Industrial Practices on Requirements Reuse: An Interview-based Study – Research Protocol

Cristina Palomares, Xavier Franch, Carme Quer

Group of Software and Service Engineering (GESSI)
Universitat Politècnica de Catalunya (UPC), Barcelona (Catalonia, Spain)
Jordi Girona num.1-3, Omega building, room S206
{cpalomares|franch|cquer}@essi.upc.edu

***Abstract* —** This document details the protocol used in an interview study on requirements reuse. It presents the different parts of such protocol as well as the interview guide used in the study and population characteristics. The presented study is part of a wider study on different topics of requirements engineering, but it is presented here separately for clarity purposes.

***Keywords* —** Requirements engineering; requirements reuse; empirical studies; interviews; study protocol.

1. Introduction

This paper presents the protocol for an interview-based study on the topic of requirements reuse. Its main purpose is to document in detail those aspects that, if included in a research paper with this level of detail, would make it too long.

The protocol is divided into the following parts:

- General goal of the study.
- Research questions.
- Selection of type of study.
- Research team.
- Population sampling strategy.
- Procedure and instruments.
- Data collection.
- Data analysis techniques.
- Threats to validity.
- The interview guide, as appendix.

Also, even if not part of the protocol, this document includes a second appendix with details about the population.

2. Goal of the Study

The main purpose of this study is to understand the current practices on requirements reuse from the point of view of requirement engineers working in industry in the context of IT companies of different characteristics.

3. Research Questions

We formulate six research questions:

ID	Text
RQ1	Is requirements reuse a usual practice in industry?
RQ2	What factors influence the level of adoption of requirements reuse?
RQ3	What types of requirements are subject of reuse?
RQ3	What is the process followed to implement requirements reuse?
RQ4	What are the benefits brought by requirements reuse?
RQ5	What are the challenges to overcome in requirements reuse?

4. Type of study

It was decided to survey professionals involved in several software development projects using semi-structured interviews. Semi-structured interviews help to ensure that common information on predetermined areas is collected, but allow the interviewer to go deeper when required [1]. Interviews were chosen over questionnaires because they allow a better understanding of the questions and a better explanation of the aspect under study (in this case, RE practices). In addition, interviews allow to promote discussions and clarifications when gathering the data, making it possible to elaborate on small aspects the study is investigating and compensate for differences in understanding and terminology, which is very important taking into account that requirements practices and requirements related concepts are very different from project to project. In addition, it is worth to mention that, due to their open nature, semi-structured interviews uncovered interesting additional input not targeted by the RQs presented above.

5. Research Team

The research team was formed by the authors of this paper. The table below shows the responsibilities of each author in the study. As it can be seen, all the members of the research team participated in the development of this protocol. The data collection (i.e., the actual interviews) was carried by one of the authors, the data analysis by several authors, and both processes were supervised by the rest of researchers. Not all the authors are involved equally in all the steps, and this means that the authorship in the different papers stemming from this study may vary. For instance, some paper may not use at all the statistical analysis performed in 4.3.

Responsibility	CP	XF	CQ
1. Develop protocol	X	X	X
2. Data collection	X		
3. Supervision of data collection		X	
4.1 Data analysis: Coding steps 1-4	X	X	
4.2 Data analysis: Coding step 5	X	X	X
4.3 Data analysis: Statistical analysis	X		
5. Supervision of data analysis		X	
6. Reporting	X	X	X

6. Sampling

As noticed by Méndez et al. [2], there is a great variability on the way that requirements are defined and handled from project to project. Therefore, the aim was to include subjects that were practitioners involved in several software development industrial projects from different companies.

The target population was practitioners in charge of requirements engineering responsibilities in software development projects. For convenience, participating companies were chosen from the Swedish industrial network. They covered as many different characteristics as possible with respect to size, application domain, and business area. In order to get different views regarding their requirements elicitation and specification processes, it was aimed to interview two subjects from the same company although at the end we had one company with just one subject and another one with three. Therefore, a total of 24 interviews were conducted to subjects from these 12 companies. In Appendix II we provide further details about the characterization of the interviewed subjects, companies and projects considered during the interviews.

7. Procedure and Instruments

In order to gather data from the target population, a semi-structured interview guide was designed following the guidelines stated by Oates [3]. In general, the guide asked the respondent to focus on a single finished project that s/he were familiar with. Considering a single project instead of many projects allowed a better interpretation and assessment of contextual information. Otherwise, it would have been very difficult to establish relationships among the considerations of the requirements engineering practices used and the characteristics of the project for which the considerations were established. The project was chosen by the interviewee without any intervention from the conductors. In addition to this particularization of the inquiries, some follow-up questions were added (such as: *Is this typically how you do this? If not, how do you usually do it?*) in order to identify and understand potential representative practices, as suggested by Lutters and Seaman [4] and Patton [5]. It allowed a richer vision of the requirements processes undertaken by the interviewees and their opinions. The interview guide is included in Appendix I.

The interview guide was designed in English. Interviews were performed in English too, which is not the mother tongue neither of the interviewer nor the interviewees. However, being the interviewer mother tongue Spanish and the interviewees' mother tongue Swedish, there was no other language that could be used to communicate among them. The only exception was in the case of two interviewees that were Spanish. In those cases, the interviews were carried out in Spanish. Before starting the planned interviews, two pilot interviews were carried out to test the guide and rehearse the interview abilities of the interviewer. In addition, some calibrations of the guide were done after these pilots (mostly related about rephrasing and reordering questions). These pilots were done with researchers playing the role of interviewees. We selected researchers that the interviewer did not met before, trying to simulate a real interview environment.

The resulting guide was divided into different sections with the majority of questions being open-ended. Sections A and B corresponded to questions about the interviewee's background, the company and the selected project. Section C included the questions related to the research questions presented in this protocol. As already mentioned, the questionnaire contained more questions related to other RE activities, which were also in Section C but not included in this document.

8. Data Collection

The interview guide was emailed to each of the interviewees one week in advance, to allow them preparing before the interview session. Each of the interviewees was requested to choose the project object of the interview's questions and to fill in Section A of the interview guide (i.e., personal information, company information and project information). These answers were sent back to the interviewer before the interview. Having this information beforehand helped the interviewer to set up her mind on the interviewee's organization's background, and on the selected project. At the beginning of the interview, only if necessary, some clarifications on the company and/or project at hand were done (corresponding to Section B of the guide). Afterwards, data about how requirements were elicited and specified was collected (again, this part is not reported here). Finally, data about requirements reuse was gathered.

The interviews were mostly conducted face-to-face, but 5 of them were held using Skype or similar tools. They lasted around 2 hours each, from which approximately 10 minutes were used to clarify the company and/or project (if necessary). The interviews were recorded for subsequent analysis, and notes were taken by the interviewer both during and after the interviews, using a template designed for that purpose, with the main answers provided by the interviewees.

9. Data Analysis

The notes taken during the interviews by the interviewer were exhaustively completed with the audio records. These detailed notes, together with the respondents' answers and the audio recordings, were used during the analysis. The approach followed to analyse the data was coding [6] with the support of the Atlas.ti tool (http://atlasti.com/). Multiple coding techniques were used in different steps:

1. *Attribute* coding was used first to code descriptive information (e.g., interviewer experience, company domain, company size, etc.).
2. *Provisional* coding was used to establish a predetermined 'start list' of codes prior to start the coding of the interviews' answers. These codes were defined from the answers of a survey conducted by some of the authors presented in a previous work [7]. Therefore, provisional coding was defined for the answers of those questions of the interviews that had an equivalent in the survey.
3. *Structural* coding and *initial* coding were used to segment the data that relates to a specific subresearch question and question, respectively, of the interview.
4. *Descriptive* coding, *process* coding and *magnitude* coding were used together to code the data from each group identified in the *initial* coding. *Descriptive* coding was useful to identify the basic topic (what was talked or written about) of a passage of qualitative data. *Process* coding was used to connote specific actions; usually, it was done by identifying codes that corresponded to gerunds ("-ing" words). *Magnitude* coding was used to identify subcodes of the codes coming from the *descriptive* and *process* coding. These subcodes added supplemental alphanumeric or symbolic information to an existing code to indicate its intensity, frequency, direction, presence, etc. Therefore, these subcodes could be qualitative, quantitative and/or nominal indicators. In parallel to these three coding techniques, *simultaneous* coding was used when it was needed to map a statement to two or more different codes or subcodes.
5. *Pattern* and *axial* coding were used to combine similar codes and to establish emerging categories and relationships among them. Specifically, *pattern* coding helped to group under a candidate category the similar activities or factors (i.e., codes) that recurred in the data. *Axial* coding was useful to understand how different categories influence each other, revealing aspects of potential importance.

Steps 1-4 were conducted by two of the authors (see Section 5). The coding done in Steps 1-4 was then further discussed with the whole research team in Step 5 to ensure the correct interpretation of each category and the evidence that support them. These discussions led to split, modify, discard or add categories to ensure that all the responses and their contexts were well represented. It was tried to be exhaustive with the codes and categories in order to include as much detail provided by the respondents as possible. This assessment was enriched by the information obtained from further questions (such as: *"Is this typically how you do this?*") that helped to identify and understand practices not used in the particular projects approached, but which might be representative in the companies. In this way, a broader understanding of the requirement engineering practices of each project and company, as well as of the subjects' opinions, was achieved. Frequencies of codes were also generated as an indicator of popular and unpopular practices or opinions.

Other statistical techniques have been used during the analysis of the codes done by one of the authors (see Section 5). In some cases, *Contingency tables* were used to explore frequency data and performing chi-square tests [8]. The *Chi-square test of independence* was used to test the variety of the sizes of the different contingency tables, as well as more than one type of null and alternative hypothesis. In order to avoid Type I errors (i.e., incorrect rejections of true null hypothesis), exact tests were contacted. However, since the *chi-square test of independence* helps us to decide whether we can reject or accept the null hypothesis of independence, it does not inform of the strength of any association. Cramer's V [9] is a measure that does provide an estimate of the strength of the association. Cohen suggested that for large strength of association the Cramer's V value should be above 0.5 [9].

Yet, finding an association did not provide us with further details about this association (e.g., which cases are "responsible" for this association). Therefore, following up our statistical significant results, we performed post hoc testing using adjusted standardized residuals. By analysing these values, we had a cell–by-cell comparison of the expected versus observed frequencies which helped us to understand which cases where deviated from the independency [8][10].

10. Threats to validity

We classify the threats according to Wohlin et al.'s categories [11].

Construct Validity. Construct validity concerns the relationship between observations from the study and the construct behind the research. To strengthen this aspect, this study was supported by two main principles: rigorous planning of the study, and the establishment of protocols for data collection and data analysis as suggested by [12]. Additionally, the instrument used to gather data (i.e., the interview guide) was carefully designed and piloted with two academic people that had an extensive background in industry (these interviews were discarded for the real study). The interview guide was designed in English, and the interviews were held in English too (except in two cases where the interview was carried out in Spanish). Although English was not the mother tongue neither of the interviewees nor of the interviewer, neither problems of communication nor of understanding were experienced. Furthermore, the pilots helped to improve the understandability of the questions with respect to the use of suitable vocabulary that the subject participants were familiar with. However, there existed terminology differences between the different interviews. This was addressed by: a) asking clarifications questions during the interviews when needed, and b) applying multiple codes to the same statement to capture multiple interpretations. Finally, both in the interview guide and during the actual interview, the subjects were aware that the data they provided would be confidential, anonymised, and aggregated with the rest of interviews, so the subjects could freely share their real experiences and perceptions.

Conclusion Validity. Conclusion validity is concerned with the ability to draw correct conclusions from the study. This threat was addressed from different perspectives.

The concepts (i.e., codes) were generated according to the process explained in Section 9. Throughout the coding, many concepts and their relationships were identified. However, as the research process continued, the concepts were merged and updated to develop the final categories. Traceability from the raw data to the categories and their relationships was preserved. Different types of triangulation were used to minimize possible biases. Different coding techniques (theory triangulation) were used to capture various aspects of a phenomenon. Selected cases from the dataset were analysed by two of the conductors to identify and to eliminate individual biases (researcher triangulation).

Internal Validity. Internal validity threats are related to factors that affect the causal relationship between the treatment and the outcome.

With respect to the data gathering strategy, relevant decisions were taken for achieving a further understanding of requirements engineering industrial practices. One of the main relevant decisions was to focus most of the questions of the interview guide on a single software development project. In this way, it was possible to further inquire and analyse specific contexts that generated a particular decision. This enhanced the value of the analysis and observations, as it allowed the understanding of the rationale behind certain requirements engineering practices and opinions. Nevertheless, some possible biases may be related to this strategy, for instance the fact that some time had passed since the project was completed, so it could be difficult for the participants to remember some project details. To reduce the possible side effects of this, the interview guide was sent in advance to the respondents so that they were informed of the kind of questions they were going to be asked and they could choose the project in advance and could fill the details of Section A of the interview guide (personal, company and project information). As a result, when performing the interviews, the subjects that participated in interviews rarely had difficulties remembering project details. Another factor that might affect the results was that the subjects could have selected the most successful projects. To minimize this risk, it was explained to them that the study was not focused on analysing "wrong practices" but on knowing "how it is done in industrial practices". In addition, all the respondents were open to follow-up contacts if clarifications on their answers was needed while analysing the data.

With respect to the data analysis strategy, all the interviews were recorded. The notes taken by the interviewer during and after the interview were completed with all the details provided by the subjects by listening to the audio as much times as needed. This contributed to a better understanding and assessment of the data gathered. Not having transcribed the whole interviews could have represented a threat. However, to mitigate the issue, the audio was imported to the qualitative data analysis tool used (i.e., Atlas.ti), which offered the same coding functionalities both in audio files and text files (which would be the format used for the transcript of the interviews). This functionality was used to code the interviews' audios with *initial* and *structural* coding strategies. This allowed to access easily the audio related to a specific question when doubts on the improved notes arose during analysis.

To address a single researcher bias in the coding process, triangulation was applied. Selected interviews were analysed independently by two researchers and the results were discussed to identify and eliminate any individual biases. Responses were triangulated too, especially in the case of respondents from the same organization, in order to strengthen the correct understanding of the results. In addition, the generated categories were analysed, discussed and reviewed by all researchers of the team to ensure their accuracy, understanding and agreement. Furthermore, categories were checked with respect to the data gathered in order to confirm that none of the stated categories refuted any of the conclusions.

External Validity. External validity refers to the ability to generalize the results of research efforts to industrial practice. It is important to highlight that qualitative studies, such as the one presented in this chapter, rarely attempt to make universal generalizations beyond the studied setting. Instead, as Robson explains, they are more concerned with characterizing, explaining and understanding the phenomena under the contexts of study [1]. To strengthen the external validity, several aspects were addressed. Some of the most relevant ones are listed.

First, the companies in this study were selected by a strategy combining convenience sampling and maximum variation sampling [1]. The use of this convenience sampling approach reflects the difficulty in gaining industrial participation in these kinds of surveys. Any possible bias traditionally related to convenience sampling was tried to be mitigated by combining a maximum variation sampling, so that the approached companies covered different characteristics regarding size, application domain, and business area.

Second, another aspect strengthening the external validity was that the interviewees were completely free for selecting a project for the interview, and the conductors of the study had no influence over this decision.

Finally, the approached projects were of different size and types, and the interviewees had different backgrounds (see Appendix II). Therefore, certain requirements engineering practices could have been used in a certain project of a company due to some of their characteristics but not used in some other project because some particular characteristic of the last one. Nevertheless, most of the resulting sampling companies were developing web applications, embedded systems, or systems focused on the telecommunication domain. It is possible that this factor may have an impact on how the participant companies conducted and envisage requirements reuse. Therefore, it is important to highlight that the findings of this study might be considered more relevant for this type of companies or systems. The study's findings should not be taken as assertions but as potential hypotheses that need to be further validated.

Appendix I – Interview Guide

This appendix shows the interview guide used to perform the interviews of the empirical study about reuse of knowledge in requirements engineering.

A. About the interviewee

***Answered before the interview (if possible) ***

With the following questions we want to know personal and experience aspects of the interviewee in order to better understand your answers.

> *We will not use this information to any other finality than the one described before, and they will not be published as part of the results of this study (it is not mandatory to fill all fields).*

A.1 Personal information

Name and surname: ______________________________

Contact e-mail: ______________________________

A.2 Studies
Educational background: ____________________
Subject: ____________________
Professional certificates: ____________________

A.3 Professional experience
Years in industry: ____________________
Years in university or research labs: ____________________

A.4 Professional experience in the organization
Position: ____________________
Years in this position: ____________________
Years in the organization: ____________________

A.5 About the organization
Name of the organization: ____________________
Number of employees: ____________________
Principal production: ____________________
Certifications: ____________________

A.6 About the project
Name of the project: ____________________
Domain of the project: ____________________
Number of people: ____________________
Project duration: ____________________
Finalization date: ____________________
Economic costs: ____________________

B. Clarifications on "About the interviewee"
*** Answered during the interview ***

The following questions are clarifications on some of the aspects asked at the section "About the Interviewee".

Q0a. If the company has some certification, what is the maturity level of its process development? *(select one):*

Very low☐ Low☐ Medium ☐ High☐ Very high☐

Q0b. Clarifications on the selected project (its domain, lifecycle, and so on).

C. About the project
**** Answered during the interview ****

The following questions are about the concrete aspects of our investigation. In this first part of the interview, we want to know about the practices and needs related to requirements. In particular, we want to obtain the conception of the main aspects related to requirements engineering, a profile of the requirements methodology used during the selected project and the challenges faced in relation to requirements.

C.1 General description of the organization

> *The answer to the following questions might represent the whole requirements engineering team of the selected project.*

Q1. What were the five most important activities in Requirements Engineering (RE) as it was relevant for you and your organization?

Q2. Does the role of "requirements engineer" exist in your company? Is this role played by some designated person or instead it is a hat that a person wears at some moment, and later this very person may become e.g., tester? What are the main responsibilities of this role?

Q3. What do you understand by requirements in your organization?

C.2 Elicitation and specification RE practices applied on the project

This part is not included in this protocol

C.3 Requirements reuse practices applied on the project

> *The answer to the following questions might focus only on the selected project.*

Q11. In that process of eliciting and specifying requirements, did you use previous requirements from other projects as input for this projects elicitation? Did you also reuse how the requirements were formulated based on previous requirements?

Q12. If answer was "yes" (to first question at Q11), what was the percentage of reused requirements? How do you consider this percentage (low, medium, high, very high)?

Q13. If answer was "yes" (to second question at Q11), what was the percentage of effort reused?

Q14. If answer was "yes" (to any question at Q11), do you think that there was any factor that influenced the level of reuse of requirements? Which ones (some factors from the organization, from the project, from the RE process used, from the requirements engineers themselves, etc.)? Why (not)?

Q15. More concretely (to Q14), did you think that the type of requirement influenced if requirements were reused?

How could this be applied on the project we were talking about?

Was there any particular type of requirements that were more prone to be reused from previous projects because of their type? Which ones? Why?

From the requirements resulting from the project, do you think that there is any particular type of requirement more prone to be reused in future projects? Which ones? Why?

Q16. If answer was "yes" (to any question at Q11), how were requirements reused? Did you use any particular technique to achieve such reuse?

Q17. If answer was "yes" (to any question at Q11), did you use any tool for supporting such reuse? Which ones? Were they specific tools for reusing requirements, or were they the same tools as the ones used for requirements (see Q8)?

Q18. If answer was "yes" (to any question at Q11), how was the requirements reuse process chosen?

Q19. If answer was "yes" (to any question at Q11), did you think that there was any factor influencing the choice of the requirements reuse process? Which ones (some factors from the organization, from the project, from the RE process used, from the requirements engineers themselves, etc.)? Why (not)?

Q20. Do you think requirements reuse was (or would have been) beneficial on the project at hand?

Would more reuse have been beneficial?

If yes, why?

If yes, how could you have invested in reuse in terms of:

- preparatory work?
- during the project?

If yes, why was more reuse not applied?

Appendix II – Description of population

a. Subjects

The table below provides an overview of the 24 subject's background. Most of them had an educational background related to computer science, information systems or software engineering, although a non-negligible share graduated in other types of engineering (such as chemical or civil engineering) and other areas of science (e.g., telecommunication or robotics). Most of them held either a master's degree or a bachelor's degree. The subjects had between 3 and 25 years of experience in industry (16.2 years in average) and between 0 and 15 years of experience in university or research laboratories (3.2 years in average). The subjects held different positions in their companies, and actively participated in (or were in charge of) requirements engineering related processes, at least in the project they based their answers on. Some of the subjects were new in the position or in the company (e.g., S11), while others had plenty of experience on both of them (e.g., S6).

ID	Highest Educational Background	Years in Industry	Years in University or Research Labs	Job Position	Years in Position	Years in Organization
S1	BSc in Computer Science	15	3	Business Analyst	3	3
S2	MSc in Computer Science	15	3	Project Manager	≈5	10
S3	BSc in Information Systems	20	≈4	System Analyst	6	10
S4	BSc in Computer Science	13	3	Requirement Analyst	13	13
S5	MSc in Computer Science	25	5	Requirement Analyst	2.5	4
S6	BSc in Information Systems	20	0	System Manager	15	20
S7	MSc in Computer Science	19	5	System Manager	6	19
S8	BSc in Computer Science	15	0	Senior Project Manager	15	15
S9	BSc in Energy Systems	20	0	Senior Business Consultant	6	6
S10	MSc in Computer Science	16	0	Senior Developer	9	9
S11	MSc in Software Engineering	17	5	Consultant Manager	0	0
S12	MSc in Business	12	≈5	Solution Designer	≈8	≈10
S13	BSc in Computer Science	23	0	Business Analyst	14	14
S14	PhD in Food Engineering	10	15	System Engineer	2	5
S15	MSc in Chemical Engineering	10	0	System Engineer	0.25	7
S16	BSc in Telecommunication	25	0	Product Manager	5	19
S17	MSc in Industrial Engineering	8	0	System Engineer	8	8
S18	MSc in Computer Vision and Robotics	9	5	Project Leader	2	2
S19	MSc in Electrochemistry and Electronic Sensors	3	3	Lead Engineer	0.5	2
S20	PhD in Civil Engineering	23	10	Software, Manufacturing & Electrical Engineer	1.5	16
S21	MSc in Computer Science	21	0	Senior Consultant	5	12
S22	BSc in Interaction Design	9	3	Senior Consultant	3	9
S23	BSc in Quality Engineering	15	4	Assignment Manager	3	6
S24	BSc in Mathematics, Physics and Computer Science	26	4	Requirements Engineer	3.5	3.5

b. Companies

Twelve companies participated in the study. In 11 of them, it was possible to interview more than 1 subject. The table below provides an overview of these companies and relates them to the subjects interviewed. The software companies covered a varied spectrum regarding business areas and size: 1) software consultancy companies (SCCs) that performed software development tasks for different clients as their primary business; 2) IT departments (ITDs) that usually performed or outsource some software development tasks for covering the internal demands of the organization; 3) software houses (SHs) that developed and commercialized specific proprietary solutions.

In addition, some companies explicitly stated that their business area was oriented towards a specific domain (stated between parentheses in the table). Two of the companies were from the public sector (companies C and L), and the rest of them were private.

ID Organization	ID Respondent	Number Employees	Main Business Area

A	S1,S2	≈2,000 WW	ITD of a Telecommunication Operator
B	S3, S4	≈900	SCC of the Public Sector
C	S5	≈350	SH (UI Platforms for Symbian-Based Smartphones)
D	S6, S7	≈800	SH (Telecommunication Products)
E	S8, S9	≈68,000 WW	SCC
F	S10, S11	50	SCC
G	S12, S13	800	SCC (Telecommunication Products)
H	S14, S15	≈23,000 WW	ITD of a Tetrabriks Manufacturer
I	S16, S17	≈150,000 WW	SH (Power and Automatization Systems)
J	S18, S19, S20	≈20,000	ITD of a Car Manufacturer
K	S21, S22	1,200	SCC
L	S23, S24	>1,000	Public Transport Administration

c. Projects

As explained above, each subject interviewed was asked to inform about a single finished project. As it can be observed in the table below, the resulting set of projects was very diverse in terms of domain, duration and the number of working employees. The projects were related mainly to embedded systems, websites or mobile applications, and customer business support. Regarding duration and size, the projects took from 4 months to around 10 years, and they involved from 2 individuals up to thousands of people. Only 3 subjects did not know the number of employees involved in the project, and 1 subject made the remark that it changed along the project life span. Finally, a majority of projects used a waterfall approach to software development.

ID Project	ID Subject	Project Main Functionality	Project Domain	Project Duration (in years)	Project Number Employees	Project methodology
P1	S1	Getting customer feedback	Messaging System	1	≈10	Waterfall
P2	S2	Webshop for acquiring phones and contracts with a carrier	Website	1	≈10	Waterfall
P3	S3	Translating to English a website	Website	1	10-12	Agile
P4	S4	Management of the social security rights of children	Website	1.5	≈35	Agile
P5	S5	OS for a specific smartphone taking into account the carrier's restrictions	Mobile OS	0.5	≈100	Waterfall
P6	S6	Carrier system to track the users' consumption	Machine to Machine System	0.25	7	Agile
P7	S7	Providing services to customers (charging, changing plan, consumption, etc.)	Carrier Business Support System	2.5	15-500 (depending on the stage)	Agile
P8	S8	Managing consumption energy levels measured by energy companies	Energy Measurement System	1.5	≈2	Waterfall
P9	S9	System for an energy company involving the contract and offering module	Business Support System	2	Not sure	Waterfall
P10	S10	System for a carrier involving big data, call data management, contracts management, etc.	Carrier Internal System	1	100	Agile
P11	S11	Webshop for acquiring public transport system tickets	Website	0.33	5	Agile
P12	S12	Offering roaming services to customers	Carrier Business Support System	≈1.5	≈20	Waterfall
P13	S13	Managing customer calls into the customer service centre	Carrier Internal System	1.5	25	Waterfall
P14	S14	Modifying an existing machine (and its internal system) to make it more productive	Embedded System	4	35	Waterfall
P15	S15	New machine (and internal system) for a new package	Embedded System	0.75	10	Waterfall
P16	S16	Managing control and safety processes on fabrics	Embedded System	≈1.5	≈200	Agile
P17	S17	Controlling the machines of a sugar fabric	Embedded System	1.5	6	Waterfall
P18	S18	Managing the different functionalities of a car	Embedded System	≈3	≈60	Waterfall
P19	S19	Controlling the charge of battery in electric cars	Embedded System	2	20	Waterfall

P20	S20	Controlling the machines for producing a car	Embedded System	6-7	x000	Waterfall
P21	S21	Checking films, book tickets, etc. for a cinema company	Mobile App	1	18	Waterfall
P22	S22	Integrating payment services	Mobile App, Website	0.25	12	Agile
P23	S23	Specifying a tunnel construction details and safety systems	Construction	10	Not sure	Waterfall
P24	S24	Specifying a tunnel construction details and safety systems	Construction	10	Not sure	Waterfall

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