



EWI Focus 12

The use of classifications for R&D monitoring

Cognitive statistical approach

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AGENDA

- Existing classifications & concordances
- Concordance methodologies & toolkit
- Illustration: concordance between IWT sectors and technology classifications
- Points of attention



CONCORDANCES

Ad hoc taxonomies:

- Thematic priorities (EC)
- Starting fields (VRWI)
- ...

Science classifications:

- ISI Thomson (WoS)
- Budapest-Leuven scheme
- ...

Technology classifications (patents):

- International patent classification (IPC)
- Fraunhofer classification (FhG)
- ...

Project classifications:

- IWT TII codes
- Departments, business lines,... in SOC's
- ...

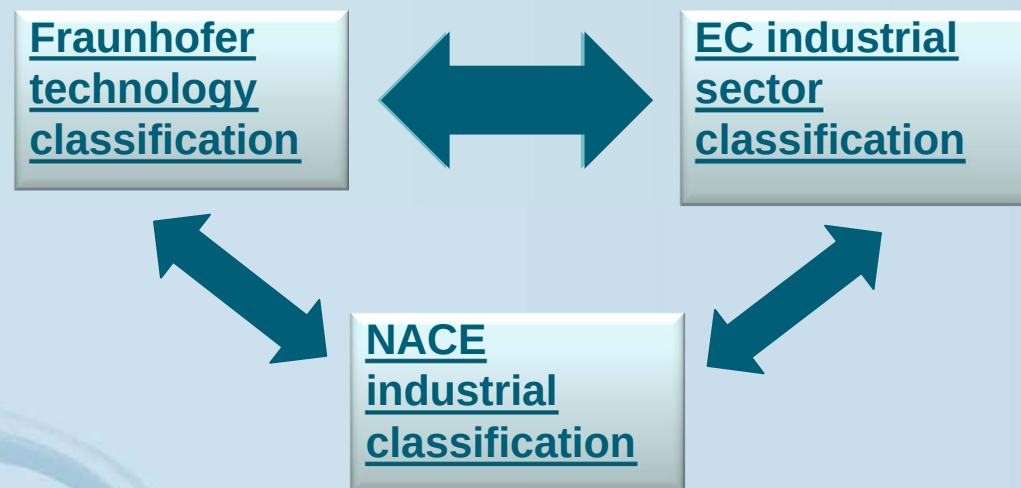
Industrial sector classifications:

- NACE
- EC classification (22 sectors)
- ...

...

METHODOLOGIES

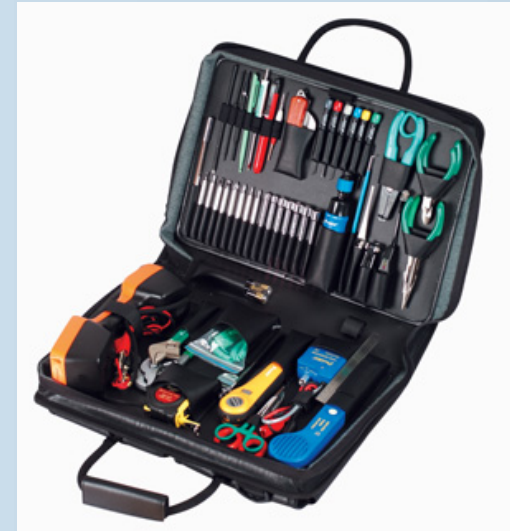
- Adopting from and reshuffling existing classifications / concordances, e.g.:



- 'Starting from scratch' (especially for new / ad hoc taxonomies): based on domain definitions, keyword searches,...

CONCORDANCE TOOLKIT

- Well-defined and up-to-date taxonomies / classification schemes
- Expert opinions
- Citation matrices
- Co-occurrence matrices



	cited FhG35																											
citing FhG35	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	2	
Electrical machinery, apparatus, energy	1	9,603692	1,1452887	0,3418369	0,0950343	0,9145406	0,3316914	0,0837335	1,7074475	0,8037741	0,7650307	0,1112845	0,7173299	0,2492033	0,1555151	0,0535162	0,0244508	0,4704875	0,0700632	0,3802175	1,2759299	0,9716642	1,3698613	0,4122075	0,2959528	0,2619101	0,4861014	0,759432
Audio-visual technology	2	1,0909934	9,959549	2,1095631	0,8673117	1,912666	2,0792759	0,8727324	1,730377	1,835666	0,5473498	0,040875	0,7803463	0,2317114	0,0790632	0,0294017	0,0160294	0,3391561	0,0169482	0,3202056	0,3314822	0,7567934	0,8529573	0,1124935	0,1233661	0,3572636	0,4403531	0,077188
Telecommunications	3	0,356631	2,0553474	10,728819	7,2494502	3,6935105	2,8588451	2,4739865	0,2373273	0,9082226	0,7613679	0,0278203	1,4348238	0,1283966	0,0082961	0,0105762	0,0106144	0,0157188	0,009061	0,016291	0,0441779	0,0493052	0,2694109	0,0249137	0,0543018	0,1069124	0,0437536	0,04323
Digital communication	4	0,0978267	0,7722944	7,2891786	20,847004	4,0236449	3,7284721	5,1169429	0,0463222	0,0770149	0,3312298	0,0162969	1,7577292	0,0495119	0,0057466	0,0117714	0,0101504	0,0045497	0,006051	0,0054227	0,0073519	0,0055563	0,0321879	0,0089177	0,0107164	0,0427438	0,0121341	0,030279
Basic communication processes	5	0,9287604	1,7368596	3,5623087	4,1346747	36,971716	2,6559505	0,1235639	1,4084392	0,1746684	1,0855946	0,0321224	1,0293319	0,1171461	0,0083037	0,0209672	0,0046627	0,0081874	0,0131398	0,0063831	0,0418895	0,0500385	1,0801463	0,0465485	0,0357822	0,0383302	0,0466722	0,148077
Computer technology	6	0,3586965	2,1051108	2,7777417	3,5222433	2,7033466	9,9722978	5,5482294	0,8429819	0,5505113	0,9576292	0,3285147	2,7707709	0,5428128	0,0424863	0,2278286	0,0531349	0,021184	0,0216078	0,0376511	0,0332181	0,0713343	0,459718	0,0902961	0,0871538	0,2421885	0,0970354	0,105057
IT methods for management	7	0,0910229	0,804146	2,5387087	4,7419659	0,1660084	5,5757953	45,615274	0,0668849	0,1606403	0,5661243	0,1916115	7,3494597	0,4299226	0,0245129	0,0813916	0,0270441	0,0108843	0,048224	0,0205795	0,015652	0,0201631	0,0629004	0,1018573	0,0951941	0,6688587	0,1441684	0,074804
Semiconductors	8	1,7627517	1,8040172	0,2235528	0,0397749	1,3475489	0,7516144	0,0817703	14,667313	2,0379625	0,7914484	0,0983802	0,2870257	0,103876	0,3590695	0,0605066	0,0252287	0,5242921	0,0140209	0,7401222	0,8332534	2,0905019	3,835067	0,3554094	0,2536674	0,2651206	0,820727	0,267177
Optics	9	0,8585843	1,8275808	0,8426891	0,0709115	0,2061305	0,5140321	0,1376902	2,0609652	10,892416	0,7196312	0,1420608	0,3128121	0,4172657	0,5641145	0,1006082	0,0539644	1,1052752	0,031048	0,7741405	0,5490639	0,7640163	2,0273147	0,2018843	0,1623389	0,3983381	0,4013395	0,170887
Measurement	10	0,8192513	0,5684359	0,7471533	0,2917485	1,2816866	0,9175984	0,4618819	0,8661571	0,7693397	9,2444637	3,7999538	1,7225812	1,005218	0,3027004	1,5290233	0,1837552	0,1045753	0,0927902	0,1152293	0,2061932	0,2432806	3,0496705	0,9266378	0,3790513	0,4951856	0,4154916	0,694399
Analysis of biological materials	11	0,1438284	0,0698786	0,033284	0,0196045	0,0484137	0,3655068	0,2402582	0,1387673	0,2081295	3,6990382	19,598182	0,1663248	0,7721798	1,3692712	9,4090421	4,2652666	0,2571834	0,4270374	0,3181112	0,1436744	0,1626031	2,1357709	1,252488	0,2946033	0,1733482	0,0532309	0,183399
Control	12	0,6736169	0,6865674	1,3757212	1,6094262	1,0916524	2,7560412	7,0921501	0,3052284	0,3184347	1,832943	0,1672547	14,402401	0,3311327	0,0221704	0,0419079	0,0140601	0,0279779	0,1096928	0,0475697	0,0832688	0,1068365	0,1833316	0,2428661	0,1936332	0,9770634	0,7053726	0,590462
Medical technology	13	0,3076854	0,2706178	0,1639812	0,0610933	0,16151	0,5224545	0,43585	0,1297371	0,4896645	1,0714403	0,798408	0,378643	12,551139	0,2414997	0,431259	1,2490348	0,5365601	0,3742643	0,3708721	0,2603187	0,4872228	0,5386429	0,6814385	0,5732345	0,7130615	0,4112386	0,349079
Organic fine chemistry	14	0,1853492	0,101853	0,0116104	0,0054975	0,0132892	0,047476	0,0256526	0,4005852	0,5833771	0,2676633	1,128834	0,0229648	0,2351555	10,266731	1,9146951	2,7927966	1,9809912	1,5537593	2,9773075	0,627773	0,2834633	0,4427898	2,2130107	0,4454108	0,0876093	0,0584259	0,07007
Biotechnology	15	0,085559	0,0511822	0,0168584	0,0165738	0,0247015	0,2620572	0,1047403	0,0992301	0,1688932	1,5493054	9,4610956	0,0636134	0,4720953	2,137052	21,657784	2,8857212	0,3913231	4,750685	0,8543589	0,1363905	0,1326863	1,7891203	1,2409668	0,6403627	0,0960193	0,0373198	0,085761
Pharmaceuticals	16	0,0338137	0,0265466	0,0147361	0,0141968	0,0146638	0,0623373	0,0571499	0,0322505	0,0892296	0,1591416	3,8488628	0,0210389	1,2609851	3,5834395	2,9397592	15,291837	0,7212695	3,288263	0,8007019	0,2119395	0,1042504	0,4067403	0,4613144	0,1222707	0,0971052	0,0539147	0,055169
Macromolecular chemistry, polymers	17	0,457649	0,3239793	0,0138184	0,0039002	0,0141645	0,0218605	0,0079303	0,485314	0,9381617	0,092234	0,2117816	0,0253694	0,4480828	9,5495612	0,3820204	0,6343994	9,3561508	0,5379728	2,6758863	0,7604888	1,1908957	0,30302	0,9209812	0,3067363	0,2582404	0,1442567	0,073923
Food chemistry	18	0,0785415	0,0230897	0,0111088	0,0068911	0,0168082	0,031788	0,0466039	0,0177136	0,0360444	0,0945885	0,4519355	0,1362108	0,3250671	1,4285506	5,5069161	3,3085238	0,5727005	39,830417	1,1939781	0,1871468	0,1808707	0,0619232	1,0217423	0,5686092	0,9123514	0,2174625	0,070847
Basic materials chemistry	19	0,3940398	0,3148341	0,017742	0,0056034	0,0134768	0,0381138	0,0253297	0,7172575	0,8371462	0,101063	0,2928627	0,0408151	0,3238958	3,0158054	0,9916991	0,7667547	2,7452062	1,19946	7,429702	1,1261234	1,1159258	0,2848415	1,2331808	0,8941937	0,2101152	0,3099797	0,276409
Materials, metallurgy	20	1,2377532	0,3198716	0,0385984	0,0065234	0,0453143	0,0323649	0,0218897	0,7377385	0,5217505	0,1846981	0,1221198	0,0904512	0,0200239	0,5621446	0,1093512	0,1732856	0,7528212	0,17343	1,1326317	13,163891	2,2418558	1,2215774	1,714672	1,9627086	0,1495692	1,5869386	0,683088
Surface technology, coating	21	0,8937936	0,7539656	0,0399106	0,0063343	0,0479779	0,074003	0,0207723	1,9853048	0,7767634	0,2196561	0,1275293	0,1181652	0,4697864	0,2862258	0,0926861	0,0931868	1,3942551	0,1776388	1,1883292	2,2303938	9,4874825	1,0359964	0,9468464	0,5783495	0,9906125	1,0837483	0,526613

CONCORDANCE TOOLKIT

- Well-defined and up-to-date taxonomies / classification schemes
- Expert opinions
- Citation matrices
- Co-occurrence matrices
- Validation and quality controls

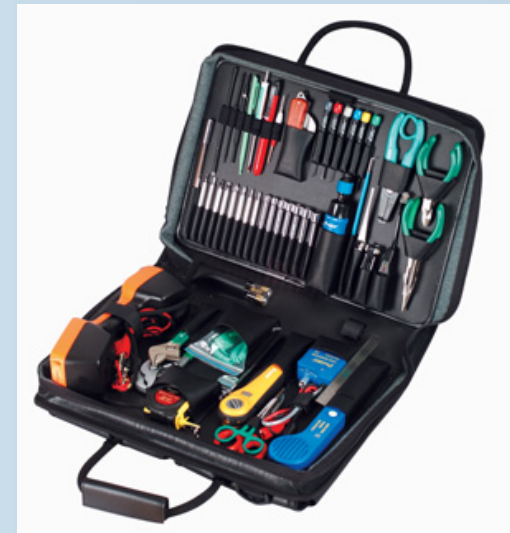
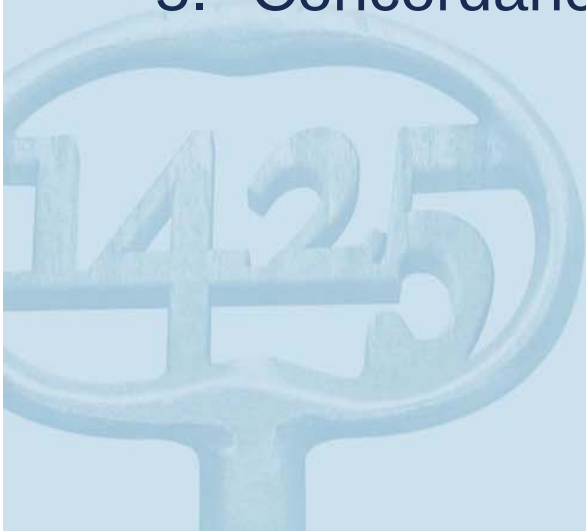


ILLUSTRATION: IWT sectors <> technology domains

STEPWISE APPROACH (a case 'from scratch'):

1. Mapping TII codes to IPC4 codes
2. Vertical reduction (of TII codes, IWT sector list)
3. Diagnosis of horizontal overlap (in IPC4 codes)
4. Citation correlation control
5. Concordance with Fraunhofer technology classification



1. Mapping TII codes on IPC4 codes

- Mapping existing TII codes on IPC4 codes (based on keywords, 'manual' / 'human rater' allocation)
 - working sheet containing all (+/- 370) TII-codes and their matching IPC4 codes.



1. Mapping TII codes on IPC4 codes (example)

TII code	Description	IPC4	IPC TITLE
7	MATERIALS PROD & PRODUCTION	B/C/F	PERFORMING OPERATIONS; TRANSPORTING/CHEMISTRY; METALLURGY/MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING
70	Basic Materials	B27/B28/C	WORKING OR PRESERVING WOOD OR SIMILAR MATERIAL; NAILING OR STAPLING MACHINES IN GENERAL/WORKING CEMENT, CLAY, OR STONE/CHEMISTRY
700	Coal Processing	C10B	Destructive distillation of carbonaceous materials for production of gas, coke, tar, or similar materials
701	Glass/Crystals	C03	GLASS; MINERAL OR SLAG WOOL
702	Leather Processing	C14	SKINS; HIDES; PELTS; LEATHER
703	Oil Processing	C10	PETROLEUM, GAS OR COKE INDUSTRIES; TECHNICAL GASES CONTAINING CARBON MONOXIDE; FUELS; LUBRICANTS; PEAT
704	Paper Processing	D21	PAPER-MAKING; PRODUCTION OF CELLULOSE
705	Rubber Processing	C08C	Treatment or chemical modification of rubbers
7050	Vulcanisation	C08C	Treatment or chemical modification of rubbers
706	Stone/Clay Processing	B28B/B28C/B28D	
707	Textiles/Fiber Processing	D01/...	NATURAL OR ARTIFICIAL THREADS OR FIBRES; SPINNING
708	Wood Processing	B27K/B27M	Processes, apparatus or selection of substances for impregnating, staining, dyeing or bleaching of wood, or for treating of wood with permeant liquids, not otherwise provided for; Chemical or physical treatment of cork, cane, reed, straw or similar materials/Working of wood not provided for in subclasses
7080	Veneering	B27D/B27L	Working veneer or plywood/ Removing bark or vestiges of branches; Splitting wood; Manufacture of veneer, wooden sticks, wood shavings, wood fibres or wood powder
71	Advanced Materials	B27/B28/C	WORKING OR PRESERVING WOOD OR SIMILAR MATERIAL; NAILING OR STAPLING MACHINES IN GENERAL/WORKING CEMENT, CLAY, OR STONE/CHEMISTRY
710	Ceramics	C04	CEMENTS; CONCRETE; ARTIFICIAL STONE; CERAMICS; REFRACTORIES
7100	Ceramic Composites	C04B	Lime; Magnesia; Slag; Cements; Compositions thereof, e.g. mortars, concrete or like building materials; Artificial stone; Ceramics; Refractories; Treatment of natural stone
711	Composites	NOT FOUND	SAME CLASS AS OTHER COMPOSITES 7100, 7111
7110	Light Alloys	C22C	Alloys

2. Vertical reduction

- Existing TII codes were re-evaluated and grouped further.
- This resulted in a vertically reduced table of 62 new IWT sectors (taking into account frequently occurring sectors and logic / intuitive connections between merged codes).



2. Vertical reduction: resulting table with IWT sectors and IPC codes

Number new IWT sector	NEW SECTOR FOR IWT	Amount of combined sectors	Dropped	CODES IPC
-	62	332	47	-
	BIOLOGY, BIOTECHNOLOGY 1			
1	Agriculture Forestry Animal/cattle breeding Fishing technology	13		A01C/A01D/A01F/A01G/A01K/A01B
2	Bioengineering Biochemical eng.	6		B01J/A61J/C01B/C01C/C01D/C01F/C01G/C12Q/C12S/C08C/C08F/C08G/C08H/C07B/C12M
3	Pharmaceuticals Biomedicine Genetic engineering	5		A61K/A61P/A61Q/C07D/C07H/C07J/C07K/C12N/C12P/C12Q
4	Microbiology Molecular Biology	6		C12C/C12F/C12G/C12H/C12J/C12M/C12N/C12P/C08B/C08C/C08F/C08G/C08H/C08J/C08L/C12Q/C12S/A01N
5	Biomaterials	2		C03/C04/C07/C08/C10/C11/C13/C14
6	Medical engineering	10		A61K/A61F/A61C/A61B/A61N/A61F/A61N
6		42	1	
	ENERGY TECHNOLOGIES 2			
7	Combustion & ignition	5		F02B/F02C/F02D/F02F/F02G/F02K/F02M/F02N/F02P/F01K/F23B/F23C/F23D/F23G/F23H/F23J/F23K/F23L/F23M/F23N/F23Q/F23R
8	Oil & gas extraction and treatment technology	9		F03B/F03C/E21B/C10B/C10L/F25J/F26B
9	Electricity generation	17		F01K/F01L/H05H/G21J/G21B/G21C/F21K/F03D/H02J/F17C
10	Energy saving	1		F24B/F24C/F24D/F24F/F24H/F24J/F25B/F25D/H02J/F17/F17C/F01K/F28D
11	Heating and cooling technology	3		F24B/F24C/F24D/F24F/F24H/F24J/F25B/F25D
12	Energy storage	4		H01M/F02C
6		39	6	
	ENVIRONMENTAL TECHNOLOGIES 3			
13	Environmental Monitoring	6		G05B G21F/G10K
14	Marine Technologies	2		B63B/B63C/B63G/B63H/B63J
15	Water Treatment	3		C02F
16	Protection Technologies	2		G21F
17	Waste Management/Treatment + Recycling Technologies 371	7		B08B/B07B/B07C
5		20	19	

2. Vertical reduction: resulting table with IWT sectors and IPC codes

	Inform. technol., Telecomm. 4			
18	Information technology application fields	6		G06F/G05B/H03M/G06T/G02F/H04N/G09C
19	Information technology systems	20		G06F/G06T/G06N/G01C/G06K/G09G/H04N H01L/G06K/G08B/G06E/G06T/G01C/G09G/H04 N/G01N/G08C/ G01Q/G10L
20	Semiconductors	1		H03H/H01L
21	Information technology - software	19		G06F/G06Q/G09B/ G10L/G06N/H04L
22	Telecommunications	4		H04J/H04N/H04Q/H04B/H04H
23	Digital communication	2		H04L
24	Space Technology	1		H04B/H04H/H04W
25	Video technology	1		G11B/H04N
	8	54	2	
	BASIC INDUSTRIAL TECHNOLOGIES 5			
26	Machinery/assembly	2		B01F
27	Electronics	5		H03B/H03C/H03D/H03H/H03J/H03F/H03G/H01B
28	Audio Technologies	1		G10BG10C/G10D/G10F/G10G/G10H/G10K/G10 L
29	Hydraulics and pneumatics	1		E02B
30	Operations Management	9		B65B/F01K/F02C/F02G/F02K/F25B/F28D/G21D
31	Measurement and Control	8		G01R/H01G/G01K/G01H/G01L/G01F/G01B/G01 S/G01V
32	Mining and drilling	2		E21C/E21B/E21C
33	Optics	6		G02B/G02C/G02F/G03B/G03C/G03D/G03F/G03 G/G03H/G01P
34	Plasma Technology	3		H05H
	9	37	12	

2. Vertical reduction: resulting table with IWT sectors and IPC codes

	SECTORAL INDUSTRIAL TECHNOL 6			
35	Agricultural Chemicals	3		C07BC07/C/C07D/C07F/C07G/C07H/C07J/C07K/C08B/C08C/C08F/C08G/C08H/C08J/C08K/C08L/C05B/C05C/C05D/C05F/C05G/A01N
36	Basic - Synthetic - Fine Chemicals	3		C01B/C01C/C01D/C01F/C01G
37	Cosmetics and Perfumes	2		C11B//A61Q
38	Ind. Chemistry and Process Engineering	3		F17D
39	Paints and Pigments - Coatings and Varnishes	1		C09B/C09C/C09D/C09F/C09G/C09H/C09J/C09K
40	Construction Building Technologies (and destruction?)	8		E01B/E01C/E01D/E01F/E01H/E04B/E04D/E04F/E04G/E04H
41	Building Construction Material	1		E04C
42	Insulation Technology	1		F16/F16B/F16C/F16D/F16F/F16G/F16H/F16J/F16K/F16L/F16M/F16N/F16P/F16S/F16T
43	Soil Mechanics	1		A01B
44	Electrical Engineering and Products/Machinery	9		H01B/H01C/H01F/H01G/H01H/H01J/H01K/H01L
45	Food Processing	23		A21B/A21C/A21D/A22B/A22C/A23B/A23C/A23D/A23F/A23G/A23J/A23K/A23L/A23N/A23P/C12P/C12C/C12G/F25D
46	Games, Sport, Leisure	4		A63B/A63C/A63D/A63F/A63G/A63H/A63J/A63K
47	Industrial Equipment and Machinery	7		B23B/B23C/B23D/B23F/B23G/B23H/B23K/B23P/B23Q
48	Laminating	1		not found
49	Mech. Eng. & Production	7		F22B/F04B/F04C/F04D/F04F
50	Mecatronics	1		not found
51	Printing/Publishing	8		B41B/B41C/B41D/B41F/B41G/B41J/B41K/B41L/B41M/B41N
52	Textiles & Processing	7		D01B/D01C/D01D/D01F/D01G/D01H//D03C/D03D/D03J/D04C/D04D/D04G/D04H/D06P
53	Transport Technologies	1		subdivisions
54	Aeronautics/Aviation	1		B64B/B64C/B64D/B64F/B64G
55	Motorvehicules	2		B62D/B60L
56	Rail	1		B60F/B60F/B61B/B61C/B61D/B61F/B61G/B61H/B61J/B61K/B61L
57	Road	1		B60F/B62B/B62C/B62D/B62H/B62J/B62K/B62M
58	Shipbuilding	1		B63B/B63C/B63G/B63H/B63J
	24	97	6	

2. Vertical reduction: resulting table with IWT sectors and IPC codes

	MATERIALS PROD & PRODUCTION 7			
59	Materials previously considered traditional	12		C10B/C10L/C10G/C03C/D21/B31/C08C/B28B/B28C/B28D D01 t.e.m. D07 B27K/B27M/B27D/B27L
60	Advanced materials	14		C04B/C22C/C09F/B29B/B29C/B29D/C10G/C08F/C08L/G01N
61	Metallurgy	13		C09J/F16D/B22C/B22D/B22F/C21B/C21C/C21D/C22B/C23F/B23K/C25D/C23C/B32B/C01B/C22/B21C/B21D/B21H/B24B/C23C/B05/B23H/C03C/C04B/09D/C23D/C23F/C30B/F23D/F23G/C21D/H05B/B01J
62	Macromolecular chemistry, polymers	4		C09J/F16D
	4	43	1	

3. Diagnosis of horizontal overlap

- Diagnosing overlapping IPC codes across the defined 62 IWT sectors:
 - 3 sectors merged with other sectors
 - 1 sector was eliminated because of complete overlap

35	Agricultural Chemicals	Organische Chemie	merge with 36 : chemicals	C07BC07/C/C07D/C07F/C07G/C07H/C07J/C07K/C08B/C08C/C08F/C08G/C08H/C08J/C08K/C08L/C05B/C05C/C05D/C05F/C05G/A01N
36	Basic - Synthetic - Fine Chemicals	Inorganische Chemie	merge with 35: Agr. Chemicals	C01B/C01C/C01D/C01F/C01G
44	Electrical Engineering and Products	Elektrische bouwkunde	Merge with 47 industr. Equipm. & Mach.	H01B/H01C/H01F/H01G/H01H/H01J/H01K/H01L
47	Industrial Equipment and Machinery	Industriële uitrusting en machines	Merge with 44 Electr. Eng. & Prod.	B23B/B23C/B23D/B23F/B23G/B23H/B23K/B23P/B23Q
59	Materials previously considered traditional	traditioneel beschouwde materialen	merge with 60	C10B/C10L/C10G/C03C/D21/B31/C08C/B28B/B28C/B28D/D01 t.e.m. D07
60	Advanced materials	nieuwe materialen	merge with 59	B27K/B27M/B27D/B27L C04B/C22C/C09F/B29B/B29C/B29D/C10G/C08F/C08L/G01N
62	Macromolecular chemistry, polymers	Macromoleculaire chemie, polymeren	drop	C09J/F16D (are also in Paints & Varnishes 39 and Insulation techn. 42)

- Resulting in a new list of 58 IWT sectors.

4. Citation correlation control

- Sample: period 1996 to 2010 → citation numbers per grouped IPC3 combinations
- Correlations between citation numbers for the different IPC3 classes per IWT sector → results generally satisfactory (correlations between 0,7 and 0,9).
- For lower coefficients: re-evaluation of IPC classes and if needed, reshuffle to other domains:
 - 10 (Energy saving) and 11 (Heating, Cooling) merged due to overlapping IPC codes.
 - 16 (Protection technologies) eliminated due to lack of concurring IPC codes.
 - 20 (Semi-conductors) and 27 (Electronics) merged due to overlapping IPC codes.
 - 49 (Transport) technologies eliminated (= aggregation of all transport).
- Resulting in a list of 54 IWT sectors

5. Concordance with Fraunhofer technology classification

- Concordance of resulting list (54 IWT sectors) with Fraunhofer technology classifications (30 / 35 domains): to provide a more transparent picture (based on manual evaluation).
- Final validation by IWT partner, leading to the split of 2 sectors.

→ Resulting in final list of 56 IWT sectors



5. Concordance with Fraunhofer technology classification

IWT nr	IWT sector	FhG35	Title_IPC35
1	Aeronautics/Aviation	32	Transport
2	Agricultural chemistry	18	Food chemistry
		19	Basic materials chemistry
3	Agricultural engineering	29	Other special machines
4	Assembly	31	Mechanical elements
5	Audio Technologies	2	Audio-visual technology
		5	Basic communication processes
6	Basic - Synthetic - Fine Chemicals	17	Macromolecular chemistry, polymers
		19	Basic materials chemistry
7	Basic Materials (first refining of raw materials: cement, glass, slagwool? Wooden articles...)	14	Organic fine chemistry
		17	Macromolecular chemistry, polymers
		19	Basic materials chemistry
8	Bioengineering Biochemical eng.	15	Biotechnology
9	Biomaterials	14	Organic fine chemistry
		15	Biotechnology
10	Building Construction Material	20	Materials, metallurgy
11	Building Repairs/Maintenance	31	Mechanical elements
12	Chemical Engin. and Production	23	Chemical engineering
13	Combustion & ignition	27	Engines, pumps, turbines
14	Construction Building Technologies (and destruction?)	35	Civil engineering
15	Cosmetics and Perfumes	14	Organic fine chemistry
			Pharmaceuticals (IPC Not present in Patstat 09/2009)
		16	

5. Concordance with Fraunhofer technology classification

IWT nr	IWT sector	FhG35	Title_IPC35
16	Derivative Materials (from fossil fuel: plastics)	14	Organic fine chemistry
		17	Macromolecular chemistry, polymers
		19	Basic materials chemistry
17	Digital communication	6	Computer technology
		7	IT methods for management
18	Electrical Engineering and Products	1	Electrical machinery, apparatus, energy
		12	Control
		2	Audio-visual technology
		22	Micro-structure and nano-technology
19	Electricity generation	27	Engines, pumps, turbines
20	Electronics/Semiconductors	8	Semiconductors
21	Energy storage	1	Electrical machinery, apparatus, energy
		12	Control
		2	Audio-visual technology
		22	Micro-structure and nano-technology
22	Environmental Monitoring	24	Environmental technology
23	Food Processing	29	Other special machines
24	Games, Sport, Leisure	24	Environmental technology
		26	Machine tools
		33	Furniture, games
		34	Other consumer goods
25	Heating and cooling technology	30	Thermal processes and apparatus

5. Concordance with Fraunhofer technology classification

IWT nr	IWT sector	FhG35	Title_IPC35
26	Hydraulics and pneumatics	27	Engines, pumps, turbines
27	Information technology - software	6	Computer technology
		7	IT methods for management
28	Information technology application fields	6	Computer technology
		7	IT methods for management
29	Information technology systems	6	Computer technology
		7	IT methods for management
30	Insulation Technology	24	Environmental technology
31	Machines Eng. & Production	26	Machine tools
32	Marine Technologies		
		24	Environmental technology
33	Measurement and Control	10	Measurement
		12	Control
		14	Organic fine chemistry
34	Mechatronics	1	Electrical machinery, apparatus, energy
		12	Control
		2	Audio-visual technology
		22	Micro-structure and nano-technology
35	Medical engineering	13	Medical technology
36	Metallurgy	20	Materials, metallurgy
37	Microbiology		
	Molecular Biology		
	Genetic engineering	15	Biotechnology
38	Mining and drilling	35	Civil engineering
39	Motorvehicules	32	Transport
40	Nuclear Technology	13	Medical technology
		23	Chemical engineering
		24	Environmental technology
		27	Engines, pumps, turbines

5. Concordance with Fraunhofer technology classification

IWT nr	IWT sector	FhG35	Title_IPC35
41	Oil & gas extraction and treatment technology	27	Engines, pumps, turbines
42	Optics	9	Optics
43	Paints and Pigments - Coatings and Varnishes	21	Surface technology, coating
44	Pharmaceuticals Biomedicine	14	Organic fine chemistry
		16	Pharmaceuticals
			Pharmaceuticals (IPC Not present in Patstat 09/2009)
45	Plasma Technology	2	Audio-visual technology
		5	Basic communication processes
46	Printing/Publishing	24	Environmental technology
		25	Handling
		28	Textile and paper machines
47	Rail	32	Transport
48	Road	32	Transport
49	Shipbuilding	32	Transport
50	Soil Mechanics	27	Engines, pumps, turbines

5. Concordance with Fraunhofer technology classification

IWT nr	IWT sector	FhG35	Title_IPC35
51	Space Technology	19	Basic materials chemistry
		29	Other special machines
		32	Transport
52	Telecommunications	3	Telecommunications
		4	Digital communication
		5	Basic communication processes
		23	Chemical engineering
53	Textiles & Processing	28	Textile and paper machines
		29	Other special machines
		2	Audio-visual technology
54	Video technology	5	Basic communication processes
55	Waste Management/Treatment Recycling Technologies		
56	Water Treatment	24	Environmental technology
		24	Environmental technology

POINTS OF ATTENTION

1. Coverage on both sides of the concordance?

- Depending on the objective of the scheme
- E.g. 1: science-technology concordance, based on scientific references in patents: limited coverage of scientific disciplines
- E.g. 2: concordance between industrial sectors and technology domains: no coverage of service-related sectors on the technology side

2. Need for continuous revisions and updates (due to changing taxonomies)

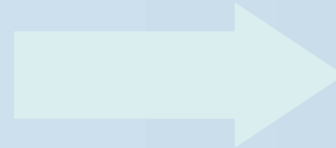
- E.g. NACE 1 becomes NACE 2: merging of sectors, splitting of sectors
 - need for review of existing concordance with IPC domains
 - diagnosis of transitions sometimes uncovers bugs in existing, established taxonomies (iterative feedback loops)



NACE version 1



NACE version 2



POINTS OF ATTENTION

1. Coverage on both sides of the concordance?

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- E.g. NACE 1 becomes NACE 2: merging of sectors, splitting of sectors
 - need for review of existing concordance with IPC domains
 - diagnosis of transitions sometimes uncovers bugs in existing, established taxonomies (iterative feedback loops)

3. Highly “organic” process

- Mutual feedback loops
- Iterations
- Importance of expert validation throughout all stages

Thank you for your attention!

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I. Electrical engineering

1. Electrical machinery and apparatus, electrical energy
2. Audio-visual technology
3. Telecommunications
4. Information technology
5. Semiconductors

II. Instruments

6. Optics
7. Analysis, measurement, control technology
8. Medical technology
9. Nuclear engineering

III. Chemistry, pharmaceuticals

10. Organic fine chemistry
11. Macromolecular chemistry, polymers
12. Pharmaceuticals, cosmetics
13. Biotechnology
14. Agriculture, food chemistry
15. Chemical and petrol industry, basic materials chemistry
16. Surface technology, coating
17. Materials, metallurgy

IV. Process engineering, special equipment

18. Chemical engineering
19. Materials processing, textiles, paper
20. Handling, printing
21. Agricultural and food processing, machinery and apparatus
22. Environmental technology

V. Mechanical engineering, machinery

23. Machine tools
24. Engines, pumps, turbines
25. Thermal processes and apparatus
26. Mechanical elements
27. Transport
28. Space technology, weapons

VI. Consumption

29. Consumer goods and equipment
30. Civil engineering, building, mining

FhG 35

1. Electrical machinery, apparatus, energy
2. Audio-visual technology
3. Telecommunications
4. Digital communication
5. Basic communication processes
6. Computer technology
7. IT methods for management
8. Semiconductors
9. Optics
10. Measurement
11. Analysis of biological materials
12. Control
13. Medical technology
14. Organic fine chemistry
15. Biotechnology
16. Pharmaceuticals
17. Macromolecular chemistry, polymers
18. Food chemistry
19. Basic materials chemistry
20. Materials, metallurgy
21. Surface technology, coating
22. Micro-structure and nano-technology
23. Chemical engineering
24. Environmental technology
25. Handling
26. Machine tools
27. Engines, pumps, turbines
28. Textile and paper machines
29. Other special machines
30. Thermal processes and apparatus
31. Mechanical elements
32. Transport
33. Furniture, games
34. Other consumer goods
35. Civil engineering

NACE 22 (EC)

EC NACE22

0. IPC's without any (unambiguous) link to one of the EC 22 NACE industries (27,9%)
1. Manufacture of food products and beverages and manufacture of machinery for these products (15 + 29.53)
2. Manufacture and sales of textiles and manufacture of machinery for these products (17+ 29.54 + 51.41/2 + 51.83 + 52.41/2)
3. Reproduction of recorded media and related manufactured goods (22.3 + 24.64/5)
4. Manufacture of basic chemicals and manufacture of paints, varnishes and similar coatings, and glues and gelatines (24.1 + 24.3 + 24.62)
5. Manufacture of pharmaceuticals (24.4)
6. Manufacture of plastic products (25.2)
7. Manufacture of other non -metallic mineral products (26)
8. Manufacture of general purpose machinery and machine tools (29.1 + 29.2 + 29.4)
9. Manufacture of office machinery and computers (30)
10. Manufacture of electrical motors, generators and transformers (31.1)
11. Manufacture of electricity distribution and control apparatus; manufacture of insulated wire and cable; manufacture of accumulators, primary cells and primary batteries; electricity, gas, steam and hot water supply (31.2 +31.3 + 31.4 + 40)
12. Manufacture of electronic valves and tubes and other electronic components (32.1)
13. Manufacture of medical and surgical equipment (33.1)
14. Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, industrial process control equipment and optical instruments and photographic equipment (33.2 + 33.3 + 33.4)
15. Manufacture of motor vehicles, manufacture of parts and accessories for motor vehicles and their engines (34.1 + 34.3)
16. Manufacture of aircraft and spacecraft (35.3)
17. Recycling (37)
18. Collection, purification and distribution of water (41 + 45. 24)
19. Construction (45 except 45.24)
20. Cargo handling and storage (63.1)
21. Telecommunications (64.2)
22. Services for computer and related activities (72 except 72.5)