-Est Marne-la-Vallée based on the inter-linking of EUPRO with CIB)
- Using EUPRO to quantify and model **impacts of publicly funded R&D networks** on knowledge creation and technological diversification (e.g. done by researchers from Utrecht University, Université Paris-Est Marne-la-Vallée)
- Analysis of **country-specific participation patterns in the FP**, with a special focus on topical orientation and main partners (e.g. done for Israel by researchers from the Samuel Neaman Institute)
- Observing **R&D hot spots** and activities funded by FP projects, at an organizational level in specific topics and geographical locations across Europe (e.g. on marine biotechnology, done by researchers from the EMBRIC project)
- Using real-world network data to test **novel statistical models for dynamic network analysis**, and to test these models in concrete empirical applications (done by researchers from University of Lugano)
- Tracing and investigating **characteristics of universities in terms of FP funding**, e.g. relation of FP funding to other university characteristics, disciplinary background of funding, etc. (done by researchers from Vrije University Brussels)

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Robinson, D., Schoen, A., Laurens, P. and Laredo, P. (2017): Developing global and local STI indicators for profiling the territorial embedding of marine biotechnology research centres. STI 2017, Paris [Fr], 6-8 September

Uhlbach, W.-H., Balland, P.-A. and Scherngell, T. (2017): The effects of the European Union Framework Programmes on the technological diversification of European regions. 2017 Annual Conference of the EU-SPRI Forum, June 7-9, Vienna Austria

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Wanzenböck, I. and Piribauer, P. (2017): R&D networks and regional knowledge production in Europe. Evidence from a space-time model. ***Papers in Regional Science*** [doi 10.1111/pirs.12236]

Wanzenböck, I., Scherngell, T. and Dünser, M. (2017): Impacts of EU funded R&D networks on the generation of Key Enabling Technologies: Empirical evidence from a regional perspective, EMAEE Conference 2017, Strasbourg [FR], 31 May 2017

Wanzenböck, I., Scherngell, T. and Dünser, M. (2017): RTI policy for co-creation activities and its effects on Key Enabling Technologies: Regional evidence from the 7th EU Framework Programme. 2017 Annual Conference of the EU-SPRI Forum, June 7-9, Vienna Austria

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Appendix

Table A 1: Taxonomy of the European Science Vocabulary (EuroSciVoc)[20]

level 0		level 1		level 2		level 3		level 4		level 5	
27	agricultural sciences	79	agricultural biotechnology	483	agricultural genetics	n.a.	livestock cloning				
						1275	plant cloning				
				481	biomass						
				487	marker assisted selection						
		81	agriculture, forestry, and fisheries	30021	agriculture	493	agronomy				
						499	horticulture	1287	fruit		
								1289	root crop		
						1281	plant breeding	1751	crops	1833	fodder
										30065	oilseed rape
										1831	oleaginous plant
						491	plant protection				
						1279	sustainable agriculture				
						497	viticulture				
				489	fisheries						
				495	forestry	1285	dendrology	1755	dendrochronology		
						1283	silviculture	n.a.	coppicing		
		83	animal and dairy science	507	animal husbandry	1291	animal feed				
				505	apiculture						
				503	dairy						
				501	pets						
		85	other agricultural sciences								
		87	veterinary science								
25	engineering and technology	65	chemical engineering	415	biochemical engineering						
				n.a.	chemical engineering software						
				411	chemical process engineering						
		77	civil engineering	479	architecture engineering	1271	home automation				
						1269	smart city				
						1267	sustainable architecture	1749	sustainable building		
				477	construction engineering						
				473	structural engineering	1255	earthquake engineering	1747	base isolation		
								1745	seismic loading		
						1253	hydraulic engineering				
						1257	structural health monitoring				
				475	transportation engineering	1263	airport engineering				
						1259	highway engineering				
						1265	port and harbor engineering				
						1261	railroad engineering				
		73	electrical engineering, electronic engineering, information engineering	451	electrical engineering	457	automation and control systems				
						1211	control engineering				
						1209	power engineering	1703	electric power distribution		
								1707	electric power generation	1825	combined heat and power
								1705	electric power transmission		
				453	electronic engineering	1213	analogue electronics				
						449	computer hardware	1203	computer processor		
								1207	quantum computer		
								1205	supercomputer		
						1217	digital electronics				
						459	robotics	1229	autonomous robots	1729	drones
								1233	cognitive robots		
								1231	soft robotics		
								1227	swarm robotics		
						1215	signal processing	1709	compressed sensing		
				30020	information engineering	455	telecommunications	1223	mobile phone		
								1225	radio technology	1721	bluetooth
										1725	cognitive radio
										1719	microwave technology
										1727	radar
										1723	radio frequency
										1717	satellite radio
								1221	telecommunications network	1715	data network
										1713	optical network
										1827	fiber-optic ne
								1219	wireless	1711	5g
		71	environmental biotechnology	443	bioremediation	1197	bioleaching				
						1195	bioreactor				
						1199	compost				
						1201	phytoremediation				
				447	biosensing						
		67	environmental engineering	425	energy and fuels	1159	biofuels				
						1161	electric energy				
						1171	energy conversion				
						1165	fossil energy	1679	coal		
								1683	gas		
								1681	petroleum		
						1173	fuel cell				
						1163	liquid fuels				
						1167	nuclear energy				
						1169	renewable energy	1693	geothermal energy		
								1687	hybrid energy		
								1689	hydroelectricity	1823	marine energy
										1821	tidal energy
										1819	wave power
								1691	hydrogen energy		
								1685	solar energy		
								1695	windpower		
						1175	synthetic fuels				
				421	geological engineering						
				427	geotechnics						
				417	mining and mineral processing						
				423	natural resource management	1157	desalination				
				419	remote sensing						
				429	waste management	1179	energy efficiency				
						1177	energy recovery				
						1181	recycling				
						1185	remanufacturing				
						1183	waste water				
				431	water management	1187	irrigation				

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level 0		level 1		level 2		level 3		level 4		level 5	
25	engineering and technology	61	industrial biotechnology	383	biomaterials	1147	bioplastics	1677	polyhydroxyalkanoates		
								n.a.	polyhydroxyurethanes		
								1675	polylactic acid		
								1673	polyurethane		
				385	bioprocessing technologies	1149	biocatalysis				
						1151	fermentation				
				381	metabolic engineering						
		63	materials engineering	397	ceramics						
				391	coating and films						
				409	colors						
				387	composites	1155	biocomposites				
						1153	carbon fiber				
				401	crystals						
				393	fibers						
				403	liquid crystal						
				389	metallurgy						
				407	nanocomposites						
				395	paper and wood						
				405	synthetic dyes						
				399	textiles						
		75	mechanical engineering	n.a.	applied mechanics						
				469	manufacturing engineering	1247	additive manufacturing				
						1245	product engineering				
						1249	subtractive manufacturing				
				467	mechatronics						
				471	thermodynamic engineering	1251	heat engineering				
				463	tribology	1243	lubrication				
						1241	surface roughness				
				461	vehicle engineering	1239	aerospace engineering	1741	aeronautical engineering		
								1737	aircraft	1829	rotorcraft
								1739	satellite technology		
						1235	automotive engineering	1731	autonomous vehicle		
								1733	drive by wire		
						1237	naval engineering	1735	sea vessels		
		57	medical engineering	375	medical laboratory technology	1139	diagnostic technologies				
						n.a.	laboratory samples analysis				
		69	nanotechnology	435	nano-materials	1193	bulk nanostructured materials				
						1189	nanocrystal				
						1191	two-dimensional nanostructures	1699	graphene		
								1697	silicene		
				441	nano-processes						
				439	nanoelectromechanical systems						
				433	nanoelectronics						
				437	nanophotonics						
		59	other engineering and technologies	377	food and beverages	1145	food packaging	1143	food safety		
				379	microtechnology						
31	humanities	109	arts	601	architectural design						
				597	art history	591	folklore	1403	musicology	1793	ethnomusicology
										1791	popular music studies
				595	modern and contemporary art	589	film				
						599	radio and television				
				593	performing arts	1405	dramaturgy				
				603	visual arts						
		113	history and archaeology	611	archaeology	1431	archaeometry				
						1425	bioarchaeology				
						1429	ethnoarchaeology				
						1427	underwater archaeology				
				613	history	30033	ancient history				
						30036	contemporary history				
						30034	medieval history				
						30035	modern history				
		107	languages and literature	583	languages - general						
				587	linguistics	1399	phonetics				
						1401	phonology				
						1397	sign language				
				581	literary genres	1393	essay	1789	science fiction		
				577	literature - general	585	literary theory	1395	literary criticism		
		n.a.	other humanities								
		111	philosophy, ethics and religion	605	ethics	1407	ethical principles	1795	justice	1837	human rights
						30041	ethical theories				
				609	philosophy	1415	epistemology				
						30040	history of philosophy	30040	history of philosophy		
								1423	ancient philosophy		
								1421	contemporary philosophy		
								1417	medieval philosophy		
								1413	modern philosophy		
						1419	metaphysics	30060	ontology		
								1799	teleology		
						30039	philosophy of language				
						1797	political philosophy				
				607	religion	1409	christianity				
						1411	islam	30058	history of islam		
								30056	muslim culture		
								30057	muslim society		
						30038	judaism				

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level 0		level 1		level 2		level 3		level 4		level 5	
21	medical and health sciences	35	basic medicine	151	anatomy and morphology	625	muscular system				
				155	immunology	643	immunotherapy				
						641	t cell				
				149	medical genetics						
				157	medicinal chemistry						
				153	neurology	633	alzheimer				
						637	amyotrophic lateral sclerosis				
						629	epilepsy				
						639	multiple sclerosis				
						631	muscular dystrophy	1433	duchenne muscular dystrophy		
						627	parkinson				
						635	stroke				
				145	pathology						
				159	pharmacology and pharmacy	651	adverse drug reactions				
						649	drug resistance	1437	antibiotic resistance		
								1435	multidrug resistance		
						645	drug safety				
						653	pharmaceutical drug	1439	vaccines		
						647	pharmacokinetics				
				161	physiology	30022	cytology				
						655	homeostasis	1441	intestinal homeostasis		
						30023	pathophysiology				
				147	toxicology						
		39	clinical medicine	183	allergology	685	drug allergy				
						683	food allergy				
				185	anaesthesiology						
				199	andrology						
				243	angiology	743	vascular diseases	1477	cerebrovascular diseases		
				221	cardiology	713	cardiovascular diseases	1463	arteriosclerosis		
						711	paediatric cardiology				
				197	clinical microbiology						
				241	clinical neurology						
				181	critical care medicine						
				239	dentistry						
				211	dermatology	1801	melanoma				
				203	embryology						
				189	emergency medicine	687	graft versus host disease				
				179	endocrinology	681	diabetes	1447	diabetic nephropathy		
				177	gastroenterology	679	inflammatory bowel disease				
				229	general medicine						
				175	gerontology						
				219	hematology						
				30013	hepatology						
				209	integrative and complementary medicine						
				30012	internal medicine						
				231	nephrology	723	kidney diseases				
						725	renal dialysis				
				207	obstetrics and gynaecology	695	gynaecology				
						697	obstetrics	1457	childbirth		
								1459	fetal medicine		
								1461	postnatal		
				239	odontology	741	dental implantology				
						737	orthodontics				
						739	periodontics				
				225	oncology	717	cancer	1475	bladder cancer		
								1471	breast cancer		
								1469	colorectal cancer		
								30053	head and neck cancer		
								1467	liver cancer		
								1473	prostate cancer		
								1465	skin cancer	30063	basal cell
						719	leukemia			30064	squamous cell carcinoma
				213	ophthalmology	703	glaucoma				
						699	retinopathy				
						701	strabismus				
				187	orthopaedics						
				205	otorhinolaryngology						
				195	paediatrics						
				227	physiotherapy						
				217	pneumology	707	asthma				
						705	lung diseases				
						709	tuberculosis				
				235	psychiatry	733	anxiety disorders				
						727	obsessive-compulsive disorder				
						735	posttraumatic stress disorder				
						731	schizophrenia				
						729	sleep disorders				
				201	radiology	693	medical imaging	1449	computed tomography		
								1455	magnetic resonance imaging		
								1451	x-ray radiography		
						691	nuclear medicine				
				215	rheumatology						
				223	surgery	715	robotic surgery				
						30025	surgical procedure				
				237	transplantation						
				233	urology						
		33	health sciences	125	dietetics						
				133	epidemiology						
				n.a.	health care sciences						
				30011	health care services	623	ehealth				
						621	malaria				
				121	infectious diseases	n.a.	RNA virus	n.a.	coronavirus		
								n.a.	ebola		
								619	hiv		
								n.a.	influenza		
				123	inflammatory diseases						
				127	medical ethics						
				143	nursing						
				117	nutrition						
				135	parasitology						
				137	public and environmental health	n.a.	epidemics prevention	n.a.	immunisation		
								n.a.	modeling of disease spread		
				119	social biomedical sciences	617	family planning				
						615	sexual health				
				139	sport and fitness sciences						
				141	substance abuse						
				129	tropical medicine						

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level 0		level 1		level 2		level 3		level 4		level 5	
21	medical and health sciences	37	medical biotechnology	163	cells technologies	657	stem cells				
				165	genetic engineering	659	gene therapy				
				169	medical bioproducts	675	heart valve				
						677	implants				
				171	nanomedicine						
				173	prosthetics						
				167	tissue engineering	665	artificial bone				
						671	artificial pancreas	30050	closed-loop systems		
								30052	continuous glucose monitors		
								30051	current studies		
						663	bioartificial liver				
		41	other medical sciences	249	forensic science						
				247	history of medicine						
23	natural sciences	49	biological sciences	315	biochemistry	999	biochemical research methods				
						997	biomolecules	1611	carbohydrates		
								1617	enzymes		
								1615	lipids		
								n.a.	nucleic acid		
								1613	proteins	1815	proteomics
				323	biodiversity conservation						
				321	behavioural sciences biology	1001	behavioural ecology				
						30027	ethology	1003	biological interaction		
				353	biological morphology	1051	comparative morphology				
						1049	functional morphology				
				319	biology						
				329	biophysics						
				311	botany						
				313	cell biology	993	cell metabolism				
						995	cell polarity				
						991	cell signaling				
				349	developmental biology						
				335	ecology	1009	ecosystems				
						1011	invasive species				
						1013	landscape ecology				
				343	evolutionary biology						
				347	freshwater biology						
				337	genetics and heredity	1023	chromosome				
						1015	dna				
						1025	genome				
						1027	heredity				
						1017	mutation				
						1019	nucleotide				
						1021	rna				
				317	marine biology						
				341	microbiology	1035	bacteriology				
						1031	mycology	1621	ethnolichenology		
								1619	ethnomycology		
						1029	phycology				
						1033	protozoology				
						325	virology				
				309	molecular biology	987	molecular evolution				
						989	molecular genetics				
						985	molecular neuroscience				
						983	structural biology				
				353	morphology						
				327	neurobiology	30028	neuroscience				
						1007	cognitive neuroscience				
						1005	computational neuroscience				
				333	reproductive biology						
				339	synthetic biology						
				345	zoology	1039	entomology	1623	apidology		
						1043	ichthyology				
						1037	invertebrate zoology				
						1045	mammalogy	1627	cetology		
								1625	primatology		
						1041	ornithology				
		53	chemical sciences	361	analytical chemistry	1079	calorimetry				
						1657	inorganic qualitative analysis				
						1081	mass spectrometry				
						1083	quantitative analysis	1663	volumetric analysis		
						1077	spectroscopy				
				373	electrochemistry	1133	bioelectrochemistry	1669	electrofusion		
								1667	electroporation		
						1129	electric batteries				
						1135	electrocatalysis				
						1131	electrolysis				
						1137	electrophoresis				
				365	inorganic chemistry	1115	bioinorganic chemistry				
						1111	inorganic compounds				
						1113	metals				
				371	nuclear chemistry	1123	nuclear reactions				
						1125	radiation chemistry				
						1127	radiochemistry				
				363	organic chemistry	1103	alcohols				
						1101	aldehydes				
						1099	aliphatic compounds				
						1089	amines				
						1095	aromatic compounds				
						1109	heterocyclic compounds				
						1105	hydrocarbons				
						1097	ketones				
						1107	organic acids				
						1091	organic reactions				
						1087	organohalogen compounds				
						1085	organometallic chemistry				
						1093	volatile organic compounds				
				367	physical chemistry	1117	photochemistry	1665	photocatalysis		
						1121	quantum chemistry				
						1119	thermochemistry				
				369	polymer science						

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level 0		level 1		level 2		level 3		level 4		level 5	
23	natural sciences	47	computer and information sciences	297	artificial intelligence	929	computational creativity				
						931	computational intelligence				
						935	computer vision				
						927	expert systems				
						925	heuristic programming				
						933	machine learning	1589	deep learning		
								1587	reinforcement learning		
								1595	supervised learning		
								1591	transfer learning		
								1591	unsupervised learning		
						937	pattern recognition				
				301	computational science	953	multiphysics				
				295	computer security	915	access control				
						917	cryptography				
						923	data protection				
						919	network security				
				299	data science	951	big data				
						947	business intelligence				
						949	data analysis				
						945	data exchange				
						943	data mining				
						941	data processing				
						939	natural language processing				
				303	databases	957	storage and preservation				
				305	internet	971	internet access				
						967	internet of things				
						961	internet protocol				
						959	semantic web				
						963	transport layer				
						965	web development				
						969	world wide web	1597	web accessibility		
				307	software	979	application software	1603	graphic design		
								1607	simulation software		
								1605	video games		
						975	computer programming				
						977	malicious software				
						30031	software development	981	software architecture		
						973	system software	1599	device drivers		
								1601	operating systems		
		45	earth and related environmental sciences	30018	atmospheric sciences	30032	climatology	30055	climatic changes	1813	arctic oscillation
										1809	el niño
										1811	north atlantic oscillation
								835	climatic zones		
								837	dendroclimatology		
						281	meteorology	847	atmospheric circulation	1553	atmospheric turbulence
								843	atmospheric pressure		
								839	solar radiation		
								841	troposphere		
				277	environmental sciences	831	ozone depletion				
						829	pollution				
				285	geochemistry	865	aqueous geochemistry				
						869	biogeochemistry				
						863	cosmochemistry				
						859	isotope geochemistry				
						867	organic geochemistry				
				291	geology	897	geochronology				
							geomorphology	n.a.	climatic geomorphology		
								1569	speleology		
						895	lithology				
						903	mineralogy	1577	crystallography		
								1579	optical mineralogy		
						891	petrology	1555	experimental petrology		
								n.a.	igneous petrology		
								1559	metamorphic petrology		
								n.a.	sedimentary petrology		
						905	sedimentology				
						901	seismology	1573	microseisms		
								1575	plate tectonics		
								n.a.	seismometry		
						899	volcanology				
				30019	geophysics						
				287	hydrology	871	drainage basin				
						883	ecohydrology				
						877	hydrogeology				
						n.a.	hydroinformatics				
						879	hydrometeorology				
						n.a.	isotope hydrology				
						351	limnology				
						n.a.	surface hydrology				
				289	oceanography	n.a.	geological oceanography				
						885	ocean chemistry				
						887	physical oceanography				
				275	palaeontology	827	biostratigraphy				
						819	paleobotany				
						823	paleoclimatology				
						815	paleoecology				
						n.a.	paleozoology				
						821	palynology				
				293	physical geography	911	cartography	1585	geographic information systems		
						907	glaciology	1581	cryosphere		
								1583	glacial geology		
						913	natural disaster				
				283	soil science	857	edaphology				
						855	land-based treatment				
						853	pedology				
						n.a.	soil genesis				
						849	soil morphology				

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level 0		level 1		level 2		level 3		level 4		level 5	
23	natural sciences	51	mathematics	355	applied mathematics	1055	dynamical systems				
						1057	game theory				
						1059	mathematical model				
						1053	mathematical physics				
						1061	numerical analysis				
						357	statistics and probability				
				359	pure mathematics	1073	algebra	1651	algebraic geometry		
								1653	commutative algebra		
								1655	linear algebra		
						1069	arithmetic	1641	logarithm		
								1639	prime numbers		
						1063	discrete mathematics	1629	graph theory		
						1065	geometry				
						1067	mathematical analysis	1635	complex analysis		
								1637	differential equations	1817	partial differential equat
								1633	fourier analysis		
								1631	functional equations		
						1071	topology	1645	algebraic topology		
								1647	computational topology		
								1649	knot theory		
						357	statistics and probability				
		n.a.	other natural sciences								
		43	physical sciences	273	acoustics	813	ultrasound				
				257	astronomy	761	astrochemistry				
						759	astrophysics	1487	black hole		
								1489	dark matter		
						30030	extragalactic astronomy				
						763	galactic astronomy	1493	milky way		
								769	solar astronomy		
								30054	solar physics		
						773	history of astronomy				
						767	observational astronomy	1501	gamma-ray astronomy		
								1491	gravitational waves		
								1503	infrared astronomy		
								1499	optical astronomy		
								1495	radio astronomy		
								1497	x-ray astronomy		
						775	physical cosmology	1517	big bang		
								1519	galaxy formation and evolution		
						771	planetary science	1513	asteroids		
								807	celestial mechanics		
								1509	comets		
								1805	meteorites		
								1803	meteors		
								1515	planetary geology		
								1511	planets	1807	exoplanetology
								1507	satellites		
								1515	topography		
						765	space exploration				
						757	stellar astronomy	1479	asteroseismology		
								1481	neutron star		
								1483	supernova		
								1485	white dwarf		
				267	atomic physics						
				269	classical mechanics	809	continuum mechanics				
						811	fluid mechanics	1549	fluid dynamics		
								1547	fluid statics		
						30029	solid mechanics				
						805	statistical mechanics				
				263	condensed matter physics	801	bose-einstein condensates				
						797	mesoscopic physics				
						799	quantum gases				
						803	soft matter physics				
						795	solid-state physics				
				259	electromagnetism and electronics	781	electrical conductivity	1523	semiconductor		
						785	electromagnetism				
						783	microelectronics				
						787	optoelectronics				
						777	semiconductor device				
						779	spintronics	1521	molecular spintronics		
				255	molecular and chemical physics						
				253	nuclear physics	753	nuclear decay				
						755	nuclear fission				
						751	nuclear fusion				
				251	optics	747	cavity optomechanics				
						749	fibre optics				
						745	laser physics				
				271	plasma physics						
				30017	quantum field theory	793	quantum physics	1545	quantum optics		
				30015	quantum mechanics						
				n.a.	relativistic mechanics						
				789	string theory						
				261	theoretical physics	791	particles	1533	fermion		
								1535	gluons		
								1539	higgs boson		
								1543	leptons		
								1527	particle accelerator		
								1541	photons		
								1537	quarks		
								1531	w boson		
								1529	z boson		
				265	thermodynamics						

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level 0		level 1		level 2		level 3		level 4		level 5	
29	social sciences	91	economics and business	523	business and management	1307	business model				
						1311	commerce	1759	e-commerce		
						1313	employment				
						1309	entrepreneurship				
				521	economics	1295	biological economics				
						1301	econometrics				
						1305	macroeconomics				
						1297	microeconomics				
						1293	monetary and finances				
						1299	production economics	1757	productivity		
						1303	sustainable economy				
		105	educational sciences	573	didactics						
				575	inclusive education						
				571	pedagogy	1391	active learning				
						1389	inquiry based learning				
						1387	teaching				
				569	special education						
		89	law	515	admiralty law						
				517	constitutional law						
				511	criminology						
				1837	human rights	n.a.	concepts in human rights				
						n.a.	history of human rights				
						30048	human rights law	n.a.	national state of emergency	n.a.	pandemic risk
						1839	human rights violations	1841	human trafficking		
								30061	political violence		
								30062	sexual violence		
						30049	international protection of human rights				
						n.a.	regional human rights				
				519	international law						
				513	law enforcement agencies						
				509	penology						
		103	media and communications	565	information science						
				567	journalism						
				563	library science	1385	archives				
						1383	public libraries				
		95	other social sciences	535	social sciences interdisciplinary	1327	sustainable development				
		97	political science	543	government systems	1335	civil society				
						1337	democracy				
						1333	e-governance				
						1331	nongovernmental organization				
				541	political communication						
				537	public administration	1329	bureaucracy				
				539	public policy						
		93	psychology	525	behavioural psychology						
				533	cognitive psychology	30043	mental processes	1319	attention		
								1325	emotion		
								1323	learning		
								1317	perception		
								1321	personality		
				529	psycholinguistics						
				527	psychotherapy	1315	psychoanalysis				
				531	social psychology						
		99	social and economic geography	545	cultural and economic						
				547	transport	1343	electric vehicles				
						1349	freight transport				
						1351	navigation systems	1767	inertial navigation system		
								1765	satellite navigation system	1835	global navigation satellit
						1347	public transport				
						1341	social aspects of transport				
						1345	sustainable transport	1763	intelligent transport system		
						1339	transport planning	1761	air traffic management		
						549	urban studies				
				101	sociology	561	anthropology	1379	ethnology		
								1381	physical anthropology	1787	paleoanthropology
								1377	social and cultural anthropology		
						553	demography	1355	census		
								1357	fertility		
								1353	mortality		
						1361	family studies				
						1363	gender studies	1769	gender equality		
								n.a.	women's studies		
						1369	globalization				
						559	governance	1375	crisis management	1781	flood risk management
										1783	seismic risk management
								1371	public services		
								1373	taxation		
						551	ideologies				
						555	industrial relations	1359	automation		
						1367	social problems	1777	ageism		
								1779	corruption		
								1775	migration		
								1773	racism		
								1771	social inequality		
								1365	social work		

Table A 2: List of International Cooperation Partner Countries (ICPC) participating in EU FP

Country	Code	Type of Country
ANGOLA	AGO	ICPC - Africa
BENIN	BEN	ICPC - Africa
BOTSWANA	BWA	ICPC - Africa
BURKINA FASO	BFA	ICPC - Africa
BURUNDI	BDI	ICPC - Africa

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CAMEROON	CMR	ICPC - Africa
CAPE VERDE	CPV	ICPC - Africa
CENTRAL AFRICAN REPUBLIC	CAF	ICPC - Africa
CHAD	TCD	ICPC - Africa
CONGO	COG	ICPC - Africa
CONGO, DEMOCRATIC REPUBLIC	COD	ICPC - Africa
EQUATORIAL GUINEA	GNQ	ICPC - Africa
ERITREA	ERI	ICPC - Africa
ETHIOPIA	ETH	ICPC - Africa
GABON	GAB	ICPC - Africa
GAMBIA	GMB	ICPC - Africa
GHANA	GHA	ICPC - Africa
GUINEA	GIN	ICPC - Africa
GUINEA-BISSAU	GNB	ICPC - Africa
KENYA	KEN	ICPC - Africa
LESOTHO	LSO	ICPC - Africa
LIBERIA	LBR	ICPC - Africa
MADAGASCAR	MDG	ICPC - Africa
MALAWI	MWI	ICPC - Africa
MALI	MLI	ICPC - Africa
MAURITANIA	MRT	ICPC - Africa
MAURITIUS	MUS	ICPC - Africa
MOZAMBIQUE	MOZ	ICPC - Africa
NAMIBIA	NAM	ICPC - Africa
NIGER	NER	ICPC - Africa
NIGERIA	NGA	ICPC - Africa
RWANDA	RWA	ICPC - Africa
SAO TOME AND PRINCIPE	STP	ICPC - Africa
SENEGAL	SEN	ICPC - Africa
SEYCHELLES	SYC	ICPC - Africa
SIERRA LEONE	SLE	ICPC - Africa
SOMALIA	SOM	ICPC - Africa
SOUTH AFRICA	ZAF	ICPC - Africa
SUDAN	SDN	ICPC - Africa
SWAZILAND	SWZ	ICPC - Africa
TANZANIA	TZA	ICPC - Africa
TOGO	TGO	ICPC - Africa
UGANDA	UGA	ICPC - Africa
ZAMBIA	ZMB	ICPC - Africa
ZIMBABWE	ZWE	ICPC - Africa
AFGHANISTAN	AFG	ICPC - Asia
BANGLADESH	BGD	ICPC - Asia
BHUTAN	BTN	ICPC - Asia
CAMBODIA	KHM	ICPC - Asia
CHINA	CHN	ICPC - Asia
INDIA	IND	ICPC - Asia
INDONESIA	IDN	ICPC - Asia
IRAN	IRN	ICPC - Asia
IRAQ	IRQ	ICPC - Asia
LAO PEOPLE'S DEMOCRATIC REPUBLIC	LAO	ICPC - Asia

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MALAYSIA	MYS	ICPC - Asia
MALDIVES	MDV	ICPC - Asia
MONGOLIA	MNG	ICPC - Asia
MYANMAR	MMR	ICPC - Asia
NEPAL	NPL	ICPC - Asia
OMAN	OMN	ICPC - Asia
PAKISTAN	PAK	ICPC - Asia
PHILIPPINES	PHL	ICPC - Asia
SRI LANKA	LKA	ICPC - Asia
THAILAND	THA	ICPC - Asia
VIET NAM	VNM	ICPC - Asia
YEMEN	YEM	ICPC - Asia
BARBADOS	BRB	ICPC - Carribean
CUBA	CUB	ICPC - Carribean
DOMINICAN REPUBLIC	DOM	ICPC - Carribean
GUYANA	GUY	ICPC - Carribean
HAITI	HTI	ICPC - Carribean
JAMAICA	JAM	ICPC - Carribean
SAINT LUCIA	LCA	ICPC - Carribean
SURINAME	SUR	ICPC - Carribean
TRINIDAD AND TOBAGO	TTO	ICPC - Carribean
ARMENIA	ARM	ICPC - Eastern Europe and Central Asia (EECA)
AZERBAIJAN	AZE	ICPC - Eastern Europe and Central Asia (EECA)
BELARUS	BLR	ICPC - Eastern Europe and Central Asia (EECA)
GEORGIA	GEO	ICPC - Eastern Europe and Central Asia (EECA)
KAZAKHSTAN	KAZ	ICPC - Eastern Europe and Central Asia (EECA)
KYRGYZSTAN	KGZ	ICPC - Eastern Europe and Central Asia (EECA)
Russian Federation	RUS	ICPC - Eastern Europe and Central Asia (EECA)
TAJIKISTAN	TJK	ICPC - Eastern Europe and Central Asia (EECA)
TURKMENISTAN	TKM	ICPC - Eastern Europe and Central Asia (EECA)
UKRAINE	UKR	ICPC - Eastern Europe and Central Asia (EECA)
UZBEKISTAN	UZB	ICPC - Eastern Europe and Central Asia (EECA)
ARGENTINA	ARG	ICPC - Latin America
BOLIVIA, PLURINATIONAL STATE OF	BOL	ICPC - Latin America
BRAZIL	BRA	ICPC - Latin America
CHILE	CHL	ICPC - Latin America
COLOMBIA	COL	ICPC - Latin America
COSTA RICA	CRI	ICPC - Latin America
ECUADOR	ECU	ICPC - Latin America
EL SALVADOR	SLV	ICPC - Latin America
GUATEMALA	GTM	ICPC - Latin America
HONDURAS	HND	ICPC - Latin America
MEXICO	MEX	ICPC - Latin America
NICARAGUA	NIC	ICPC - Latin America
PANAMA	PAN	ICPC - Latin America
PARAGUAY	PRY	ICPC - Latin America
PERU	PER	ICPC - Latin America
URUGUAY	URY	ICPC - Latin America
VENEZUELA, BOLIVARIAN REPUBLIC OF	VEN	ICPC - Latin America
ALGERIA	DZA	ICPC - Mediterranean Partner Countries (MPC)

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EGYPT	EGY	ICPC - Mediterranean Partner Countries (MPC)
Jordan	JOR	ICPC - Mediterranean Partner Countries (MPC)
LEBANON	LBN	ICPC - Mediterranean Partner Countries (MPC)
Libya	LBY	ICPC - Mediterranean Partner Countries (MPC)
MOROCCO	MAR	ICPC - Mediterranean Partner Countries (MPC)
SYRIA	SYR	ICPC - Mediterranean Partner Countries (MPC)
TUNISIA	TUN	ICPC - Mediterranean Partner Countries (MPC)
FIJI	FJI	ICPC - Pacific
PAPUA NEW GUINEA	PNG	ICPC - Pacific
SAMOA	WSM	ICPC - Pacific
SOLOMON ISLANDS	SLB	ICPC - Pacific
TONGA	TON	ICPC - Pacific
VANUATU	VUT	ICPC - Pacific

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Table A 3: Concordance table Technology Areas (all levels)

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Technology Area (level 1)	Technology Area (level 2)	Technology Area (level 3)
1 ELECTRONICS, IT AND TELECOMS TECHNOLOGY	1.1 Information Processing, Information System	Advanced Systems Architecture
		Archivistics/Documentation/Technical Documentation
		Artificial Intelligence (AI)
		Computer Games
		Computer Hardware technology
		Computer Software technology
		Computer Technology/Graphics, Meta Computing
		Data Processing / Data Interchange, Middleware
		Data Protection, Storage Technology, Cryptography, Data Security
		Databases, Database Management, Data Mining
		Electronic Commerce, Electronic Payment, Electronic Signature
		Human Interactive
		Imaging, Image Processing, Pattern Recognition
		Information Processing, Information System
		Information Technology/Informatics
		Internet Technologies
		Knowledge Management, Process Management
		Quantum Informatics
		Simulation
		Simulation, Simulation Engineering
		Speech Processing/Technology
		User Interfaces, Usability
	1.2 Electronics, Microelectronics	Automation, Robotics Control Systems
		Digital Systems, Digital Representation
		Electronic circuits, components and equipment
		Electronic engineering
		Electronics, Microelectronics
		Embedded Systems and Real Time Systems
		High Frequency Technology, Microwaves
		Magnetic and superconductory technology
		Micromachining
		Nanotechnologies related to electronics and microelectronics
		Optical Networks and Systems
		Peripherals Technologies (Mass Data Storage, Display Technologies)
		Printed circuits and integrated circuits
		Semiconductors
		Smart cards and access systems
	1.3 Telecommunications	Audiovisual Equipment and Communication technology
		Broadband Technologies
		Mobile Communications
		Narrow Band Technologies
		Network Technology, Network Security
		Satellite Technology / Systems / Positioning / Communication
		Telecommunications
	1.4 Multimedia	Cultural Heritage
		E-Learning
		E-Publishing, Digital Content
		Human Language Technologies
		Information Filtering, Semantics, Statistics
		Multimedia
		Visualisation, Virtual Reality
	1.5 IT and Telematics technology	Application Service Providing (ASP)
		e-Government
		Environment Management Systems
		GIS Geographical Information Systems
		IT and Telematics technology
		Software for health

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		Software for tourism
		Software for transport, logisitics and human resources (Enterprise Resource Planning - ERP)
2 INDUSTRIAL MANUFACTURING, MATERIAL AND TRANSPORT	2.1 Materials Technology	Adhesives
		Building materials
		Ceramic Materials and Powders
		Colours and varnish
		Composite materials
		Fine Chemicals, Dyes and Inks
		Glass
		Iron and Steel, Steelworks
		Materials Handling Technology (solids, fluids, gases)
		Materials Technology
		Metals and Alloys
		Optical Materials
		Paper technology
		Plastics, Polymers
		Properties of Materials, Corrosion/Degradation
	2.2 Industrial Manufacture	Cleaning (sandblasting, brushing)
		Coatings
		Drying
		Erosion, Removal (spark erosion, flame cutting, laser/plasma cutting, electrochemical erosion,waterjet cutting)
		Forming (rolling, forging, pressing, drawing)
		Hardening, heat treatment
		Industrial Manufacture
		Joining techniques (rivetting, screw driving, gluing)
		Jointing (soldering, welding, sticking)
		Machine Tools technology
		Machining (turning, drilling, moulding, milling, planing, cutting)
		Machining, fine (grinding, lapping)
		Mixing (powder, etc.), separation (sorting, filtering)
		Moulding, injection moulding, extrusion, sintering
		Surface treatment (painting, galvano, polishing, CVD, PVD)
	2.3 Construction Technology	Building Materials, Components and Methods
		Civil engineering
		Construction Equipment
		Construction Technology
		Fire Resistance
		Mechanical Engineering, Hydraulics, Vibration and Acoustic Engineering
		Pipeline Technology
		Pulp Technology related to construction technology
		Sensory/Multisensory Technology, Instrumentation related to construction technology
		Sound Insulation
	2.4 Transport and Shipping Technologies	Design of Vehicles
		Hybrid and Electric Vehicles technology
		Railway Vehicles technology
		Road Vehicles technology
		Shipbuilding technology
		Traction/Propulsion Systems
		Transport and Shipping Technologies
	2.5 Transport Infrastructure	Air Transport technology
		Intermodal Transport technology
		Logistics
		Railway Transport technology
		Road Transport technology
		Traffic Engineering / Control Systems
		Transport Infrastructure

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		Water Transport technology
	2.6 Design and Modeling / Prototypes	Design and Modeling / Prototypes
	2.7 Process control and logistics	Process control and logistics
	2.8 Signal Processing	Signal Processing
	2.9 Aerospace Technology	Aeronautical technology / Avionics
		Aerospace Technology
		Aircraft technology
		Helicopter technology
3 BIOLOGICAL SCIENCES / TECHNOLOGIES	3.1 Medical technology	Clinical Research, Trials
		Cytology, Cancerology, Oncology
		Dentistry / Odontology, Stomatology
		Diagnostics, Diagnosis
		Environmental Medicine, Social Medicine,Sports Medicine technology
		Gene - DNA Therapy
		Heart and blood circulation illnesses
		Medical devices technology (instrumentation, medical imaging, radiology)
		Medical technology
		Neurology, Brain Research
		Pharmaceutical Products / Drugs
		Surgery
		Virus, Virology, Vaccines/ Antiobiotics / Bacteriology
	3.2 Biology / Biotechnology	Biochemistry / Biophysics
		Biology / Biotechnology
		Cellular and Molecular Biology
		Enzymology / Protein Engineering / Fermentation
		Genetic Engineering
		In vitro Testing, Trials
		Microbiology
		Molecular design
		Toxicology
	3.3 Micro- and Nanotechnology related to Biological sciences	Micro- and Nanotechnology related to Biological sciences
	3.4 Genome Research	Bioinformatics
		Gene Expression, Proteom Research
		Genome Research
		Population genetics
4 ENERGY TECHNOLOGY	4.1 Renewable Sources of Energy	Gaseous biomass
		Geothermal Energy
		Hydropower
		Liquid biomass
		Photovoltaics
		Renewable Sources of Energy
		Solar/Thermal energy
		Solid biomass
		Unconventional and Alternative Energies
		Waste incineration
		Wind energy
	4.2 Rational use of energy	Energy management
		Lighting, illumination
		Process optimisation, waste heat utilisation
		Rational use of energy
		Thermal insulation, energy efficiency in buildings
	4.3 Energy production, transmission and conversion	Energy production, transmission and conversion
		Fuel cell, hydrogen production
		Furnace technology, construction of heating boilers

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		Generators, electric engines and power converters
		Heat exchangers
		Heat pump, cooling technologies
		Heating, ventilation
		Turbines, fluid machinery, reciprocating engines, combined heat and power
	4.4 Energy Storage and Transport	Energy Storage and Transport
		Heat storage
		Heat transport and supply, district heating
		Storage of electricity, batteries
		Transmission of electricity
		Transport and storage of gas and liquid fuels
		Transport and storage of hydrogen
	4.5 Other Energy Topics	Combustion, Flames
		Fuel Technology
		Other Energy Topics
	4.6 Printing	Flexography
		Printed Reel Material
		Printing
	4.7 Fossil Energy Sources	Coal and Hydrocarbons
		Fossil Energy Sources
		Gaseous fossil fuel
		Liquid fossil fuel
	4.8 Mining Technologies	Mining Technologies
5 TECHNOLOGY FOR PROTECTING MAN AND THE ENVIRONMENT	5.1 Environment technology	Air Pollution
		Ecology
		Environment technology
		Environmental Engineering / Technology
		Measurement and Detection of Pollution
		Natural Disasters
		Remote sensing technology
		Soil Pollution
		Water Pollution / Treatment
	5.2 Waste Management technology	Biotreatment / Compost / Bioconversion
		Incineration and Pyrolysis
		Land and Sea Disposal
		Radioactive Waste
		Recycling, Recovery
		Waste Management technology
	5.3 Safety technology	Acoustic safety
		Assessment of Risk
		Fire Safety Technology
		Hazardous Materials
		Radiation Protection
		Safety technology
6 OTHER INDUSTRIAL TECHNOLOGIES	6.1 Textiles Technology	Dyeing related to Textiles Technology
		Finisher related to Textiles Technology
		Textiles Technology
		Thermoplastic textile fibres
		Weaving related to Textiles Technology
		Woven technical textiles for industrial applications
	6.2 Chemical Technology and Engineering	Agro chemicals
		Chemical Technology and Engineering
		Colours, dyes related to Chemical Technology and engineering
		Electrical Engineering and Technology / Electrical Equipment
		Man made fibres
		Organic Substances
		Pharmaceutics
		Plastics and Rubber related to Chemical Technology and engineering
		Rubber

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		Soaps, detergents
	6.3 Other Industrial Technologies_subgroup	Cleaning Technology
		Other Industrial Technologies_subgroup
	6.4 Apparatus Engineering	Apparatus Engineering
	6.5 Footwear / Leather Technology	Dry filling related to Footwear / Leather Technology
		Footwear / Leather Technology
		Tanned leather process related to Footwear / Leather Technology
	6.6 Process Plant Engineering	Plant Design and Maintenance
		Process Plant Engineering
	6.7 Sound Engineering/Technology	Sound Engineering/Technology
7 AGRICULTURE AND MARINE RESOURCES	7.1 Agricultural technology	Agricultural technology
		Agriculture Machinery / Technology
		Crop Production technology
		Horticulture technology
		Pesticides
		Plant selection/production technology
		Precision agriculture technology
		Veterinary Medicine
	7.2 Animal Selection/Production / Husbandry technology	Animal Selection/Production / Husbandry technology
	7.3 Resources of the Sea, Fisheries	Aquaculture technology
		Fish / Fisheries / Fishing Technology
		Marine Science
		Resources of the Sea, Fisheries
	7.4 Biocontrol	Biocontrol
		Forest technology
		Sylviculture, Forestry
		Wood technology
8 CHEMISTRY, PHYSICAL AND EXACT SCIENCES	8.1 Micro- and Nanotechnology related to physical and exact sciences	Micro- and Nanotechnology related to physical and exact sciences
	8.2 Meteorology / Climatology	Acoustics
		Laser Technology
		Meteorology / Climatology
		Sensors/Multisensor Technology, Instrumentation
		Thermodynamics
	8.3 Chemistry	Chemistry
		Computational Chemistry and Modelling
		Inorganic Chemistry
		Organic Chemistry
		Petrochemistry, Petroleum Engineering
	8.4 Membrane / Filtration technology	Membrane / Filtration technology
	8.5 Analytical Chemistry	Analytical Chemistry
	8.6 Mathematics, Statistics	Algorithms and Complexity
		Mathematical modelling
		Mathematics, Statistics
	8.7 Earth Sciences	Earth Sciences
		Geology, Geological Engineering, Geotechnics
		Tectonics, Seismology
	8.8 Hydraulics	Hydraulics
9 MEASUREMENTS AND STANDARDS	9.1 Measurement Tools	Acoustic Technology related to measurements
		Analyses / Test Facilities and Methods
		Chemical material testing
		Electrical Technology related to measurements
		Measurement Tools

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		Mechanical Technology related to measurements
		Optical material testing
		Optical Technology related to measurements
		Other Non Destructive Testing
		Sensor Technology related to measurements
	9.2 Electronic measurement systems	Electronic measurement systems
	9.3 Reference Materials	Reference Materials
	9.4 Standards	Standards
		Technical Standards
	9.5 Recording Devices	Recording Devices
10 AGROFOOD TECHNOLOGY	10.1 Technologies for the food industry	Drink Technology
		Food Additives / Ingredients
		Food Processing
		Food Technology
		Technologies for the food industry
	10.2 Food quality and safety	Detection and Analysis methods
		Food Microbiology / Toxicology / Quality Control
		Food Packaging / Handling technology
		Food quality and safety
		Safe production methods
		Tracability of food
	10.3 Nutrition and Health	Nutrition and Health
undefined	undefined	CO2net
		Laminate
		Packaging / Handling
		Packaging technology for materials
		Seed coating
		undefined