

APPENDIX A – RESULTS OF THE STATISTICAL TEST

Table A.1. The results of the statistical tests regarding the seriousness of the OSR vs. demographic part of the survey (survey questions 2 and 10, 11, 12¹)

		Seriousness of OSR vs. respondents' roles			Seriousness of OSRs vs. organizations' size			Seriousness of OSRs vs. development methodologies		
		<i>Null hypothesis (H0)</i> : there is no significant association between the respondent role and the seriousness of OSRs			<i>Null hypothesis (H0)</i> : there is no significant association between the size of the companies that the respondents work for and the seriousness of OSRs			<i>Null hypothesis (H0)</i> : there is no significant association between the development methodologies used and the seriousness of OSRs		
		Value	Df	Asymp Sig. (2-sided)	Value	Df	Asymp Sig. (2-sided)	Value	Df	Asymp Sig. (2-sided)
Pearson Chi-Square		20.363 ²	24	p=0.68	10.380 ³	18	p=0.92	10.38 ⁴	30	p=0.117

Table A.2. The results of the statistical tests regarding the relationship between the definition of OSRs and the respondents' roles, the size of organizations and the development methodologies (questionnaire questions 1 and 10, 11 12).

		Definition of OSR vs. respondents' roles			Seriousness of OSRs vs. organizations' size			Seriousness of OSRs vs. development methodologies		
		The <i>null hypothesis (H0)</i> assumes that there is no significant relationship between the respondents' roles and the definition of OSRs. While, the <i>alternative hypothesis (H1)</i> predicts a significant relationship between the two variables.			The null hypothesis (H0) assumes that there is no significant relationship between the organizations size and the definition of OSRs. Besides, the alternative hypothesis (H1) assumes a significant relationship between the two variables.			The <i>null hypothesis</i> assumes that there is no significant relationship between the definition of OSRs and the developments methodologies.		
		Value	Df	Asymp Sig. (2-sided)	Value	Df	Asymp Sig. (2-sided)	Value	Df	Asymp Sig. (2-sided)
Pearson Chi-Square		X2 = 44.228 ⁵	48	p=0.628	X2=32.897 ⁶	36	p=0.617>0.05	X2 = 94.03 ⁷	60	p=0.003<0.05

¹ The questionnaire questions can be found at

http://fileadmin.cs.lth.se/serg/ExperimentPackages/Obsolete/AppendixB_SurveyQuestions.pdf

² 19 cells (52.8%) have expected count less than 5. The minimum expected count is .73.

³ 14 cells (50.0%) have expected count less than 5. The minimum expected count is .67.

⁴ There are more than 20% of cells have expected cell counts less than 5, and some cells have expected values of less than one

⁵ Chi-square test requires that at most 20% of the cells have predicted value less than 5. But, there are some roles like 'system integrator' and 'software maintainer' that received 3 and 2 responses, respectively. These two categories were merged with the 'others' category in order to reduce the number of cells that received less than 5.

⁶ In addition, in this test, one of chi-square test conditions was violated i.e. more than 20% of cells have expected cell counts less than 5. Thus, chi-square results may be invalid.

Requirements related to standards.	30.4% (66)	30.9% (67)	24.0% (52)	11.5% (25)	3.2% (7)	2.26	217
Requirements obtained from market analysis, domain experts and competitors.	9.7% (21)	27.6% (60)	30.0% (65)	22.6% (49)	10.1% (22)	2.96	217
Requirements about the company's organization and policies.	10.6% (23)	21.8% (47)	38.4% (83)	20.4% (44)	8.8% (19)	2.95	216
Hardware related requirements.	12.0% (26)	34.3% (74)	21.3% (46)	20.4% (44)	12.0% (26)	2.86	216
Functional requirements originated from customers.	14.4% (31)	22.7% (49)	26.9% (58)	21.8% (47)	14.4% (31)	2.99	216
Functional requirements originated from end users.	14.8% (32)	22.7% (49)	24.1% (52)	21.3% (46)	17.1% (37)	3.03	216
Functional requirements originated from developers.	7.3% (16)	23.4% (51)	29.8% (65)	25.2% (55)	14.2% (31)	3.16	218
Incorrect requirements (misunderstood stakeholders requirements).	5.6% (12)	9.3% (20)	19.6% (42)	22.4% (48)	43.0% (92)	3.88	214
Ambiguous requirements	6.5% (14)	9.8% (21)	21.0% (45)	30.4% (65)	32.2% (69)	3.72	214
Inconsistent requirements.	4.7% (10)	10.0% (21)	24.2% (51)	28.4% (60)	32.7% (69)	3.74	211
Requirements related to third party components e.g. COTS.	7.0% (15)	29.4% (63)	34.1% (73)	22.0% (47)	7.5% (16)	2.93	214
Requirements related to design and architecture.	14.0% (30)	36.3% (78)	27.0% (58)	17.2% (37)	5.6% (12)	2.64	215
Replaceability requirements. (How easy it is to exchange a given software component within a specified environment)	10.7% (23)	36.3% (78)	29.3% (63)	15.8% (34)	7.9% (17)	2.74	215
Usability requirements.	15.1% (33)	34.4% (75)	23.9% (52)	19.3% (42)	7.3% (16)	2.69	218
Interoperability requirements. (the ability of a software component to interact with other components or systems)	14.6% (32)	26.5% (58)	28.8% (63)	22.4% (49)	7.8% (17)	2.82	219

Table A.5. The results of statistical test between the ways to discover OSRs and the respondents' roles, size of organizations and the development methodologies (questionnaire questions 4 and 10, 11,12).

	Ways to discover OSRs vs. respondents' roles			Ways to discover OSRs vs. size of organizations			Ways to discover OSRs vs. development methodologies		
Hypotheses	Null hypothesis: there is no significant relationship between the ways to discover OSRs and the respondents' roles			Null hypothesis: there is no significant relationship between the ways to discover OSRs and the size of organizations			Null hypothesis: there is no significant relationship between the ways to discover OSRs and the development methodologies		
	Value	df	Asymp. Sig (2-sided)	Value	Df	Asymp. Sig (2-sided)	Value	Df	Asymp. Sig (2-sided)
Pearson Chi-Square	72.622 ⁸	50	p-value 0.02	X2=29.443 ⁹	30	p=0.494	110.404	50	1.89 E-6 ¹⁰
							More than 20% of cells in this table have expected		

⁸ The chi-square statistic is significant at the 0.05 level. More than 20% of cells in this sub-table have expected cells counts less than 5. The minimum expected cell count in this sub-table is less than one. Chi-square results may be invalid.

⁹ More than 20% of the cells have expected cell counts less than 5. Thus, chi-square results may be invalid.

¹⁰ More than 20% of cells in this sub-table have expected cell count less than 5. Chi-square results may be invalid.

			cell counts less than 5. Chi-square results may be invalid.
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Table A.5a. The results of statistical test between the ways to discover OSRs and the top 5 development methodologies (questionnaire questions 4 and 10, 11,12).

Ways to discover OSRs vs. top 5 development methodologies			
Hypotheses	<i>Null hypothesis:</i> there is no significant relationship between the ways to discover OSRs and the development methodologies		
	Value	Df	Asymp. Sig (2-sided)
Pearson Chi-Square	48.134	25	p-value =0.004 ASSUMPTIONS NOT VIOLATED

Table A.6. The results of statistical test between the actions to be taken against OSRs and the respondents' roles, size of organizations and the development methodologies (questionnaire questions 5 and 10,11,12)

	Actions to be taken against OSRs vs. respondents' roles			Actions to be taken against OSRs vs. size of organizations			Actions to be taken against OSRs vs. development methodologies		
Hypotheses	<i>Null hypothesis:</i> there is no significant relationship between the actions to be taken against OSRs and the respondents' roles			<i>Null hypothesis:</i> there is no significant relationship between the actions to be taken against OSRs and the size of organizations			<i>Null hypothesis:</i> there is no significant relationship between the actions to be taken against OSRs and the development methodologies		
	Value	df	Asymp. Sig (2-sided)	Value	Df	Asymp. Sig (2-sided)	Value	Df	Asymp. Sig (2-sided)
Pearson Chi-Square	33.163 ¹¹	40	p=0.769	37.928 ¹²	50	p=0.895	71.015 ¹³	50	p=0.027 ASSUMPTIONS VIOLATED

¹¹ More than 20% of the cells have expected cell counts less than 5. Therefore chi-square results may be invalid.

¹² More than 20% of the cells have expected cell counts less than 5 and the minimum expected count of some cells is less than one. Therefore, chi-square results may be invalid.

¹³ This result is significant but rejected due to violations of chi-square test conditions (the conditions are: more than 20% of the cells have expected cell count less than 5 and many cells have minimum expected cell count of less than one).

Table A.7. The results of statistical test between the existence of requirements process that takes into consideration OSRs and the demographic part of the survey (questionnaire questions 2 and 10, 12)

	Phases of RE process where OSRs should be managed vs. respondents' roles			Phases of RE process where OSRs should be managed vs. development methodologies		
Hypotheses	<i>Null hypothesis:</i> there is no significant relationship between the phases of requirements engineering lifecycle and the respondents roles			<i>Null hypothesis:</i> there is no significant relationship between the organizations size and the presence of OSR process		
	Value	df	Asymp. Sig (2-sided)	Value	Df	Asymp. Sig (2-sided)
Pearson Chi-Square	X2=98.425 ¹⁴	80	p=0.079	TO FIX		Non-significant

Table A.8 The results of statistical test between the respondents' roles and the methodologies used by the respondents and the existence of the process of managing OSRs. (questionnaire questions 9 and 10, 12, 14).

	Existence of OSRs process vs. respondents' roles			Existence of OSRs process vs. size of organizations			Existence of OSRs process vs. development methodologies		
Hypotheses	<i>Null hypothesis:</i> there is no significant relationship between the respondents roles and the existence of the OSR process			<i>Null hypothesis:</i> there is no significant relationship between the organizations size and the presence of OSR process			<i>Null hypothesis:</i> There is no significant relationship between the development methodologies used by the respondents and the present of OSR process		
	Value	df	Asymp. Sig (2-sided)	Value	Df	Asymp. Sig (2-sided)	Value	Df	Asymp. Sig (2-sided)
Pearson Chi-Square	25.485 ¹⁵	8	0.0012	4.759 ¹⁶	6	0.58	18.247	10	0.051

Table A.8a The results of statistical test between the type of requirements engineering and the existence of the process of managing OSRs (questionnaire questions 9 and 15).

	Existence of OSRs process vs. types of requirements engineering		
Hypotheses	<i>Null hypothesis:</i> there is no significant relationship between the types of requirements engineering and the existence of the OSR process		
	Value	df	Asymp.

¹⁴ More than 20% of cells in this case have expected cell counts less than 5. As a result, chi-square may be invalid.

¹⁵ 4 cells (22.2%) have expected count less than 5. The minimum expected count is 3.08.

¹⁶ 5 cells (35.7%) have expected count less than 5. The minimum expected count is 2.84.

			Sig (2-sided)
Pearson Chi-Square	11.826	5	0.059

Table A.9. Cross-tabulation between the respondents' roles and results for the question regarding the existence of OSR process (questionnaire questions 10 and 9)

Role	No	Yes	Total
Software project manager	5.6% [12]	4.7% [10]	10.3% [22]
Software product manager	4.7% [10]	0.9% [2]	5.6% [12]
Software team leader	5.1% [11]	2.3% [5]	7.5% [16]
Software architect/designer	8.9% [19]	1.4% [3]	10.3% [22]
Requirements specialist	17.3% [37]	7.9% [17]	25.2% [54]
Developer/Programmer/coder	7.5% [16]	0.5% [1]	7.9% [17]
Software tester	5.1% [11]	0.5% [1]	5.6% [12]
Researcher/academician	11.2% [24]	0.5% [1]	11.7% [25]
Other	8.9% [19]	7% [15]	15.9% [34]
TOTAL	74.3% [159]	25.7% [55]	100% [214]

Table A.10 Contingency table between development methodologies and the existence of OSR process.

Development methodology	Answered <i>No</i> to Question 9 in the questionnaire [1]	Answered <i>Yes</i> to the questionnaire question 9 [1]
Agile	24.9%	23.3%
Incremental/Evolutionary	20.30%	16.7%
Waterfall	18.5%	15.8%
Prototyping	7.8%	12.5%
Rational Unified Model	7.5%	8.3%
Components-based software engineering	5%	8.3%
Ad hoc (no method)	6.8%	1.7%
Rapid application development	3.9%	5%
Spiral development	2.5%	5.8%
Formal methods	2.8%	2.5%

Table A.11 The result for the top 5 methodologies and the first question.

	Waterfall development	Incremental/evolutionary development	Agile software development	Prototyping	Rational Unified model	Response Totals
Is no longer required for the current release	63.4% 45	64.6% (51)	53.1% (52)	60.5% (23)	37.5% (12)	61.1% (113)
Has no value for the potential	39.4% (28)	40.5% (32)	42.9% (42)	34.2% (13)	31.3% (10)	40% (74)

users						
Is duplicated/ redundant	26.8% (19)	31.6% (25)	28.6% (28)	21.1% (8)	18.8% (6)	29.2% (54)
Is rejected	23.9% (17)	20.3% (16)	20.4% (200)	21.1% (8)	9.4% (3)	19.5% (36)
Was never used or implemented	42.3% (30)	27.8% (22)	35.7% (35)	36.8% (14)	34.4% (11)	33.5% (62)
Answered questions	71	79	98	38	32	185