

University of Groningen

Design of a Methodology to Support Software Release Decisions

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APPENDIX A: CASE STUDY PROTOCOL

A1. Questionnaires

Two questionnaires, prepared in advance, are used during the case studies:

1. The first questionnaire, with open-ended questions, is used to obtain background information from the software manufacturer in the case study; on characteristics of the software manufacturer's organization, characteristics of products developed, characteristics of the market, and a high-level description of the selected project(s).
2. The second questionnaire, with open and closed-end questions, is distributed to informants selected in each project, prior to the interview. See Appendix B for the questionnaire used in the first set of case studies in the Exploration phase, and Appendix D for the questionnaire used in the second set of case studies in the Testing phase.

A2. Preparation

In each case study selected, an internal coordinator, in the organization of the software manufacturer, is identified, to act as the direct contact person during the entire case study.

The researcher and the internal coordinator prepare the case study through the following activities:

- ❖ Determine the characteristics of the software manufacturer organization, the products being developed and the market, using the first questionnaire.
- ❖ Determine the unit of analysis [single project or multiple projects] and project(s) involved.
- ❖ Select informants to be interviewed. For each selected project the following informants are considered important [there is flexibility to also select other people]:
 - *Senior management representative*, responsible for the strategy and product roadmap;
 - *Marketing*: responsible for investigation of the market place for the software application [e.g. competition, customer needs, prices and quantities];
 - *Development*: responsible for the development of the software product [project leader], person responsible for the definition, and correct implementation, of the software architecture [software architect]; person responsible for the verification of the correct implementation of requirements [test manager];
 - *Maintenance & Exploitation*: person responsible for maintaining and exploiting the software product after its release.
- ❖ Distribute a brief description of the research study to all informants, with the objectives of the overall research in general, and the case study in particular, the procedure, and the questionnaire with different categories of questions, so informants can prepare themselves appropriately.
- ❖ Plan interviews [date, time, and selection of interview room]. Average interview - 2.0 hours.
- ❖ Identify relevant documentation for study by the researcher [e.g. process descriptions, minutes of meetings].

A3. Interviews

Interviews may be either with one informant [‘one on one’] or with multiple informants. Multiple informants in one interview will only be allowed if they can speak freely [no political or hierarchical obstacles between informants]. Multiple informants are in one interview session, should the unit of analysis involve more than one project. In this case informants of different projects, fulfilling the same role [e.g. development project leader], might be present in the same interview session. Each interview is digitally recorded.

The researcher starts each interview by briefly explaining the objectives, and the procedure of the interview. Further questions from informant(s) are answered.

The researcher conducts the interview by asking questions, using the questionnaire as a guideline. The need for interpretation and cross-checking is considered important here. The questions to be elaborated depend on the role of the informant in the organization/project, and specific issues raised during an interview. The researcher conducting the interview, can, at any time, decide to ask additional questions, if of the opinion that further relevant information could be elicited. Every informant is free to reply, but in irrelevant discussions between informants the researcher can intervene.

At the end of the interview, informants are given the opportunity to supply supplementary information on issues that have, in their opinion, not been sufficiently addressed.

A4. Documentation

The research is supported by documentation as far as possible. Examples of documentation are the description of the business case, the project plan, and minutes of meetings where the business case, the project plan/status and the release of a software application are discussed.

A5. Report

When all interviews of a particular case study have been completed, the researcher will write a case report within four weeks after the final interview. The case report will be distributed to persons interviewed, by the coordinator of each participating software manufacturer. The software manufacturer will be asked to formally agree to the contents of the case report within four weeks. For any supposed deficiencies, or contentious points, the researcher will react within two weeks, either by acknowledging and fixing the deficiency, or by demonstrating that there is no deficiency. If no agreement can be reached between the software manufacturer and the researcher on the contents of the case study report, the results of the entire case study will be rejected and not be further used in the research project.

A6. Confidentiality

The data obtained in each case study will be confidential. All interview reports, supplied documentation and the final case reports will be archived by the researcher in a safe place, and be destroyed two months after the research project ends. Each software manufacturer participating in a case study is free to use the contents of the case study report internally and/or externally.

APPENDIX B: QUESTIONNAIRE 1

Part I: Product Definition

Id.	Question																																																																								
1.	Does the organization or the project have a documented process in place to define the scope of the project? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know																																																																								
2.	Does each project need to have a business case, stating expected benefits versus costs? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know																																																																								
3.	Was a business case developed for this project? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know																																																																								
4.	Which stakeholders were involved in defining the project constraints and product requirements? _____ _____ _____																																																																								
5.	Which expectations, constraints and requirements were defined and which priorities were assigned to them [1: Very low - 5: Very high]? <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">▪ Expected revenue</td> <td style="width: 5%;">1</td> <td style="width: 5%;">2</td> <td style="width: 5%;">3</td> <td style="width: 5%;">4</td> <td style="width: 5%;">5</td> <td style="width: 5%;">O</td> <td style="width: 5%;">Do not know</td> </tr> <tr> <td>▪ Functional requirements</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Reliability</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Maintainability</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Time-to-market</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Development cost</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Operational cost</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Compliance with standards</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Other(s): _____</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td></td> <td></td> </tr> </table>	▪ Expected revenue	1	2	3	4	5	O	Do not know	▪ Functional requirements	1	2	3	4	5	O	Do not know	▪ Reliability	1	2	3	4	5	O	Do not know	▪ Maintainability	1	2	3	4	5	O	Do not know	▪ Time-to-market	1	2	3	4	5	O	Do not know	▪ Development cost	1	2	3	4	5	O	Do not know	▪ Operational cost	1	2	3	4	5	O	Do not know	▪ Compliance with standards	1	2	3	4	5	O	Do not know	▪ Other(s): _____	1	2	3	4	5		
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▪ Other(s): _____	1	2	3	4	5																																																																				
6.	In case the product developed is a subsequent version, what were the priorities of the first version? <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">▪ Revenue</td> <td style="width: 5%;">1</td> <td style="width: 5%;">2</td> <td style="width: 5%;">3</td> <td style="width: 5%;">4</td> <td style="width: 5%;">5</td> <td style="width: 5%;">O</td> <td style="width: 5%;">Do not know</td> </tr> <tr> <td>▪ Functional requirements</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Reliability</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Maintainability</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Time-to-market</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Development cost</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Operational cost</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Compliance with standards</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Other(s): _____</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td></td> <td></td> </tr> </table>	▪ Revenue	1	2	3	4	5	O	Do not know	▪ Functional requirements	1	2	3	4	5	O	Do not know	▪ Reliability	1	2	3	4	5	O	Do not know	▪ Maintainability	1	2	3	4	5	O	Do not know	▪ Time-to-market	1	2	3	4	5	O	Do not know	▪ Development cost	1	2	3	4	5	O	Do not know	▪ Operational cost	1	2	3	4	5	O	Do not know	▪ Compliance with standards	1	2	3	4	5	O	Do not know	▪ Other(s): _____	1	2	3	4	5		
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▪ Other(s): _____	1	2	3	4	5																																																																				
7.	In case the product developed is the first version, what will the priorities be of future versions? <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">▪ Revenue</td> <td style="width: 5%;">1</td> <td style="width: 5%;">2</td> <td style="width: 5%;">3</td> <td style="width: 5%;">4</td> <td style="width: 5%;">5</td> <td style="width: 5%;">O</td> <td style="width: 5%;">Do not know</td> </tr> <tr> <td>▪ Functional requirements</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Reliability</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Maintainability</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Time-to-market</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Development cost</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Operational cost</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Compliance with standards</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>O</td> <td>Do not know</td> </tr> <tr> <td>▪ Other(s): _____</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td></td> <td></td> </tr> </table>	▪ Revenue	1	2	3	4	5	O	Do not know	▪ Functional requirements	1	2	3	4	5	O	Do not know	▪ Reliability	1	2	3	4	5	O	Do not know	▪ Maintainability	1	2	3	4	5	O	Do not know	▪ Time-to-market	1	2	3	4	5	O	Do not know	▪ Development cost	1	2	3	4	5	O	Do not know	▪ Operational cost	1	2	3	4	5	O	Do not know	▪ Compliance with standards	1	2	3	4	5	O	Do not know	▪ Other(s): _____	1	2	3	4	5		
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▪ Compliance with standards	1	2	3	4	5	O	Do not know																																																																		
▪ Other(s): _____	1	2	3	4	5																																																																				
8.	How were the estimates for effort and schedule derived? _____ _____ O Do not know																																																																								
9.	Was enough time spent on deriving estimates for effort and schedule? <input type="checkbox"/> Yes <input type="checkbox"/> No, because: _____ <input type="checkbox"/> Do not know																																																																								
10.	Were different project alternatives considered? <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> No <input type="checkbox"/> Do not know																																																																								

Part IIa: Product Design

Id.	Question
1.	Were different architecture or design alternatives considered? <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> No <input type="checkbox"/> Do not know
2.	How were the reliability requirements addressed in the software architecture? _____ O Do not know
3.	How were the reliability requirements addressed at component level? _____ O Do not know
4.	How were the maintainability requirements addressed in the software architecture? _____ O Do not know
5.	How were the maintainability requirements addressed at component level? _____ O Do not know

Part IIb: Product Realization and Testing

Id.	Question
6.	Was the business case kept up to date during product implementation and test? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know
7.	How were the reliability requirements evaluated during implementation and test? _____ O Do not know
8.	To which extent was the level of reliability known at the release moment? Not at all 1 2 3 4 5 Very much O Do not know
9.	How were the maintainability requirements evaluated during implementation and test? _____ O Do not know
10.	To which extent was the level of corrective maintainability known at the release moment? Not at all 1 2 3 4 5 Very much O Do not know
11.	To which extent was it known what the costs are to repair a defect after the software has been released? Not at all 1 2 3 4 5 Very much O Do not know
12.	To which extent was the level of adaptive/perfective maintainability known at the release moment? Not at all 1 2 3 4 5 Very much O Do not know

Part III: Product Release

Id.	Question
1.	Does your organization or the project considered have a formal process in place for release decision-making? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know
2.	Was a formal decision process followed to arrive at the release decision? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know
3.	Were different release alternatives considered? <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> No <input type="checkbox"/> Do not know
4.	Describe how the decision to release the software was made (especially how alternatives were compared). _____ _____ _____
5.	Which stakeholders were involved in making the release decision? _____ _____ _____
6.	Was the release decision based purely on rational thinking? <input type="checkbox"/> Yes <input type="checkbox"/> No, because: _____ <input type="checkbox"/> Do not know
7.	Was the release decision based on a cost-benefit analysis? <input type="checkbox"/> Yes <input type="checkbox"/> No, because: _____ <input type="checkbox"/> Do not know
8.	Was the release decision made under time pressure? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know
9.	Was the level of available information sufficient to make the release decision? <input type="checkbox"/> Yes <input type="checkbox"/> No, because: _____ <input type="checkbox"/> Do not know
10.	Did you consider the release decision a routine decision? <input type="checkbox"/> Yes, because: _____ <input type="checkbox"/> No, because: _____ <input type="checkbox"/> Do not know
11.	Did you consider the release decision a recurring decision? <input type="checkbox"/> Yes, because: _____ <input type="checkbox"/> No, because: _____ <input type="checkbox"/> Do not know
12.	Could all possible release alternatives be considered, including the probability of criteria considered? <input type="checkbox"/> Yes <input type="checkbox"/> No, because: _____ <input type="checkbox"/> Do not know
13.	How many times was the release decision considered? _____ O Do not know
14.	Were the originally stated project objectives met? Not at all 1 2 3 4 5 Very much O Do not know
15.	If the originally stated project objectives were not met, what were the reasons for any discrepancies? _____ _____ O Do not know
16.	How do you assess the quality of the release decision-making process? Very low 1 2 3 4 5 Very high O Do not know
17.	How do you assess the rightness of the outcome of the release decision-making process? Very low 1 2 3 4 5 Very high O Do not know

APPENDIX C: CROSS-REFERENCE - QUESTIONNAIRE 1

Exploratory case study question	Questions
1. Which product development strategies do different software manufacturer types use?	I.5 – I.7
2. Do laws-like generalizations for product development strategies exist like Moore's model?	I.5 – I.7
3. Which market entry strategies do different software manufacturer types use?	III.3 – III.4
4. Which methods are used to estimate development cost and schedule?	I.8 – I.9
5. Are different project and design alternatives considered?	I.10, II.1
6. To which extent are reliability requirements defined, deployed and evaluated?	II.2 – II.3, II.7 – II.8
7. To which extent are maintainability requirements defined, deployed and evaluated?	II.4 – II.5, II.9 – II.12
8. How do software manufacturers estimate post-release operational cost for short-term corrective activities and long-term product enhancements prior to the release decision?	II.10 – II.12
9. To which extent is a formal collective decision-making process applied to software release decisions?	I.1, III.1 – III.2, IV.1 – IV.2
10. How can a software release decision be characterized?	III.10 – III.13
11. Which decision-making models apply to software release decisions?	III.5 – III.14
12. Which models of choice are used for software release decisions?	III.3 – III.4

Figure C-1: Cross-reference between exploratory Case Study Questions and Questionnaire 1

APPENDIX D: QUESTIONNAIRE 2**Part I: Project Start (available information)**

Id.	Question	
1.	What were the objectives for developing the product?	<input type="radio"/> Do not know
2.	How strategic was the development of the product to the organization? Not at all 1 2 3 4 5 Very much	<input type="radio"/> Do not know
3.	For which market was the product initially expected to be developed? <input type="checkbox"/> Internal product <input type="checkbox"/> Mass-market (B2C) software or firmware <input type="checkbox"/> Commercial (B2B) software or firmware <input type="checkbox"/> Other(s) _____ <input type="checkbox"/> Do not know	Embedded: Yes / No Embedded: Yes / No Embedded: Yes / No Embedded: Yes / No
4.	What was the initially expected number of customers/end-users for the product? _____	<input type="radio"/> Do not know
5.	What was the initially expected level of competition from other software manufacturers? None 1 2 3 4 5 Very high	<input type="radio"/> Do not know
6.	Was the product developed on basis of a contract? <input type="checkbox"/> No <input type="checkbox"/> Yes, explanation: _____ <input type="checkbox"/> Do not know	
7.	Which criteria were initially considered important [1: Very low - 5: Very high]? <ul style="list-style-type: none"> ▪ Revenue 1 2 3 4 5 ▪ Functional requirements 1 2 3 4 5 ▪ Quality level 1 2 3 4 5 ▪ Time-to-market 1 2 3 4 5 ▪ Development cost 1 2 3 4 5 ▪ Operational cost 1 2 3 4 5 ▪ Compliance with standards 1 2 3 4 5 ▪ Other(s): _____ 1 2 3 4 5 	<input type="radio"/> Do not know <input type="radio"/> Do not know <input type="radio"/> Do not know <input type="radio"/> Do not know <input type="radio"/> Do not know <input type="radio"/> Do not know <input type="radio"/> Do not know
8.	What was the initially expected product size (function points, lines of code, other)? _____	<input type="radio"/> Do not know
9.	What was the initially expected product lifetime? _____	<input type="radio"/> Do not know
10.	What was the initially expected revenue? _____	<input type="radio"/> Do not know
11.	What was the initially expected development time? _____	<input type="radio"/> Do not know
12.	What was the initially expected development cost? _____	<input type="radio"/> Do not know
13.	What was the initially expected operational cost? _____	<input type="radio"/> Do not know
14.	Which financial models were used for the initial cost/benefit calculation (NPV, IRR, other)? _____	<input type="radio"/> Do not know
15.	Which software cost estimation models were used to plan the project (COCOMO, SLIM, other)? _____	<input type="radio"/> Do not know
16.	Were different project/product alternatives evaluated using the defined criteria (see question 7) as a reference? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know	
17.	To which extent were risks/uncertainties present when the project start decision was made? Not at all 1 2 3 4 5 Very much	<input type="radio"/> Do not know
18.	To which extent were appropriate measures defined to reduce the identified risks/uncertainties? Not at all 1 2 3 4 5 Very much	<input type="radio"/> Do not know

Part II: Project Start (decision-making process)

Id.	Question
1.	Which stakeholders were involved in deciding whether to start the project or not? <input type="checkbox"/> Senior management representative(s) <input type="checkbox"/> Product Management representative(s) <input type="checkbox"/> Market/Customer/End-user representative(s) <input type="checkbox"/> Project leader(s) development <input type="checkbox"/> Responsible person(s) for operation/maintenance <input type="checkbox"/> Other(s) _____ Group size: ____
2.	Were to your opinion any important stakeholders missing? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
3.	How much did the opinions of stakeholders diverge prior to the project start decision? Not at all 1 2 3 4 5 Very much O Do not know
4.	How complete and reliable was the available information as input for the project start decision? Not at all 1 2 3 4 5 Very complete and reliable O Do not know
5.	What was the primary reason to stop the search process for additional information? <input type="checkbox"/> Level of available information sufficiently high <input type="checkbox"/> Time pressure <input type="checkbox"/> Budget constraint <input type="checkbox"/> Other(s) _____ <input type="checkbox"/> Do not know
6.	To which extent did stakeholders accept the available information? Not at all 1 2 3 4 5 Completely O Do not know
7.	To which extent did stakeholders change their initial position because of available information? Not at all 1 2 3 4 5 Completely O Do not know
8.	To which extent did stakeholders change their initial position in exchange of favours? Not at all 1 2 3 4 5 Completely O Do not know
9.	To which extent did stakeholders change their initial position because other stakeholders challenged them? Not at all 1 2 3 4 5 Completely O Do not know
10.	Which rule was applied in deciding to accept the project? <input type="checkbox"/> Majority Vote (the option with the highest number of votes is selected) <input type="checkbox"/> Delegation (one person is appointed to make the decision) <input type="checkbox"/> Negotiation (compromise to a middle position) <input type="checkbox"/> Spontaneous agreement (a decision is arrived at without considering the decision factors) <input type="checkbox"/> Arbitrary (decision is made by some arbitrary means, such as flipping a coin) <input type="checkbox"/> Decision leader decides without discussion <input type="checkbox"/> Decision leader decides after discussion <input type="checkbox"/> Consensus (a state of mutual agreement is reached) <input type="checkbox"/> Other(s) _____ <input type="checkbox"/> Do not know
11.	To which extent was the project start decision made based upon the available quantitative information? Not at all 1 2 3 4 5 Completely O Do not know
12.	How much did the opinions of stakeholders diverge after the decision to start the project was made? Not at all 1 2 3 4 5 Very much O Do not know
13.	To which extent were measures defined and implemented reduce any differences in stakeholder opinions? Not at all 1 2 3 4 5 Very much O Do not know

Part III: Product Development (monitoring market situation and project status)

Id.	Question (market situation related)
1.	Which stakeholders were involved to monitor the market situation during product development? <input type="checkbox"/> Senior management representative(s) <input type="checkbox"/> Product Management representative(s) <input type="checkbox"/> Market/Customer/End-user representative(s) <input type="checkbox"/> Project leader(s) development <input type="checkbox"/> Responsible person(s) for operation/maintenance <input type="checkbox"/> Other(s) _____ Group size: ____
2.	Were to your opinion any important stakeholders missing? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
3.	How frequently was the actual market situation compared with the initially expected situation? _____ O Do not know
4.	How frequently did this comparison lead to a redefinition of the business case and/or project scope? _____ O Do not know
5.	To which extent were activities defined to collect market information prior to the release decision? Not at all 1 2 3 4 5 Completely O Do not know
Id.	Question (project status related)
6.	Which stakeholders were involved to monitor the project status during product development? <input type="checkbox"/> Senior management representative(s) <input type="checkbox"/> Product Management representative(s) <input type="checkbox"/> Market/Customer/End-user representative(s) <input type="checkbox"/> Project leader(s) development <input type="checkbox"/> Responsible person(s) for operation/maintenance <input type="checkbox"/> Other(s) _____ Group size: ____
7.	Were to your opinion any important stakeholders missing? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
8.	To which extent were measures defined and implemented to reduce any differences in stakeholder opinions? Not at all 1 2 3 4 5 Very much O Do not know
9.	How frequently was the actual project status compared with the initially expected situation? _____ O Do not know
10.	How frequently did this comparison lead to a redefinition of the business case and/or project scope? _____ O Do not know
11.	To which extent were activities defined to collect product information prior to the release decision? Not at all 1 2 3 4 5 Completely O Do not know
12.	To which extent were these defined activities (question 11) successfully implemented? Not at all 1 2 3 4 5 Completely O Do not know
13.	To which extent were activities defined to collect supporting product information prior to the release decision? Not at all 1 2 3 4 5 Completely O Do not know
14.	To which extent were these defined activities (question 13) successfully implemented? Not at all 1 2 3 4 5 Completely O Do not know
15.	Were different project/product alternatives evaluated using updated criteria (see question I.7) as a reference? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
16.	To which extent were risks/uncertainties identified during product development? Not at all 1 2 3 4 5 Very much O Do not know
17.	To which extent were appropriate measures defined to reduce the identified risks/uncertainties? Not at all 1 2 3 4 5 Very much O Do not know
Id.	Question (release date)
18.	Which software defect prediction models were used to determine the release date (Goel-Okumoto, other)? <input type="checkbox"/> _____ <input type="checkbox"/> Do not know
19.	How frequently was the originally planned release date postponed? _____ O Do not know
20.	Which criteria were decisive [1: Not at all - 5: Very much] for the delay? <ul style="list-style-type: none"> ▪ Functional requirements not implemented 1 2 3 4 5 O Do not know ▪ Quality level too low 1 2 3 4 5 O Do not know ▪ Non-compliance with standards 1 2 3 4 5 O Do not know ▪ Expected operational cost too high 1 2 3 4 5 O Do not know ▪ Other(s): _____ 1 2 3 4 5

Part IV: Product Release (available information)

Id.	Question
1.	To which extent was the release decision made based upon meeting the defined objectives (see I.1)? Not at all 1 2 3 4 5 Completely O Do not know
2.	What was the expected number of customers/end-users for the product at release time? <input type="checkbox"/> _____ <input type="checkbox"/> Do not know
3.	What was the expected level of competition from other software manufacturers at release time? None 1 2 3 4 5 Very high O Do not know
4.	Which criteria were important for the release decision [1: Very low - 5: Very high]? <ul style="list-style-type: none"> ▪ Expected revenue/loss 1 2 3 4 5 O Do not know ▪ Implemented functional requirements 1 2 3 4 5 O Do not know ▪ Quality level 1 2 3 4 5 O Do not know ▪ Time-to-market pressure 1 2 3 4 5 O Do not know ▪ Development cost spent so far 1 2 3 4 5 O Do not know ▪ Compliance with standards 1 2 3 4 5 O Do not know ▪ Expected operational cost 1 2 3 4 5 O Do not know ▪ Other(s): _____ 1 2 3 4 5
5.	Were different release alternatives evaluated using updated criteria (see question I.7) as a reference? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
6.	What was the actual product size at release time (function points, lines of code, other)? _____ O Do not know
7.	What was the expected product lifetime at release time? _____ O Do not know
8.	What was the expected revenue, related to the product lifetime at release time? _____ O Do not know
9.	What was the spent development time from project start to product release? _____ O Do not know
10.	What was the spent development cost at release time? _____ O Do not know
11.	What was the expected operational cost at release time? _____ O Do not know
12.	Were any resources allocated for the expected operational cost? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
13.	What was the expected reliability level at release time (for instance number of defects left)? _____ O Do not know
14.	What was the expected maintainability level at release time? Very low 1 2 3 4 5 Very high O Do not know
15.	How riskful was it to release the product? Not at all 1 2 3 4 5 Very riskful O Do not know

Part V: Product Release (decision-making process)

Id.	Question
1.	Which stakeholders were involved in deciding to release the project? <input type="checkbox"/> Senior management representative(s) <input type="checkbox"/> Product Management representative(s) <input type="checkbox"/> Market/Customer/End-user representative(s) <input type="checkbox"/> Project leader(s) development <input type="checkbox"/> Responsible person(s) for operation/maintenance <input type="checkbox"/> Other(s) _____ Group size: ____
2.	Were to your opinion any important stakeholders missing? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
3.	How much did the opinions of stakeholders diverge prior to the release decision? Not at all 1 2 3 4 5 Very much O Do not know
4.	How complete and reliable was the available information as input for the product release decision? Not at all 1 2 3 4 5 Very complete and reliable O Do not know
5.	Was the amount of information optimal to make the release decision? <input type="checkbox"/> Yes <input type="checkbox"/> No, information was missing <input type="checkbox"/> No, there was too much information <input type="checkbox"/> Do not know
6.	What was the primary reason to stop the search process for additional information? <input type="checkbox"/> Level of available information sufficiently high <input type="checkbox"/> Time pressure <input type="checkbox"/> Budget constraint <input type="checkbox"/> Other(s) _____ <input type="checkbox"/> Do not know
7.	To which extent did stakeholders accept the available information? Not at all 1 2 3 4 5 Completely O Do not know
8.	To which extent did stakeholders change their initial position because of available information? Not at all 1 2 3 4 5 Completely O Do not know
9.	To which extent did stakeholders change their initial position in exchange of favours? Not at all 1 2 3 4 5 Completely O Do not know
10.	To which extent did stakeholders change their initial position because other stakeholders challenged them? Not at all 1 2 3 4 5 Completely O Do not know
11.	Which rule was applied in deciding to release the product? <input type="checkbox"/> Majority Vote (the option with the highest number of votes is selected) <input type="checkbox"/> Delegation (one person is appointed to make the decision) <input type="checkbox"/> Negotiation (compromise to a middle position) <input type="checkbox"/> Spontaneous agreement (a decision is arrived at without considering the decision factors) <input type="checkbox"/> Arbitrary (decision is made by some arbitrary means, such as flipping a coin) <input type="checkbox"/> Decision leader decides without discussion <input type="checkbox"/> Decision leader decides after discussion <input type="checkbox"/> Consensus (a state of mutual agreement is reached) <input type="checkbox"/> Other(s) _____ <input type="checkbox"/> Do not know
12.	To which extent was the decision to release the product based upon the available quantitative information? Not at all 1 2 3 4 5 Completely O Do not know
13.	How much did the opinions of stakeholders diverge after the decision to release the product was made? Not at all 1 2 3 4 5 Very much O Do not know

Part VI. Product in Operation (available information)

Id.	Question
1.	Were any unexpected problems encountered after the release of the product? <input type="checkbox"/> No, proceed with question 3 <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
2.	Which corrective actions were taken to eliminate or reduce the encountered problems? _____ _____ _____ O Do not know
3.	Was the project leader officially discharged from his/her responsibilities? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely (date): _____ <input type="checkbox"/> Do not know
4.	What is the actual number of customers/end-users for the product? _____ O Do not know
5.	What is the actual level of competition from other software manufacturers? None 1 2 3 4 5 Very high O Do not know
6.	What is the actually expected product lifetime at this moment? _____ O Do not know
7.	What is the actually expected revenue at this moment? _____ O Do not know
8.	What is the actually expected operational cost at this moment? _____ O Do not know
9.	What is the actually expected reliability level at this moment? _____ O Do not know
10.	What is the actually expected maintainability level at this moment? Very low 1 2 3 4 5 Very high O Do not know
11.	Does the released product meet the originally defined objectives (see I.1)? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know
12.	Has the project been evaluated afterwards or it is planned to have an evaluation? <input type="checkbox"/> No <input type="checkbox"/> Yes, namely: _____ <input type="checkbox"/> Do not know

Part VII: Evaluation of release decision

Id.	Question
1.	Was the decision to release the product a 'right' decision? Please explain your answer. <input type="checkbox"/> Yes, because: _____ _____ <input type="checkbox"/> No, because: _____ _____ <input type="checkbox"/> Do not know
2.	Which recommendations can be given regarding the information level at project start? _____ _____
3.	Which recommendations can be given regarding the decision-making process at project start? _____ _____
4.	Which recommendations can be given regarding the monitoring of the market situation? _____ _____
5.	Which recommendations can be given regarding the monitoring of the project status? _____ _____
6.	Which recommendations can be given regarding the information level at release time? _____ _____
7.	Which recommendations can be given regarding the decision-making process at release time? _____ _____
8.	Which recommendations can be given regarding the information level during operation? _____ _____
9.	Which recommendations can be given regarding the evaluation of projects? _____ _____
10.	Which other issues have not been addressed but are important to mention? _____ _____
11.	Do you consider this research and its results to be relevant for your organization? Not at all 1 2 3 4 5 Very much <input type="radio"/> Do not know

APPENDIX E: CROSS-REFERENCE - QUESTIONNAIRE 2

Practice	Questions
P-A1: Project Definition	I.14 – I.16
P-A2: Project Control	I.16, III.15, IV.5
P-A3: Uncertainty Management	I.17 – I.18, III.16 – III.17, IV.15
P-A4: Selection of Alternatives	III.3 – III.4, III.9 – III.10
P-B1: Verification Definition	III.11
P-B2: Verification Implementation	III.12
P-B3: Artefact Identification	III.13
P-B4: Artefact Implementation	III.14
P-C1: Information Perfection	V.4, V.5, V.12
P-C2: Aspiration Levels	II.12 – II.13, III.8, V.3
P-C3: Stakeholder Involvement	V.1 – V.2
P-C4: Decision Choice	V.11
P-D1: Maintenance Budget	IV.11 – IV.12
P-D2: Product Rollout	VI.1 – VI.2
P-D3: Project Discharge	VI.3
P-D4: Project Appraisal	VI.12

Figure E-1: Cross-reference between Practices of the Methodology and Questionnaire 2

APPENDIX F: OVERVIEW OF PROCESS AREAS

	Process Area: Release Definition
Goal	Define and control the product development strategy
Inputs	<ul style="list-style-type: none"> - customer and end-user requirements - organizational requirements - implementation status
Outputs	<ul style="list-style-type: none"> - project deliverables - project status - release criteria - project history
Practice P-A1: Project Objectives	
Description	Define product development strategy
When	Start: project proposal phase End: investment appraisal prior to the project launch
Responsible	Senior Management, Project Steering Committee
Involved	-
Methods	<p>Different project alternatives can be evaluated from different perspectives:</p> <ol style="list-style-type: none"> 1. For investment evaluations from a financial point of view, Renkema and Berghout (1997) present a comprehensive overview. Berghout (1997) presents a multicriteria-portfolio-method. The NPVI-method in this thesis (Section 6.4) is an addition to the Basic NPV method. 2. Regarding software cost estimation models overviews are given by for instance Fenton and Pfeleger (1997), Boehm and Abts (2000), and Briand and Wieczorek (2000). Further, the non-traditional approach using Bayesian nets as proposed by Fenton <i>et al.</i> (2004) may be considered. 3. A method to identify and align the expectations of the stakeholders involved is for instance the Win-Win Negotiation Model (In 2001).
Practice P-A2: Project Control	
Description	Control the project's progress with respect to the product development strategy
When	Start: after the project launch following the investment appraisal End: release decision
Responsible	Development
Involved	Senior Management, Marketing, Maintenance & Exploitation
Methods	Possible implementation forms are milestone-trend analysis, earned value calculations, and quality gates. These methods have been described in most standard textbooks regarding (software) project management.
Practice P-A3: Uncertainty Management	
Description	Identify sources of uncertainty and implement effective measures to reduce or eliminate them
When	Start: after the project launch following the investment appraisal End: release decision
Responsible	Development
Involved	Senior Management, Marketing, Maintenance & Exploitation
Methods	Uncertainty management can be implemented as a Risk Management process, tailored to the specific needs of the software manufacturer organization. The only difference is that probabilities and the resulting impact are expressed on an ordinal scale instead of on an interval or absolute scale. A comprehensive reference in this field is supplied by Dorofee <i>et al.</i> (1996).
Practice P-A4: Selection of Alternatives	
Description	Select alternatives that most closely meets the product development strategy
When	Start: after the project launch following the investment appraisal End: release decision
Responsible	Project Steering Committee
Involved	Senior Management
Methods	The methods for defining the project objectives can also be used to select different implementation alternatives during the course of a project (see P-A1). Especially the NPVI-method can be used when different implementation alternatives can be expressed in relative differences with respect to a base strategy (see Section 6.4). Overviews of specific methods to compare different architectures are presented by for instance Dobrica and Niemelä (2002), and Ionita <i>et al.</i> (2002).

Figure F-1: Overview of 'Release Definition' Process Area and identified Practices

Process Area: Release Information	
Goal	Define and acquire the information needed as input for the release decision
Inputs	- project deliverables
Outputs	- implementation status
Practice P-B1: Verification Definition	
Description	Define in which way the correct implementation of the functional requirements and non-functional requirements is verified
When	Start: after the project launch following the investment appraisal End: release decision
Responsible	Development
Involved	Maintenance & Exploitation
Methods	Possible forms are reviews, inspections, tests and audits. These methods have been described in most standard textbooks about software engineering (see for instance: Sommerville 1995; Pressman 2000; Vliet 2000). Note that often distinction is made between appraisal methods (applied in the earlier project phases) opposed to testing (and repair) in the later project phases. If available, data with respect to defect potentials and removal efficiencies can be used to find the optimal balance between the appraisal and testing effort (Sassenburg 2002b). Regarding reliability, identified as an important non-functional requirement, the software reliability prediction and estimation models as presented in Section 3.3.2 may be considered. Especially software reliability prediction models like COQUALMO (Chulani 1999) and Orthogonal Defect Classification (Chillarege <i>et al.</i> , 1992) are considered important, due to their predictive nature. Additionally, non-traditional approaches like Bayesian nets (Fenton and Neil 2005) and Goal Structuring Notation (Weinstock <i>et al.</i> 2004) might be considered, although more research is needed in this area to validate their practical applicability.
Practice P-B2: Verification Implementation	
Description	Deploy activities to verify the correct implementation of the functional requirements and non-functional requirements using the available definitions
When	Start: after the project launch following the investment appraisal End: release decision
Responsible	Development
Involved	Maintenance & Exploitation
Methods	See P-B1.
Practice P-B3: Artefact Identification	
Description	Identify which artefacts related to the product are to be developed to support future maintenance and exploitation activities
When	Start: after the project launch following the investment appraisal End: release decision
Responsible	Development
Involved	Marketing, Maintenance & Exploitation
Methods	No specific methods can be recommended here as it depends on organizational process definitions as well as the product requirements which artefacts are considered important.
Practice P-B4: Artefact Implementation	
Description	Deploy activities to implement the identified artefacts
When	Start: after the project launch following the investment appraisal End: release decision
Responsible	Development
Involved	Marketing, Maintenance & Exploitation
Methods	No specific methods are recommended.

Figure F-2: Overview of 'Release Information' Process Area and identified Practices

	Process Area: Release Decision
Goal	Establish a broad basis for the release decision outcome
Inputs	<ul style="list-style-type: none"> - release criteria - implementation status - product status
Outputs	- product to be released (incl. artefacts)
Practice P-C1: Information Perfection	
Description	Assure that the information perfection level is within the zone of cost effectiveness
When	<p>Start: project launch after investment appraisal End: release decision</p> <p>Identification and collection of relevant information as input to the release decision (see P-B1 through P-B4) starts directly after the project launch following the investment appraisal.</p>
Responsible	Marketing, Development, Maintenance & Exploitation
Involved	Senior Management
Methods	No specific methods can be recommended here. It will normally require experience to get an understanding of the zone of cost effectiveness, but is also will depend on the level of uncertainty confronted with. As discussed in Section 7.3.2 it might be the case that software manufacturers with higher process capability are able to reduce uncertainty due to institutionalized processes and the availability of a larger historical database.
Practice P-C2: Aspiration Levels	
Description	Reduce differences in opinions through management of meaning processes and strategies
When	<p>Start: project proposal phase End: release decision</p> <p>Managing potential differences in aspiration levels is important in all phases, especially when defining the development strategy (P-A1), controlling the project's progress (P-A2), managing uncertainties (P-A3), and selecting between alternatives (P-A4).</p>
Responsible	Senior Management, Marketing, Development, Maintenance & Exploitation
Involved	-
Methods	No specific methods can be recommended here.
Practice P-C3: Stakeholder Involvement	
Description	Involve all stakeholders throughout the project, especially in the release decision
When	<p>Start: project proposal phase End: release decision</p> <p>Stakeholder involvement is important in all phases, especially when defining the development strategy (P-A1), controlling the project's progress (P-A2), managing uncertainties (P-A3), and selecting between alternatives (P-A4).</p>
Responsible	Senior Management, Marketing, Development, Maintenance & Exploitation
Involved	-
Methods	No specific methods can be recommended here.
Practice P-C4: Decision Choice	
Description	Apply a negotiated decision-making strategy, and reach a state of mutual agreement among the stakeholders using consensus as the decision rule (interacting group type)
When	<p>Start: project proposal phase End: pre-determined interval after the release decision</p> <p>Consensus as a decision rule is important in all phases, especially when defining the development strategy (P-A1), controlling the project's progress (P-A2), managing uncertainties (P-A3), and selecting between alternatives (P-A4).</p>
Responsible	Senior Management, Marketing, Development, Maintenance & Exploitation
Involved	-
Methods	No specific methods can be recommended here, other than the recommendation to build a team spirit so that all stakeholders involved obtain a good understanding of reasons for possibly different positions.

Figure F-3: Overview of 'Release Decision' Process Area and identified Practices

	Process Area: Release Implementation
Goal	Establish congruence between the expected and actual release decision outcome and determine lessons learned
Inputs	<ul style="list-style-type: none"> - implementation status - product to be released (incl. artefacts) - project history
Outputs	<ul style="list-style-type: none"> - released product - appraisal results - product status
Practice P-D1: Maintenance Budget	
Description	Reserve a maintenance budget for corrective maintenance actions in case problems are encountered during the product rollout
When	<p>Start: first orientation during the project proposal phase End: project discharge</p> <p>The expected maintenance budget should be identified as early as possible as it is part of the product development strategy. Its expected value should be continuously updated, so it reflects the latest insights.</p>
Responsible	Maintenance & Exploitation
Involved	Senior Management, Development
Methods	No specific methods are recommended, as each software manufacturer organization should define its own procedure for implementation.
Practice P-D2: Product Rollout	
Description	Carefully monitor the implementation of the released product and take appropriate corrective actions in case of encountered problems.
When	<p>Start: after the release decision End: project discharge</p> <p>This activity starts directly after the release decision and continues until the expected outcome is met or when, in extreme cases, the release decision is reversed. Note that this practice takes over the practices P-A2 (post-release project control) and P-A3 (post-release uncertainty management).</p>
Responsible	Development, Maintenance & Exploitation
Involved	Senior Management, Marketing
Methods	No specific methods are recommended, as each software manufacturer organization should define its own procedure for implementation.
Practice P-D3: Project Discharge	
Description	Officially discharge the Project Steering Committee responsible for the development of the product and the implementation of the released product from these responsibilities when all obligations have been met
When	<p>Start: after the release decision (preparations) End: project discharge</p> <p>Discharge of development responsibility takes place after all obligations have been met.</p>
Responsible	Senior Management
Involved	Project Steering Committee
Methods	No specific methods are recommended, as each software manufacturer organization should define its own procedure for implementation.
Practice P-D4: Project Appraisal	
Description	Appraise the important aspects of the project (for instance the identification of the reasons for discrepancies between initial project objectives and actual results, the identification of strengths and weaknesses to augment the software manufacturer organization's memory (repository) as a source for increasing its capabilities.
When	<p>Start: after project discharge End: project appraisal</p> <p>This is the last project activity before project completion.</p>
Responsible	Senior Management
Involved	Project Steering Committee
Methods	No specific methods are recommended, as each software manufacturer organization should define its own procedure for implementation.

Figure F-4: Overview of 'Release Implementation' Process Area and identified Practices