AN INTERNATIONAL DELPHI POLL ON FUTURE TRENDS IN "INFORMATION LINGUISTICS"

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ABSTRACT

The results of an international Delphi poll on information linguistics which was carried out between 1982 and 1983 are presented.

As part of conceptual work being done in information science at the University of Constance an international Delphi poll was carried out from 1982 to 1983 with the aim of establishing a mid-term prognosis for the development of "information linguistics". The term "information linguistics" refers to a scientific discipline combining the fields of linguistic data processing, applied computer science, linguistics, artificial intelligence, and information science. A Delphi poll is a written poll of experts - carried out in this case in two phases. The results of the first round were incorporated into the second round, so that participants in the poll could react to the trends as they took shape.

1. Some demoscopic data

1.1 Return rate

Based on sophisticated selection procedures 385 international experts in the field of information linguistics were determined and were sent questionnaires in the first round (April 1982). 90 questionnaires were returned. In the second round 360 questionnaires were mailed out (January 1983) and 56 were returned, 48 of these from experts who had answered in the first round. The last questionnaires were accepted at the end of June 1983.

Overlapping data in the two rounds

first round (90)		second round (56)
2	48	8

In the following we refer to four sets of data:
Set_A 90 from round 1
Set_B 48 from round 1 with answers in round 2
Set_C 56 from round 2
Set_D 48 from round 2 with answers in round 1

But we shall concentrate primarily on Set_C because - according to the Delphi philosophy - the data of the second round are the most relevant. There were 8 persons within Set_C who did not answer in the first round. But they also were aware of the results of the first round; therefore a Delphi effect was possible. (In the following the whole integers refer to absolute numbers; the decimal figures to relative/procentual numbers)

1.2 Qualification according to academic degree

The survey singled out highly competent people, as reflected in academic degree(data from A and C):

Tab.1 Qualification of participants

	Set_A		Set_C	
B.S./B.A	23	25.6	16	28.6
M.S./M.A./Dipl.	40	44.4	28	50.0
Ph.D./Dr.	62	68.9	37	66.1
Professor	14	15.6	15	26.8

1.3 Age

Since Delphi polls are concerned with future developments, it has been claimed in the past that the age and experience of people in the field influence the rating. In this paper, however, we cannot prove this hypothesis. Here are the mere statistical facts, only taken from Set_C (they do not differ significantly in the other sets)

Tab.2 Age of participants

-30	30-35	36-40	41-45	46-50	50- years
3 5.6	14 25.9	14 25.9	10 18.5	5 9.3	8 14.8

1.4 Experience

The number of years these trained specialists have been working in the general area of information linguistics were as follows

Tab.3 Experience in information linguistics

-2	3-5	6-10	10- years of experience
3 5.6	7 13.0	13 24.1	31 57.4

These data in particular confirm our impression that very qualified and experienced people answered the questionnaire. Almost 60% have worked longer than 10 years in the general area of information linguistics.

1.5 Size of research groups

Most of those answering the questionnaire work in a research-group. Table 4 gives an impression of the size of the groups in Set_A and Set_C:

Tab.4 Size of research groups

	1-2	3-5	6-10	11-50	50 -
Set_A	16 19.0	25 29.8	21 25.0	18 21.4	4 4.8
Set_C	14 26.4	17 32.1	12 22.6	8 15.1	2 3.8

1.6. Represented subject fields

Among those answering in the two rounds, the following fields were represented:

Tab.5 Scientific background of participants

	Set_A	Set_C
information science	32 35.6	17 30.4
computer science	36 40.0	20 35.7
linguistics	21 27.3	16 28.6
natural sciences/ mathematics	15 16.7	12 21.4
engineering	3 3.3	2 3.6
humanities/social sciences	15 16.7	12 21.4

1.7 Research and application/development

With respect to whether participants are mainly involved in research (defined as: basic groundwork, mainly of theoretical interest, experimental environment) or in application/development (defined as: mainly of interest from the point of view of working systems (i.e. commercial, industrial), applicable to routine tasks) the results were as follows:

Tab.6 Involved in research or application

	Set_A	Set_B	Set_C	Set_D
research	59 65.6	31 64.6	39 69.6	33 68.8
application	27 30.0	16 33.3	16 28.6	15 31.3

1.8 Working environment

Tab.7 Types of institutions

	Set_A	Set_C
university	45 50.0	30 53.6
research institute	7 7.8	4 7.1
industrial research	17 18.9	12 21.4
information industry	8 8.9	2 3.6
indust. administ.	-	1 1.8
public administration	8 8.9	4 7.1
public inf. systems	3 3.3	2 3.6

Most of the work in information linguistics so far has concentrated on English (generally more than 80%, with slight differences in the single sub-areas, i.e. acoustic 80.6%, indexing 82.5%, question-answering 83.3%).

2. Content of the questionnaire

2.1 Sub-areas

The discipline "information linguistics" was not defined theoretically but ostensively instead by a number of sub-areas.

		abreviation
1.	Acoustic/phonetic procedures	Ac
2.	Morphological/syntactic procedures	Mo
3.	Semantic/pragmatic procedures	Se
4.	Contribution of new hardware	Ha
5.	Contribution of new software	So
6.	Information/documentation languages	Il
7.	Automatic indexing	In
8.	Automatic abstracting	Ab
9.	Automatic translation	Tr
10.	Reference and data retrieval systems	Re
11.	Question answering and understanding systems	Qu

2.2 Single topics

The sub-areas included a varying number of topics (from 6 to 15). These topics were chosen based on the author's experience in information linguistics, on a pre-test with mostly German researchers and practitioners, on advices from members of FID/LD, and on long discussions with Don Walker, Hans Karlgren, and Udo Hahn. Altogether, there were 91 topics in the first round and 90 in the second round, as follows:.

ac1 Segmentation of Acoustic Input
ac2 Speaker Dependent Speech Recognition
ac3 Speaker Independent Speech Recognition
ac4 Speech Understanding
ac5 Identification of Intonational/Prosodic Information with respect to Syntax
ac6 Identification of Intonational/Prosodic Information with respect to Semantics
ac7 Automatic Speech Synthesis

mo1 Automatic Correction of Incomplete or False Input
mo2 Analysis of Incomplete or Irregular Input
mo3 Morphological Analysis (Reduction Algorithms)
mo4 Automatic Determination of Parts of Speech
mo5 Automatic Analysis of Functional Notions
mo6 Partial Parsing Recognition Techniques
mo7 Partial Parsing Transformation Techniques
mo8 Recognition of Syntactic Paraphrases
mo9 Recognition of Textual Paraphrases
mo10 Question Recognition
mo11 Grammars of Syntactic Parsing of Unrestricted Natural Language Input

se1 Semantic Classification of Verbs or Predicates
se2 Organizing Domain-Specific Frame/Script-Type Structures
se3 Semantically Guided Parsing
se4 Semantic Parsing

se5 Knowledge Acquisition
se6 Analysis of Quantifiers
se7 Analysis of Deictic Expressions
se8 Analysis of Anaphoric/Cataphoric Expressions (Pronominalization)
se9 Processing of Temporal Expressions
se10 Establishment of Text Cohesion and Text Coherence
se11 Recognition of Argumentation Patterns
se12 Management of Vague and Incomplete Knowledge
se13 Automatic Management of Plans
se14 Formalizing Speech Act Theory
se15 Processing of 'Unpragmatical' Input

ha1 Personal Computers for Linguistic Procedures
ha2 Parallel Processing Systems
ha3 New Mass Memory Technologies
ha4 Associative Memory
ha5 Terminal Support
ha6 Hardware Realization of Natural Language Analysis Procedures
ha7 Communication Networks

so1 Standard Programming Languages for Information Linguistics
so2 Development of Modular Standard Programs (Hardware-Independent)
so3 Natural Language Programming
so4 Parallel Processing Techniques
so5 Alternative File Organization
so6 New Database System Architecture for the Purpose of Information Linguistics
so7 Flexible Data Management Systems

il1 Compatibility of Documentation Languages in Distributed Networks
il2 Enrichment of Information Languages by Statistical Relations
il3 Enrichment of Information/Documentation Languages by Linguistic Semantics
il4 Enrichment of Higher Documentation Languages by Artificial Intelligence Methods
il5 Standardization of Information/Documentation Languages
il6 Documentation Languages for Non-Textual Data
il7 Information/Documentation Languages for Heterogeneous Domains
il8 Determination of Linguistic Relations
il9 Adaptation of Ordinary Language Dictionary Databases
il10 (cancelled in the second round)
il11 Statistical Models of Domain-Specific Scientific Languages

in1 Improvement of Automatic Indexing by Morphological Reduction Algorithms
in2 Improvement of Automatic Indexing by Syntactic Analysis
in3 Improvement of Automatic Indexing by Semantic Approaches
in4 Probabilistic Methods of Indexing
in5 Indexing Functions
in6 Automatic Indexing of Full-texts

ab1 Abstracting Methodology
ab2 Automatic Extracting
ab3 Automatic Indicative Abstracting
ab4 Automatic Informative Abstracting
ab5 Automatic Positional Abstracting
ab6 Graphic Representation of Text Structures

tr1 Development of Sophisticated Multi-Lingual Lexicons
tr2 Automatic Translation of Restricted Input
tr3 Interactive Translation Systems
tr4 Fully Automatic Translation Systems
tr5 Multilingual Translation Systems
tr6 Integration of Information and Translation Systems

re1 Iterative Index and/or Query Modification by Enrichment of Term Relations
re2 Natural Language Front-End to Database Systems
re3 Graphic Display for Query Formulation support
re4 Multi-Lingual Databases and Search Assistance
re5 Public Information Systems

qu1 Integration of Reference Retrieval and Question Answering Systems
qu2 Linguistic Modeling of Question/Answer Interaction
qu3 Formal Dialogue Behavior
qu4 Belief Structures
qu5 Heuristic/Common Sense Knowledge
qu6 Change of Roles in Man-Machine Communication
qu7 Automatic Analysis of Phatic Expressions
qu8 Inferencing
qu9 Variable Depth of System Answers
qu10 Natural Language Answer Generation

Each topic was defined by textual paraphrase, e.g. for ab4: "procedures of text condensation that stress the overall, true-to-scale compression of a given text; although varying in length (according to the degree of reduction); can be used as a substitute for original texts".

3. Answer parameters for the sub-areas

3.1 Competence (=CO)

At the beginning of every sub-area participants were requested to rate their competence according to three parameters "good" (with a specialist's knowledge), "fair" (with a working knowledge), and "superficial" (with a layman's knowledge). Tab.8 shows the self-estimation of competence within the sub-areas (data taken from Set_C):

Tab. 8 Competence

	good	rank	fair	rank	superficial	rank
Ac	4	11	14	8	34	1
Mo	25	3	17	5	8	7
Se	24	4	17	5	10	5
Ha	13	10	23	1	14	3
So	18	7	22	2	8	7
Il	18	7	18	4	12	4
In	21	6	17	5	9	6
Ab	14	9	20	3	16	2
Tr	24	4	5	11	0	11
Re	31	2	12	10	8	7
Qu	32	1	13	9	7	10

Tab.9 Desirability

	++	+	-	--
In	19	19	1	0
Ab	21	22	4	0
Tr	33	11	1	0
Re	35	13	0	0
Qu	35	8	3	0

3.2 Desirability (=DE)

With respect to the application oriented subject areas the category of desirability was used in order to determine the social desirability according to the following 4-point scale: "very desirable"/++ (will have a positive social effect, little or no negative social effect, extremely beneficial), "desirable"/+ (in general positive, minor negative social effects), "undesirable"/- (negative social effect, socially harmful), "very undesirable"/-- (major negative social effect, socially not justifiable).

Tab.9 (data from Set C) shows that the negative parameters (—, -) were never or only seldom used. Information linguistics is not judged - according to the estimation of the experts - as a socially harmful scientific discipline.

4. Answer parameters for the single topics

The following parameters were used as ratings for the sub-areas and the single topics. Their definitions were given in more detail in the questionnaire.

Tab.10 Evaluation parameters

IMPORTANCE(=I)	FEASIBILITY(=F)	DATE OF REALIZ. (=DR)
++ very i.	++ def. f.	realized
+ i.	+ poss. f.	1984 +/-2
		1989 +/-3
		1996 +/-10
- slightly i.	- doubtf. f.	2010 +/-10
—·un-i.	—def. un-f.	non-realistic

These categories of scientific importance, feasibility, and date of realization were to be judged from two points of view:

research(=R) - defined as: basic groundwork, mainly of theoretical interest

application/development (=A) - defined as: mainly of interest for working systems, applicable to routine tasks

Therefore every single topic was evaluated according to six parameters:

Importance for research I/R
Importance for application I/A
Feasibility for research F/R
Feasibility for application A/A
Date of realization considering research DR/R
Date of realization considering application DR/A

5. More detailed results

5.1 Sub-areas

5.1.1 Competence

Competence was an important influence on evaluation. In general one can say that people with "good" competence (or more correctly: with competence estimation of "good") in a sub-area gave topics higher ratings for importance and feasibility both from the research and the application points of view. Nevertheless, there were differences. Those with "good" competence differed more widely in evaluations of research-oriented topics than in application-oriented topics, whereas those with "superficial" competence in the sub-areas were closer to the average in their evaluations of application-oriented topics than of research-oriented topics. Here are some examples of the differences (as reflected in the averages of the sub-areas). Tab. 11 is to be read as follows: (line 1) in the sub-area "Acoustic" those with "good" competence evaluated 5.6% higher than the average with respect to importance for research, whereas people with "superficial" competence in the same sub-area evaluated 6.9% lower than average.

Tab.11 Competence differences

(g=good;s=superficial)

I/R		I/A		F/R		F/A	
CO/g	CO/s	CO/g	CO/s	CO/g	CO/s	CO/g	CO/s
Ac5.6+	3.0-	In4.7+	5.1-	Ac25.1+	3.9-	Ac9.4+	0.6-
Ha1.8+	9.3-	Ab4.3+	13.8-	Se1.1-	5.8+	Ha7.5+	7.0-
In5.4+	19.8-			In6.2+	19.4-	In5.0+	19.4-
Ab7.2+	8.4-						

As can be seen in the column F/R, sometimes the general trend is reversed (Semantic: values from "competent" participants are lower than from participants with "superficial" competence).

5.1.2 Desirability

There is also a connection between desirability and the values of importance and feasibility. Those who gave high ratings for desirability (DE++) in general gave higher values to the single topics in the respective sub-areas, both in comparison to the average values and to the values of those who gave only high desirability (DE+) to a given sub-area. The differences between DE++ and DE+ are even higher than those between C/g und C/s. Only the F/R data in the translation and retrieval areas are lower for D++ than for D+, in all other cases the D++ values are higher. Some examples:

Tab.12 Desirability differences

	I/R		I/A		F/R		F/A	
	DE++	DE+	DE++	DE+	DE++	DE+	DE++	DE+
In	6.6+	4.3-	4.5+	4.9-	6.9+	10.9-	11.4+	15.3-
Ab	6.8+	0.6-	13.2+	5.8-	0.9+	0.2+	7.9+	4.3-
Tr	2.8+	5.9-	0.4+	1.1-	2.1-	8.3+	2.9+	3.2-
Re	1.9+	8.3-	0.1+	-	0.2-	0.6+	2.0+	4.1-
Qu	4.0+	8.1-	7.5+	14.2-	3.8+	11.4-	7.7+	23.5-

5.1.3 Importance, Feasibility, Date of Realization

(In the following tables the values of the answers ++ (very important, definitely feasible) and + (important, possibly feasible) have been added

together, and the values from the single topics have been averaged. Exact year-data were calculated from the answers on the 6-point rating scale, cf. Tab.10. In order to show the Delphi effect the data in Tab. 13 are taken from Set_A, in Tab.14 from Set_C)

Tab.13 Averaged I-, F-, DR-values from Set A

	Importance		Feasibility		Realization	
	I/R	I/A	F/R	F/A	DR/R	DR/A
Ac	85.4	82.5	62.5	49.4	1997	2000
Mo	84.0	87.7	84.1	75.9	1987	1990
Se	89.2	81.2	67.5	53.3	1995	1999
Ha	84.8	87.9	84.6	76.0	1986	1991
So	88.1	88.9	80.8	72.1	1988	1994
IL	77.6	79.0	83.1	74.6	1987	1993
In	90.2	90.0	79.9	74.7	1986	1990
Ab	79.8	77.7	69.2	58.7	1991	1997
Tr	87.5	87.1	72.3	63.0	1994	1998
Re	87.7	90.7	86.8	78.3	1985	1989
Qu	87.5	80.2	74.2	61.1	1991	19989

Tab.14 Averaged I-, F-, DR-values from Set C

	I/R	I/A	F/R	F/A	DR/R	DR/A
Ac	90.9	84.0	64.2	46.4	1998	2001
Mo	90.1	89.3	88.4	78.6	1987	1991
Se	92.6	83.4	70.3	49.4	1996	2000
Ha	82.4	83.8	88.6	75.8	1987	1993
So	88.0	88.3	80.1	67.5	1989	1996
IL	82.8	83.4	88.0	77.0	1988	1997
In	89.4	90.5	89.6	79.2	1986	1991
Ab	75.6	75.0	68.8	52.3	1992	1999
Tr	89.3	91.5	69.7	53.2	1994	2000
Re	83.8	91.7	91.7	83.9	1986	1991
Qu	88.4	80.8	76.8	52.7	1992	1999

The average values in Tab. 13 and 14 should not be over-interpreted. In particular, ranking is unjustified. One cannot simply conclude that, say, the sub-area "Semantics" (92.6) is more important than that of "Abstracting" (75.6) with respect to research because the average value is higher; or that Indexing (79.2) is more feasible from an application point of view than Abstracting (52.3). Such conclusions may be true, and this is why the values in Tab. 13 and 14 are given, but the parameters should actually only be applied to the single topics in the sub-areas. Cross-group ranking is not allowed for methodological reasons.

But nevertheless the data are interesting enough. It is obvious that the following relation is in general true:

I/R (-values) > I/A > F/R > F/A

There are some exceptions to this general rule, such as Re-I/A>I/R (both in Set_A and Set_C); Ha-F/R>I/R (in Set_C); (Re-F/R and F/A)>I/R (in Set_C); and Il-F/R>I/R(both in Set_A and Set_C).

There seems to be a non-trivial gap between importance and feasibility (both with respect to research and application). In other words, there are more problems than solutions. And there is an even broader gap between application and research. From a practical point of view there is some skepsis concerning the possibility of solving important research problems. And what seems to be feasible from a research point of view looks different from an application one.

The values in the second round are in general higher than in the first one. This is an argument against the oft cited Delphi hypothesis that the feedback-mechanism - i.e. that the data of the previous round are made known at the start of the following round - has an averaging effect. The increase-effect can probably be explained by the fact that the percentage of qualified and "competent" people was higher in the second round (perhaps these were the ones who were motivated to take on the burden of a second round) - and, as Tab.11 shows, people who rated themselves "competent" tend to evaluate higher.

Between the two rounds the decline in the sub-areas "Software" and "Hardware" (apart from the parameter F/R) is striking. There is an overall increase for "Morphology" and "Information Languages" for all parameters, and a dramatic increase for the topics in "Indexing" for F/R (9.7%), and a dramatic decline for the "Translation"- and "Question-Answering"-topics for the parameter F/A (9.8 and 8.4%).

The dates of realization do not change dramatically. On the average there is a difference of one year (and this makes sense because there was almost one year between round 1 and 2). There is a tendency from a research point of view for the expectation of realization to be somewhat earlier from an application standpoint. But the differences are not so dramatic as to justify the conclusion that researchers are more optimistic than developers/practitioners.

5.2 Single topics

Tab.15 and 16 show the two highest rated topics in each sub-area in the first two columns and the two lowest rated topics in each sub-area in the last two columns. These represent average data from Set_C. The four columns in the middle show the estimation of participants who work in research or application, respectively. As part of the demoscopic data it was determined whether participants work more in research or in application (cf. Tab.6). Notice that both groups answered from a research and application point of view. In a more detailed analysis (which will be published later) this - and other aspects - can be pursued. In Tab.15 and 16 the data for very high importance (++) and high importance (+) have been added together.

Tab.15 Topics according to importance

most important topics (++^+) average		research		application		less important average(—^-)	
I/R	I/A	I/R	I/A	I/R	I/A	I/R	I/A
ac1	ac7	ac1	ac1	ac1	ac2	ac6	ac6
ac3	ac2	ac3	ac2	ac2	ac3	ac7	ac5
mo8	mo1	mo8	mo1	mo8	mo1	mo1	mo9
mo11	mo10	mo11	mo3	mo9	mo2	mo7	mo4
se5	se3	se5	se3	se2	se2	se15	se15
se2	se12	se8	se2	se3	se5	se7	se11
ha7	ha7	ha4	ha3	ha7	ha5	ha6	ha6
ha4	ha5	ha2	ha7	ha2	ha7	ha1	ha2
so6	so7	so6	so5	so3	so4	so1	so3
so7	so5	so5	so7	so4	so6	so3	so4
il10	il10	il4	il1	il1	il1	il5	il11
il4	il1	il1	il4	il7	il6	il11	il5
in3	in1	in3	in6	in3	in3	in4	in5
in2	in6	in6	in3	in6	in6	in5	in4
ab4	ab3	ab4	ab2	ab3	ab3	ab2	ab6
ab5	ab2	ab5	ab3	ab1	ab4	ab6	ab5
tr3	tr3	tr2	tr3	tr3	tr1	tr1	tr5
tr5	tr2	tr5	tr2	tr4	tr3	tr6	tr1
re2	re1	re2	re1	re1	re1	re3	re3
re1	re5	re1	re2	re2	re5	re4	re4
qu5	qu1	qu2	qu1	qu1	qu1	qu7	qu7
qu2	qu8	qu5	qu8	qu5	qu2	qu3	qu3

Tab. 16 Most feasible, less feasible topics

most feasible topics (++^+) average		research		application		less feasible average(—^-)	
F/R	F/A	F/R	F/A	F/R	F/A	F/R	F/A
ac7	ac7	ac2	ac7	ac2	ac2	ac6	ac6
ac2	ac2	ac5	ac1	ac7	ac7	ac4	ac4
mo3	mo3	mo3	mo3	mo1	mo1	mo9	mo11
mo10	mo10	mo10	mo10	mo2	mo2	mo5	mo5
se3	se2	se3	se9	se2	se2	se15	se15
se6	se6	se2	se2	se6	se6	se11	se11
ha5	ha5	ha5	ha5	ha4	ha4	ha6	ha6
ha7	ha1	ha7	ha3	ha5	ha5	ha2	ha2
so2	so2	so2	so1	so2	so2	so3	so3
so1	so1	so1	so2	so7	so5	so4	so4
il10	il10	il9	il6	il1	il1	il7	il4
il9	il9	il8	il9	il7	il7	il6	il5
in1	in4	in4	in4	in3	in4	in6	in3
in2	in1	in5	in5	in4	in3	in3	in6
ab2	ab2	ab2	ab2	ab2	ab2	ab4	ab5
ab3	ab3	ab3	ab3	ab1	ab3	ab5	ab6
tr3	tr3	tr3	tr3	tr3	tr3	tr4	tr4
tr2	tr1	tr2	tr1	tr2	tr2	tr5	tr5
re1	re3	re1	re3	re1	re1	re4	re4
re3	re5	re3	re5	re2	re3	re5	re2
qu1	qu1	qu1	qu1	qu1	qu10	qu4	qu4
qu2	qu10	qu2	qu10	qu5	qu1	qu9	qu9

A final Table shows the data for short term and long term topics, only the two closest and the two most distant topics in each sub-area are given (data from Set_C).

Tab.17 Short term and long term topics

short term R/R		R/A		long term R/R		R/A	
ac7	1987	ac7	1992	ac4	2003	ac4	2006
ac2	1991	ac2	1997	ac6	2003	ac6	2006
mo3	1984	mo3	1984	mo9	1997	mo9	2000
mo10	1984	mo6	1986	mo11	1992	mo11	1997
se2	1987	se1	1992	se15	2000	se11	2005
se1	1988	se6	1995	se11	2000	se14	2005
ha5	1984	ha5	1985	ha6	1996	ha6	1999
ha7	1984	ha3	1988	ha2	1991	ha2	1997
so1	1984	so1	1987	so3	1998	so3	2001
so2	1987	so2	1992	so4	1993	so4	1998
il2	1986	il9	1990	il10	1989	il4	1997
il9	1986	il2	1991	il5	1989	il3	1996
in1	1984	in1	1986	in3	1989	in3	1997
in4	1984	in4	1987	in6	1988	in6	1997
aa2	1986	aa2	1991	aa5	1996	aa4	2002
aa3	1988	aa3	1996	aa6	1996	aa6	2001
at3	1985	at3	1990	at4	2000	at4	2006
at2	1985	at2	1992	at5	1998	at5	2005
re2	1984	re3	1987	re4	1992	re4	1998
re1	1984	re1	1988	re5	1986	re5	1990
qu1	1988	qu1	1997	qu9	1997	qu4	2001
qu2	1988	qu2	1997	qu4	1997	qu5	2001

Finally I would like to thank all those who participated in the Delphi rounds. It was an extremely time-consuming task to answer the questionnaire, which was more like a book than a folder. I hope the results justify the efforts. The analysis would not have been possible without the help of my colleagues - Udo Hahn for the conceptual design, and Dr.J.Staud together with Annette Woehrle, Frank Dittmar and Gerhard Schneider for the statistical analysis. This project has been partially financed by the FID/LD-committee and by the "Bundesministerium fuer Forschung und Technologie/ Gesellschaft fuer Information und Dokumentation", Grant PT 200.08.

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