



RISIS

Research infrastructure for research
and innovation policy studies



RISIS – Categorizations and potentials for harmonisation (WP6)

Research infrastructures for the assessment of science,
technology and innovation policy

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Group Meeting 10

Agenda

- I. Short overview and status of WP6
 - I. Objectives and Workprogramm
 - II. Current developments of datasets
- II. Categorizations and potentials for harmonisation
 - I. overview on classifications used in the datasets
 - II. group discussion on potentials for harmonization
- III. Outlook and next steps

Objectives WP6

- Organise the preparation for the opening of the 10 datasets
- Opening of the datasets needs substantial preparatory activities concerning
 - technical aspects, e.g. database system, data format, database location, potential interfaces
 - substantive aspects related to database contents, e.g. harmonisation of sectoral and institutional classifications, denotations of organisations (WP8), geographical information (WP9)
 - legal aspects, e.g. access rights, IPR, obligations for users and providers

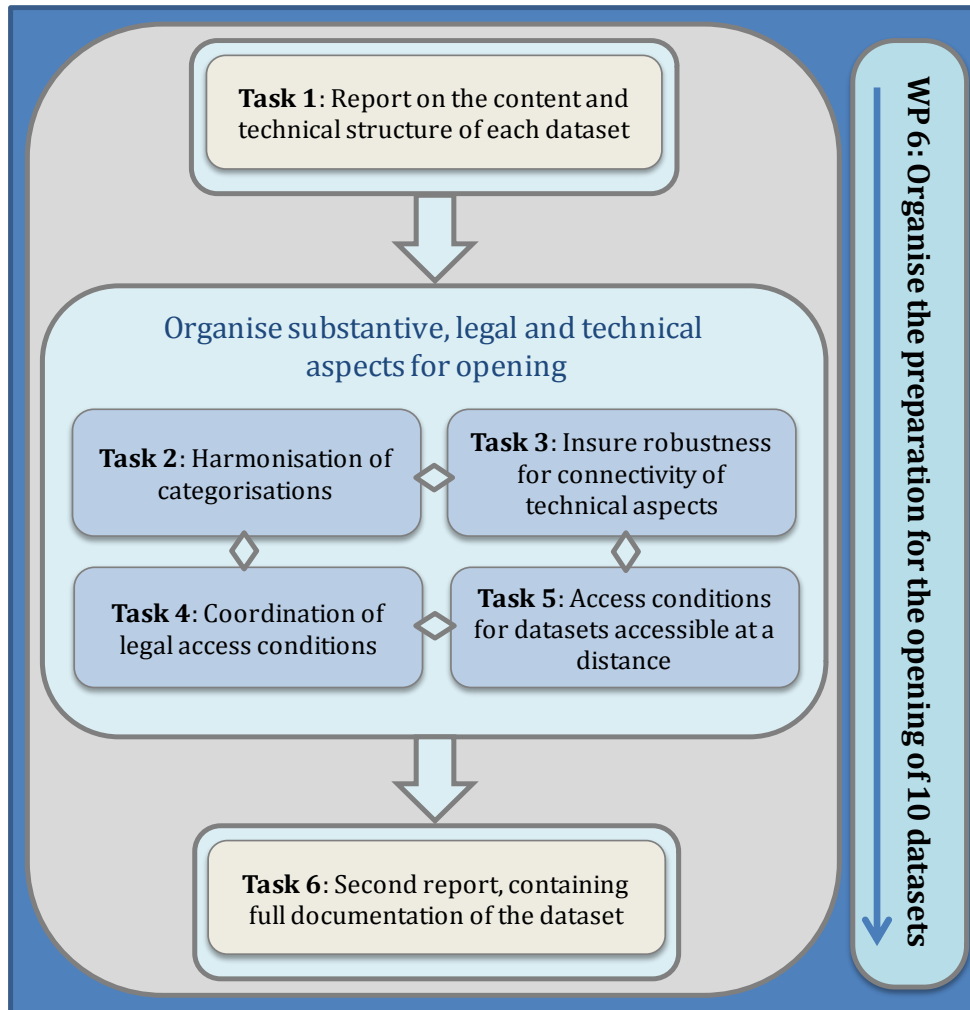
Datasets: properties and challenges

- mostly local use,
- very different technical choices which were selected for research developments rather than for favouring access and interconnectivity
- ad hoc solutions for solving disambiguation issues and for categorisations
- low levels of documentation (on their contents, but even more on their sphere of validity and on relevant conditions of use)

10 Datasets

- 'CIB - Corporate Invention Board' (UPEMLV)
(invention activities of the 2000 world largest R&D performers;
- 'ETER' (USI)
(full dataset on European Universities with key indicators)
- 'EUPRO' (AIT)
(research projects funded by the EU FPs and all participating organisations)
- 'JOREP – Joint and Open Programmes' (CNR)
(European trans-national joint cooperation programmes)
- 'Leiden Ranking of Universities' (UL)
(data from the Leiden ranking plus a more detailed level)
- 'MORE' (NIFU)
(largest survey of career path and international mobility in EU27)
- 'Nanotechnology Dynamics' (UPEMLV)
(publications and patents dealing with the production of nanotechnology)
- 'Profile' (IFQ)
(long term monitoring of researcher careers in Germany)
- 'SIPER' (UNIMAN)
(repository of research and innovation policy evaluations)
- 'VICO' (Polimi)
(dataset focused on new high tech companies in Europe)

Workprogramm WP6



Status of Tasks

✓	Task 1	Establish a report on the content and technical structure of each datasets
<i>Started 10/14</i>	Task 2	Coordinate the work on the different categorisations used in the 10 datasets. A collective discussion will be initiated for all categorisations used in order to insure harmonisation
<i>Started 10/14</i>	Task 3	Stimulate an exchange with all databases holders to insure robustness and potential for connectivity of technical aspects
<i>Started 10/14</i>	Task 4	Coordinate work on principles and conditions of legal access of the datasets as well as obligations for users
<i>2015</i>	Task 5	Two datasets (SIPER, EUMIDA/ETER) that will be accessible at a distance require the access to be rebuilt
<i>2017</i>	Task 6	Produce a second report, containing a full documentation of the dataset taking into account the changes introduced through the collective work and explaining conditions of 'relevant' use

Conclusions from Task 1

- Finalized in November 2014
 - Harmonized reports have been sent to the FCB
 - Poster presentations at STI in Leiden
- Main input for the following tasks on categorization (Task 2), technical issues (Task 3) and legal issues (Task 4)
- Current development of the datasets (updates, extensions, changes in legal or technical setting, etc.)

Current Developments of datasets

■ EUPRO

- Ongoing Update
 - extracting and integrating FP projects up to December 2013
 - standardisation of organisation names
 - assignment of organisation types and NUTS-2 regions
- Implementation of new Entity Relationship Model (ERM)
 - new table of unique organisations (registry in EUPRO)
 - starting to construct table on demography of public organisations (-> WP8)
 - table ‚projects‘ stays basically the same
 - table ‚participations‘ intended to link tables ‚projects‘ and ‚organisations‘, giving participation specific characteristics
 - add variables on supra-national classification of organisations
- Ideas for long-term further development
 - standardisation of instruments and contract types (potential link to JOREP)
 - implementation of canned queries based on different definitions of organisations
 - Adding further variables based on discussion on harmonisation of categorisation (e.g., NABS)

Task 2: Definition and harmonisation of classifications

The objective of Task 2 is

- to coordinate the work on the categorisations used in the 10 datasets
- to stimulate a collective discussion among all WP6 partners on how the categorisations of the datasets may be harmonised in a reasonable way
- to implement respective harmonisations and/or extensions of the datasets

By categorisations, we refer under this task to sectorial classifications, such as economic or technological categories defined by a statistical authority or by own efforts

Task 2 workplan

Task 2 has started after finalisation of the Task 1 reports (autumn 2014)

The following work steps are to be conducted:

- I. Screening of all categorisations used in the datasets
- II. Identification of potential discussion points for harmonisations between the datasets
- III. Collective discussion on these suggestions among all partners (start at the annual RISIS week in January 2015)
- IV. Implement respective harmonisations in the datasets

Classification dimensions

- the reports on the datasets have been analysed in a systematic way to identify and list the categorisations currently in use
- Categorisations were assessed for along several dimensions of conceptual interest
 - (i) economy
 - (ii) science and technology
 - (iii) organisations
 - (iv) geography
- For each categorisation dimension, several sub-categories of interest are considered

Classifications used

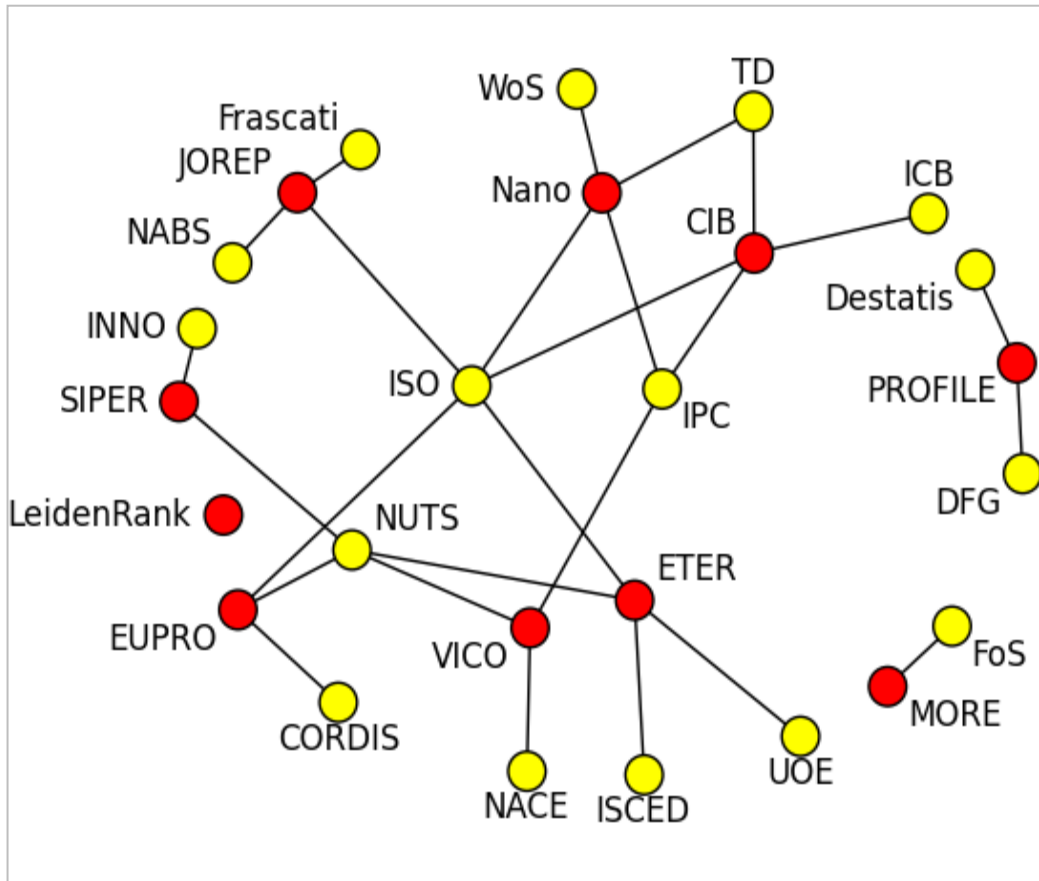
- standardised classification systems produced by different statistical authorities like Eurostat, OECD, etc.
 - CORDIS CORDIS subject index
 - Destatis DESTATIS Studienbereiche
 - DFG DFG Subject Areas
 - EC European Commission's list of associated / third countries in FP7
 - FoS Field of science and technology classification (Eurostat)
 - Frascati Frascati Manual (OECD, 2002) performing sector
 - ICB Industry Classification Benchmark
 - INNO Adapted INNO-Appraisal Scheme
 - IPC International Patent Classification (WIPO)
 - IPO Initial public offering
 - ISCED International Standard Classification of Education
 - ISO ISO Country Codes
 - NABS Nomenclature for analysis of scientific programmes and budgets (OECD, 2002)
 - NACE Statistical Classification of Economic Activities (Eurostat)
 - NUTS Nomenclature of Territorial Units for Statistics
 - TD Technology fields of patents
 - UOE UOE data collection on education systems
 - WoS Web of Science subject classifications
- custom categorisation systems produced by own efforts by the dataset maintainer

Overview on classifications used

Classification		ERA dynamics			Firm innovation dynamics		Public sector research		Research careers		Repository
Dimension	Category	EUPRO	JOEP	Nano	CIB	VICO	ETER	LeidenRank	MORE	PROFILE	SIPER
Economy	Industry Sectors	-	-	-	ICB	NACE, <i>Custom</i>	-	-	-	-	-
	R&D intensity	-	-	-	-	-	-	-	-	-	-
Science and Technology (S&T)	Scientific Fields	Cordis	-	WoS	-	-	-	<i>Custom</i>	FoS	DFG, DESTATIS	-
	Technological Fields	-	-	IPC, TD	IPC, TD	IPC	-	-	-	-	-
	Public R&D Funding Classif.	-	NABS, <i>Custom</i>	-	-	-	-	-	-	-	INNO
	Level / Fields of Education	-	-	-	-	-	ISCED	-	-	ISCED, DESTATIS	-
Organisations	Basic Type	<i>Custom</i>	Frascati	<i>Custom</i>	-	-	<i>Custom</i>	-	-	-	-
	Type of Public Organisation	-	<i>Custom</i>	-	-	-	-	-	-	-	-
Geography	National Classification	ISO	ISO	ISO	ISO	<i>Custom</i>	ISO	<i>Custom</i>	-	-	-
	Supra-National Classif.	-	-	<i>Custom</i>	<i>Custom</i>	-	-	-	-	-	-
	Sub-National Classif.	NUTS	-	<i>Custom</i>	-	NUTS	NUTS	-	-	-	NUTS
	Relative Concepts	-	-	-	-	-	UOE	-	-	-	-

Notes: Black font: standardised classification schemes used; Red font: Custom classification schemes (further details on these are given in the reports on the content and technical structure of each dataset)

Overview on classifications used: A network perspective



CORDIS: CORDIS subject index

Destatis: Destatis Studienbereiche

DFG: DFG Subject Areas

EC: European Commission's list of associated / third countries in FP7

FoS: Field of science and technology classification (Eurostat)

Frascati: Frascati Manual (OECD, 2002) research topics / performing sector

ICB: Industry Classification Benchmark

INNO: Adapted INNO-Appraisal Scheme

IPC: International Patent Classification (WIPO)

IPO: Initial public offering

ISCED: International Standard Classification of Education

ISO: ISO Country Codes

NACE: Statistical Classification of Economic Activities (Eurostat)

NUTS: Nomenclature of Territorial Units for Statistics

TD: Technology fields of patents

UOE: UOE data collection on education systems

WoS: Web of Science subject classifications

Potentials for harmonisation/extension

Classification		ERA dynamics			Firm innovation dynamics		Public sector research		Research careers		Repository
Dimension	Category	EUPRO	JOEP	Nano	CIB	VICO	ETER	LeidenRank	MORE	PROFILE	SIPER
Economy	Industry Sectors	NACE	-	NACE	ICB, NACE	NACE, Custom	-	-	-	-	-
	R&D intensity	OECD	-	OECD	OECD	OECD	-	-	-	-	-
Science	Scientific Fields	Cordis	-	WoS, FoS	-	-	FoS	Custom, FoS	FoS	DFG, DESTATIS, FoS	-
and Technology	Technological Fields	-	-	IPC, TD	IPC, TD	IPC	-	-	-	-	-
(S&T)	Public R&D Funding Classif.	NABS	NABS, Custom	-	-	-	-	-	-	-	INNO, NABS
	Level / Fields of Education	-	-	-	-	-	ISCED	-	ISCED	ISCED, DESTATIS	-
Organisations	Basic Type	Custom, Frascati	Frascati	Custom, Frascati	-	-	Custom	-	-	-	Frascati
	Type of Public Organisation	-	Custom	-	-	-	-	-	-	-	-
Geography	National Classification	ISO	ISO	ISO	ISO	Custom, ISO	ISO	Custom, ISO	ISO	ISO	ISO
	Supra-National Classif.	EC-ATC	EC-ATC	Custom	Custom	-	-	EC-ATC	-	-	EC-ATC
	Sub-National Classif.	NUTS	-	Custom, NUTS	-	NUTS	NUTS	NUTS	NUTS	NUTS	NUTS
	Relative Concepts	-	-	-	-	-	UOE	-	-	-	-

Notes:

Black font: standardised classification schemes used

Red font: Custom classification schemes (further details on these are given in the reports on the content and technical structure of each dataset)

Green font: Preliminary suggestion for potential discussion points on harmonisations; to be discussed at the RISIS week in January 2015

Cordis	CORDIS subject index
Destatis	DESTATIS Studienbereiche
DFG	DFG Subject Areas
EC-ATC	European Commission's list of associated / third countries in FP7
FoS	Field of science and technology classification (Eurostat)
Frascati	Frascati Manual (OECD, 2002) performing sector
ICB	Industry Classification Benchmark
INNO	Adapted INNO-Appraisal Scheme
IPC	International Patent Classification (WIPO)
IPO	Initial public offering
ISCED	International Standard Classification of Education
ISO	ISO Country Codes
NABS	Nomenclature for analysis of scientific programmes and budgets (OECD, 2002)
NACE	Statistical Classification of Economic Activities (Eurostat)
NUTS	Nomenclature of Territorial Units for Statistics
OECD	OECD classification of R&D intensity
TD	Technology fields of patents
UOE	UOE data collection on education systems
WoS	Web of Science subject classifications

A collective discussion

- Reflection of each partner on potential harmonisations/extensions for their own dataset
 - Is the harmonisation action relevant?
 - Is the harmonisation action feasible?
- Further suggestion from all partners
- Adding of new categorisations systems, like R&D intensity?
- Agreement on implementation by e-mail after discussion at RISIS week; preparation of respective activity sheets

Outlook and next steps Task 2

- Agreement of harmonisation actions
- Implementation and re-organisation of each dataset
- Potentially joint analysis of specific research questions using harmonised classifications
- Communication of harmonised datasets to the FCB during 2015

Outlook and next steps WP6

Task	Action	Lead partner
Task 2	<ul style="list-style-type: none"> • Development of an agreed upon harmonisation of classifications • Implementation of harmonisation; site visits of datasets 	AIT
Task 3	<ul style="list-style-type: none"> • Development of technical connectivity scheme • Implementation of technical connectivity scheme 	VUA
Task 4	<ul style="list-style-type: none"> • Development of a joint accreditation system for access to the datasets • Implementation of accreditation system (with WP2) 	UL

Appendix

ISIC Rev 3.1

International Standard Industrial Classification of All Economic Activities

- Agriculture, hunting and forestry
- Fishing
- Mining and quarrying
- Manufacturing
- Electricity, gas and water supply
- Construction
- Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
- Hotels and restaurants
- Transport, storage and communications
- Financial intermediation
- Real estate, renting and business activities
- Public administration and defence; compulsory social security
- Education
- Health and social work
- Other community, social and personal service activities
- Activities of private households as employers and undifferentiated production activities of private households
- Extraterritorial organizations and bodies

Source: <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=17>

NACE Rev 1.1

Statistical Classification of Economic Activities in the European Community

- Agriculture, hunting and forestry
- Fishing
- Mining and quarrying
- Manufacturing
- Electricity, gas and water supply
- Construction
- Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
- Hotels and restaurants
- Transport, storage and communications
- Financial intermediation
- Real estate, renting and business activities
- Public administration and defence; compulsory social security
- Education
- Health and social work
- Other community, social and personal service activities
- Activities of households
- Extraterritorial organizations and bodies

Source: http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_CLS_DLD&StrNom=NACE_1_1

NACE Rev 2

Statistical Classification of Economic Activities in the European Community

- A AGRICULTURE, FORESTRY AND FISHING
- B MINING AND QUARRYING
- C MANUFACTURING
- D ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY
- E WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES
- F CONSTRUCTION
- G WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES AND MOTORCYCLES
- H TRANSPORTATION AND STORAGE
- I ACCOMMODATION AND FOOD SERVICE ACTIVITIES
- J INFORMATION AND COMMUNICATION
- K FINANCIAL AND INSURANCE ACTIVITIES
- L REAL ESTATE ACTIVITIES
- M PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES
- N ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES
- O PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY
- P EDUCATION
- Q HUMAN HEALTH AND SOCIAL WORK ACTIVITIES
- R ARTS, ENTERTAINMENT AND RECREATION
- S OTHER SERVICE ACTIVITIES
- T ACTIVITIES OF HOUSEHOLDS AS EMPLOYERS; UNDIFFERENTIATED GOODS- AND SERVICES-PRODUCING ACTIVITIES OF HOUSEHOLDS FOR OWN USE
- U ACTIVITIES OF EXTRATERRITORIAL ORGANISATIONS AND BODIES

Source:

05.02.2015

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http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NACE_REV2&StrLanguageCode=EN&IntPcKey=8&StrLayoutCode=HIERARCHIC

Frascati Manual 2002

ISIC arranged for the purpose of R&D statistics

- Agriculture, hunting and forestry
- Mining and quarrying
- Manufacturing
 - Food, beverages and tobacco
 - Textiles, fur and leather
 - Wood, paper, printing, publishing
 - Coke, petroleum, nuclear fuel, chemicals and products, rubber and plastics
 - Non-metallic mineral products
 - Basic metals
 - Fabricated metal products, machinery and equipment, instruments and transport
 - Furniture; other manufacturing, n.e.c.
 - Recycling
- Electricity, gas and water supply
- Construction
- Services Sector
 - Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
 - Hotels and restaurants
 - Transport, storage and communications
 - Financial intermediation
 - Real estate, renting and business activities
 - Community, social and personal service activities, etc.

Source: <http://dx.doi.org/10.1787/9789264199040-en>

Frascati Manual 2002

Fields of science and technology

- Natural sciences.
 - Mathematics and computer sciences
 - Physical sciences
 - Chemical sciences
 - Earth and related environmental sciences
 - Biological sciences
- Engineering and technology.
 - Civil engineering
 - Electrical engineering, electronics
 - Other engineering sciences
- Medical sciences.
 - Basic medicine
 - Clinical medicine
 - Health sciences
- Agricultural sciences.
 - Agriculture, forestry, fisheries and allied sciences
 - Veterinary medicine
- Social sciences.
 - Psychology
 - Economics
 - Educational sciences
 - Other social sciences
- Humanities.
 - History
 - Languages and literature
 - Other humanities

Source: <http://dx.doi.org/10.1787/9789264199040-en>

FOS 2007

Field of science and technology classification (Eurostat)

FOS1

FOS101
FOS102
FOS103
FOS104
FOS105
FOS106
FOS107

FOS2

FOS201
FOS202
FOS203
FOS204
FOS205
FOS206
FOS207
FOS208
FOS209
FOS210
FOS211

FOS3

FOS301
FOS302
FOS303
FOS304
FOS305

1 Natural sciences

2 Mathematics
2 Computer and information sciences
2 Physical sciences
2 Chemical sciences
2 Earth and related environmental sciences
2 Biological sciences
2 Other natural sciences

1 Engineering and technology

2 Civil engineering
2 Electrical, electronic & information engin.
2 Mechanical engineering
2 Chemical engineering
2 Materials engineering
2 Medical engineering
2 Environmental engineering
2 Environmental biotechnology
2 Industrial Biotechnology
2 Nano-technology
2 Other engineering and technologies

1 Medical and health sciences

2 Basic medicine
2 Clinical medicine
2 Health sciences
2 Health biotechnology
2 Other medical sciences

FOS4

FOS401
FOS402
FOS403
FOS404
FOS405

FOS5

FOS501
FOS502
FOS503
FOS504
FOS505
FOS506
FOS507
FOS508
FOS509

FOS6

FOS601
FOS602
FOS603

FOS604
FOS605

NSP

1 Agricultural sciences

2 Agriculture, forestry, and fisheries
2 Animal and dairy science
2 Veterinary science
2 Agricultural biotechnology
2 Other agricultural sciences

1 Social sciences

2 Psychology
2 Economics and business
2 Educational sciences
2 Sociology
2 Law
2 Political Science
2 Social and economic geography
2 Media and communications
2 Other social sciences

1 Humanities

2 History and archaeology
2 Languages and literature
2 Philosophy, ethics and religion
Art (arts, history of arts, performing arts, music)
2 Other humanities

1 Not specified

Source: Eurostat, METADATA

Web of Science – Research Areas

- Five research domains (defined by subgroups)
 - Arts & Humanities
 - Life Sciences & Biomedicine
 - Physical Sciences
 - Social Sciences
 - Technology

Source: http://images.webofknowledge.com/WOKRS513R8.1/help/WOS/hp_research_areas_easca.html

IPC International Patent classification (WIPO)

SECTION A — HUMAN NECESSITIES

- AGRICULTURE
- FOODSTUFFS; TOBACCO
- PERSONAL OR DOMESTIC ARTICLES
- HEALTH; LIFE-SAVING; AMUSEMENT

SECTION B — PERFORMING OPERATIONS; TRANSPORTING

- SEPARATING; MIXING
- SHAPING
- PRINTING
- TRANSPORTING
- MICRO-STRUCTURAL TECHNOLOGY; NANO-TECHNOLOGY

SECTION C — CHEMISTRY; METALLURGY

- CHEMISTRY
- METALLURGY
- COMBINATORIAL TECHNOLOGY

SECTION D — TEXTILES; PAPER

- TEXTILES OR FLEXIBLE MATERIALS NOT OTHERWISE PROVIDED FOR
- PAPER

SECTION E — FIXED CONSTRUCTIONS

- BUILDING
- EARTH OR ROCK DRILLING; MINING

SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

- ENGINES OR PUMPS
- ENGINEERING IN GENERAL
- LIGHTING; HEATING
- WEAPONS; BLASTING

SECTION G — PHYSICS

- INSTRUMENTS
- NUCLEONICS

SECTION H — ELECTRICITY

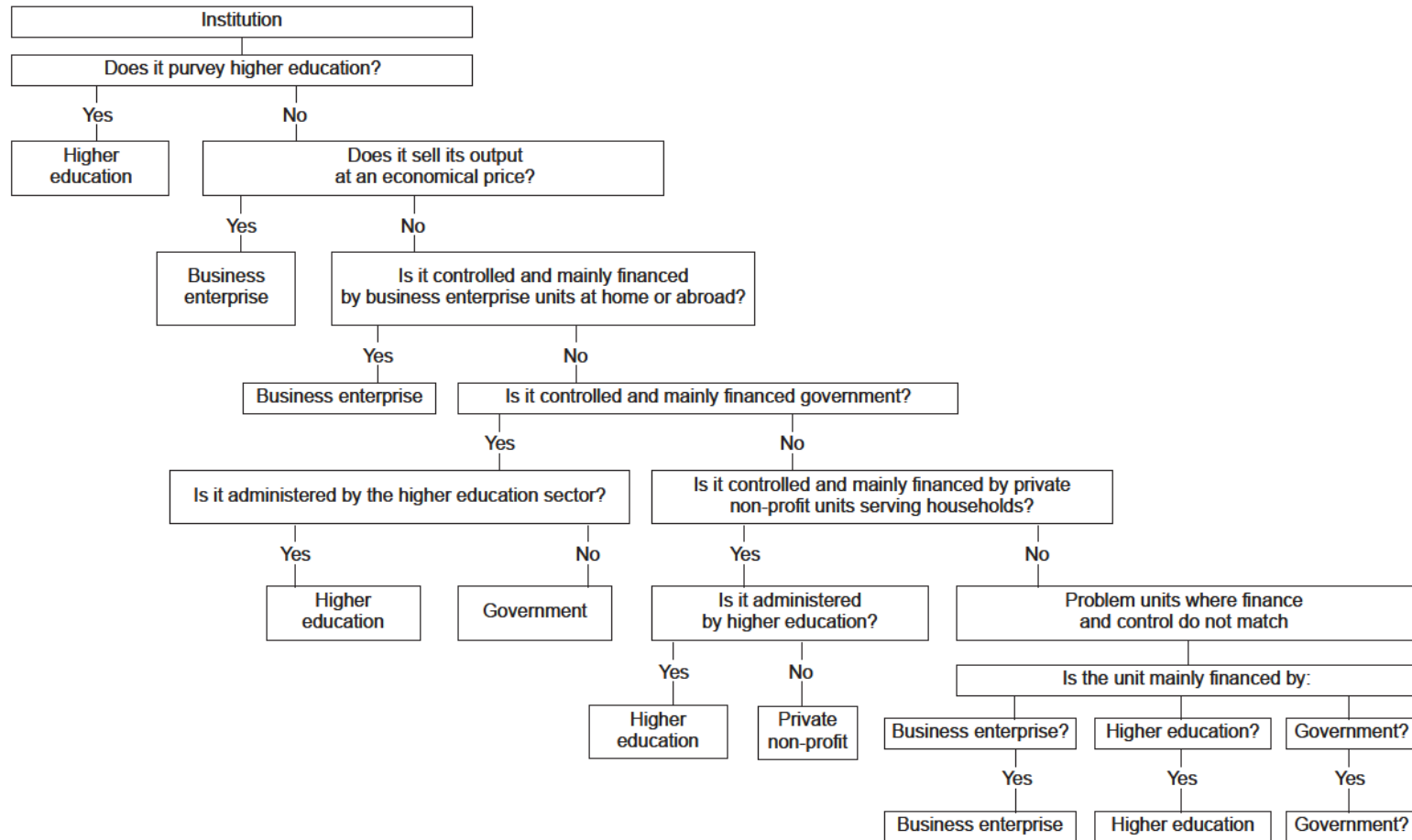
Source: <http://web2.wipo.int/ipcpub/#>

NABS 1992

(Nomenclat. for the Analysis & Comparison of Scientific Programmes & Budgets)

1. Exploration and exploitation of the Earth.
2. Infrastructure and general planning of land use.
3. Control and care of the environment.
4. Protection and improvement of human health.
5. Production, distribution and rational utilisation of energy.
6. Agricultural production and technology.
7. Industrial production and technology.
8. Social structures and relationships.
9. Exploration and exploitation of space.
10. Non-oriented research.
11. Other civil research.
12. Defence.

Decision tree for sectoring R&D units (OECD 2002)



Source: OECD.

Definition of business enterprise sector

(Frascati Manual 2002)

- Definition
 - all firms, organizations and institutions whose primary activity is the market production of goods and services (other than higher education) for sale to the general public at an economically significant price;
 - private non-profit institutions mainly serving them
- The business sector includes:
 - **private enterprises** (corporations or quasi-corporations)
 - **public enterprises** mainly engaged in market production and sale of the kind of goods and services which are often produced by private enterprises, although, the price set for these may be less than the full cost of production.
 - **non-profit institutions (NPI)**
 - NPIs engaged in market production whose main activity is the production of goods and services for sale at prices designed to recover most or all of their costs (research institutes, clinics, hospitals, medical practitioners in private, fee-paying practices, etc)
 - NPI serving business, created and managed by associations of businesses whose activities they are designed to promote (chambers of commerce and agricultural, manufacturing or trade associations)

Definition of government sector

(Frascati Manual 2002)

- Definition
 - all departments, offices and other bodies which furnish, but normally do not sell to the community, those common services, other than higher education, which cannot otherwise be conveniently and economically provided, as well as those that administer the state and the economic and social policy of the community. (Public enterprises are included in the business enterprise sector.)
 - NPIs controlled and mainly financed by the government, but not administered by the higher education sector

- 4 levels of government
 - Central and federal government units.
 - Provincial and state government units.
 - Local and municipal government units.
 - NPIs controlled and mainly financed by government

Definition of private non-profit sector

(Frascati Manual 2002)

- Definition
 - Non-market, private non-profit institutions serving households (i.e. the general public) either without charge or at prices that are not economically significant.
 - Private individuals or households
- Examples
 - professional or learned societies, charities, relief or aid agencies, trades unions, consumers' associations, etc.

Definition of higher education sector

(Frascati Manual 2002)

- Definition
 - All universities, colleges of technology and other institutions of post-secondary education, whatever their source of finance or legal status.
 - It also includes all research institutes, experimental stations and clinics operating under the direct control of or administered by or associated with higher education institutions.
- Subclassifications
 - Teaching units (e.g. faculty or departments)
 - Research institutes or centres.
 - Clinics, health centres or university hospitals.
 - Other units at the borderline of the higher education sector not elsewhere classified.

Sectoral Classification I

- Classification of economic activities
 - ISIC Rev 3.1 (International Standard Industrial Classification of All Economic Activities)
 - NACE Rev 1.1 (Statistical Classification of Economic Activities in the European Community)
 - Frascati Manual 2002 (ISIC arranged for the purpose of R&D statistics)
 - NACE Rev 2 (updated version of Rev 1.1, 2006)
 - ...

- Classification of scientific and technological fields
 - Frascati Manual 2002 (Fields of science and technology)
 - FOS 2007 – Field of science and technology classification (Eurostat)
 - Web of Science (WoS) Research Areas
 - IPC International Patent classification (WIPO)
 - ...

Sectoral Classification II

- Classification of socio-economic objectives (SEO)
 - NABS 1992 (Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets)
 - ...

Institutional Classification

- System of National Accounts (SNA, 1968/2008)
 - non-financial corporations
 - financial corporations
 - general government
 - non-profit institutions serving households
 - Households

- Frascati Manual 2002 (definition of sectors in R&D derived from the United Nations System of National Accounts)
 - Business enterprise
 - Government
 - Private non-profit
 - Higher education

- ...