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Paper

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# A Survey on Documenting and Using Design Rationale when Developing Domain-specific Modeling Languages

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## Abstract

This document reports on the results of a survey which is part of a long-term research project conducted at the Institute for Information Systems and New Media at the Vienna University of Economics and Business (WU Vienna) and which targeted experts on domain-specific modeling languages (DSMLs). We define a DSML as being a specialized modeling language tailored primarily for graphical modeling tasks in a particular application domain, supporting the model-driven development (MDD) of software systems for this domain. As a special kind of domain-specific languages (DSLs), DSMLs provide end users with at least one graphical or diagrammatic concrete syntax; in contrast to textual or form/table-based DSLs, for instance. We asked DSML experts identified via dedicated scientific venues (e.g. authors of published articles, program committee members of conferences, associate editors of journals) to take part in the survey. Venues included premier outlets for researchers and practitioners in the field of MDD and DSMLs, such as, the ACM/IEEE 18th International Conference on Model Driven Engineering Languages and Systems (MoDELS) or the International Journal on Software and Systems Modeling (SoSyM). With this survey, we collected expert opinions on different aspects of documenting and using design rationale when developing DSMLs. In the context of DSML development, design rationale is the reasoning and justification of decisions made when designing, creating, and using the core artifacts of a DSML (e.g. abstract and concrete syntax, behavior specification, metamodeling infrastructure, MDD tool chain).

## 1 Design of the Questionnaire

### 1.1 Question Types

- *Crucial question:* Crucial questions are used to identify break-off, partial, and complete questionnaires (see Section 2). All crucial questions are mandatory questions.
- *Mandatory question:* A mandatory question, when presented to the participant, must be answered to continue filling out the questionnaire (please note that not all mandatory questions must be presented to a participant because of filter questions; see below).
- *Optional question:* An optional question can be left out by the participant to continue filling out the questionnaire.
- *Filter question:* A filter question controls the process of the questionnaire (e.g., depending on an answer, a subsequent question is shown or not).

## 2 Outcome Rates

We define two crucial questions (justifying relevance of scientific and industry DSMLs as well as importance of design rationale documentation):

- Question [B002]: *To how many DSMLs have you contributed professionally (in academia and/or industry) so far?*
- Question [C001]: *Please indicate your perceptions regarding DSML design rationale. Do you think that it is important to use design rationale as part of DSML design documentation?*

Less than 50% of presented crucial questions answered equals break-off (i.e. none of the two questions), 50-100% of presented crucial questions and less than 100% of presented mandatory questions answered

equals partial, and 100% of presented crucial questions and 100% of presented mandatory questions answered equals complete.<sup>1</sup>

We compute the response rate of our survey according to the Response Rate 2 [RR2] method documented in [1]:

$$RR2 = \frac{(I + P)}{(I + P) + (R + NC + O) + (UH + UO)}$$

Response Rate 2 [RR2] is the number of complete [I] and partial [P] interviews divided by the number of interviews (complete plus partial) plus the number of non-interviews (refusal and break-off [R] plus non-contacts [NC] plus others [O]) plus all cases of unknown eligibility (unknown if housing unit [UH], plus unknown, other [UO]) [1]. For our survey, the outcome rates are as follows:

- I = 62
- P = 18
- R = 15
- NC = 0
- O = 0
- UH = 291
- UO = 13
- RR2 = 0.2005

### 3 Survey Results

#### 3.1 Agreement to Participate

Mandatory question [A001]: *(no question asked)*

- [A001\_01]: I agree to participate in this survey, realizing that I may withdraw at any time. I agree that the data collected for this study may be published and used by the investigators for research purposes. [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked

Table 1: Agreement to participate [A001\_01]. Sample size = 80.

	Not checked	Checked
Frequency	0 (0%)	80 (100%)

#### 3.2 DSML Contribution Rate

Crucial and filter question [B002]: *To how many DSMLs have you contributed professionally (in academia and/or industry) so far?*

- Filter:
  - Iff [B002\_02] and [B002\_01] equal '0', continue with question [Z004] (see Section 3.10), omitting all questions in between.
  - Iff [B002\_04] or [B002\_03] are larger than '0', show question [C049] (see Section 3.8).
- [B002\_02]: I have contributed to . . . industry DSML(s) so far, [type: metric; input: open]
  - Free text

---

<sup>1</sup>The definition works for both questionnaire versions (>0 DSMLs and 0 DSMLs).

- [B002\_04]: of which . . . is/are based on the UML. Note: An industry DSML is developed as part of one or several predominantly industry-driven software-development projects with the primary aim to create or to improve a commercial software product. An industry-driven software-development project can include preparatory and intermediate steps towards developing a commercial end product (e.g. evolutionary prototypes, pilot systems). [type: metric; input: open]
  - Free text
- [B002\_01]: I have contributed to . . . scientific DSML(s) so far, [type: metric; input: open]
  - Free text
- [B002\_03]: of which . . . is/are based on the UML. Note: A scientific DSML is developed as part of one or several predominantly research-driven software-development projects which result in non-commercial software artifacts (e.g. research prototypes, experiment materials). A research-driven software-development project aims at exploring, collecting, systematizing, and validating knowledge on software engineering, in general, and DSML engineering, in particular. [type: metric; input: open]
  - Free text

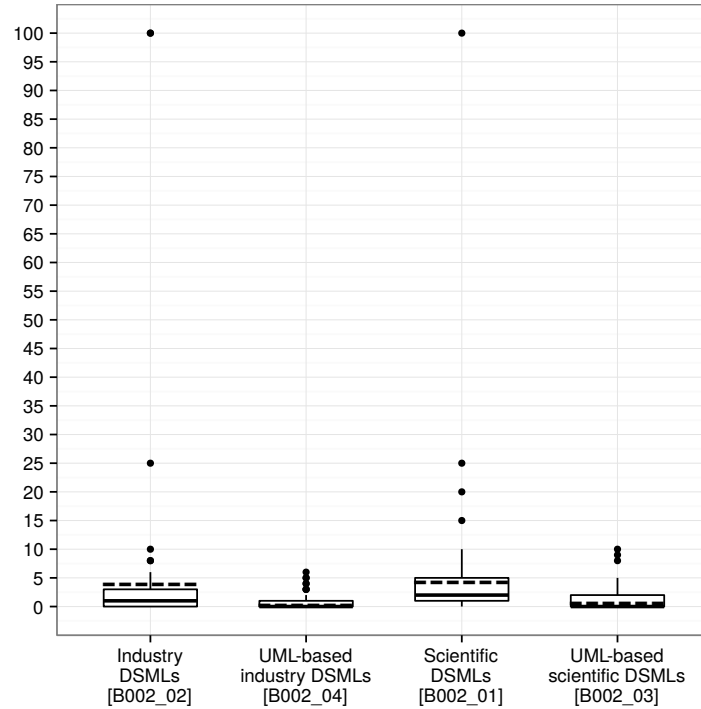


Figure 1: Number of DSMLs the participants contributed professionally (in academia and/or industry).

Table 2: Number of DSMLs the participants contributed professionally (in academia and/or industry). Sample size = 80.

	Industry [B002_02]	DSMLs	UML-based industry DSMLs [B002_04]	Scientific [B002_01]	DSMLs	UML-based scientific DSMLs [B002_03]
Mean	4.56		0.84	4.88		1.26
Standard deviation	15.73		1.34	11.59		2.05
Min./max.	0/100		0/6	0/100		0/10
Median	1		0	2		0
Lower quartile	0		0	1		0
Upper quartile	3		1	5		2

Table 3: Number of Industry DSMLs [B002\_02]. Sample size = 80.

Number of DSMLs	Frequency
0	27 (34%)
1	16 (20%)
2	12 (15%)
3	8 (10%)
4	6 (8%)
5	4 (5%)
6	1 (1%)
8	2 (2%)
10	1 (1%)
25	1 (1%)
100	2 (2%)

Table 4: Number of UML-based industry DSMLs [B002\_04]. Sample size = 80.

Number of DSMLs	Frequency
0	48 (60%)
1	14 (18%)
2	10 (12%)
3	3 (4%)
4	2 (2%)
5	2 (2%)
6	1 (1%)

Table 5: Number of Scientific DSMLs [B002\_01]. Sample size = 80.

Number of DSMLs	Frequency
0	12 (15%)
1	18 (22%)
2	11 (14%)
3	10 (12%)
4	2 (2%)
5	10 (12%)
6	5 (6%)
7	1 (1%)
8	2 (2%)
9	1 (1%)
10	4 (5%)
15	1 (1%)
20	1 (1%)
25	1 (1%)
100	1 (1%)

Table 6: Number of UML-based scientific DSMLs [B002\_03]. Sample size = 80.

Number of DSMLs	Frequency
0	42 (52%)
1	14 (18%)
2	13 (16%)
3	1 (1%)
4	4 (5%)
5	3 (4%)
8	1 (1%)
9	1 (1%)
10	1 (1%)

### 3.3 Years

Mandatory question [B006]: *When did you contribute to the DSMLs indicated before?*

- [B006]: Start year (approx.) [type: nominal; input: selection]
  - 2015 = 2015; 2014 = 2014; 2013 = 2013; 2012 = 2012; 2011 = 2011; 2010 = 2010; 2009 = 2009; 2008 = 2008; 2007 = 2007; 2006 = 2006; 2005 = 2005; 2004 = 2004; 2003 = 2003; 2002 = 2002; 2001 = 2001; 2000 = 2000; 1999 = 1999; 1998 = 1998; 1997 = 1997; 1996 = 1996; 1995 = 1995; 1994 = 1994; 1993 = 1993; 1992 = 1992; 1991 = 1991; 1990 = 1990; 1989 = 1989; 1988 = 1988; 1987 = 1987; 1986 = 1986; 1985 = 1985; 1984 = 1984; 1983 = 1983; 1982 = 1982; 1981 = 1981; 1980 = 1980; 1979 = 1979; 1978 = 1978; 1977 = 1977; 1976 = 1976; 1975 = 1975; 1974 = 1974; 1973 = 1973; 1972 = 1972; 1971 = 1971; 1970 = 1970; -9 = Not answered
- [B007]: End year (approx.) [type: nominal; input: selection]
  - 2015 = 2015; 2014 = 2014; 2013 = 2013; 2012 = 2012; 2011 = 2011; 2010 = 2010; 2009 = 2009; 2008 = 2008; 2007 = 2007; 2006 = 2006; 2005 = 2005; 2004 = 2004; 2003 = 2003; 2002 = 2002; 2001 = 2001; 2000 = 2000; 1999 = 1999; 1998 = 1998; 1997 = 1997; 1996 = 1996; 1995 = 1995; 1994 = 1994; 1993 = 1993; 1992 = 1992; 1991 = 1991; 1990 = 1990; 1989 = 1989; 1988 = 1988; 1987 = 1987; 1986 = 1986; 1985 = 1985; 1984 = 1984; 1983 = 1983; 1982 = 1982; 1981 = 1981; 1980 = 1980; 1979 = 1979; 1978 = 1978; 1977 = 1977; 1976 = 1976; 1975 = 1975; 1974 = 1974; 1973 = 1973; 1972 = 1972; 1971 = 1971; 1970 = 1970; -9 = Not answered

Table 7: Start year (approx.) and end year (approx.). Sample size = 72.

	Start year (approx.) [B006]	End year (approx.) [B007]
2015	0 (0%)	49 (68%)
2014	2 (3%)	5 (7%)
2013	2 (3%)	4 (6%)
2012	1 (1%)	2 (3%)
2011	4 (6%)	1 (1%)
2010	9 (12%)	2 (3%)
2009	6 (8%)	2 (3%)
2008	4 (6%)	1 (1%)
2007	3 (4%)	2 (3%)
2006	4 (6%)	1 (1%)
2005	4 (6%)	0 (0%)
2004	6 (8%)	0 (0%)
2003	2 (3%)	0 (0%)
2002	1 (1%)	0 (0%)
2001	3 (4%)	0 (0%)
2000	5 (7%)	1 (1%)
1999	4 (6%)	0 (0%)
1998	1 (1%)	0 (0%)
1997	0 (0%)	0 (0%)
1996	1 (1%)	0 (0%)
1995	2 (3%)	0 (0%)
1994	1 (1%)	0 (0%)
1993	3 (4%)	0 (0%)
1992	0 (0%)	0 (0%)
1991	0 (0%)	0 (0%)
1990	1 (1%)	0 (0%)
1989	0 (0%)	0 (0%)
1988	0 (0%)	0 (0%)
1987	1 (1%)	0 (0%)
1986	0 (0%)	0 (0%)
1985	0 (0%)	0 (0%)
1984	0 (0%)	0 (0%)
1983	0 (0%)	0 (0%)
1982	0 (0%)	0 (0%)
1981	0 (0%)	0 (0%)
1980	0 (0%)	0 (0%)
1979	0 (0%)	0 (0%)
1978	0 (0%)	0 (0%)
1977	0 (0%)	0 (0%)
1976	0 (0%)	0 (0%)
1975	0 (0%)	0 (0%)
1974	0 (0%)	0 (0%)
1973	0 (0%)	0 (0%)
1972	0 (0%)	0 (0%)
1971	0 (0%)	0 (0%)
1970	0 (0%)	0 (0%)
Not answered	2 (3%)	2 (3%)

Table 8: Duration (in years) [B006], [B007]. Sample size = 70.

Frequency	
2	2 (3%)
3	5 (7%)
4	6 (9%)
5	5 (7%)
6	11 (16%)
7	1 (1%)
8	6 (9%)
9	3 (4%)
10	3 (4%)
11	3 (4%)
12	3 (4%)
13	3 (4%)
14	1 (1%)
15	2 (3%)
16	5 (7%)
17	3 (4%)
18	1 (1%)
20	1 (1%)
21	1 (1%)
23	3 (4%)
26	1 (1%)
29	1 (1%)

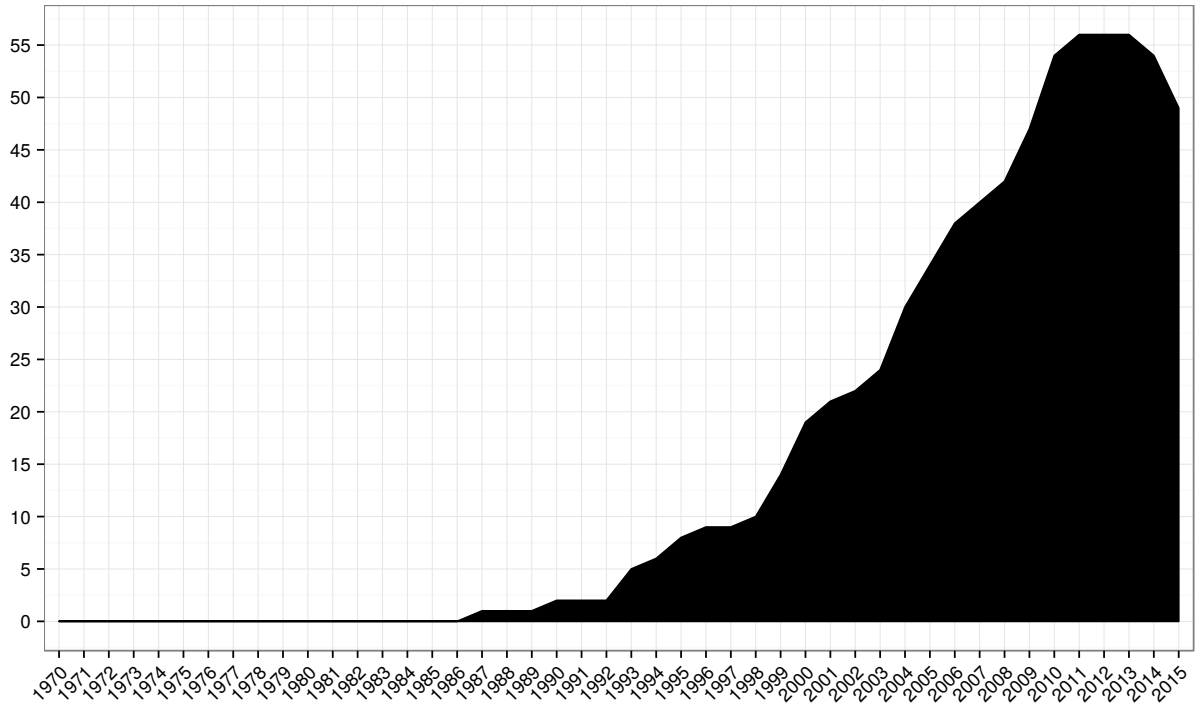


Figure 2: Cumulative contribution years [B006], [B007]. Sample size = 70.



Table 9: Cumulative contribution years [B006], [B007]. Sample size = 70.

	Frequency
2015	49
2014	54
2013	56
2012	56
2011	56
2010	54
2009	47
2008	42
2007	40
2006	38
2005	34
2004	30
2003	24
2002	22
2001	21
2000	19
1999	14
1998	10
1997	9
1996	9
1995	8
1994	6
1993	5
1992	2
1991	2
1990	2
1989	1
1988	1
1987	1
1986	0
1985	0
1984	0
1983	0
1982	0
1981	0
1980	0
1979	0
1978	0
1977	0
1976	0
1975	0
1974	0
1973	0
1972	0
1971	0
1970	0

### 3.4 Employers, Job Descriptions, and Roles

#### 3.4.1 Employers

Mandatory question [B003]: *When contributing to the DSMLs indicated before, you worked for a/ as a:*

- [B003\_01]: For-profit organization (e.g. privately held company) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B003\_02]: Non-profit organization (e.g. publicly funded university) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B003\_03]: Freelancer/Independent [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B003\_04]: Other employer [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B003\_04a]: Other employer (free text) [type: text; input: open]
  - Free text

Table 10: Employers [B003]. Sample size = 72.

	Not checked	Checked
For-profit organization (e.g. privately held company) [B003_01]	46 (64%)	26 (36%)
Non-profit organization (e.g. publicly funded university) [B003_02]	10 (14%)	62 (86%)
Freelancer/Independent [B003_03]	68 (94%)	4 (6%)
Other employer [B003_04]	69 (96%)	3 (4%)

Table 11: Other employer (free text) [B003\_04a]. Sample size = 72.

	Frequency
Bell-Northern Research	1
government institution	1
Transfer projects	1

#### 3.4.2 Job Descriptions

Mandatory and filter question [B004]: *When contributing to the DSMLs indicated before, your job description included:*

- Filter:
  - Iff [B004\_03] is checked, show question [B005] (see Section 3.4.3).
- [B004\_01]: Tertiary education (e.g. university lecturer) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B004\_02]: Research (e.g. research associate) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B004\_03]: Software development (e.g. software architect, developer, tester) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B004\_04]: Other description [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B004\_04a]: Other description (free text) [type: text; input: open]
  - Free text

Table 12: Job descriptions [B004]. Sample size = 72.

	Not checked	Checked
Tertiary education (e.g. university lecturer) [B004_01]	45 (62%)	27 (38%)
Research (e.g. research associate) [B004_02]	17 (24%)	55 (76%)
Software development (e.g. software architect, developer, tester) [B004_03]	49 (68%)	23 (32%)
Other description [B004_04]	68 (94%)	4 (6%)

Table 13: Other description (free text) [B004\_04a]. Sample size = 72.

	Frequency
-	1
CEO	1
consultant	1
Product Manager	1

### 3.4.3 Job Roles

Mandatory question [B005]: *Your job description included software development. In the software-development projects involving these DSMLs, you took the following role(s):*

- [B005\_01]: Project manager [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B005\_02]: Business analyst/designer [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B005\_03]: Systems analyst, requirements specifier [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B005\_04]: Software architect/designer [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B005\_05]: Software developer/implementer [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B005\_06]: Software tester [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B005\_07]: Other role(s) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [B005\_07a]: Other role(s) (free text) [type: text; input: open]
  - Free text

Table 14: Job roles [B005]. Sample size = 23.

	Not checked	Checked
Project manager [B005_01]	10 (43%)	13 (57%)
Business analyst/designer [B005_02]	21 (91%)	2 (9%)
Systems analyst, requirements specifier [B005_03]	15 (65%)	8 (35%)
Software architect/designer [B005_04]	3 (13%)	20 (87%)
Software developer/implementer [B005_05]	7 (30%)	16 (70%)
Software tester [B005_06]	17 (74%)	6 (26%)
Other role(s) [B005_07]	20 (87%)	3 (13%)

Table 15: Other role(s) (free text) [B005\_07a]. Sample size = 23.

	Frequency
DSM consultant	1
Product Manager	1
Technical writer	1

### 3.5 Application Domains

Mandatory question [C036]: *Which application domains were targeted by the DSMLs, to which you contributed?*

- [C036\_01]: Service-oriented architectures [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_02]: Web services [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_03]: Embedded systems [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_04]: Model verification and validation [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_05]: Software development techniques [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_06]: Security requirements [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_07]: Model checking [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_08]: Requirements analysis [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_09]: Web applications [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_10]: Data warehouses [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_11]: Graphical user interfaces [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_12]: Real-time systems [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_13]: Software development process management [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_14]: Software testing and debugging [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_15]: Others [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C036\_16]: Don't know [type: dichotomous; input: checkbox]

- 1 = Not checked; 2 = Checked
- [C036\_15a]: Others (free text) [type: text; input: open]
  - Free text

Table 16: Application domains [C036]. Sample size = 70.

		Not checked	Checked
Service-oriented architectures	[C036_01]	52 (74%)	18 (26%)
Web services	[C036_02]	58 (83%)	12 (17%)
Embedded systems	[C036_03]	43 (61%)	27 (39%)
Model verification and validation	[C036_04]	49 (70%)	21 (30%)
Software development techniques	[C036_05]	39 (56%)	31 (44%)
Security requirements	[C036_06]	58 (83%)	12 (17%)
Model checking	[C036_07]	60 (86%)	10 (14%)
Requirements analysis	[C036_08]	52 (74%)	18 (26%)
Web applications	[C036_09]	51 (73%)	19 (27%)
Data warehouses	[C036_10]	69 (99%)	1 (1%)
Graphical user interfaces	[C036_11]	53 (76%)	17 (24%)
Real-time systems	[C036_12]	53 (76%)	17 (24%)
Software development process management	[C036_13]	58 (83%)	12 (17%)
Software testing and debugging	[C036_14]	54 (77%)	16 (23%)
Others	[C036_15]	53 (76%)	17 (24%)
Don't know	[C036_16]	70 (100%)	0 (0%)

Table 17: Others (free text) [C036\_15a]. Sample size = 70.

	Frequency
automotive	1
Building Information Modelling	1
chemical processing	1
Cloud Computing	1
Content feeding on different targeted systems (such as CMS)	1
context-aware (mobile) user interfaces	1
early level testing	1
Electronic Health Records	1
Emergency Resource Management	1
Enterprise systems	1
ERP	1
farmacologist	1
financial systems	1
gestural interaction	1
High Performance Computing	1
High-performance system	1
insurance systems	1
interactive television	1
Knowledge management	1
language development	1
linguistics	1
logistics	1
medical	1
medical diagnostic processes	1
Model-Driven Language Engineering	1
Model Transformation	1
multimodal user interfaces	1
Organisational modelling	1
Production Systems	1
Quantity Surveying	1
Robotics	1
software architecture (DSML as a way to structure the implementation)	1
software visualization	1
telecom	1

### 3.6 Metamodeling Languages

Mandatory question [C034]: *Which metamodeling languages were used to develop your DSMLs?*

- [C034\_01]: Meta Object Facility 1.4 (MOF 1.4) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked

- [C034\_02]: Meta Object Facility 2.x (MOF 2.x) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_03]: Ecore [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_04]: Kernel Meta: Meta: Model (KM3) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_05]: Kermeta [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_06]: Meta: GME [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_07]: XMF Xcore [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_08]: XML Schema Definition (XSD) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_09]: Others [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_10]: Don't know [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C034\_09a]: Others (free text) [type: text; input: open]
  - Free text

Table 18: Metamodeling languages [C034]. Sample size = 70.

	Not checked	Checked
Meta Object Facility 1.4 (MOF 1.4) [C034_01]	59 (84%)	11 (16%)
Meta Object Facility 2.x (MOF 2.x) [C034_02]	51 (73%)	19 (27%)
Ecore [C034_03]	26 (37%)	44 (63%)
Kernel Meta: Meta: Model (KM3) [C034_04]	67 (96%)	3 (4%)
Kermeta [C034_05]	68 (97%)	2 (3%)
Meta: GME [C034_06]	69 (99%)	1 (1%)
XMF Xcore [C034_07]	69 (99%)	1 (1%)
XML Schema Definition (XSD) [C034_08]	62 (89%)	8 (11%)
Others [C034_09]	45 (64%)	25 (36%)
Don't know [C034_10]	68 (97%)	2 (3%)

Table 19: Others (free text) [C034\_09a]. Sample size = 70.

	Frequency
a	1
ad-hoc	1
Ad hoc metamodeling language	1
ASF+SDF	1
atom3	1
custom	1
Custom implementation	1
Enterprise Architect	1
Flex	1
GOPPRR	1
GOPPRR (MOF was spec only from the case, implementation in GOPPRR)	1
Haskell type system	1
home grown reflexive meta modeling language	1
ITU-T Z.111	1
Java extended with annotations	1
metaedit+ (GOPPRR?)	1
MPS	1
none	1
prolog	1
Racket	1
text	1
the one used by atompm	1
UML Profiles	1
Umple	1
Visual Studio SDK's meta-models	1

### 3.7 Model-Driven Development Tool Chains

Mandatory question [C035]: *Into which model-driven development (MDD) tool chains were your DSMLs integrated?*

- [C035\_01]: Eclipse (EMF, GMF, Sirius etc.) [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_02]: Obeo Designer [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_03]: MetaCase MetaEdit+ [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_04]: Gentleware Poseidon [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_05]: NoMagic MagicDraw [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_06]: Rational Software Architect [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_07]: Sparx Systems Enterprise Architect [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_08]: Actifsource [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_09]: Microsoft Visual Studio [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_10]: Others [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_11]: None [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_12]: Don't know [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C035\_10a]: Others (free text) [type: text; input: open]
  - Free text

Table 20: Model-driven development tool chains [C035]. Sample size = 70.

		Not checked	Checked
Eclipse (EMF, GMF, Sirius etc.)	[C035_01]	24 (34%)	46 (66%)
Obeo Designer	[C035_02]	69 (99%)	1 (1%)
MetaCase MetaEdit+	[C035_03]	65 (93%)	5 (7%)
Gentleware Poseidon	[C035_04]	69 (99%)	1 (1%)
NoMagic MagicDraw	[C035_05]	61 (87%)	9 (13%)
Rational Software Architect	[C035_06]	63 (90%)	7 (10%)
Sparx Systems Enterprise Architect	[C035_07]	61 (87%)	9 (13%)
Actifsource	[C035_08]	70 (100%)	0 (0%)
Microsoft Visual Studio	[C035_09]	66 (94%)	4 (6%)
Others	[C035_10]	42 (60%)	28 (40%)
None	[C035_11]	65 (93%)	5 (7%)
Don't know	[C035_12]	70 (100%)	0 (0%)



Table 21: Others (free text) [C035\_10a]. Sample size = 70.

	Frequency
a	1
Absolut	1
ad-hoc	1
Adonis	1
atom3	1
atompmp	2
Eclipse Papyrus	1
Eclipse Xtext	1
emacs	1
Frag ( <a href="http://www.infosys.tuwien.ac.at/Staff/zdun/frag-doc/">http://www.infosys.tuwien.ac.at/Staff/zdun/frag-doc/</a> )	1
home grown MDD tooling infrastructure	1
in-house tool chains	1
Integranova	1
JavaScript	1
Matlab	1
MPS	1
none	1
paper	1
Papyrus	4
petshop	1
properitary	1
Proprietary	1
Racket	1
Simulink	1
Spin	1
Standalone	1
StarUML	2
The Moose Platform ( <a href="http://moosetechnology.org">http://moosetechnology.org</a> )	1
Umple	1
Uppaal	1
vim	1
XMF-Mosaic	1
XModeler	1
XOTel	1

### 3.8 UML Versions

Mandatory question [C049]: *You contributed to [XX] UML-based DSMLs. Which UML version(s) were your DSMLs based on?*

- [C049\_01]: UML 1.3 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_02]: UML 1.4 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_03]: UML 1.5 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_04]: UML 2.0 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_05]: UML 2.1.1 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_06]: UML 2.1.2 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_07]: UML 2.2 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_08]: UML 2.3 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked

- [C049\_09]: UML 2.4 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_10]: UML 2.4.1 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_11]: UML 2.5 [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked
- [C049\_12]: Don't know [type: dichotomous; input: checkbox]
  - 1 = Not checked; 2 = Checked

Table 22: UML versions [C049]. Sample size = 42.

	Not checked	Checked
UML 1.3 [C049_01]	39 (93%)	3 (7%)
UML 1.4 [C049_02]	35 (83%)	7 (17%)
UML 1.5 [C049_03]	34 (81%)	8 (19%)
UML 2.0 [C049_04]	28 (67%)	14 (33%)
UML 2.1.1 [C049_05]	39 (93%)	3 (7%)
UML 2.1.2 [C049_06]	41 (98%)	1 (2%)
UML 2.2 [C049_07]	35 (83%)	7 (17%)
UML 2.3 [C049_08]	37 (88%)	5 (12%)
UML 2.4 [C049_09]	37 (88%)	5 (12%)
UML 2.4.1 [C049_10]	32 (76%)	10 (24%)
UML 2.5 [C049_11]	35 (83%)	7 (17%)
Don't know [C049_12]	37 (88%)	5 (12%)

### 3.9 Design Rationale

#### 3.9.1 Design Rationale Usage

Crucial question [C001]: *Please indicate your perceptions regarding DSML design rationale.*

- [C001\_01]: Do you think that it is important to use design rationale as part of DSML design documentation? As a design documentation, design rationale offers a picture of the history of the design and reasons for the design choices leading to the final product. [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered

Table 23: Design rationale usage [C001]. Sample size = 68.

	1	2	3	4	5	-1	-9
Frequency	1 (1%)	4 (6%)	10 (15%)	32 (47%)	17 (25%)	4 (6%)	0 (0%)

#### 3.9.2 Design Rationale Documentation Activities

Mandatory question [C013]: *Did you perform the following activities to document design rationale (for at least one DSML)? If yes, how do you rate their usefulness?*

- [C013\_01]: Meeting protocols (e.g. brainstorming sessions, focus groups, design meetings) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never performed; -2 = Don't know; -9 = Not answered
- [C013\_02]: Interview protocols, questionnaires (e.g. with different stakeholders) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never performed; -2 = Don't know; -9 = Not answered

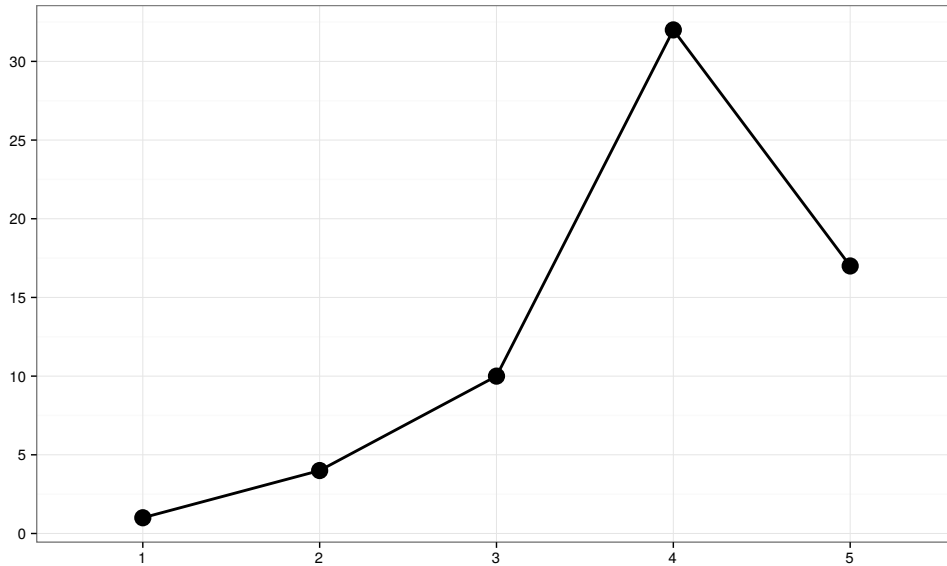


Figure 3: Design rationale usage [C001].

- [C013\_03]: Conceptual diagrams (e.g. decision-flow modeling) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never performed; -2 = Don't know; -9 = Not answered
- [C013\_04]: Work diaries (e.g. recording individual events that occur during the day) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never performed; -2 = Don't know; -9 = Not answered
- [C013\_05]: Think-aloud-session protocols (e.g. think out loud while performing a task) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never performed; -2 = Don't know; -9 = Not answered
- [C013\_06]: Participant observations (e.g. recording participants' activities) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never performed; -2 = Don't know; -9 = Not answered
- [C013\_07]: Written documentation (e.g. writing software manuals, source-code comments, changelog files, SCM commit messages, issue-tracker entries) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never performed; -2 = Don't know; -9 = Not answered

Optional question [C044]: *Comments on your ratings above (e.g. explanations for “Don't know” answers, mentioning a documentation activity not listed above)*

- [C044\_01]: [01] [type: text; input: open]
  - Free text

Table 24: Design rationale documentation activities [C013]. Sample size = 68.

	1	2	3	4	5	-1	-2	-9
Meeting protocols (e.g. brainstorming sessions, focus groups, design meetings) [C013_01]	2 (3%)	7 (10%)	7 (10%)	20 (29%)	21 (31%)	10 (15%)	1 (1%)	0 (0%)
Interview protocols, questionnaires (e.g. with different stakeholders) [C013_02]	1 (1%)	6 (9%)	13 (19%)	12 (18%)	7 (10%)	28 (41%)	1 (1%)	0 (0%)
Conceptual diagrams (e.g. decision-flow modeling) [C013_03]	2 (3%)	2 (3%)	9 (13%)	18 (26%)	16 (24%)	20 (29%)	1 (1%)	0 (0%)
Work diaries (e.g. recording individual events that occur during the day) [C013_04]	6 (9%)	2 (3%)	8 (12%)	8 (12%)	2 (3%)	39 (57%)	3 (4%)	0 (0%)
Think-aloud-session protocols (e.g. think out loud while performing a task) [C013_05]	7 (10%)	2 (3%)	6 (9%)	15 (22%)	4 (6%)	32 (47%)	2 (3%)	0 (0%)
Participant observations (e.g. recording participants' activities) [C013_06]	4 (6%)	5 (7%)	11 (16%)	8 (12%)	6 (9%)	32 (47%)	1 (1%)	1 (1%)
Written documentation (e.g. writing software manuals, source-code comments, changelog files, SCM commit messages, issue-tracker entries) [C013_07]	0 (0%)	8 (12%)	9 (13%)	24 (35%)	22 (32%)	4 (6%)	0 (0%)	1 (1%)

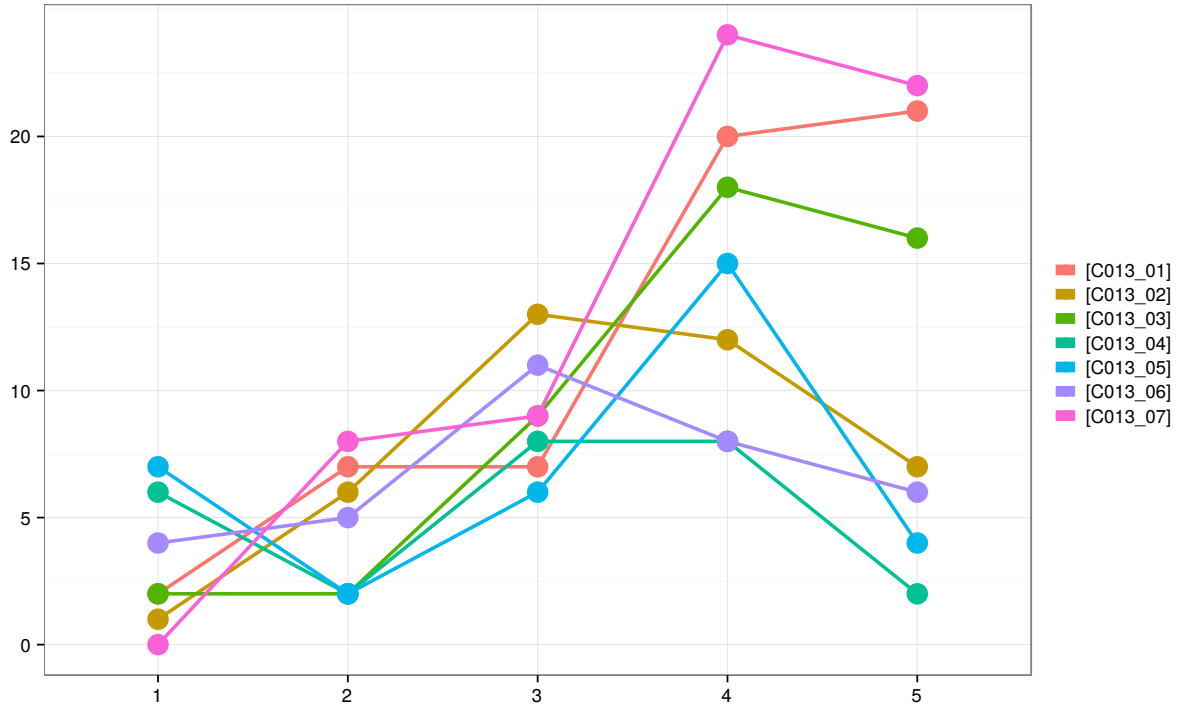


Figure 4: Design rationale documentation activities [C013].

Table 25: Comments on design rationale documentation activities [C044].

#1	Literature study Studying competitive, existing systems
#2	Some of these don't necessarily *document* design rationale, but play an important part in eliciting requirements and other factors, or documenting the design.
#3	guys, in industry you don't have time to do all this academic bullshit. "Interview protocols" - get real. You talk to people, but that hardly qualifies as a proper interview... the questions I have seen so far are very much biased towards one particular kind of DSL/way of defining them, and it doesn't appear to be one that is of any practical relevance... do some qualitative research before you do quantitative studies!!
#4	Test-driven development is a documentation activity that should be in the list, since the tests are excellent documentation medium of well organized.
#5	Some of these are not documentation activities. They were performed, but not necessarily documented.
#6	Did not use recording as customers usually don't want that.
#7	I did perform work diaries in some cases. But I have not used them systematically.
#8	We actually produced two documents for the User Requirements Notation (URN) standard: ITU-T Z.150 for the language requirements themselves (hence providing good rationale context) ITU-T Z.151 the URN language definition
	Many intermediate documents were produced along the way.
	Still, some design decisions were not documented, especially regarding the alternatives considered.

### 3.9.3 Design Rationale Documentation Details

Mandatory question [C046]: *Did you document the following details of design rationale (for at least one DSML)? If yes, how do you rate their usefulness?*

- [C046\_01]: Issues: The major questions, problems, or aspects of the DSML under development addressed in a decision-making activity. [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never documented; -2 = Don't know; -9 = Not answered
- [C046\_02]: Alternatives: Solutions or proposals about aspects of the DSML under development, which are at issue. [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never documented; -2 = Don't know; -9 = Not answered
- [C046\_03]: Criteria: The reasons, arguments, or opinions which evaluate an alternative solution or proposal. [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never documented; -2 = Don't know; -9 = Not answered
- [C046\_04]: Decision-making context: References to and/or details of preceding or succeeding design decisions, for example. [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never documented; -2 = Don't know; -9 = Not answered
- [C046\_05]: Activity context: Contextual information about the decision-making activity (e.g. activity time, number and identity of decision makers). [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never documented; -2 = Don't know; -9 = Not answered
- [C046\_06]: Project context: Details on the overall development project related to or affected by a design decision (e.g. current project phase, planning of follow-up activities). [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never documented; -2 = Don't know; -9 = Not answered

Table 26: Design rationale documentation details [C046]. Sample size = 65.

	1	2	3	4	5	-1	-2	-9
Issues: The major questions, problems, or aspects of the DSML under development addressed in a decision-making activity. [C046_01]	0 (0%)	1 (2%)	10 (15%)	26 (40%)	13 (20%)	15 (23%)	0 (0%)	0 (0%)
Alternatives: Solutions or proposals about aspects of the DSML under development, which are at issue. [C046_02]	0 (0%)	1 (2%)	15 (23%)	19 (29%)	10 (15%)	20 (31%)	0 (0%)	0 (0%)
Criteria: The reasons, arguments, or opinions which evaluate an alternative solution or proposal. [C046_03]	0 (0%)	1 (2%)	7 (11%)	27 (42%)	9 (14%)	21 (32%)	0 (0%)	0 (0%)
Decision-making context: References to and/or details of preceding or succeeding design decisions, for example. [C046_04]	0 (0%)	6 (9%)	11 (17%)	19 (29%)	2 (3%)	27 (42%)	0 (0%)	0 (0%)
Activity context: Contextual information about the decision-making activity (e.g. activity time, number and identity of decision makers). [C046_05]	0 (0%)	7 (11%)	7 (11%)	13 (20%)	3 (5%)	35 (54%)	0 (0%)	0 (0%)
Project context: Details on the overall development project related to or affected by a design decision (e.g. current project phase, planning of follow-up activities). [C046_06]	1 (2%)	2 (3%)	16 (25%)	20 (31%)	3 (5%)	22 (34%)	1 (2%)	0 (0%)

Optional question [C047]: *Comments on your ratings above (e.g. explanations for “Don't know” answers, mentioning a design rationale detail not listed above)*

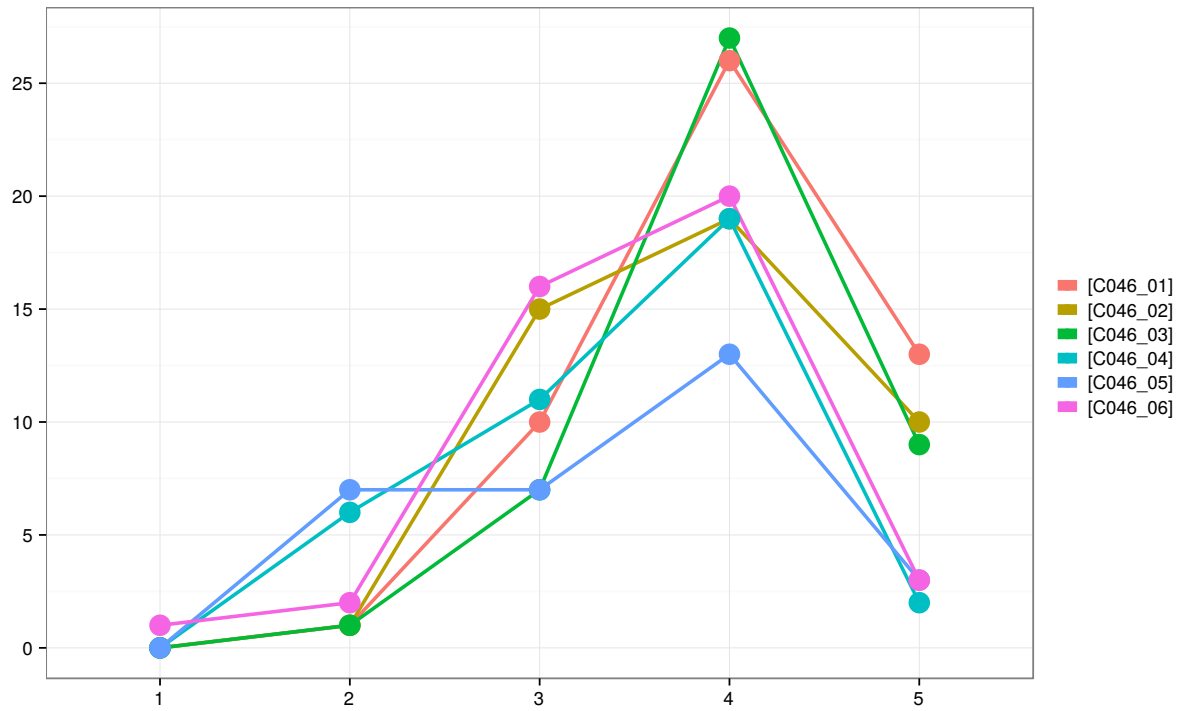


Figure 5: Design rationale documentation details [C046].

- [C047\_01]: [01] [type: text; input: open]
  - Free text

Table 27: Comments on design rationale documentation details [C047].

#1	I feel these are useful, but in practice the results are used only rarely. Within the first year of a project, I can generally remember more of the rationale than I could record. Later, the number of existing users and their investment in learning means the payback of a change must be larger to be worthwhile, so the need to revisit the rationale is smaller. Also, as time passes the rationale may be superceded by changes in the situation or our understanding. Overall, I'd say the recording of the design and its changes at points of time has been more useful than the recording of the rationale.
#2	Only documented via tests, examples and code comments
#3	We always try to ask about the use cases and usage situations of the languages so that we don't focus on the language itself but on how to use it. Typical such issues are e.g. reuse of existing models, are there core models/components, how models are read, check, validated by different person over time etc.
#4	These things were documented in research papers, but more as a result of the dissemination obligation, not so much to support the development/design process. Of course, the above aspects contributed to the design, but they have not been documented, otherwise than in research papers, or an occasional comment in the code.
#5	looking at this list i realize i should document everything much better. both for research and also for development purposes..
#6	The industry projects did not really document design decisions.
#7	I do not quite get the points you mentioned above. I am currently writing a book about the domain specific languages we use to visualize software. The book use a kind of tutorial approach. No idea whether this match the points you mentioned above.

### 3.9.4 Design Rationale Documentation Barriers

Mandatory question [C045]: *Did you encounter the following barriers to documenting design rationale (for at least one DSML)? If yes, how would you rate them?*

- [C045\_01]: There were no standards or requirements in the project or organization to document design decisions. [type: ordinal; input: scale]
  - 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered
- [C045\_02]: The extra work of documenting design decisions was not justified. [type: ordinal; input: scale]

- 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered
- [C045\_03]: The ones meant to document the design decisions were not the ones to benefit from (re-)using them later (e.g. in another project). [type: ordinal; input: scale]
  - 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered
- [C045\_04]: The project or organization set time and budget constraints. [type: ordinal; input: scale]
  - 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered
- [C045\_05]: Tool support for documenting design decisions was absent. [type: ordinal; input: scale]
  - 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered
- [C045\_06]: Documenting design decisions disrupted the actual decision-making process. [type: ordinal; input: scale]
  - 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered
- [C045\_07]: Documenting design decisions allowed stakeholders to review and to challenge the reasons for making the decisions at a later point. [type: ordinal; input: scale]
  - 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered
- [C045\_08]: It was unclear what to document exactly (e.g. issues, alternatives, criteria). [type: ordinal; input: scale]
  - 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered
- [C045\_09]: There were no prior design decisions available for reuse. [type: ordinal; input: scale]
  - 1 = Not a barrier at all; 5 = Extreme barrier; -1 = Never encountered; -2 = Don't know; -9 = Not answered

Optional question [C048]: *Comments on your ratings above (e.g. explanations for “Don't know” answers, mentioning a barrier not listed above)*

- [C048\_01]: [01] [type: text; input: open]
  - Free text

Table 28: Design rationale documentation barriers [C045]. Sample size = 62.

	1	2	3	4	5	-1	-2	-9
There were no standards or requirements in the project or organization to document design decisions. [C045_01]	12 (19%)	8 (13%)	7 (11%)	19 (31%)	3 (5%)	10 (16%)	3 (5%)	0 (0%)
The extra work of documenting design decisions was not justified. [C045_02]	7 (11%)	10 (16%)	13 (21%)	14 (23%)	5 (8%)	8 (13%)	5 (8%)	0 (0%)
The ones meant to document the design decisions were not the ones to benefit from (re-)using them later (e.g. in another project). [C045_03]	10 (16%)	6 (10%)	13 (21%)	12 (19%)	0 (0%)	14 (23%)	7 (11%)	0 (0%)
The project or organization set time and budget constraints. [C045_04]	3 (5%)	7 (11%)	12 (19%)	16 (26%)	11 (18%)	10 (16%)	3 (5%)	0 (0%)
Tool support for documenting design decisions was absent. [C045_05]	10 (16%)	10 (16%)	5 (8%)	18 (29%)	7 (11%)	8 (13%)	4 (6%)	0 (0%)
Documenting design decisions disrupted the actual decision-making process. [C045_06]	7 (11%)	9 (15%)	13 (21%)	6 (10%)	4 (6%)	18 (29%)	5 (8%)	0 (0%)
Documenting design decisions allowed stakeholders to review and to challenge the reasons for making the decisions at a later point. [C045_07]	9 (15%)	10 (16%)	11 (18%)	4 (6%)	3 (5%)	18 (29%)	7 (11%)	0 (0%)
It was unclear what to document exactly (e.g. issues, alternatives, criteria). [C045_08]	4 (6%)	14 (23%)	11 (18%)	10 (16%)	2 (3%)	17 (27%)	4 (6%)	0 (0%)
There were no prior design decisions available for reuse. [C045_09]	8 (13%)	12 (19%)	8 (13%)	13 (21%)	4 (6%)	12 (19%)	5 (8%)	0 (0%)

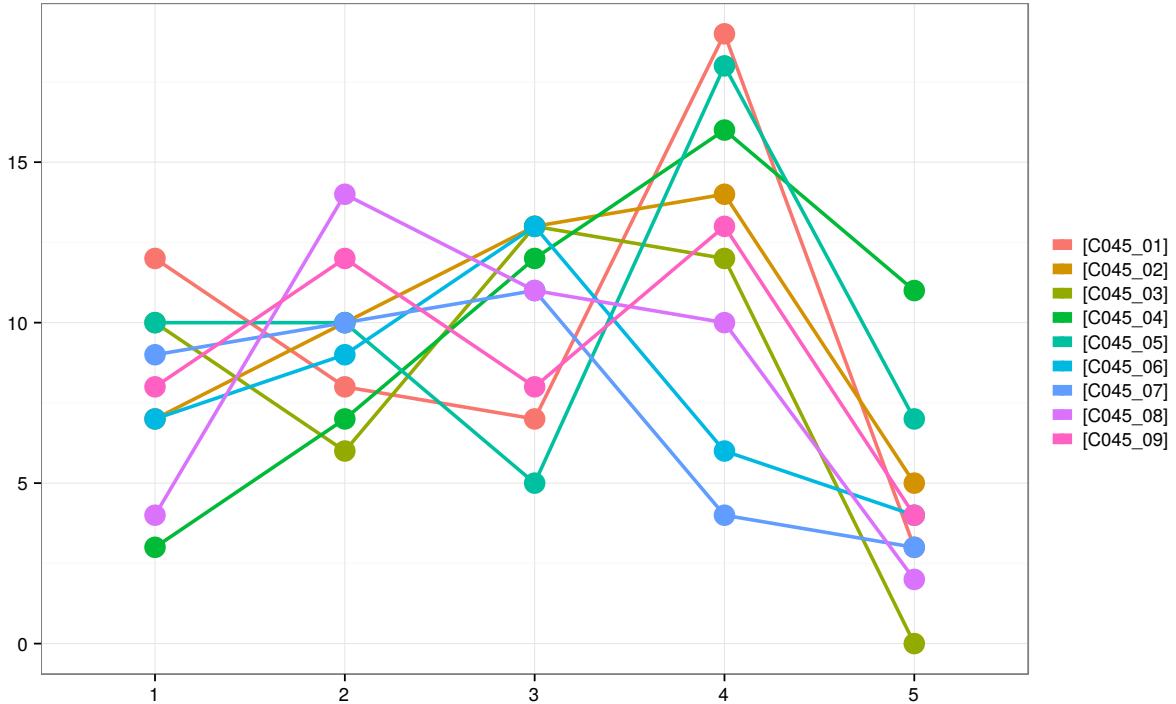


Figure 6: Design rationale documentation barriers [C045].



Table 29: Comments on design rationale documentation barriers [C048].

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#1	we never monitored our own processes in a structured fashion so this knowledge about barriers is unavailable. We encountered problems with over-documentation; i.e. spending time on documenting design decisions rather than user documentation was not appreciated.
#2	Q2, 3, 5,6,7,8,9: no documentation => no barrier. silly question
#3	Some of the questions are worded in a way that makes the given answer options meaningless. For instance, "The extra work of documenting design decisions was not justified.": how do the "barrier" answers make sense here?
#4	Often the decision decision is based on language use case, and then alternative language use scenarios are discussed to identify the most suitable part. Note: we expect that language can change so decision desisions can change later on (like next week, year etc). so there is no danger on being fixed on some decision.
#5	dont know about how docs would have helped since there was not much of that done. perhaps because deadlines to deliver products not docs..
#6	One barrier is that ITU-T did not want to create a new DSML based on UML or on EMF. They had a culture based on grammars for describing abstract syntaxes. We wanted to use a metamodel. We ended up creating a new standard (Z.111) where the correspondence between the grammar and the metamodel (for capturing abstract syntaxes) was defined.
#7	The industry projects did not really document design decisions.
#8	You are asking many question that I do not understand them...

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### 3.9.5 Design Rationale Reuse

Mandatory question [C018]: *Did you (re)use design rationale available from the following sources and documented in the following formats for making design decisions (on at least one DSML)? If yes, how do you rate their usefulness?*

- [C018\_01]: Books/Monographs for practitioners (e.g. Model-Driven Software Development by Thomas Stahl and Markus Völter) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never used; -2 = Don't know; -9 = Not answered
- [C018\_02]: Scientific publications (e.g. journal articles on DSMLs) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never used; -2 = Don't know; -9 = Not answered
- [C018\_03]: Gray literature (e.g. technical reports, white papers on DSMLs) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never used; -2 = Don't know; -9 = Not answered
- [C018\_04]: Case-study reports (e.g. on DSML customer projects) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never used; -2 = Don't know; -9 = Not answered
- [C018\_05]: Standardization body specifications & guidelines (e.g. OMG MDA Guide) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never used; -2 = Don't know; -9 = Not answered
- [C018\_06]: Documented design decisions (i.e. self-documented design decisions from former projects) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never used; -2 = Don't know; -9 = Not answered
- [C018\_07]: Pattern collections (e.g. Patterns for Model-Driven Software-Development by Markus Völter and Jorn Bettin) [type: ordinal; input: scale]
  - 1 = Not at all useful; 5 = Extremely useful; -1 = Never used; -2 = Don't know; -9 = Not answered

Table 30: Design rationale reuse [C018]. Sample size = 61.

	1	2	3	4	5	-1	-2	-9
Books/Monographs for practitioners (e.g. Model-Driven Software Development by Thomas Stahl and Markus Völter) [C018_01]	2 (3%)	4 (7%)	17 (28%)	13 (21%)	2 (3%)	21 (34%)	2 (3%)	0 (0%)
Scientific publications (e.g. journal articles on DSMLs) [C018_02]	1 (2%)	2 (3%)	12 (20%)	27 (44%)	13 (21%)	5 (8%)	1 (2%)	0 (0%)
Gray literature (e.g. technical reports, white papers on DSMLs) [C018_03]	2 (3%)	6 (10%)	16 (26%)	24 (39%)	0 (0%)	12 (20%)	1 (2%)	0 (0%)
Case-study reports (e.g. on DSML customer projects) [C018_04]	1 (2%)	9 (15%)	10 (16%)	17 (28%)	5 (8%)	18 (30%)	1 (2%)	0 (0%)
Standardization body specifications & guidelines (e.g. OMG MDA Guide) [C018_05]	5 (8%)	8 (13%)	11 (18%)	17 (28%)	10 (16%)	9 (15%)	1 (2%)	0 (0%)
Documented design decisions (i.e. self-documented design decisions from former projects) [C018_06]	2 (3%)	7 (11%)	8 (13%)	15 (25%)	4 (7%)	24 (39%)	1 (2%)	0 (0%)
Pattern collections (e.g. Patterns for Model-Driven Software-Development by Markus Völter and Jorn Bettin) [C018_07]	0 (0%)	10 (16%)	8 (13%)	9 (15%)	2 (3%)	31 (51%)	1 (2%)	0 (0%)

Optional question [C041]: *Comments on your ratings above (e.g. explanations for “Don't know” answers, mentioning a design rationale documentation format not listed above)*

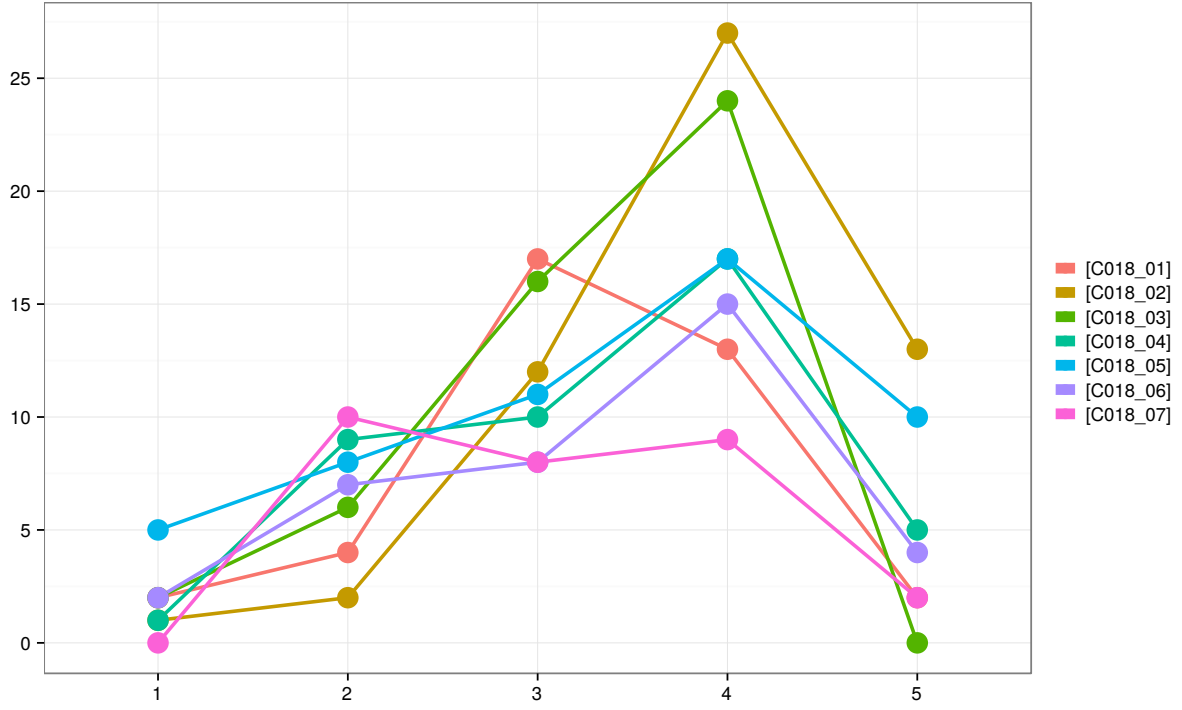


Figure 7: Design rationale reuse [C018].

- [C041\_01]: [01] [type: text; input: open]
  - Free text

Table 31: Comments on design rationale reuse [C041].

#1	As an author of some of the above categories of publications, I answered whether I considered the information in those publications to be useful, rather than the publication itself (which I wouldn't have needed). Some publications by others contain what I would claim are anti-patterns, generally from an attempt to apply to DSLs principles from standard languages, or to make a DSL as generic as possible, or because the tooling the author had in mind required so much effort to use.
#2	These monographies were not available when we started working on URN.
#3	The industry projects did not really document design decisions.

### 3.9.6 Design Rationale Details

Mandatory question [C004]: *Imagine that already documented DSML design rationale is available for reuse in an ongoing decision-making activity. How do you rate the importance of the following details contained by design-decision documentation for your current decision making?*

- [C004\_01]: Problem statement: Describes the problem that has been repeatedly observed for several DSML design projects. [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_02]: Decision context: Describes the context for a specific design decision (including decision requirements, assumptions, constraints, preceding decisions). [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_03]: Stakeholders: Describes stakeholders responsible for and interested in a decision. [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_04]: Viewpoints: Describes the problem and solution alternatives from different views (e.g. for different stakeholders). [type: ordinal; input: scale]

- 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_05]: Status: Describes the concrete realization of a decision, such as, pending, decided, approved, or rejected. [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_06]: Decision options: Describes candidate solutions (alternatives) for a specific design problem. [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_07]: Decision drivers: Describes forces which steer the DSML designer towards a particular option (including strengths and weaknesses of an option). [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_08]: Decision consequences: Describes consequences and tradeoffs of selecting an option (or, a combination of options) for subsequent decisions. [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_09]: Applications: Describes how different design options were applied in DSML projects. [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered
- [C004\_10]: Sketch: Describes a concrete example of applying one of the options. [type: ordinal; input: scale]
  - 1 = Not at all important; 5 = Extremely important; -1 = Don't know; -9 = Not answered

Table 32: Design rationale details [C004]. Sample size = 57.

	1	2	3	4	5	-1	-9
Problem statement: Describes the problem that has been repeatedly observed for several DSML design projects. [C004_01]	1 (2%)	2 (4%)	14 (25%)	18 (32%)	21 (37%)	1 (2%)	0 (0%)
Decision context: Describes the context for a specific design decision (including decision requirements, assumptions, constraints, preceding decisions). [C004_02]	2 (4%)	2 (4%)	20 (35%)	17 (30%)	14 (25%)	2 (4%)	0 (0%)
Stakeholders: Describes stakeholders responsible for and interested in a decision. [C004_03]	2 (4%)	10 (18%)	16 (28%)	18 (32%)	7 (12%)	4 (7%)	0 (0%)
Viewpoints: Describes the problem and solution alternatives from different views (e.g. for different stakeholders). [C004_04]	3 (5%)	5 (9%)	18 (32%)	15 (26%)	14 (25%)	2 (4%)	0 (0%)
Status: Describes the concrete realization of a decision, such as, pending, decided, approved, or rejected. [C004_05]	6 (11%)	12 (21%)	18 (32%)	12 (21%)	5 (9%)	4 (7%)	0 (0%)
Decision options: Describes candidate solutions (alternatives) for a specific design problem. [C004_06]	3 (5%)	4 (7%)	18 (32%)	17 (30%)	12 (21%)	3 (5%)	0 (0%)
Decision drivers: Describes forces which steer the DSML designer towards a particular option (including strengths and weaknesses of an option). [C004_07]	3 (5%)	1 (2%)	19 (33%)	21 (37%)	9 (16%)	4 (7%)	0 (0%)
Decision consequences: Describes consequences and tradeoffs of selecting an option (or, a combination of options) for subsequent decisions. [C004_08]	1 (2%)	1 (2%)	17 (30%)	20 (35%)	14 (25%)	4 (7%)	0 (0%)
Applications: Describes how different design options were applied in DSML projects. [C004_09]	2 (4%)	7 (12%)	11 (19%)	20 (35%)	16 (28%)	1 (2%)	0 (0%)
Sketch: Describes a concrete example of applying one of the options. [C004_10]	0 (0%)	1 (2%)	13 (23%)	19 (33%)	24 (42%)	0 (0%)	0 (0%)

Optional question [C038]: *Comments on your ratings above (e.g. explanations for “Don't know” answers, mentioning a design-decision documentation detail not listed above)*

- [C038\_01]: [01] [type: text; input: open]
  - Free text

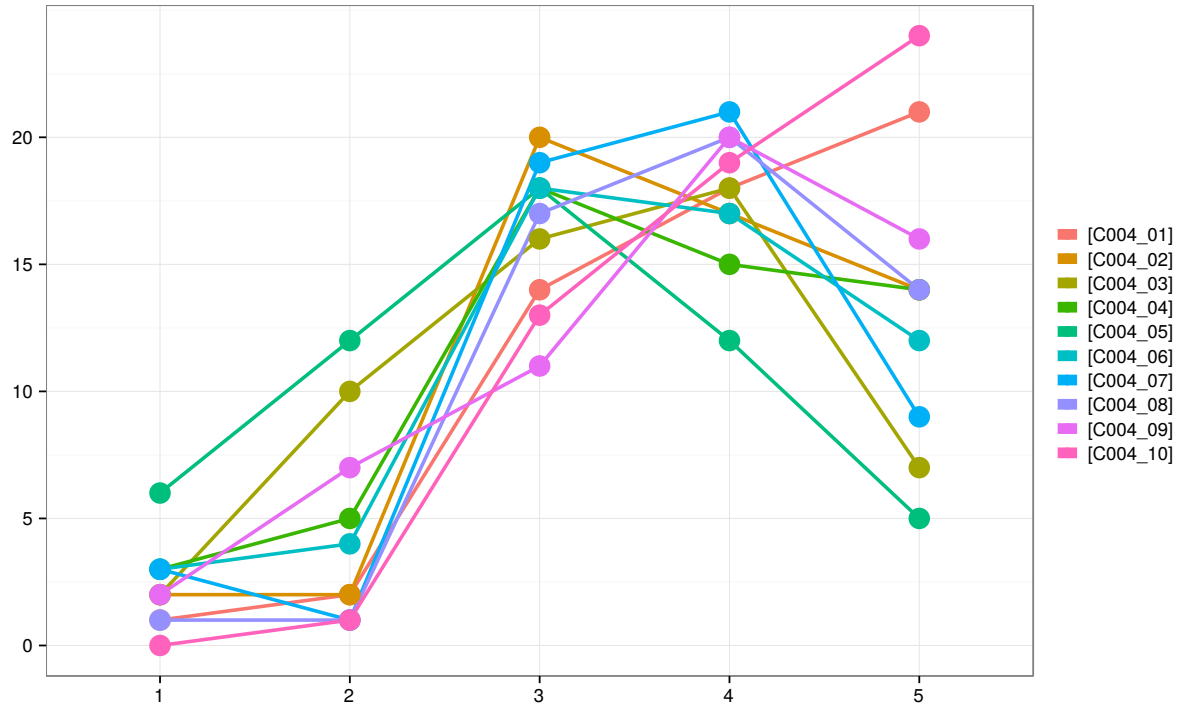


Figure 8: Design rationale details [C004].

Table 33: Comments on design rationale details [C038].

#1	This is true "design"; all details matter and all ways of contextualizing and concretizing the design to make early evaluation and improvement possible matter a lot.
#2	For "Problem statement" it's unclear whether you're talking about recording design rationale, or about general principles of DSML design.
#3	In on-going projects it is very important to realize how the change will affect to already made models and what is needed to update them - and if the tool can update existing models automatically.
#4	why do the percentage of this questionnaire go up by smaller and smaller numbers?
#5	I never use the descision options (alternatives)... it may certainly help but I have no idea on this importance. Decisions consequence where not really important since in many DSML cases the problems is sufficiently scoped to avoid such constraints. However, I saw that when using it in a model transformation context it would be interesting to document the transformation to understand the consequences.

### 3.10 Gender

Mandatory question [Z004]: *Your gender?*

- [Z004]: Gender [type: nominal; input: selection]
  - 1 = Female; 2 = Male; -9 = Not answered

Table 34: Gender [Z004]. Sample size = 62.

	Female	Male	Not answered
Frequency	6 (10%)	56 (90%)	0 (0%)

### 3.11 Country of Residence

Mandatory question [Z005]: *Which is your current country of residence?*

- [Z005]: Residence [type: nominal; input: selection]
  - 4 = Afghanistan; 248 = Åland Islands; 8 = Albania; 12 = Algeria; 16 = American Samoa; 20 = Andorra; 24 = Angola; 660 = Anguilla; 28 = Antigua and Barbuda; 32 = Argentina; 51 = Armenia; 533 = Aruba; 36 = Australia; 40 = Austria; 31 = Azerbaijan; 44 = Bahamas; 48 = Bahrain; 50 = Bangladesh; 52 = Barbados; 112 = Belarus; 56 = Belgium; 84 = Belize; 204 = Benin; 60 = Bermuda; 64 = Bhutan; 68 = Bolivia (Plurinational State of); 535 = Bonaire, Sint Eustatius and Saba; 70 = Bosnia and Herzegovina; 72 = Botswana; 76 = Brazil; 92 = British Virgin Islands; 96 = Brunei Darussalam; 100 = Bulgaria; 854 = Burkina Faso; 108 = Burundi; 132 = Cabo Verde; 116 = Cambodia; 120 = Cameroon; 124 = Canada; 136 = Cayman Islands; 140 = Central African Republic; 148 = Chad; 830 = Channel Islands; 152 = Chile; 156 = China; 344 = China, Hong Kong Special Administrative Region; 446 = China, Macao Special Administrative Region; 170 = Colombia; 174 = Comoros; 178 = Congo; 184 = Cook Islands; 188 = Costa Rica; 384 = Côte d'Ivoire; 191 = Croatia; 192 = Cuba; 531 = Curaçao; 196 = Cyprus; 203 = Czech Republic; 408 = Democratic People's Republic of Korea; 180 = Democratic Republic of the Congo; 208 = Denmark; 262 = Djibouti; 212 = Dominica; 214 = Dominican Republic; 218 = Ecuador; 818 = Egypt; 222 = El Salvador; 226 = Equatorial Guinea; 232 = Eritrea; 233 = Estonia; 231 = Ethiopia; 234 = Faeroe Islands; 238 = Falkland Islands (Malvinas); 242 = Fiji; 246 = Finland; 250 = France; 254 = French Guiana; 258 = French Polynesia; 266 = Gabon; 270 = Gambia; 268 = Georgia; 276 = Germany; 288 = Ghana; 292 = Gibraltar; 300 = Greece; 304 = Greenland; 308 = Grenada; 312 = Guadeloupe; 316 = Guam; 320 = Guatemala; 831 = Guernsey; 324 = Guinea; 624 = Guinea-Bissau; 328 = Guyana; 332 = Haiti; 336 = Holy See; 340 = Honduras; 348 = Hungary; 352 = Iceland; 356 = India; 360 = Indonesia; 364 = Iran (Islamic Republic of); 368 = Iraq; 372 = Ireland; 833 = Isle of Man; 376 = Israel; 380 = Italy; 388 = Jamaica; 392 = Japan; 832 = Jersey; 400 = Jordan; 398 = Kazakhstan; 404 = Kenya; 296 = Kiribati; 414 = Kuwait; 417 = Kyrgyzstan; 418 = Lao People's Democratic Republic; 428 = Latvia; 422 = Lebanon; 426 = Lesotho; 430 = Liberia; 434 = Libya; 438 = Liechtenstein; 440 = Lithuania; 442 = Luxembourg; 450 = Madagascar; 454 = Malawi; 458 = Malaysia; 462 = Maldives; 466 = Mali; 470 = Malta; 584 = Marshall Islands; 474 = Martinique; 478 = Mauritania; 480 = Mauritius; 175 = Mayotte; 484 = Mexico; 583 = Micronesia (Federated States of); 492 = Monaco; 496 = Mongolia; 499 = Montenegro; 500 = Montserrat; 504 = Morocco; 508 = Mozambique; 104 = Myanmar; 516 = Namibia; 520 = Nauru; 524 = Nepal; 528 = Netherlands; 540 = New Caledonia; 554 = New Zealand; 558 = Nicaragua; 562 = Niger; 566 = Nigeria; 570 = Niue; 574 = Norfolk Island; 580 = Northern Mariana Islands; 578 = Norway; 512 = Oman; 586 = Pakistan; 585 = Palau; 591 = Panama; 598 = Papua New Guinea; 600 = Paraguay; 604 = Peru; 608 = Philippines; 612 = Pitcairn; 616 = Poland; 620 = Portugal; 630 = Puerto Rico; 634 = Qatar; 410 = Republic of Korea; 498 = Republic of Moldova; 638 = Réunion; 642 = Romania; 643 = Russian Federation; 646 = Rwanda; 652 = Saint Barthélemy; 654 = Saint Helena; 659 = Saint Kitts and Nevis; 662 = Saint Lucia; 663 = Saint Martin (French part); 666 = Saint Pierre and Miquelon; 670 = Saint Vincent and the Grenadines; 882 = Samoa; 674 = San Marino; 678 = Sao Tome and Principe; 680 = Sark; 682 = Saudi Arabia; 686 = Senegal; 688 = Serbia; 690 = Seychelles; 694 = Sierra Leone; 702 = Singapore; 534 = Sint Maarten (Dutch part); 703 = Slovakia; 705 = Slovenia; 90 = Solomon Islands; 706 = Somalia; 710 = South Africa; 728 = South Sudan; 724 = Spain; 144 = Sri Lanka; 275 = State of Palestine; 729 = Sudan; 740 = Suriname; 744 = Svalbard

and Jan Mayen Islands; 748 = Swaziland; 752 = Sweden; 756 = Switzerland; 760 = Syrian Arab Republic; 762 = Tajikistan; 764 = Thailand; 807 = The former Yugoslav Republic of Macedonia; 626 = Timor-Leste; 768 = Togo; 772 = Tokelau; 776 = Tonga; 780 = Trinidad and Tobago; 788 = Tunisia; 792 = Turkey; 795 = Turkmenistan; 796 = Turks and Caicos Islands; 798 = Tuvalu; 800 = Uganda; 804 = Ukraine; 784 = United Arab Emirates; 826 = United Kingdom of Great Britain and Northern Ireland; 834 = United Republic of Tanzania; 840 = United States of America; 850 = United States Virgin Islands; 858 = Uruguay; 860 = Uzbekistan; 548 = Vanuatu; 862 = Venezuela (Bolivarian Republic of); 704 = Viet Nam; 876 = Wallis and Futuna Islands; 732 = Western Sahara; 887 = Yemen; 894 = Zambia; 716 = Zimbabwe; -2 = other text response; -9 = Not answered

- [Z005s]: Residence (free text) [type: text; input: open]
  - Free text

Table 35: Country of residence [Z005]. Sample size = 62.

	Frequency
Argentina	1 (2%)
Australia	2 (3%)
Austria	8 (13%)
Belgium	1 (2%)
Canada	7 (11%)
Chile	1 (2%)
Denmark	1 (2%)
Finland	3 (5%)
Åland Islands	1 (2%)
France	5 (8%)
Germany	8 (13%)
Israel	2 (3%)
Italy	7 (11%)
Netherlands	1 (2%)
Poland	1 (2%)
Romania	1 (2%)
Serbia	2 (3%)
Spain	3 (5%)
Sweden	2 (3%)
Turkey	1 (2%)
United Kingdom of Great Britain and Northern Ireland	1 (2%)
United States of America	3 (5%)

### 3.12 Further Comments

Optional question [Z003]: *Anything else you would like to say (e.g. comments or improvements to the questionnaire)?*

- [Z003\_01]: [01] [type: text; input: open]
  - Free text

Table 36: Further comments [Z003].

---

#1	<p>Most questions were regarding the industrial applications; but those are not the most interesting. In these contexts we often apply well known and tried and tested strategies, simply matching past design elements to the current situation. In the academic context however, we are exploring harder problems and taking higher risks. The design exploration is much more risky and more deep and there is a bigger need for documentation and creating improvement loops; i.e. managing the design process.</p> <p>I also missed questions or answers regarding rapid prototyping, which we use a key design and design evaluation tool.</p>
#2	<p>...forcing me to type in a country?! Folks, you have methodology issues.</p>
#3	<p>I question strongly your definition of a DSML as being visual. Textual DSMLs are just as legitimate, and are very widely used. In fact, I would guess there might be 20 times more textual DSMLs out there in industry than graphical ones. You do a disservice to the industry by using such a narrow definition. Graphical DSMLs historically have taken much more effort to get right since there are lots more degrees of freedom in their concrete syntax; and they tend to be less readily adopted since people have to commit to specific modelling user interfaces. DSMLs have been used for decades in industry, often in isolated projects, and usually never documented. When I was in industry (large telecom company with a huge number of employees and projects) you would often find people creating DSMLs – sometimes just in the context of one developer or one small team.</p> <p>I don't see there is much difference between design rationale for DSMLs and design rationale for other aspects of software.</p> <p>Your separation of research vs. industry DSMLs is artificial; I have witnessed cases where a DSML made its way from academia to industry and vice-versa, via graduate students for example.</p> <p>There are also DSMLs that are UML-based but not using the UML metamodel or profiles, but by implementing UML notation in a separate tool.</p> <p>The boundaries between what is a DSML and what is a general purpose ML are also very blurred. I was involved in several predecessors of UML long ago; at the time some people would have used the term 'domain specific' because the languages were specific to OO software or to Real Time software. I once had a paper turned down for a general-purpose modelling language because a reviewer said 'this is just another domain-specific modelling language, and we have too many of them, they are not worth writing about because everybody does them'.</p>
#4	<p>some coffee with it</p>
#5	<p>We also actually used our DSML (URN, and especially its Goal-oriented Requirement Language) to capture some rationales!</p>
#6	<p>Good luck!</p>
#7	<p>Very interesting questionnaire tackling an important aspect for DSML design</p>

---



## References

- [1] The American Association for Public Opinion Research. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*. AAPOR, 7th edition, 2011.

## A DSML Design Rationale Questionnaire

In this section of the appendix, all pages of the questionnaire, the PHP source code for structuring the questionnaire, and the assigned variables and values are shown.

**Dear colleague!**

Thank you very much for participating in our survey!

This survey targets you as an expert on **domain-specific modeling languages** (DSMLs). We define a DSML as being a specialized modeling language tailored primarily for graphical modeling tasks in a particular application domain, supporting the model-driven development (MDD) of software systems for this domain. As a special kind of domain-specific languages (DSLs), DSMLs provide end users with at least one graphical or diagrammatic concrete syntax; in contrast to textual or form-/table-based DSLs, for instance.

With this survey, we want to collect expert opinions on different aspects of documenting and using **design rationale** when developing DSMLs. In the context of DSML development, design rationale is the reasoning and justification of decisions made when designing, creating, and using the core artifacts of a DSML (e.g. abstract and concrete syntax, behavior specification, metamodeling infrastructure, MDD tool chain).

According to our pre-tests, you will approximately need **15-20 minutes** to complete the questionnaire.

**The questionnaire is completely anonymous.**

The survey is part of a long-term research project conducted at the [Institute for Information Systems and New Media](#) at the [Vienna University of Economics and Business \(WU Vienna\)](#).

If you have any questions or experience any problems during or after the study, do not hesitate to contact [Bernhard Hoisl](#).

Question [A001]

- ☐ I agree to participate in this survey, realizing that I may withdraw at any time. I agree that the data collected for this study may be published and used by the investigators for research purposes.

**A001\_01** I agree to participate in this survey, realizing that I may withdraw at any time. I agree that the data collected for this study may be published and used by the investigators for research purposes.

1 = Not checked  
2 = Checked

**To how many DSMLs have you contributed professionally (in academia and/or industry) so far?**  
[B002]

Note: A DSML **based on the Unified Modeling Language (UML)** is a DSML which has the UML as its host modeling language. The DSML is built on top of and/or extends the UML metamodel (e.g. by using UML profiles and/or metamodel extensions).

I have contributed to  **industry DSML(s)** so far, of which  is/are based on the UML.

Note: An **industry DSML** is developed as part of one or several predominantly industry-driven software-development projects with the primary aim to create or to improve a commercial software product. An industry-driven software-development project can include preparatory and intermediate steps towards developing a commercial end product (e.g. evolutionary prototypes, pilot systems).

I have contributed to  **scientific DSML(s)** so far, of which  is/are based on the UML.

Note: A **scientific DSML** is developed as part of one or several predominantly research-driven software-development projects which result in non-commercial software artifacts (e.g. research prototypes, experiment materials). A research-driven software-development project aims at exploring, collecting, systematizing, and validating knowledge on software engineering, in general, and DSML engineering, in particular.

**B002\_02** I have contributed to ... industry DSML(s) so far,  
**B002\_04** of which ... is/are based on the UML. Note: An industry DSML is developed as part of one or several predominantly industry-driven software-development projects with the primary aim to create or to improve a commercial software product. An industry-driven software-development project can include preparatory and intermediate steps towards developing a commercial end product (e.g. evolutionary prototypes, pilot systems).  
**B002\_01** I have contributed to ... scientific DSML(s) so far,  
**B002\_03** of which ... is/are based on the UML. Note: A scientific DSML is developed as part of one or several predominantly research-driven software-development projects which result in non-commercial software artifacts (e.g. research prototypes, experiment materials). A research-driven software-development project aims at exploring, collecting, systematizing, and validating knowledge on software engineering, in general, and DSML engineering, in particular.  
Free input (integer)

---

**Page 03**

PHP code

```
if (value('B002_03') > value('B002_01')) {
    markFail('B002_01');
    markFail('B002_03');
    text('DSMLs-Error');
    repeatPage();
}
if (value('B002_04') > value('B002_02')) {
    markFail('B002_02');
    markFail('B002_04');
```

```
text('DSMLs-Error');
repeatPage();
}
```

text('DSMLs-Error')

The number of UML-based DSMLs cannot be higher than the total number of DSMLs!

text('DSMLs-Error')

The number of UML-based DSMLs cannot be higher than the total number of DSMLs!

PHP code

```
if (value('B002_01') == 0 && value('B002_02') == 0) {
    goToPage('last');
}
```

PHP code

```
html('
<div class="info spacing">
<div class="symbol">
<div class="content">Please answer the following questions based on your
experience with all of your <b>' . (value('B002_01') + value('B002_02')) .
' DSMLs (whether scientific, industry, UML-based, or others)</b>.</div>
</div>
</div>
');
```

When did you contribute to the DSMLs indicated before? [B006]

Start year (approx.)

[Please choose] ▼

**B006** Start year (approx.)

2015 = 2015  
2014 = 2014  
2013 = 2013  
2012 = 2012  
2011 = 2011  
2010 = 2010  
2009 = 2009  
2008 = 2008  
2007 = 2007  
2006 = 2006  
2005 = 2005

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 1977 = 1977  
 1976 = 1976  
 1975 = 1975  
 1974 = 1974  
 1973 = 1973  
 1972 = 1972  
 1971 = 1971  
 1970 = 1970  
 -9 = Not answered

Question [B007]

End year (approx.)

[Please choose] ▼

**B007** End year (approx.)

2015 = 2015  
 2014 = 2014  
 2013 = 2013  
 2012 = 2012  
 2011 = 2011  
 2010 = 2010  
 2009 = 2009  
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 1978 = 1978  
 1977 = 1977  
 1976 = 1976  
 1975 = 1975  
 1974 = 1974  
 1973 = 1973  
 1972 = 1972  
 1971 = 1971  
 1970 = 1970  
 -9 = Not answered

When contributing to the DSMLs indicated before, you worked for a/ as a: [B003]

- ☐ For-profit organization (e.g. privately held company)  
☐ Non-profit organization (e.g. publicly funded university)  
☐ Freelancer/Independent  
☐ Other employer:  (separate multiple entries by commas)

**B003\_01** For-profit organization (e.g. privately held company)  
**B003\_02** Non-profit organization (e.g. publicly funded university)  
**B003\_03** Freelancer/Independent  
**B003\_04** Other employer  
 1 = Not checked  
 2 = Checked  
**B003\_04a** Other employer (free text)  
 Free text

When contributing to the DSMLs indicated before, your job description included: [B004]

- ☐ Tertiary education (e.g. university lecturer)  
☐ Research (e.g. research associate)  
☐ Software development (e.g. software architect, developer, tester)  
☐ Other description:  (separate multiple entries by commas)

**B004\_01** Tertiary education (e.g. university lecturer)  
**B004\_02** Research (e.g. research associate)  
**B004\_03** Software development (e.g. software architect, developer, tester)  
**B004\_04** Other description  
 1 = Not checked  
 2 = Checked  
**B004\_04a** Other description (free text)  
 Free text

## PHP code

```
if (value('B006') > value('B007')) {
    text('Years-Error');
    repeatPage();
}
```

## text("Years-Error")

The end year cannot precede the start year!

## PHP code

```
if (value('B004_03') == 2) {
    question('B005');
} else {
    goToPage('next');
}
```

## question('B005')

**Your job description included software development. In the software-development projects involving these DSMLs, you took the following role(s): [B005]**

- ☐ Project manager
- ☐ Business analyst/designer
- ☐ Systems analyst, requirements specifier
- ☐ Software architect/designer
- ☐ Software developer/implementer
- ☐ Software tester
- ☐ Other role(s):  (separate multiple entries by commas)

**B005\_01** Project manager  
**B005\_02** Business analyst/designer  
**B005\_03** Systems analyst, requirements specifier  
**B005\_04** Software architect/designer  
**B005\_05** Software developer/implementer  
**B005\_06** Software tester  
**B005\_07** Other role(s)  
     1 = Not checked  
     2 = Checked  
**B005\_07a** Other role(s) (free text)



## PHP code

```

if (value('B002_01') > 0 && value('B002_02') > 0) {
    html('<p>On the subsequent pages, you will be presented questions on your
experience in DSML development and your expert opinion on documenting
design rationale in this context.</p>');
    html('<p>Please answer these questions based on your experience with your
<b>' . value('B002_02') . ' industry DSMLs (whether UML-based or others)
</b>.</p>');
}

```

## PHP code

```

if (value('B002_01') > 0 && value('B002_02') > 0) {
    html('<div class="info spacing">');
    html('<div class="symbol">');
    html('<div class="content">Please answer the following questions based on
your experience with your <b>' . value('B002_02') . ' industry DSMLs
(whether UML-based or others)</b>.</div>');
    html('</div>');
    html('</div>');
}

```

**Which application domains were targeted by the DSMLs, to which you contributed? [C036]**

Note: The list shows common domains but is not meant to be exhaustive. If you do not find a domain you developed a DSML for, then please classify the domain of your DSML according to the [2012 ACM Computing Classification System](#) (link opens in a new window).

- ☐ Service-oriented architectures
- ☐ Web services
- ☐ Embedded systems
- ☐ Model verification and validation
- ☐ Software development techniques
- ☐ Security requirements
- ☐ Model checking
- ☐ Requirements analysis
- ☐ Web applications
- ☐ Data warehouses
- ☐ Graphical user interfaces
- ☐ Real-time systems
- ☐ Software development process management
- ☐ Software testing and debugging
- ☐ Others:  (separate multiple entries by

commas)

☐ Don't know

**C036\_01** Service-oriented architectures  
**C036\_02** Web services  
**C036\_03** Embedded systems  
**C036\_04** Model verification and validation  
**C036\_05** Software development techniques  
**C036\_06** Security requirements  
**C036\_07** Model checking  
**C036\_08** Requirements analysis  
**C036\_09** Web applications  
**C036\_10** Data warehouses  
**C036\_11** Graphical user interfaces  
**C036\_12** Real-time systems  
**C036\_13** Software development process management  
**C036\_14** Software testing and debugging  
**C036\_15** Others  
**C036\_16** Don't know  
1 = Not checked  
2 = Checked  
**C036\_15a** Others (free text)  
Free text

---

Page 07

PHP code

```
if (value('B002_01') > 0 && value('B002_02') > 0) {  
    html('<div class="info spacing">');  
    html('<div class="symbol">');  
    html('<div class="content">Please answer the following questions based on  
your experience with your <b>' . value('B002_02') . ' industry DSMLs  
(whether UML-based or others)</b>.</div>');  
    html('</div>');  
    html('</div>');  
}
```

**Which metamodeling languages were used to develop your DSMLs? [C034]**

Note: The list shows common metamodeling languages but is not meant to be exhaustive.

- ☐ Meta Object Facility 1.4 (MOF 1.4)
- ☐ Meta Object Facility 2.x (MOF 2.x)
- ☐ Ecore
- ☐ Kernel MetaMetaModel (KM3)
- ☐ Kermeta
- ☐ MetaGME
- ☐ XMF Xcore
- ☐ XML Schema Definition (XSD)

Others:  (separate multiple entries by

☐ commas)

☐ Don't know

**C034\_01** Meta Object Facility 1.4 (MOF 1.4)  
**C034\_02** Meta Object Facility 2.x (MOF 2.x)  
**C034\_03** Ecore  
**C034\_04** Kernel MetaMetaModel (KM3)  
**C034\_05** Kermeta  
**C034\_06** MetaGME  
**C034\_07** XMF Xcore  
**C034\_08** XML Schema Definition (XSD)  
**C034\_09** Others  
**C034\_10** Don't know  
1 = Not checked  
2 = Checked  
**C034\_09a** Others (free text)  
Free text

**Into which model-driven development (MDD) tool chains were your DSMLs integrated? [C035]**

Note: The list shows common MDD tool chains but is not meant to be exhaustive.

☐ Eclipse (EMF, GMF, Sirius etc.)

☐ Obeo Designer

☐ MetaCase MetaEdit+

☐ Gentleware Poseidon

☐ NoMagic MagicDraw

☐ Rational Software Architect

☐ Sparx Systems Enterprise Architect

☐ Actifsource

☐ Microsoft Visual Studio

☐ Others:  (separate multiple entries by commas)

☐ None

☐ Don't know

**C035\_01** Eclipse (EMF, GMF, Sirius etc.)  
**C035\_02** Obeo Designer  
**C035\_03** MetaCase MetaEdit+  
**C035\_04** Gentleware Poseidon  
**C035\_05** NoMagic MagicDraw  
**C035\_06** Rational Software Architect  
**C035\_07** Sparx Systems Enterprise Architect  
**C035\_08** Actifsource  
**C035\_09** Microsoft Visual Studio  
**C035\_10** Others  
**C035\_11** None  
**C035\_12** Don't know

1 = Not checked  
2 = Checked

**C035\_10a** Others (free text)  
Free text

#### PHP code

```
if (value('B002_02') > 0) {  
    $dsmls = value('B002_04');  
} else {  
    $dsmls = value('B002_03');  
}  
if ($dsmls > 0) {  
    html('  
        <div class="title">  
            <p>You contributed to ' . $dsmls . ' UML-based DSMLs. Which UML  
version(s) were your DSMLs based on?</p>  
        </div>  
    ');  
    question('C049');  
}
```

#### question('C049')

Question [C049]

- ☐ UML 1.3
- ☐ UML 1.4
- ☐ UML 1.5
- ☐ UML 2.0
- ☐ UML 2.1.1
- ☐ UML 2.1.2
- ☐ UML 2.2
- ☐ UML 2.3
- ☐ UML 2.4
- ☐ UML 2.4.1
- ☐ UML 2.5
- ☐ Don't know

**C049\_01** UML 1.3  
**C049\_02** UML 1.4  
**C049\_03** UML 1.5  
**C049\_04** UML 2.0  
**C049\_05** UML 2.1.1  
**C049\_06** UML 2.1.2  
**C049\_07** UML 2.2  
**C049\_08** UML 2.3  
**C049\_09** UML 2.4  
**C049\_10** UML 2.4.1

**C049\_11** UML 2.5  
**C049\_12** Don't know  
 1 = Not checked  
 2 = Checked

PHP code

```
if (value('B002_01') > 0 && value('B002_02') > 0) {
  html('<div class="info spacing">');
  html('<div class="symbol">');
  html('<div class="content">Please answer the following questions based on
your experience with your <b>' . value('B002_02') . ' industry DSMLs
(whether UML-based or others)</b>.</div>');
  html('</div>');
  html('</div>');
}
```

**Please indicate your perceptions regarding DSML design rationale. [C001]**

Note: Design rationale is the reasoning and justification of decisions made when designing, creating, and using the core artifacts of a DSML (e.g. abstract and concrete syntax, behavior specification, metamodeling infrastructure, MDD tool chain).

	Not at all important					Extremely important		Don't know
Do you think that it is important to use design rationale as part of DSML design documentation? As a design documentation, design rationale offers a picture of the history of the design and reasons for the design choices leading to the final product.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>

**C001\_01** Do you think that it is important to use design rationale as part of DSML design documentation? As a design documentation, design rationale offers a picture of the history of the design and reasons for the design choices leading to the final product.  
 1 = Not at all important  
 5 = Extremely important  
 -1 = Don't know  
 -9 = Not answered

**Did you perform the following activities to document design rationale (for at least one DSML)? If yes, how do you rate their usefulness? [C013]**

	Not at all useful					Extremely useful		Never performed	Don't know
Meeting protocols (e.g. brainstorming sessions, focus groups, design meetings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>
Interview protocols, questionnaires (e.g. with different stakeholders)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>

Conceptual diagrams (e.g. decision-flow modeling)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work diaries (e.g. recording individual events that occur during the day)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Think-aloud-session protocols (e.g. think out loud while performing a task)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Participant observations (e.g. recording participants' activities)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Written documentation (e.g. writing software manuals, source-code comments, changelog files, SCM commit messages, issue-tracker entries)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**C013\_01** Meeting protocols (e.g. brainstorming sessions, focus groups, design meetings)  
**C013\_02** Interview protocols, questionnaires (e.g. with different stakeholders)  
**C013\_03** Conceptual diagrams (e.g. decision-flow modeling)  
**C013\_04** Work diaries (e.g. recording individual events that occur during the day)  
**C013\_05** Think-aloud-session protocols (e.g. think out loud while performing a task)  
**C013\_06** Participant observations (e.g. recording participants' activities)  
**C013\_07** Written documentation (e.g. writing software manuals, source-code comments, changelog files, SCM commit messages, issue-tracker entries)  
  
1 = Not at all useful  
5 = Extremely useful  
-1 = Never performed  
-2 = Don't know  
-9 = Not answered

**Comments on your ratings above (e.g. explanations for “Don’t know” answers, mentioning a documentation activity not listed above) [C044]**

Note: If you feel that a documentation activity is missing and would like to mention it here, please also indicate its usefulness on a Likert scale from 1 (not at all useful) to 5 (extremely useful).

**C044\_01** [01]  
Free text

## PHP code

```

if (value('B002_01') > 0 && value('B002_02') > 0) {
    html('<div class="info spacing">');
    html('<div class="symbol">');
    html('<div class="content">Please answer the following questions based on
your experience with your <b>' . value('B002_02') . ' industry DSMLs
(whether UML-based or others)</b>.</div>');
    html('</div>');
    html('</div>');
}

```

Did you document the following details of design rationale (for at least one DSML)? If yes, how do you rate their usefulness? [C046]

	Not at all useful	Extremely useful	Never documented	Don't know
<b>Issues</b> The major questions, problems, or aspects of the DSML under development addressed in a decision-making activity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Alternatives</b> Solutions or proposals about aspects of the DSML under development, which are at issue.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Criteria</b> The reasons, arguments, or opinions which evaluate an alternative solution or proposal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Decision-making context</b> References to and/or details of preceding or succeeding design decisions, for example.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Activity context</b> Contextual information about the decision-making activity (e.g. activity time, number and identity of decision makers).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Project context</b> Details on the overall development project related to or affected by a design decision (e.g. current project phase, planning of follow-up activities).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**C046\_01** Issues The major questions, problems, or aspects of the DSML under development addressed in a decision-making activity.

**C046\_02** Alternatives Solutions or proposals about aspects of the DSML under development, which are at issue.

**C046\_03** Criteria The reasons, arguments, or opinions which evaluate an alternative solution or proposal.

**C046\_04** Decision-making context References to and/or details of preceding or succeeding design decisions, for example.

**C046\_05** Activity context Contextual information about the decision-making activity (e.g. activity time, number and identity of decision makers).

**C046\_06** Project contextDetails on the overall development project related to or affected by a design decision (e.g. current project phase, planning of follow-up activities).

1 = Not at all useful  
5 = Extremely useful  
-1 = Never documented  
-2 = Don't know  
-9 = Not answered

**Comments on your ratings above (e.g. explanations for "Don't know" answers, mentioning a design rationale detail not listed above) [C047]**

Note: If you feel that a design rationale detail is missing and would like to mention it here, please also indicate its usefulness on a Likert scale from 1 (not at all useful) to 5 (extremely useful).

**C047\_01** [01]

Free text

Page 10

PHP code

```
if (value('B002_01') > 0 && value('B002_02') > 0) {
    html('<div class="info spacing">');
    html('<div class="symbol">');
    html('<div class="content">Please answer the following questions based on
your experience with your <b>' . value('B002_02') . ' industry DSMLs
(whether UML-based or others)</b>.</div>');
    html('</div>');
    html('</div>');
}
```

**Did you encounter the following barriers to documenting design rationale (for at least one DSML)? If yes, how would you rate them? [C045]**

	Not a barrier at all			Extreme barrier	Never encountered	Don't know
There were no standards or requirements in the project or organization to document design decisions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The extra work of documenting design decisions was not justified.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The ones meant to document the design decisions were not the ones to benefit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



from (re-)using them later (e.g. in another project).

The project or organization set time and budget constraints.

Tool support for documenting design decisions was absent.

Documenting design decisions disrupted the actual decision-making process.

Documenting design decisions allowed stakeholders to review and to challenge the reasons for making the decisions at a later point.

It was unclear what to document exactly (e.g. issues, alternatives, criteria).

There were no prior design decisions available for reuse.

○ ○ ○ ○ ○

○ ○ ○ ○ ○

○ ○ ○ ○ ○

○ ○ ○ ○ ○

○ ○ ○ ○ ○

○ ○ ○ ○ ○

○ ○

○ ○

○ ○

○ ○

○ ○

○ ○

- C045\_01** There were no standards or requirements in the project or organization to document design decisions.
- C045\_02** The extra work of documenting design decisions was not justified.
- C045\_03** The ones meant to document the design decisions were not the ones to benefit from (re-)using them later (e.g. in another project).
- C045\_04** The project or organization set time and budget constraints.
- C045\_05** Tool support for documenting design decisions was absent.
- C045\_06** Documenting design decisions disrupted the actual decision-making process.
- C045\_07** Documenting design decisions allowed stakeholders to review and to challenge the reasons for making the decisions at a later point.
- C045\_08** It was unclear what to document exactly (e.g. issues, alternatives, criteria).
- C045\_09** There were no prior design decisions available for reuse.
- 1 = Not a barrier at all  
5 = Extreme barrier  
-1 = Never encountered  
-2 = Don't know  
-9 = Not answered

**Comments on your ratings above (e.g. explanations for “Don’t know” answers, mentioning a barrier not listed above) [C048]**

Note: If you feel that a barrier is missing and would like to mention it here, please also rate the barrier on a Likert scale from 1 (not a barrier at all) to 5 (extreme barrier).

**C048\_01 [01]**

Free text

Page 11

PHP code

```
if (value('B002_01') > 0 && value('B002_02') > 0) {
    html('<div class="info spacing">');
    html('<div class="symbol">');
    html('<div class="content">Please answer the following questions based on
your experience with your <b>' . value('B002_02') . ' industry DSMLs
(whether UML-based or others)</b>.</div>');
    html('</div>');
    html('</div>');
}
```

**Did you (re)use design rationale available from the following sources and documented in the following formats for making design decisions (on at least one DSML)? If yes, how do you rate their usefulness? [C018]**

	Not at all useful					Extremely useful		Never used	Don't know
Books/Monographies for practitioners (e.g. <a href="#">Model-Driven Software Development</a> by Thomas Stahl and Markus Völter)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientific publications (e.g. journal articles on DSMLs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gray literature (e.g. technical reports, white papers on DSMLs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case-study reports (e.g. on DSML customer projects)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Standardization body specifications & guidelines (e.g. <a href="#">OMG MDA Guide</a> )	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Documented design decisions (i.e. self-documented design decisions from former projects)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pattern collections (e.g. <a href="#">Patterns for Model-Driven Software-Development</a> by Markus Völter and Jorn Bettin)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<b>C018_01</b>	Books/Monographies for practitioners (e.g. Model-Driven Software Development by Thomas Stahl and Markus Völter)
<b>C018_02</b>	Scientific publications (e.g. journal articles on DSMLs)
<b>C018_03</b>	Gray literature (e.g. technical reports, white papers on DSMLs)
<b>C018_04</b>	Case-study reports (e.g. on DSML customer projects)
<b>C018_05</b>	Standardization body specifications & guidelines (e.g. OMG MDA Guide)
<b>C018_06</b>	Documented design decisions (i.e. self-documented design decisions from former projects)
<b>C018_07</b>	Pattern collections (e.g. Patterns for Model-Driven Software-Development by Markus Völter and Jorn Bettin)
1 = Not at all useful 5 = Extremely useful -1 = Never used -2 = Don't know -9 = Not answered	

**Comments on your ratings above (e.g. explanations for “Don’t know” answers, mentioning a design rationale documentation format not listed above) [C041]**

Note: If you feel that a design rationale documentation format is missing and would like to mention it here, please also indicate its usefulness on a Likert scale from 1 (not at all useful) to 5 (extremely useful).

**C041\_01** [01]  
Free text

Page 12

PHP code

```
if (value('B002_01') > 0 && value('B002_02') > 0) {
    html('<div class="info spacing">');
    html('<div class="symbol">');
    html('<div class="content">Please answer the following questions based on
your experience with your <b>' . value('B002_02') . ' industry DSMLs
(whether UML-based or others)</b>.</div>');
    html('</div>');
    html('</div>');
}
```

**Imagine that already documented DSML design rationale is available for reuse in an ongoing decision-making activity. How do you rate the importance of the following details contained by design-decision documentation for your current decision making? [C004]**

|

	Not at all important			Extremely important		Don't know
<b>Problem statement</b> Describes the problem that has been repeatedly observed for several DSML design projects.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Decision context</b> Describes the context for a specific design decision (including decision requirements, assumptions, constraints, preceding decisions).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Stakeholders</b> Describes stakeholders responsible for and interested in a decision.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Viewpoints</b> Describes the problem and solution alternatives from different views (e.g. for different stakeholders).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Status</b> Describes the concrete realization of a decision, such as, pending, decided, approved, or rejected.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Decision options</b> Describes candidate solutions (alternatives) for a specific design problem.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Decision drivers</b> Describes forces which steer the DSML designer towards a particular option (including strengths and weaknesses of an option).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Decision consequences</b> Describes consequences and tradeoffs of selecting an option (or, a combination of options) for subsequent decisions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Applications</b> Describes how different design options were applied in DSML projects.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Sketch</b> Describes a concrete example of applying one of the options.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<b>C004_01</b>	<b>Problem statement</b>	Describes the problem that has been repeatedly observed for several DSML design projects.
<b>C004_02</b>	<b>Decision context</b>	Describes the context for a specific design decision (including decision requirements, assumptions, constraints, preceding decisions).
<b>C004_03</b>	<b>Stakeholders</b>	Describes stakeholders responsible for and interested in a decision.
<b>C004_04</b>	<b>Viewpoints</b>	Describes the problem and solution alternatives from different views (e.g. for different stakeholders).
<b>C004_05</b>	<b>Status</b>	Describes the concrete realization of a decision, such as, pending, decided, approved, or rejected.
<b>C004_06</b>	<b>Decision options</b>	Describes candidate solutions (alternatives) for a specific design problem.
<b>C004_07</b>	<b>Decision drivers</b>	Describes forces which steer the DSML designer towards a particular option (including strengths and

weaknesses of an option).

**C004\_08** Decision consequences Describes consequences and tradeoffs of selecting an option (or, a combination of options) for subsequent decisions.

**C004\_09** Applications Describes how different design options were applied in DSML projects.

**C004\_10** Sketch Describes a concrete example of applying one of the options.

1 = Not at all important  
 5 = Extremely important  
 -1 = Don't know  
 -9 = Not answered

**Comments on your ratings above (e.g. explanations for "Don't know" answers, mentioning a design-decision documentation detail not listed above) [C038]**

Note: If you feel that a design-decision documentation detail is missing and would like to mention it here, please also indicate how important it is on a Likert scale from 1 (not at all important) to 5 (extremely important).

**C038\_01** [01]  
 Free text

You have completed the main part of our survey. By filling out this last page and hitting the "Next" button at the bottom, your answers will be submitted.

**Your gender? [Z004]**

- ☐ Female
- ☐ Male

**Z004** Gender

1 = Female  
 2 = Male  
 -9 = Not answered

**Which is your current country of residence? [Z005]**

Note: The text input will suggest a list of countries as soon as you start typing.

**Z005 Residence**

4 = Afghanistan  
248 = Åland Islands  
8 = Albania  
12 = Algeria  
16 = American Samoa  
20 = Andorra  
24 = Angola  
660 = Anguilla  
28 = Antigua and Barbuda  
32 = Argentina  
51 = Armenia  
533 = Aruba  
36 = Australia  
40 = Austria  
31 = Azerbaijan  
44 = Bahamas  
48 = Bahrain  
50 = Bangladesh  
52 = Barbados  
112 = Belarus  
56 = Belgium  
84 = Belize  
204 = Benin  
60 = Bermuda  
64 = Bhutan  
68 = Bolivia (Plurinational State of)  
535 = Bonaire, Sint Eustatius and Saba  
70 = Bosnia and Herzegovina  
72 = Botswana  
76 = Brazil  
92 = British Virgin Islands  
96 = Brunei Darussalam  
100 = Bulgaria  
854 = Burkina Faso  
108 = Burundi  
132 = Cabo Verde  
116 = Cambodia  
120 = Cameroon  
124 = Canada  
136 = Cayman Islands  
140 = Central African Republic  
148 = Chad  
830 = Channel Islands  
152 = Chile  
156 = China  
344 = China, Hong Kong Special Administrative Region  
446 = China, Macao Special Administrative Region  
170 = Colombia  
174 = Comoros  
178 = Congo  
184 = Cook Islands  
188 = Costa Rica  
384 = Côte d'Ivoire  
191 = Croatia  
192 = Cuba  
531 = Curaçao  
196 = Cyprus  
203 = Czech Republic  
408 = Democratic People's Republic of Korea  
180 = Democratic Republic of the Congo  
208 = Denmark  
262 = Djibouti  
212 = Dominica  
214 = Dominican Republic  
218 = Ecuador  
818 = Egypt  
222 = El Salvador  
226 = Equatorial Guinea  
232 = Eritrea  
233 = Estonia  
231 = Ethiopia  
234 = Faeroe Islands  
238 = Falkland Islands (Malvinas)

242 = Fiji
246 = Finland
250 = France
254 = French Guiana
258 = French Polynesia
266 = Gabon
270 = Gambia
268 = Georgia
276 = Germany
288 = Ghana
292 = Gibraltar
300 = Greece
304 = Greenland
308 = Grenada
312 = Guadeloupe
316 = Guam
320 = Guatemala
831 = Guernsey
324 = Guinea
624 = Guinea-Bissau
328 = Guyana
332 = Haiti
336 = Holy See
340 = Honduras
348 = Hungary
352 = Iceland
356 = India
[...]
-2 = other text response
-9 = Not answered
<b>Z005s</b> Residence (free text)
Free text

#### PHP code

```
if (value('B002_03') > 0 || value('B002_04') > 0) {
    question('Z007');
} else {
    question('Z006');
}
```

#### question('Z007')

**Indicate whether you want to receive a copy of the research report and whether you agree to be contacted for a possible follow-up survey: [Z007]**

- ☐ I would like to receive a copy of the research report when it becomes available.
- ☐ You indicated that you have contributed to UML-based DSMLs. I agree to be contacted for a follow-up survey specifically on UML-based DSMLs.

Note: Your email address is stored separately from the survey's data. It is **not** possible to link email addresses to other data collected via this questionnaire. All questionnaires remain completely anonymous.

#### question('Z006')

**Indicate whether you want to receive a copy of the research report: [Z006]**

- ☐ I would like to receive a copy of the research report when it becomes available.

Note: Your email address is stored separately from the survey's data. It is **not** possible to link email addresses to other data collected via this questionnaire. All questionnaires remain completely anonymous.

**Anything else you would like to say (e.g. comments or improvements to the questionnaire)?**  
[Z003]

**Z003\_01** [01]  
Free text

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**Last page**

## **Thank you for completing the questionnaire!**

We would like to thank you very much for helping us.

Your answers were submitted, you may close the browser window or tab now.