

Does the proportion of different levels of requirement in the Kano model have certain rules in the actual development process?

An in-depth analysis of proportion of different levels of requirement in the Kano model

I. INTRODUCTION

In software development projects, the early demand analysis has a crucial impact on the success of products and the smooth development of subsequent stages. Adequate and reliable requirements analysis is beneficial to the controlling of the cost and schedule of software development in the later stages of a project. In the product requirement analysis stage, the main task is to identify and extract the real customer demand, determine the product function range, evaluate the project risk, and estimate the product cost, whose main purpose is to define the product market positioning. For customers' demand is relatively vague at the demand analysis stage, the poor professional ability of analysts and the wrong understanding of customer language may lead to the misunderstanding of their real needs. In project practice, customers' requirements are often described in qualitative and descriptive language, which easily leads to the misunderstanding between the marketing team at the early stage of software development and the engineering team at the later stage.

Through the study on the application of the proportion of different levels of requirement in the Kano model in the actual development process, this paper summarizes the methodology used to evaluate the priority of user demands in future software development process. The current study concludes that different levels of demand in the Kano model can diversify the user experience, but there is no research on the specific proportions that can achieve that effect. The purpose of this paper is to fill this gap. At the same time, most requirements specifications usually contain functional requirements and non-functional requirements. This paper also wants to summarize the proportional relationship between the two requirements through the analysis of the six requirements specifications.

Research question 1: *Does the proportion of different levels of demand in the Kano model have certain rules in actual development process?*

Research question 2: *What are the different proportions of functional and non-functional requirements in actual development projects?*

In this paper, the Kano model refers to a user demand analysis model created by Noriaki Kano, a professor at the university of Tokyo. A software development methodology is a way to organize software production processes with the use of a

well-defined set of techniques and symbols. A requirement is defined as anything that is inexorably crucial to a system's operation or existence; that is, if it were not contained in the system, the system would fail. The approach to this research question is to critically evaluate six particular SRSs for scientific projects, dividing items within the said requirements into two overarching sets: functional requirements and non-functional requirements, and further divide items into three levels sets: must-be quality, one-dimensional quality and excitement quality.

II. LITERATURE REVIEW

A. Software Development Methodology

With the continuous improvement of software development methods, the main development ideas currently used in software development are agile software development methods that ensure speed and flexibility, and system designs that focus on user requirements.

Since the emergence of software engineering (SE) as an independent scientific discipline in the 1970s, how to effectively carry out software development has been the research direction that researchers are striving for [1, 2]. With the development of software development methodology, early popular phase-based linear methods have been gradually eliminated by the times and replaced by agile software development. Agile development defines the development process as a dynamic process with an iterative cycle [3]. Moreover, due to unpredictable changes in the development process, software developers value the creativity of the development members rather than the set development process [5-7]. As agile methods become the mainstream, an increasing number of large organizations in the software industry are adopting agile development as a development method [8,9]. Customer needs, on-time delivery of the software, and the budget are largely met [10, 11]. Then, agile development only focuses on how to successfully complete the project according to the requirements, but does not pay attention to the availability of the software itself [12-14]. Although the availability of software is considered to be one of the quality attributes of software, it has gradually become a key factor in the success of software in the market [15].

As stated in the ISO 13407 standard, the premise of a user-centric design is a thorough understanding of the user's needs and requirements. With the development of the Internet, user

experience tends to be diversified and user needs become more dynamic [16]. However, there are few available instructive references on how to meet users' dynamic needs and experiences. In addition, in general, there is a time lag between product design and the needs of the final market. Diversified Internet information can cause the rapid change of users over time [17]. To solve this problem, a customized system was proposed. Customization was then unrealistic for companies that design and produce separate companies, but now it might be realized and contributes to the popularization of certain software.

B. *Kano Model*

In the late 1950s, Frederick Herzberg, an American behavioral scientist, studied the problems that people's satisfaction were affected by and proposed a theory of motivation called two-factor theory. Based on this, Kano developed a model for identifying quality attributes that affect customer satisfaction [18]. Customer satisfaction is the display and measurement of the services provided by an organization. To make customers' satisfaction live up to the organization's expectations requires the organization gain customer feedback and make corresponding improvements. The Kano model is currently the most widely used research method by researchers. For example, it is used to improve the quality of medical systems [19,20]. In general, this type of research work focuses on qualitative analysis. A small number of studies have attempted to quantify the relationship between customer demand and satisfaction [21].

III. METHODOLOGY

A. *Sampling method*

The research includes a comprehensive analysis of six design documents through purposeful sampling, and random sampling of all user requirements appearing in the document to obtain experimental data. In this article, the requirement specification is specifically selected for scientific projects from different organizations and is listed in the metadata in Appendix A.

B. *Analysis*

The analysis is carried out with several stages. Besides the adoption of qualitative research methods, the analysis is also supplemented by a set of quantitative processes. According to the Kano model, customer needs are divided into three types, namely must-be quality, one-dimensional quality and excitement (Attractive) quality. In particular, the customer needs of must-be quality mean that a product should satisfy the most basic functions that it should have. If the basic functions are not implemented, customers will be particularly dissatisfied; on the contrary, when the basic functions are fully implemented, they will not show excitement. In terms of the one-dimensional quality, the more one-dimensional qualities a product has, the more satisfied customers will be with it. However, when the one-dimensional quality is not valued, customers will be dissatisfied. Finally, an excitement quality is a product feature that customers do not expect. If the product does not provide such a feature, customers will not be dissatisfied. Because, they usually don't take the initiative to consider these needs. However, if

the product provides such a function, customers will be excited. Therefore, I collected three emotional feedbacks from participants based on these three levels of needs: ordinary, surprise, and excitement. In addition, I also use various quantitative methods to calculate the results of different ratios of different levels of demand. Based on this data, the IBM SPSS statistical package is used to generate statistics for further analysis and to try to find out the rules that exist and verify the credibility of the data. Excel is then used to generate an illustrative chart of the analysis result. The integrated process used in this study is shown in Appendix B of Figure 1-2.

IV. FINDINGS

Through the use of qualitative analysis methods mentioned, it is found that the items in the analyzed requirements specification can be divided into two general categories proposed in the research questions: functional requirements and non-functional requirements (Appendix D&E)

The analysis reveals several very interesting results. First, there is very strong evidence that the proportion of functional requirements follows a certain pattern in the software development process. To prove this, the confidence interval was estimated with the use of the IBM SPSS statistical software, with 95% confidence, it estimated that the mean proportion of the functional requirements present in the requirements specifications of scientific projects ranges from 51.46% to 85.97%. (Appendix F)

In addition, in the software development process, the proportion of the three levels of demand of the Carnot model also follows a certain law. We use the chi-square test to check whether the two variables are related and more accurately. Give the degree of reliability of this judgment. The original hypothesis "CATEGORY has no relationship with SUBCATEGORY". According to the sample calculation statistic Pearson Chi-Square and random sampling, CATEGORY has no relationship with SUBCATEGORY. The statistic shows that the probability of this situation is less than 1%. Pearson Chi -Square corresponds to a P value of 0.000, which is very small. Therefore, we think the result is not accidental. If we negate the null hypothesis, that is, CATEGORY has a relationship with SUBCATEGORY, for example, usability in Must-be Quality will significantly improve.

At the same time, in order to verify whether the data is reliable, the reliability analysis is carried out. In the analysis, the degree of consistency of the results is obtained by repeating the measurement of the same object by the same method. The reliability coefficient is preferably above 0.8, and acceptable between 0.7 and 0.8; Cronbach's alpha coefficient should be considered for reprocessing if it is below 0.6. The Cronbach's alpha coefficient is 0.732 for this measurement, indicating that the data is acceptable. (Appendix F)

However, in using the Excel analysis, we found some results that do not fully demonstrate our assumptions. For example, in Appendix I, excitement quality accounts for a larger proportion than one-dimensional quality does. For the game requirements document, more excitement quality is needed to enhance the player's gaming experience, so the demand ratio will be larger than the one that is included in the website or software requirements document. On the other hand, the documents we use have considerable errors in data sampling statistics, which causes the bias.

In terms of functional requirements and non-functional requirements, it can be found from the analysis of Excel that the six SRSs have no particularly significant proportional relationship rules. Some documents (such as games) are more about introducing game background and gameplay. Such non-functional requirements; for software or website development documents, more inclined to describe more functional requirements.

V. DISCUSSION AND CONCLUSION

This study has discussed and systematically evaluated the rules of the ratio of different levels of requirements in actual development process. From the analysis of collected data, a large amount of evidence shows that for real software development projects, must-be quality occupies the largest proportion in the actual development, one-dimensional quality the second largest proportion, and excitement quality the smallest proportion. In terms of must-be quality, the realization of basic functions (usability needs) is the most important. For excitement quality, the need for UI and user interaction is paramount. In addition, there is a significant difference in the proportion of functional and non-functional requirements in different product developments. For example, game development is more concerned with non-functional requirements such as character modeling and background matting. However, in the development of websites or apps, functional requirements such as availability, user experience, and performance are even more important. Moreover, for functional requirements, the proportion of must-be quality, dimensional quality and excitement quality decrease successively. However, in non-functional requirements, development is more than twice as often required as modeling, which means functional requirements and software development as a whole are basically the same. For non-functional requirements, modeling is not a significant factor in the end result.

The main limitation of this study is the small sample size. First of all, due to limited research time and limited human resources, it is difficult to collect a large amount of target data. Too small a volume of data may lead to some bias in the results, and no clear conclusions will be obtained. In addition, there is an important flaw in classifying requirements. In fact, people's satisfaction with demand is difficult to categorize. For example, it is difficult to have a clear line of surprises or excitement about demand. In other words, since there is only one research-

er in this analysis, this classification might be affected by cognitive bias, which ultimately affects the outcome.

In order to overcome these limitations in future work, first, the sample size and the amount of data used in the analysis need to be expanded and increased. A larger amount of data leads to more definitive results and reduce deviations that are not related to experimental factors. For example, for non-functional requirements, the proportion of subdirectories for modeling and analysis is not significantly different in some projects. In other projects, however, the percentage of these subdirectories varies greatly. If the amount of data is big enough, for this problem, there should be more clear conclusions. In addition, the classification of requirements needs to be developed with a more scientific and normative standard. At the same time, multiple people should be encouraged to participate in research to reduce the errors caused by each individual's own perceptions and prejudices.

VI. REFERENCES

- [1] Verner, J.M., Overmyer, S.P. and McCain, K.W., 1999. In the 25 years since The Mythical Man-Month what have we learned about project management?. *Information and Software Technology*, 41(14), pp.1021-1026.
- [2] Royce, W.W., 1987, March. Managing the development of large software systems: concepts and techniques. In *Proceedings of the 9th international conference on Software Engineering* (pp. 328-338). IEEE Computer Society Press.
- [3] Nerur, S. and Balijepally, V., 2007. Theoretical reflections on agile development methodologies. *Communications of the ACM*, 50(3), pp.79-83.
- [4] Cockburn, A., 2006. *Agile software development: the cooperative game*. Pearson Education.
- [5] Beck, K., 2000. *Extreme programming explained-embrace change*, reading, MA: Addison-Wesley.
- [6] Conboy, K., 2009. Agility from first principles: Reconstructing the concept of agility in information systems development. *Information systems research*, 20(3), pp.329-354.
- [7] Schwaber, K. and Beedle, M., 2001. *Agile software development with Scrum* Prentice Hall PTR Upper Saddle River, NJ, USA.
- [8] Blau, B. and Hildenbrand, T., 2011, August. Product line engineering in large-scale lean and agile software product development environments-Towards a hybrid approach to decentral control and managed reuse. In *2011 Sixth International Conference on Availability, Reliability and Security* (pp. 404-408). IEEE.
- [9] Boehm, B., 2011. Some future software engineering opportunities and challenges. In *The future of software engineering* (pp. 1-32). Springer, Berlin, Heidelberg.
- [10] Batra, D., Xia, W., VanderMeer, D.E. and Dutta, K., 2010. Balancing agile and structured development approaches to successfully manage large distributed software projects: A case study from the cruise line industry. *CAIS*, 27, p.21.
- [11] Fitzgerald, B., 2012. Software Crisis 2.0. *Computer*, 45(4), pp.89-91.
- [12] Blomkvist, S., 2005. Towards a model for bridging agile development and user-centered design. In *Human-centered software engineering—integrating usability in the software development lifecycle* (pp. 219-244). Springer, Dordrecht.

- [13] Constantine, L.L. and Lockwood, L., 2002. Process agility and software usability: Toward lightweight usage-centered design. *Information Age*, 8(8), pp.1-10.
- [14] Iso, W., 1998. 9241-11. Ergonomic requirements for office work with visual display terminals (VDTs). *The international organization for standardization*, 45(9).
- [15] Seffah, A., Desmarais, M.C. and Metzker, E., 2005. HCI, usability and software engineering integration: present and future. In *Human-centered software engineering—integrating usability in the software development lifecycle* (pp. 37-57). Springer, Dordrecht.
- [16] Wang, Y. and Yu, S., 2016, May. Design for dynamic requirement and diverse user experience. In *DS 84: Proceedings of the DESIGN 2016 14th International Design Conference* (pp. 553-560).
- [17] Pucillo, F., Cascini, G., "A framework for user experience, needs and affordances", *Design Studies*, Vol.35, No.2, 2014, pp. 160-179.
- [18] Kano, N., 1984. Attractive quality and must-be quality. *Hinshitsu (Quality, The Journal of Japanese Society for Quality Control)*, 14, pp.39-48.
- [19] Mikulić, J. and Prebežac, D., 2011. A critical review of techniques for classifying quality attributes in the Kano model. *Managing Service Quality: An International Journal*, 21(1), pp.46-66.
- [20] Paraschivescu, A.O. and COTÎRLET, A., 2012. Kano Model. *Economy Transdisciplinarity Cognition*, 15(2).
- [21] Ji, P., Jin, J., Wang, T. and Chen, Y., 2014. Quantification and integration of Kano's model into QFD for optimising product design. *International Journal of Production Research*, 52(21), pp.6335-6348.

APPENDICES

APPENDIX A: REQUIREMENTS SPECIFICATIONS METADATA

Table 1: Requirements specifications analyzed

Specification number	Specification project	Organization	Length	Revision date
023	Good Comment Car Feature Builder	Turners	36 pages	05/22/18
025	OnLine Application Processing (OLAP)	Astron	22 pages	05/30/07
037	CryptospaceX Game	CryptospaceX (CryX)	18 pages	05/23/18
039	DOOM Bible	Tom Hall (TH)	79 pages	11/28/92
010	SPARK PLATFORM	SPARK	45 pages	06/30/16
043	Generic Business Register	National Statistical Committee of Kyrgyzstan Uganda Bureau of Statistics Statistics Norway (NSCK)	79 pages	05/19/17

APPENDIX B: RESEARCH METHODOLOGY

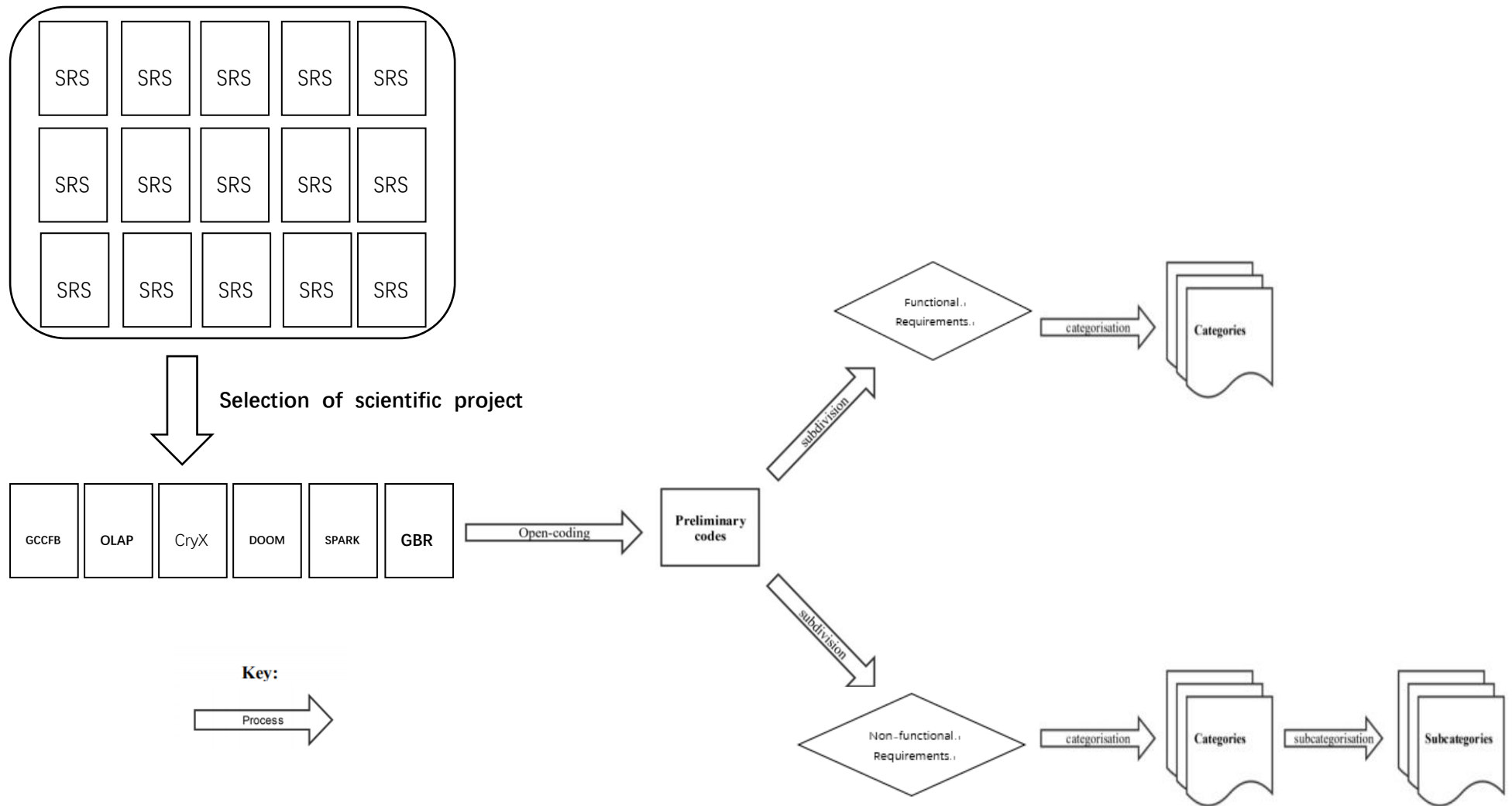


Figure 1: Processing of requirements specifications part I

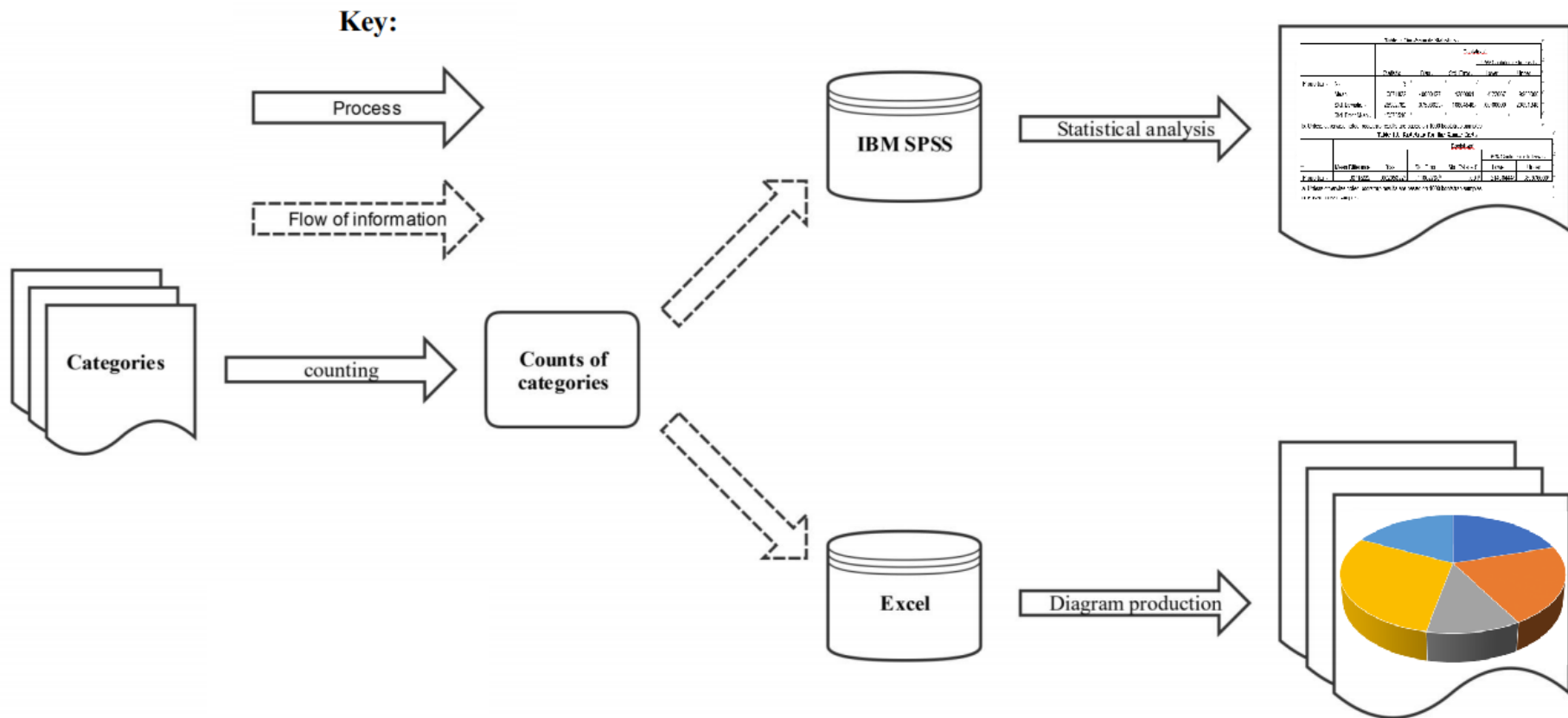


Figure 1: Processing of requirements specifications part II

APPENDIX C: CATEGORY DEFINITION TABLES

Table 2: Functional Requirements:

CATEGORY	SUBCATEGORY	DEFINITION
MUST-BE QUALITY		These attributes correspond to the basic requirements of the quality of a product. If they are not present or their performance is poor, customers will be extremely dissatisfied. On the other hand, if they are present or have sufficient performance, they do not bring satisfaction.
ONE-DIMENSIONAL QUALITY		Fulfilment of one-dimensional attributes is positively and linearly related to the level of customer satisfaction.
EXCITEMENT QUALITY		Also known as “Attractive attributes”. These attributes are key to customer satisfaction. If they are present or have sufficient performance, they will bring higher satisfaction. On the other hand, if they are not present or their performance is poor, customers will be dissatisfied. These attributes are neither required nor expected by customers.
	Usability	“Usability is concerned with how easy it is for the user to accomplish a desired task and the kind of user support the system provides.”
	Security	“Security is a measure of the system's ability to resist unauthorized usage while still providing its services to legitimate users”
	UI/Interaction	User Interface improvement or Interaction design

Table 3: Non-functional Requirements:

CATEGORY	SUBCATEGORY	DEFINITION
MODELING		
	Diagram	A diagrammatic figure or graphic used to communicate information about a part of a system.
	Use case	A use case “captures the interactions that occur between producers and consumers of information and the system itself”
DEVELOPMENT		Requirements that are required in the software development process, and these requirements usually serve the software development itself, rather than the user's needs.
	Availability	“Availability is concerned with system failure and its associated consequences. The availability of a system is the probability that it will be operational when it is needed.”
	Background	Introduction background of software or game

APPENDIX D: SRS CATEGORY HIERARCHY

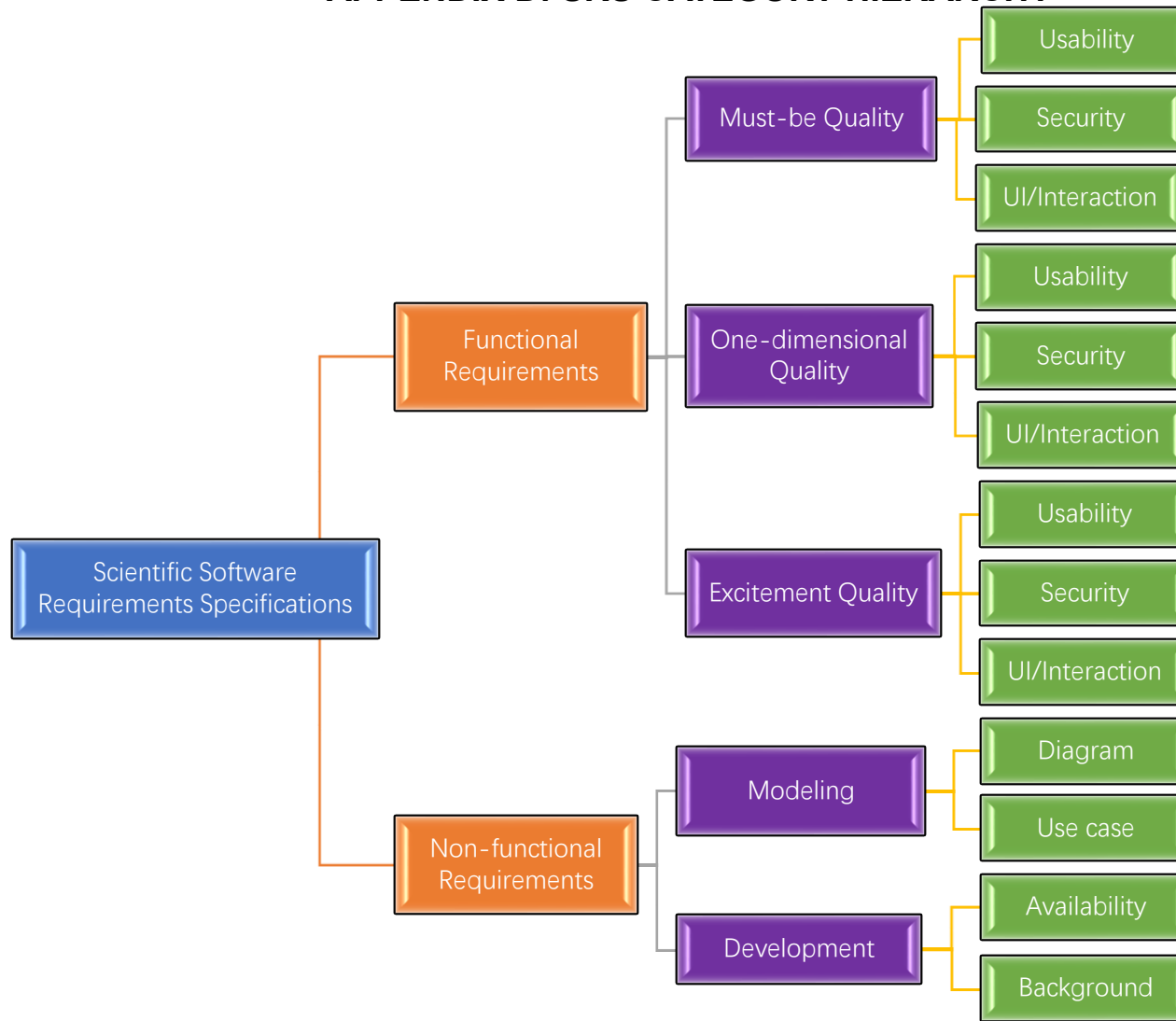


Figure 3: Category hierarchy in requirements specifications analyzed

APPENDIX E: FUNCTIONAL REQUIREMENTS VS
NON-FUNCTIONAL REQUIREMENTS

Table 4: Prevalence of functional requirements and non-functional requirements in all six requirements specifications:

	Count	Proportion
Functional Requirements	227	70.28%
Non-functional Requirements	96	29.72%
Total	323	100.00%

Figure 4: Proportion of functional requirements and non-functional requirements

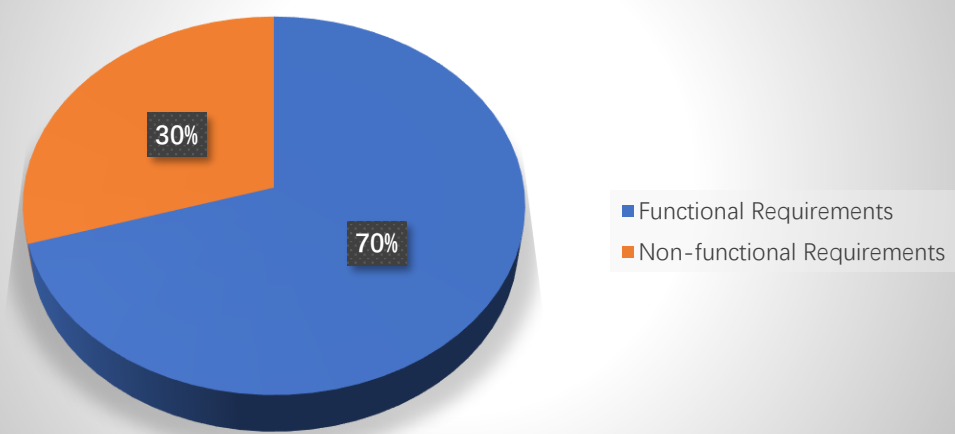


FIGURE 5: COUNT OF FUNCTIONAL REQUIREMENTS AND NON-FUNCTIONAL REQUIREMENTS

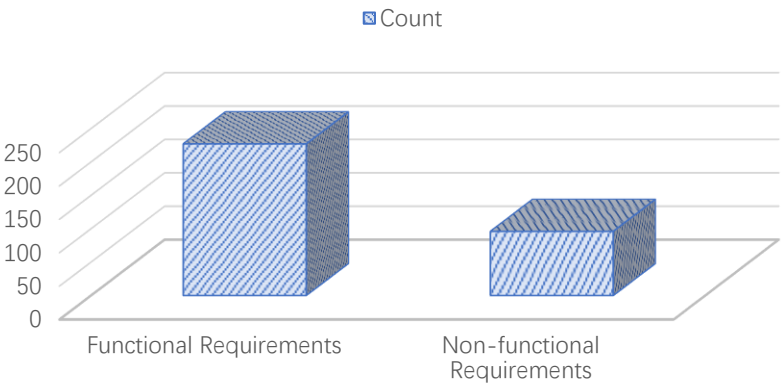


Table 5: Overall prevalence of the different categories in all six requirements specifications:

	Category	Frequency	Proportion
Functional Requirements	Must-be Quality	109	33.75%
	One-dimensional Quality	66	20.43%
	Excitement Quality	52	16.10%
Non-functional Requirements	Modeling	31	9.60%
	Development	65	20.12%
Total		323	100%

Figure 6: Count of functional requirements and non-functional requirements

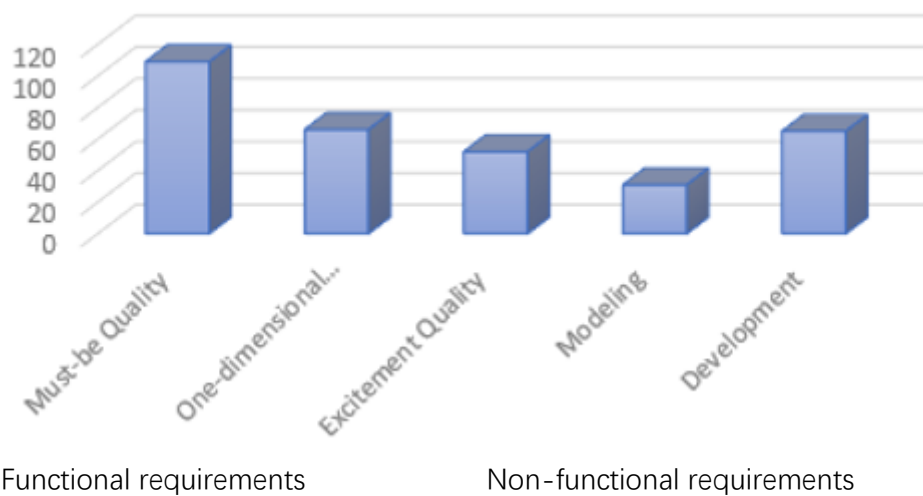
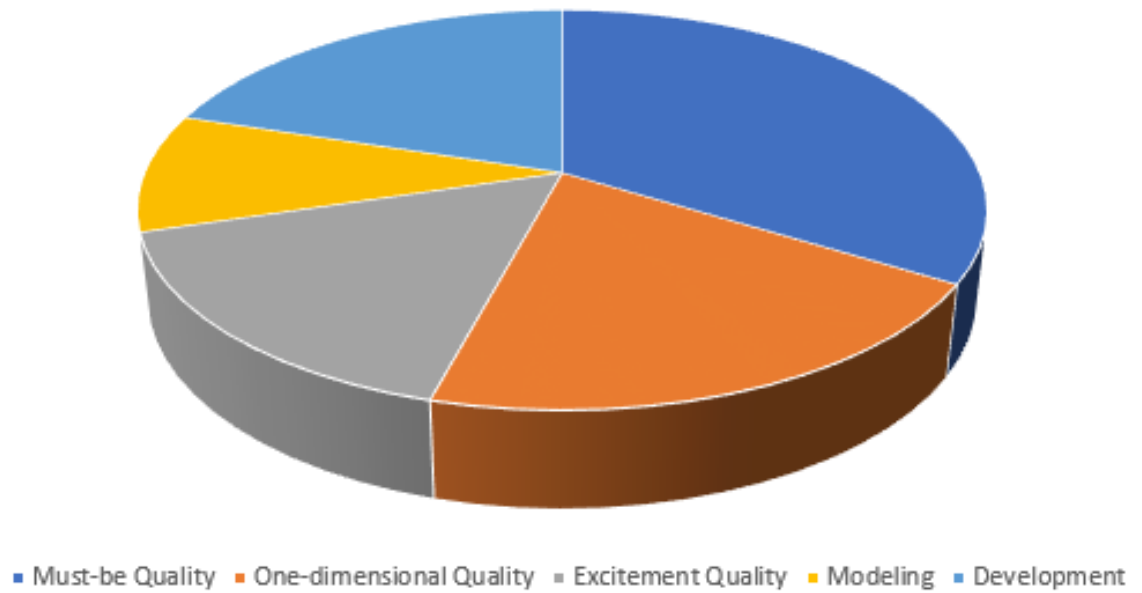


Figure 7: Relative proportion of categories in all requirements specifications



Prevalence of subcategories:

Table 6: Prevalence of Functional Requirements subcategories

Category	Subcategory	Frequency	Proportion
Must-be Quality	Usability	81	35.68%
	Security	19	8.37%
	UI/Interaction	9	4.00%
One-dimensional Quality	Usability	10	4.41%
	Security	20	8.81%
	UI/Interaction	36	15.86%
Excitement Quality	Usability	9	3.96%
	Security	13	5.73%
	UI/Interaction	30	13.22%
Total:		227	100%

Figure 8: Frequency of Functional Requirements subcategories

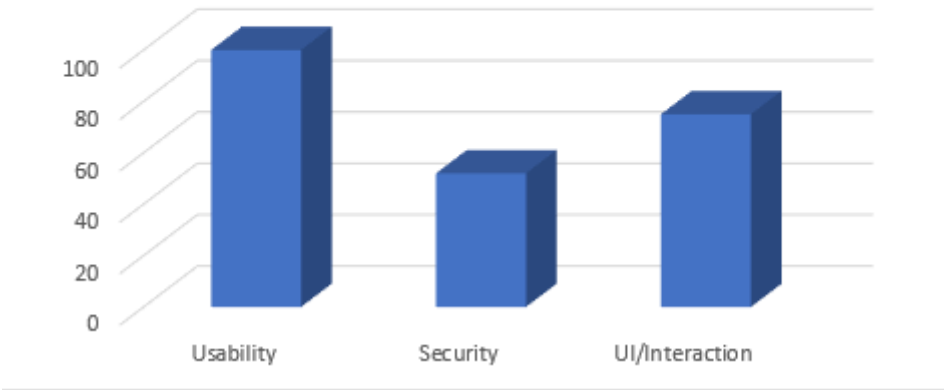
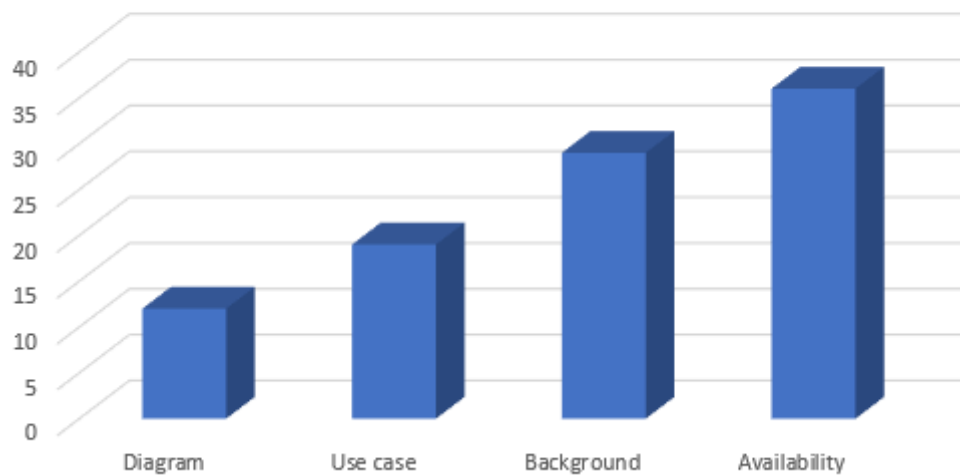


Table 7: Prevalence of Non-functional Requirements subcategories

Category	Subcategory	Frequency	Proportion
Modeling	Diagram	12	12.50%
	Use case	19	19.80%
Development	Background	29	32.21%
	Availability	36	37.50%
Total:		96	100%

Figure 9: Frequency of Non-functional Requirements subcategories



APPENDIX F: STATISTICAL ANALYSIS

Table8: Relative proportion of items that pertained to the set: Functional Requirements

	Proportion of items:
Must-be Quality	0.99
One-dimensional Quality	0.59928
Excitement Quality	0.472267
Mean proportion:	0.687182

Table 9: One-Sample Statistics

		Statistic	Bootstrap ^b			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
Proportion	N	3				
	Mean	.6871822	-.0000427	.1280091	.4722667	.9900000
	Std. Deviation	.26982782	-.07508633	.10804548	.00000000	.29891348
	Std. Error Mean	.15578516				

b. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 10: Bootstrap for One-Sample Test

		Bootstrap ^a				
		Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
					Lower	Upper
Proportion	Mean Difference	.00205822 ^b	.11062780 ^b	.001 ^b	.51460444 ^b	.85976000 ^b

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

b. Based on 881 samples

Table 11: Case Processing Summary

		N	%
Cases	Valid	323	100.0
	Excluded ^a	0	.0
	Total	323	100.0

a. Listwise deletion based on all variables in the procedure.

Table 12: Reliability Statistics

Cronbach's Alpha	N of Items
.732	5

Table 13: Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
CATEGORY * SUBCATEGORY	227	100.0%	0	0.0%	227	100.0%

Table 14: CATEGORY * SUBCATEGORY Crosstabulation

Count

		SUBCATEGORY			Total
		Usability	Security	UI/Interaction	
CATEGORY	Must-be Quality	81	19	9	109
	One-dimensional Quality	10	20	36	66
	Excitement Quality	9	14	29	52
Total		100	53	74	227

Table 15: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	85.027a	4	.000
Likelihood Ratio	93.344	4	.000
Linear-by-Linear Association	65.812	1	.000
N of Valid Cases	227		

APPENDIX G: GOOD COMMENT CAR FEATURE BUILDER PROJECT CATEGORIES

Table 16: Overall prevalence of the different categories in all five requirements specifications:

	Category	Frequency	Proportion
Functional Requirements	Must-be Quality	21	60.00%
	One-dimensional Quality	9	25.71%
	Excitement Quality	5	14.29%
Non-functional Requirements	Modeling	0	0%
	Development	0	0%
Total		35	100%

Figure 10: Frequency of categories in Good Comment Car Feature Builder Project

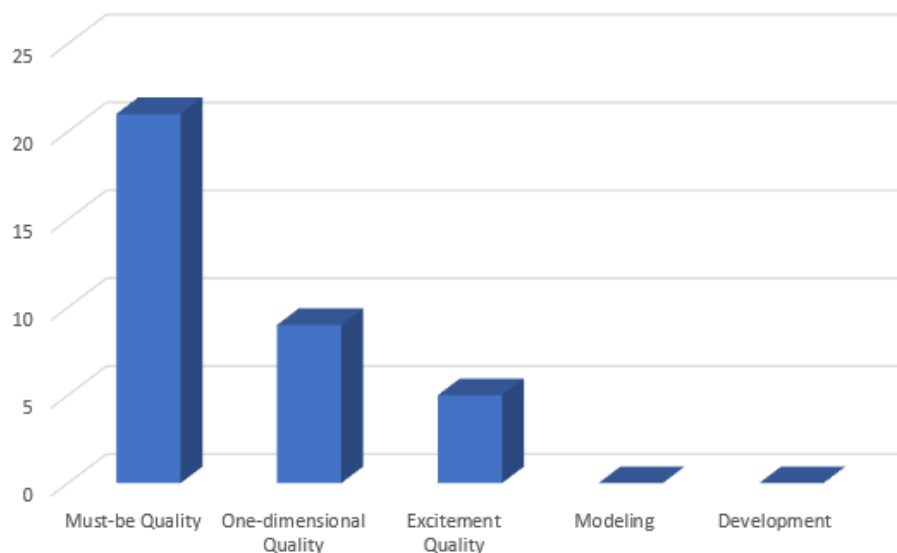
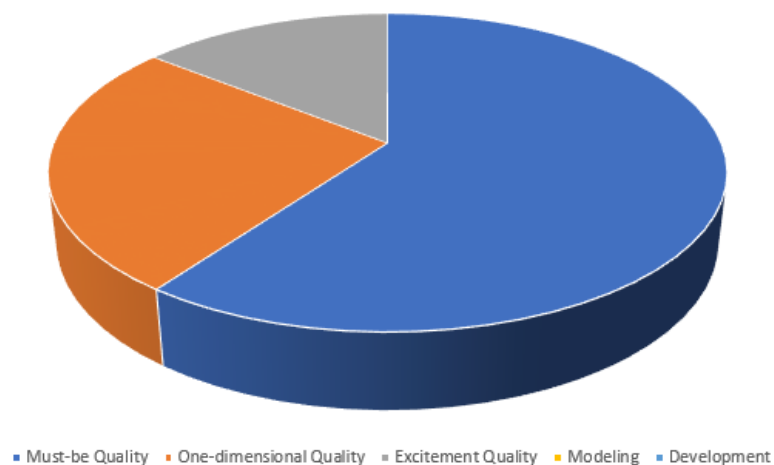


Figure 11: Frequency of categories in Good Comment Car Feature Builder Project



APPENDIX H: Online Application Processing PROJECT

CATEGORIES

Table 17: Overall prevalence of the different categories in all five requirements specifications:

	Category	Frequency	Proportion
Functional Requirements	Must-be Quality	17	54.84%
	One-dimensional Quality	8	25.81%
	Excitement Quality	6	19.35%
Non-functional Requirements	Modeling	0	0%
	Development	0	0%
Total		31	100%

Figure 12: Frequency of categories in Online Application Processing Project

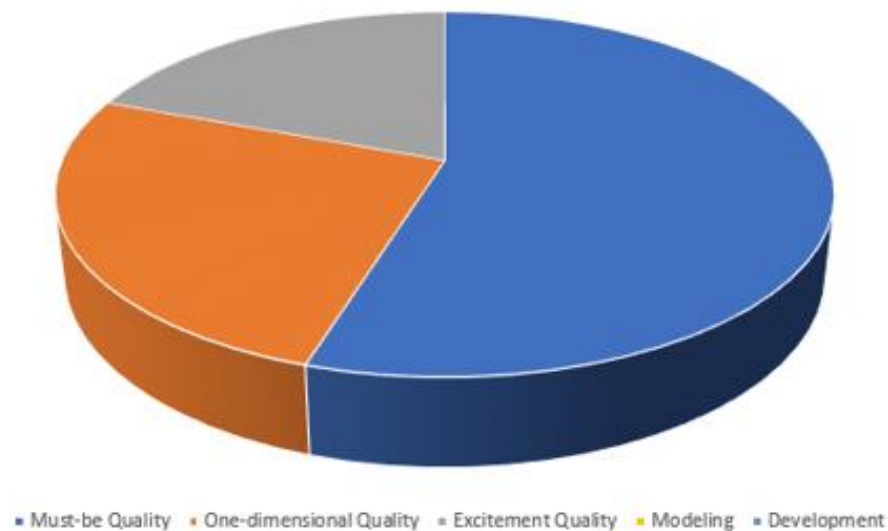
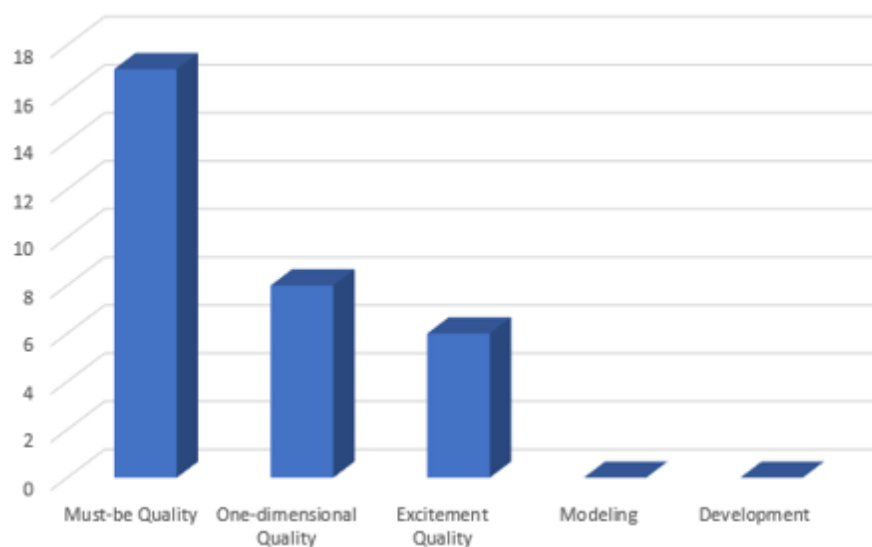


Figure 13: Relative proportion of categories in Online Application Processing Project

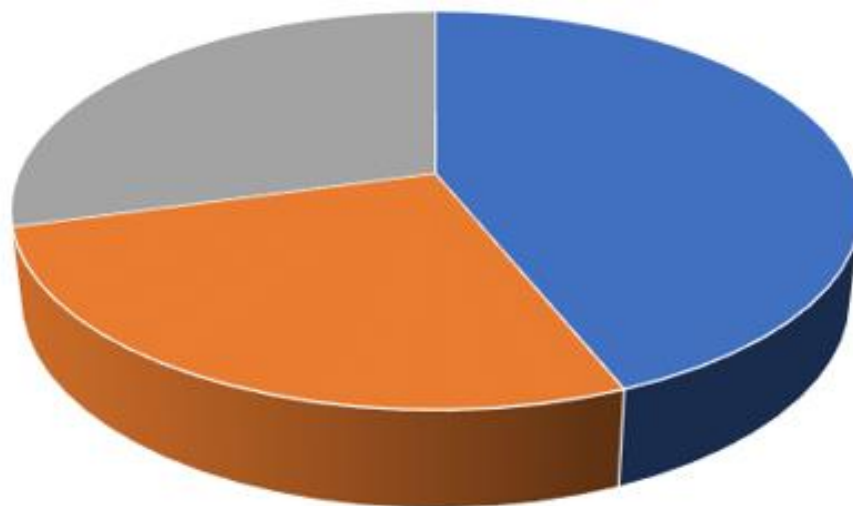


APPENDIX I: CryptospaceX Game PROJECT CATEGORIES

Table 18: Overall prevalence of the different categories in all five requirements specifications:

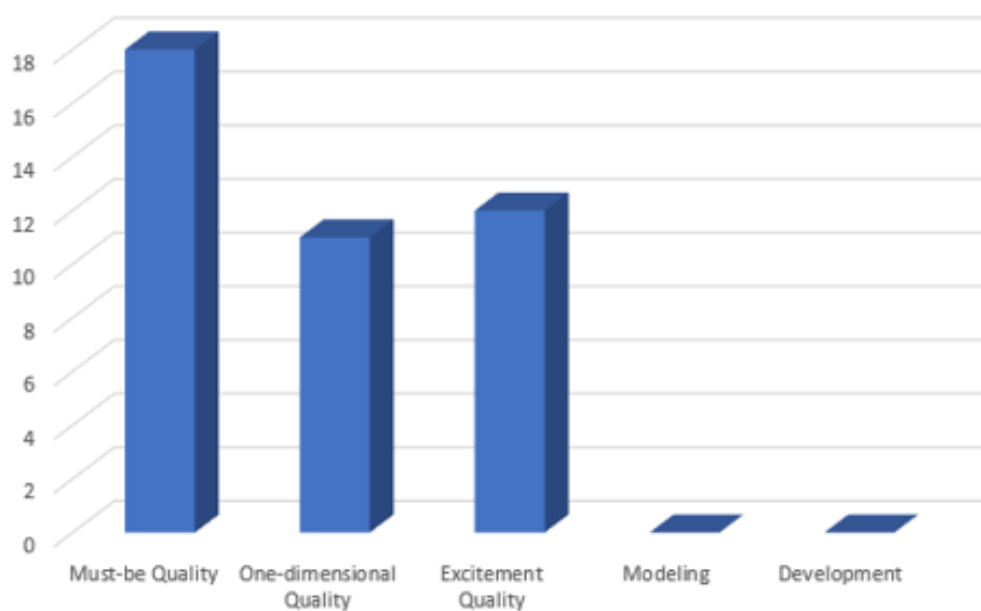
	Category	Frequency	Proportion
Functional Requirements	Must-be Quality	18	43.90%
	One-dimensional Quality	11	26.83%
	Excitement Quality	12	29.27%
Non-functional Requirements	Modeling	0	0%
	Development	0	0%
Total		41	100%

Figure 14: Frequency of categories in CryptospaceX Game Project



■ Must-be Quality ■ One-dimensional Quality ■ Excitement Quality ■ Modeling ■ Development

Figure 15: Relative proportion of categories in CryptospaceX Game Project



APPENDIX J: DOOM Bible PROJECT CATEGORIES

Table 19: Overall prevalence of the different categories in all five requirements specifications:

	Category	Frequency	Proportion
Functional Requirements	Must-be Quality	16	25.81%
	One-dimensional Quality	11	17.74%
	Excitement Quality	10	16.13%
Non-functional Requirements	Modeling	0	0%
	Development	25	40.32%
Total		62	100%

Figure 16: Frequency of categories in Online Application Processing Project

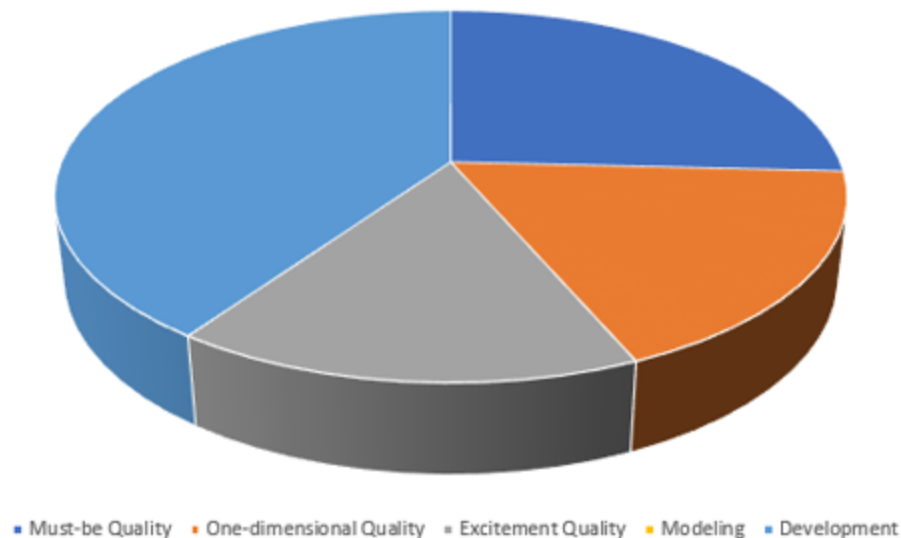
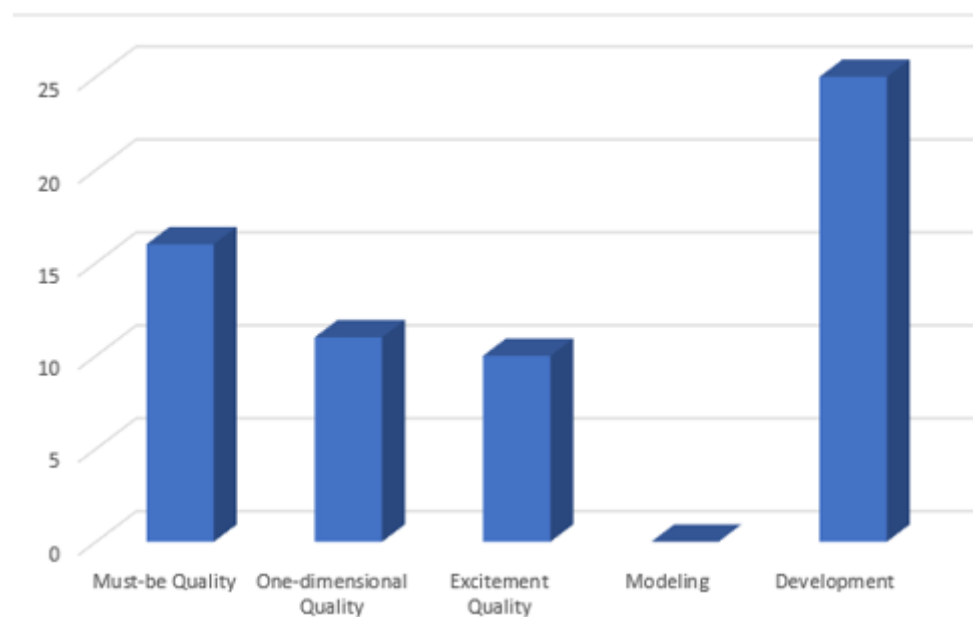


Figure 17: Relative proportion of categories in Online Application Processing Project



APPENDIX K: SPARK PLATFORM PROJECT CATEGORIES

Table 20: Overall prevalence of the different categories in all five requirements specifications:

	Category	Frequency	Proportion
Functional Requirements	Must-be Quality	16	20.25%
	One-dimensional Quality	17	21.52%
	Excitement Quality	9	11.39%
Non-functional Requirements	Modeling	23	29.11%
	Development	14	17.72%
Total		79	100%

Figure 18: Frequency of categories in SPARK PLATFORM Project

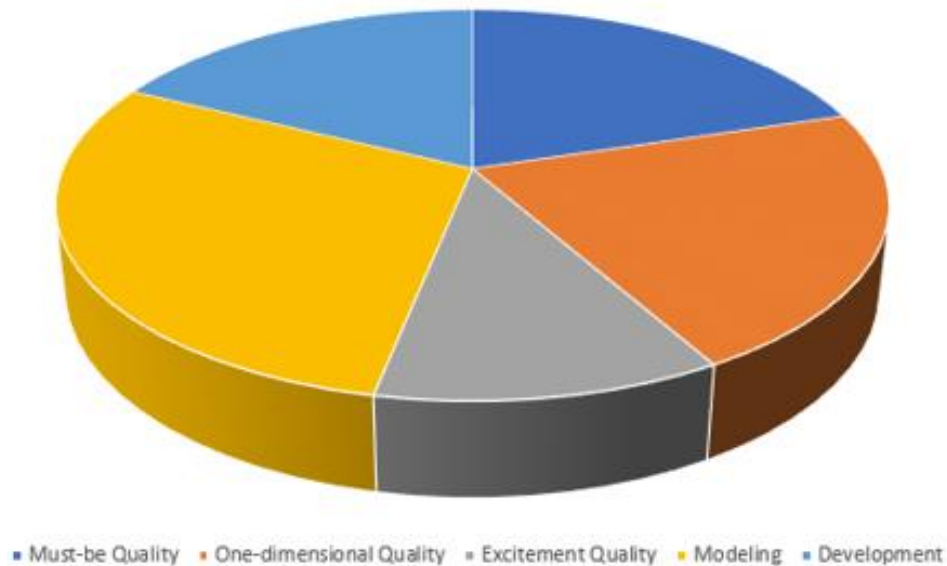
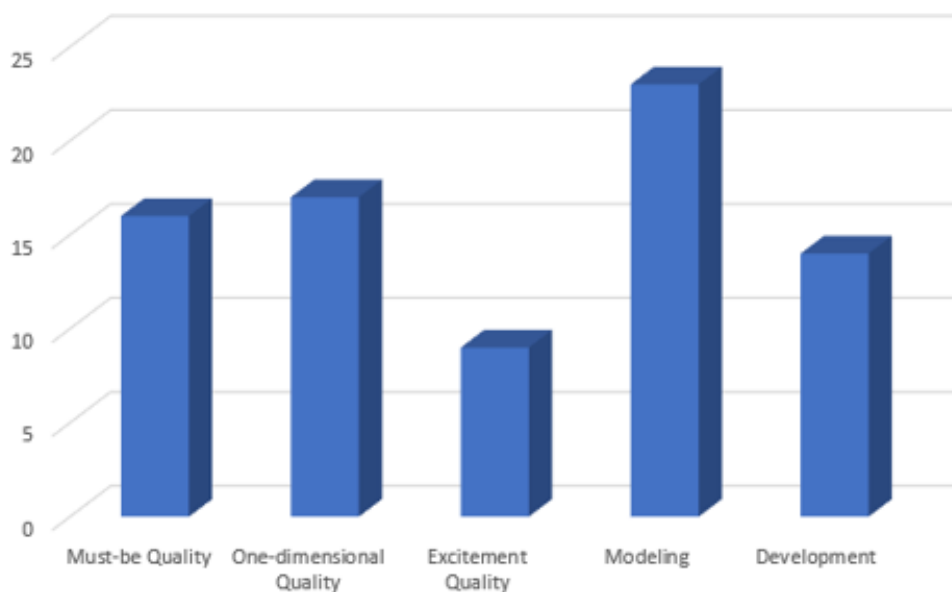


Figure 19: Relative proportion of categories in SPARK PLATFORM Project



APPENDIX L: Generic Business Register PROJECT

CATEGORIES

Table 21: Overall prevalence of the different categories in all five requirements specifications:

	Category	Frequency	Proportion
Functional Requirements	Must-be Quality	21	28.00%
	One-dimensional Quality	10	13.33%
	Excitement Quality	10	13.33%
Non-functional Requirements	Modeling	8	10.67%
	Development	26	34.67%
Total		75	100%

Figure 20: Frequency of categories in Generic Business Register Project

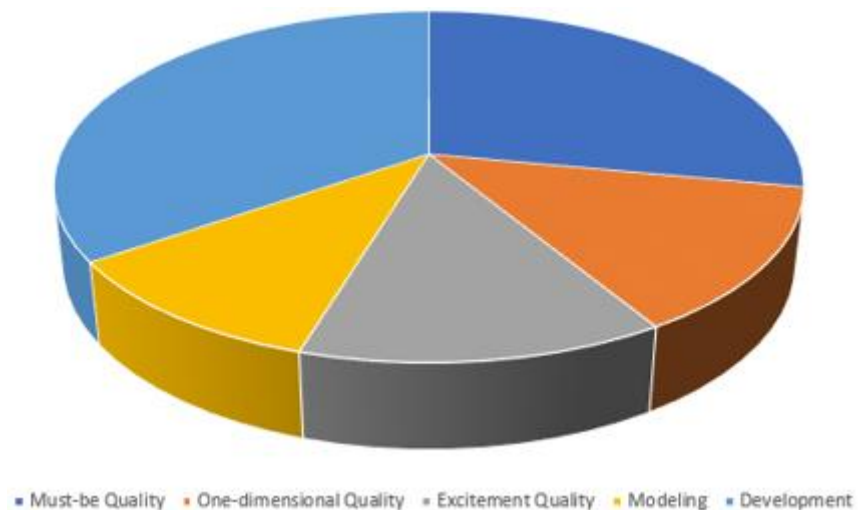
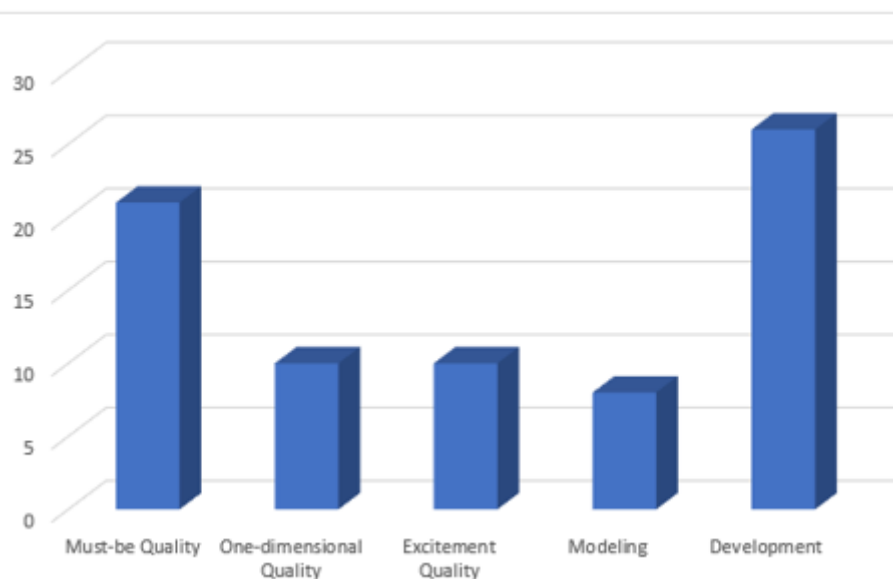



Figure 21: Relative proportion of categories in Generic Business Register Project



APPENDIX M: Functional Requirements - SRS ITEMS

Category	Subcategory	Pre-code	Spec	Page	Example
Must-be Quality	Usability	template	023 (Turners)	1	"These templates should be based on a series of pre-defined category types, (i.e. Ex-Lease, Fresh Import, NZ New...) including the ability to select key supporting features and benefits (i.e. Reverse camera, Sunroof, Ski Rack etc.)."
Must-be Quality	Usability	template	023 (Turners)	1	"Provide functionality to enable a consultant the ability to select a series of pre-defined sales driven templates to show case specific features and functions relating to a Good."
Must-be Quality	Usability	template	023 (Turners)	1	"When creating an active comment users can chose the display type. Display types control where a comment will be published;"
Must-be Quality	Usability	details	023 (Turners)	1	"Good (Generic) Comments support non-specific good details,"
Must-be Quality	Usability	templates	023 (Turners)	1	"A Consultant can attached a generic comment to a Good"
One-dimensional Quality	Usability	Interface	023 (Turners)	1	"All Generic comments are controlled and created by National Accounts"

Must-be Quality	Usability	default	023 (Turners)	2	"A consultant is unable to choose the output channel as this is defined by National Accounts. Unless otherwise specified the default is Display on All"
One-dimensional Quality	Usability	automatically	023 (Turners)	2	"Goods booked to catalogue using the Fleet EDI service, can automatically create an Active good comment."
Must-be Quality	Usability	rule	023 (Turners)	2	"Comments added at a catalogue level are like generic comments and cannot be changed. These are applied to all listings within the catalogue and are often regarding conditions"
Must-be Quality	Usability	rule	023 (Turners)	2	"The Good messages or comments are generally controlled by Marketing and apply themselves to the listings."
Excitement Quality	UI/Interaction	pre-defined	023 (Turners)	2	"Using pre-defined comments to address important features we can improve the time it takes for anyone to find the selling points and key features of the vehicle."
One-dimensional Quality	Usability	pre-defined	023 (Turners)	2	"Deploying pre-defined templates would; - Streamlined MaRS Good comment management, - Reduce typographical errors - Introduce conformity across all users"
Must-be Quality	Usability	screenshot	023 (Turners)	2	<p>"We would look to include a new functional button called "Good Comments" this would be added to the Good ribbon as shown in the following screenshot."</p> 

Must-be Quality	Usability	template	023 (Turners)	3	"The Category template section would be restricted to only allow 1 selection.
One-dimensional Quality	UI/Interaction	preview	023 (Turners)	3	"Provide function to allow user to preview the comment template populated with associated Good data [i.e tnz_name]"
One-dimensional Quality	UI/Interaction	feedback	023 (Turners)	3	"Provide feedback to the user that if they go back to the template screen and the vehicle data has been changed since last load. Refresh the vehicle data tags and Prompt user that the template needs to be saved. "
Must-be Quality	Usability	Default	023 (Turners)	4	"Default Display Option for a Comment template will always be set to Display on All"
Must-be Quality	Usability	form	023 (Turners)	4	"Allow user the function to select multi feature associated with the good. These features could be predetermined by reading the vehicle features form the Vehicle Details section of the Good form"
Must-be Quality	UI/Interaction	preview	023 (Turners)	4	"Once Comment Template and features have been selected, provide option to preview the concatenated results of the choices made."
Must-be Quality	UI/Interaction	display	023 (Turners)	4	"Preview should Include any catalogue information text campaign detail text if applicable. [Catalogue Information: Additional Comments Name], Also display number of characters presented"
One-dimensional Quality	Usability	changes	023 (Turners)	5	"Changes to the Catalogue comments"
One-dimensional Quality	Usability	changes	023 (Turners)	5	"Changes to Campaign Comments"

One-dimensional Quality	UI/Interaction	layout	023 (Turners)	5	"Changes to Turners website Good layout or design"
Excitement Quality	UI/Interaction	Auto selecting	023 (Turners)	5	"Auto selecting feature comments based on Good Vehicle Details Features selections"
Excitement Quality	UI/Interaction	Auto selecting	023 (Turners)	5	"Auto selecting Category based on Vehicle Category (ex-Lease)"
Must-be Quality	Usability	supported	023 (Turners)	5	"HTML style tags not supported when publishing to Trade Me or Turners website"
Must-be Quality	Usability	future	023 (Turners)	5	"Trade Me format and style will vary depending if it's classified or Auction. May require further discussion to understand future requirements (DRIVEN)"
Must-be Quality	Usability	limitation	023 (Turners)	6	"Minimum of 2 features per car must be selected. Consultant manually selects most appropriate."
Must-be Quality	Usability	limitation	023 (Turners)	5	"When content is published to Trade Me there is a total character count limitation of 2048. This includes all descriptive details sent about the Good (not an issue for TGL www)"
One-dimensional Quality	UI/Interaction	updated	023 (Turners)	5	"If Good details are changed or updated (i.e ODO) comments should be updated and/or refreshed."
Excitement Quality	UI/Interaction	Templates	023 (Turners)	5	"Templates could introduce higher levels of perceived duplication and provide less personal appeal."

Excitement Quality	UI/Interaction	streamlining	023 (Turners)	6	"Business will need to consider streamlining the Feature comments, look to keep these manageable (15 – 20 presets)"
One-dimensional Quality	UI/Interaction	changes	023 (Turners)	30	"Comments Builder changes Features categorised into groups a. Other includes all uncategorised features b. Features in categories (i.e. not Other) might have a limit of 1 per category c. Main template and features have requirements to be displayed and thus selected"
One-dimensional Quality	UI/Interaction	button	023 (Turners)	30	"2. Manual Comments button Get a warning when opening this – "Are you sure you want to write a manual comment?" b. Show a modal overlay where you can enter the manual comment text c. In the modal overlay you can select whether you also want a main template"
One-dimensional Quality	UI/Interaction	automatically	023 (Turners)	31	Identify how we can automatically build comments in the background when the good is created/modified: a. If there is no existing comment then assess whether a main template is been suitable (i.e. the template requirements are met) b. When features (Vehicle features, not Feature Comments) are selected for the vehicle c. When the classification is completed d. When the TREaD evaluation is performed/saved e. When the Condition Guide is published"
One-dimensional Quality	UI/Interaction	button	023 (Turners)	31	Hide the plus button for adding comments from the good form when the good type is Car

Must-be Quality	Usability	combines	025 (Astron)	6	“Each station locally combines the signals from its antennas and sends samples via a dedicated wide-area network to OLAP. A sample is a (2 × 16-bit) complex number that represents the amplitude and phase of a signal at a particular time. The receivers are polarized; they take separate samples from orthogonal (X and Y) directions”
Must-be Quality	Usability	storage	025 (Astron)	7	“1.2.2 Postprocessing In the days after an observation, the data will be postprocessed by several applications, typically the Flagger, Self calibration, and Imager. Although this is not a real-time process, there is storage space available for only a few days, so the offline processing must keep pace with the online processing since the online processing continues generating data from subsequent observations. In the full LOFAR system, the available storage will be in the order of a Petabyte, but since a 77-station, 5-hour observation already yields 75 Terabytes of data, the data cannot be retained for a long period. As the postprocessing applications currently use AIPS++, the visibilities are stored on disk in the AIPS++ Measurement Set format. In the future, a data format tailored to large data volumes may become necessary”
Must-be Quality	Usability	observati on	025 (Astron)	7	“The OLAP applications will be controlled by SAS (Scheduling and Specification) and MAC (Monitoring And Control). SAS schedules an observation and schedules the resources needed for the observation. SAS informs MAC, which starts and stops the OLAP applications at the right moment through ACC (Application Configuration and Control). ACC provides the applications with information about the observation (e.g., the beam direction and the subband numbers) through a parameter file. The application can send some monitoring information directly to MAC using the so-called

					property interface, which writes the monitoring values directly into the MAC real-time database. We are currently integrating the OLAP applications with SAS and MAC”
Must-be Quality	Usability	data	025 (Astron)	9	“ It receives the data from the station”
Must-be Quality	Security	validity	025 (Astron)	9	“It checks the validity of the data packets, and administrates bad or missing data to inform subsequent processing steps.”
Must-be Quality	Usability	input	025 (Astron)	9	“It synchronizes the different input streams.”
Must-be Quality	Usability	performs	025 (Astron)	9	“It performs coarse-grained delay compensation.”
Must-be Quality	Usability	data	025 (Astron)	9	“It reorders the data for subsequent processing.”
Must-be Quality	Usability	data	025 (Astron)	9	“It sends data to the Blue Gene/L.”
Must-be Quality	Security	Input	025 (Astron)	10	“Each Input Section node receives all subbands from one or two stations. For a full LOFAR, multiple GigabitEthernet interfaces per station are needed to handle 160-200 subbands.”
Must-be Quality	Security	pipeline	025 (Astron)	10	“To handle temporary stalls in the processing pipeline, the Input Section uses a cyclic buffer to store subband samples from each station. Some tens of seconds can be buffered, after which the old data are overwritten by new samples. One thread receives UDP packets from the stations and stores the

					samples in the cyclic buffer. This thread handles missing, duplicated, and out-of-order UDP packets. Missing data appears to the remainder of the processing pipeline as flagged dummies, so that they are not correlated and eventually appear as flagged visibilities in the measurement set. The Input Section uses an efficient algorithm to administrate missing data. Since flagged data are typically clustered, we use a sparse set datastructure. It maintains which ranges of data are flagged using a list of tuples that mark the beginning and end of each flagged range.”
Must-be Quality	Usability	data	025 (Astron)	13	“The thread that reads the data from the circular buffer, reorders the data for further processing, collectively with the other Input Section nodes. Before the reordering, each data stream contains all subbands from one station, but the correlator needs one subband from all stations. This transpose step relies on the high speed of the Infiniband network”
One-dimensional Quality	Usability	performance	025 (Astron)	14	“hardware integer-to-floating-point conversion instruction is available). To ensure optimal performance, the FIRfilter and 256-point FFT have been written in assembler. This allows for the most direct and efficient control over the execution flow inside the Blue Gene/L processors, at the cost of significantly increased complexity of the code”
One-dimensional Quality	Usability	filter	025 (Astron)	13	“A FIR filter is essentially a time-delay filter with a small (in our case 16) number of history buffers, i.e., taps (see Figure 8). Each clock tick, a sample goes in, shifting history data to the right. A weighted sum of the 16 taps goes out. Each of the 256 FIR filters has its own weight vector, that together determine the PolyPhase Filter characteristics. The FIR filters significantly suppress a signal leaking into the wrong frequency channels.”

Excitement Quality	Usability	performance	025 (Astron)	15	To achieve optimal performance, the correlator consists of a mix of both C++ and assembler, with the critical inner loops written entirely in assembler. The assembly hides load and instruction latencies, issues concurrent floating point, integer, and load/store instructions, and uses the L2 prefetch buffers in the most optimal way.
Must-be Quality	Usability	processing	025 (Astron)	16	“In the new application, each core is involved in all kinds of processing. A core receives one second (the integration time) of subband samples, filters, phase-corrects, and correlates the data, and sends the visibilities to the Storage Section. Since processing the data generally requires more time than is available in real time (e.g., processing one second of subband data from 32 stations requires approximately two seconds of processor time, plus time for communication), multiple cores are used to process the data from one subband. The first second of data is processed by the first core, the second second by the second core, etc., and wraps round after the last core, as illustrated by Figure 12. Usually, we apply this form of scheduling on a per-Pset base, and distribute the data round robin over the cores within a Pset.”
Must-be Quality	Usability	filter	025 (Astron)	17	“The filter is not equally sensitive to all frequencies in a channel. Figure 14 shows autocorrelations as function of frequency of a monochrome signal for three different channels (the channel width in this figure is 610.35 Hz). A clear ripple is visible on top of each channel. Leaking into neighboring channels is limited, at the cost of a high insensitivity at the borders of a channel. A filter with different characteristics is straightforward to implement, as long as there are 256×16 FIR-filter constants.”
One-dimensional Quality	Usability	data	025 (Astron)	18	“The data from the correlators are sent to the output section, and written into AIPS++ Measurement Sets (MS). This allows postprocessing using standard tools. For current CS1

					observations, we integrate 60 seconds of data in the Output Section, to reduce the MS sizes and to increase the signal-to-noise ratio (the small amount of installed antennas do not provide enough sensitivity to make smaller integration times useful)”
One-dimensional Quality	Usability	protocol	025 (Astron)	19	“The external bandwidth to and from the Blue Gene/L is still not sufficient for full LOFAR operation, and is the limiting factor in the entire processing pipeline. Together with Argonne National Laboratory (ANL), we are developing a new network protocol that runs on the I/O nodes and compute nodes, and speeds up external communication. This is possible since we are now able to run programs on the I/O nodes and we now understand the (undocumented) tree network protocol that internally connects all BG/L node (this was not possible or foreseen when the BG/L was acquired). A current prototype shows already a modest performance improvement over the IBM socket layer.”
Excitement Quality	Usability	Performance	025 (Astron)	19	“Performance measurements suggest that the 700 MHz PowerPC 440 core of the I/O node is fast enough to sustain 1 Gb/s over the GbE device or over the internal tree network, but not both at the same time. Thus, more computational power is needed to make a more significant bandwidth improvement. We plan to adapt the Linux kernel to enable the second, unused processor core on the I/O node, doubling the available processing power. This is quite complicated, since the L1 caches of both cores are not coherent. The second core will be used to offload functions that read and write from the tree network. The work will also be done in cooperation with ANL.”
Excitement Quality	Usability	operations	025 (Astron)	19	“We also plan to use the I/O nodes for simple operations on the data (such as adding visibilities computed by different compute nodes, which is necessary for 10-second integration times of the EoR), to reduce the amount of external communication.”

Must-be Quality	Usability	reordering	025 (Astron)	20	“The collective reordering step in the Input Section is a challenge for the full LOFAR system, since it involves switching much data. We seriously consider moving the reordering step to the Blue Gene/L for EoR observations, since this would reduce the size of the Infiniband switch of the Input Section by a factor of three (compared to normal observations), saving in the order of 100,000 Euros. Experiments with the 3D-torus network of the BG/L showed that it is sufficiently fast to reorder the data. For normal observations, we may want to keep the transpose on the Input Section, for flexibility reasons. However, this flexibility is not needed for EoR observations,”
Must-be Quality	Usability	algorithm	025 (Astron)	20	“Either a smarter encoding algorithm has to be developed (if such an algorithm exists), or the channel filter has to be implemented at the stations, or we have to accept that we cannot observe subbands with RFI, even if the RFI is narrow band. Note that this discussion involves the core stations only (plus possibly a few remote stations): there is no need to implement channel filters at the remote stations, since they will not be used for 4-bit (EoR) observations.”
One-dimensional Quality	Usability	visibilities	025 (Astron)	21	“Figure 15 showed that the time to correlate a second of data from 77 stations takes almost 10 seconds, plus the communication time. This means that the correlator outputs data with a large latency, which should be taken into account if, in the future, feedback loops will be implemented that originate from behind the correlator output and go back to before the correlator input (online calibration, for example). There are several solutions to handle this (e.g., halving the latency by sending the first half of a second of data to one compute core and the other half to another core, and adding the visibilities afterward).
One-dimensional Quality	Security	solution	025 (Astron)	21	“The OLAP applications should be made more resilient to failing hardware. With the status information that MAC will collect, it has the ability to stop and quickly restart OLAP avoiding the offending machine, using some hotspare

					hardware. We consider stopping and restarting the applications as a more feasible solution than writing software that continuously runs trying to avoid broken hardware, as there are too many types of possible failures, each requiring a different solution. Moreover, software libraries like MPI do not tolerate crashed members.”
Must-be Quality	Usability	interactions	010 (SPARK)	11	“Moreover, the observations of the design sessions highlighted that not all the affordances recorded during the interactions with artefacts can be addressed by the SAR technology (e.g.: context setting, which is usually done with slides or paper printed content). However, some other interactions with artefacts allowed for the embedment within the modules of the platform (e.g. sticking notes/comments to concepts).”
One-dimensional Quality	Usability	configuration	010 (SPARK)	13	“The system allows the configuration of a space where the participants of the design session can share concepts (textual information, graphical information – see also later) in a graphical/textual form.”
Must-be Quality	Usability	creation	010 (SPARK)	13	“The system allows the creation of users”
Must-be Quality	Usability	profile	010 (SPARK)	13	“The system allows assigning different profile for users (i.e.: session leader, session participant OR designer; client; end-user).”
Must-be Quality	Usability	profiles	010 (SPARK)	13	“The system allows the administrator to hide profiles characteristics to the participants of the design sessions”
One-dimensional Quality	Usability	extensions	010 (SPARK)	13	“The system allows the management (upload/download/delete/...) of files having different extensions (see attached file) a. Texture files b. Font files

					c. Image files (logos, textures, ...) d. 3D model files"
One-dimensional Quality	Usability	information	010 (SPARK)	13	"The system allows the management of information (upload/download/delete/...) structured as notes/post-it and coming from previous sessions within the session space a. The system allows to create connections among the different information in order to clarify the meaning they have with reference to previously shown/generated content discussed in the creative session"
One-dimensional Quality	Usability	management	010 (SPARK)	13	"The system allows the participants to upload content on the fly (according to the file formats the system can manage; for instance new files prepared by the users independently, something changed on personal laptops during the meeting, ...)"
Excitement Quality	Usability	prototype	010 (SPARK)	13	"The system allows tracking the position of a prototype"
Excitement Quality	Usability	predefined	010 (SPARK)	13	"The system allows projecting structured light within a predefined volume"
Must-be Quality	Usability	alternatives	010 (SPARK)	13	"The system allows choosing appropriate files for the projection of images from a set of available alternatives stored in (or accessible from) the space prepared for the design session"
Must-be Quality	Usability	management	010 (SPARK)	13	"The system allows the management of the files for the projection a. Images (logos, textures, icons,...) b. Textual descriptions/representations c. Pictures d. Colour editing (selection from a palette?)

					e. Size editing i. Keeping the aspect ratio ii. Modifying the aspect ratio f. Orientation editing g. Superimposition of images in different layers”
Must-be Quality	UI/Interaction	recognizing	010 (SPARK)	14	“The system allows recognizing the gestures of the people interacting with the prototype”
One-dimensional Quality	UI/Interaction	visualization	010 (SPARK)	14	“The system allows the visualization of the projected content on a screen for the sake of the other participants to the design session.”
Excitement Quality	UI/Interaction	prototype	010 (SPARK)	14	“The system allows the people handling the prototype to edit the projected images through gestures: a. Move an image from a place to another b. Rotate an image from a place to another c. Resize the image d. Resize the font/textual content e. ...”
One-dimensional Quality	UI/Interaction	operations	010 (SPARK)	14	“The system allows recording the different operations carried out on files (upload, modification, ...)”
Must-be Quality	Usability	sequence	010 (SPARK)	14	“The system allows capturing the sequence of actions/activities carried out by the participants of the design session.”
Must-be Quality	Usability	handling	010 (SPARK)	14	“The system allows handling different profile for users (i.e.: session leader, session participant OR designer; client; end-user”

Must-be Quality	Usability	report	010 (SPARK)	14	“The system allows producing a report of what happened during the session according to the related time-sequence a. Textual information i. The text written on digital notes, ... b. SAR related content i. Sequence of projected ideas (as superimposed layers of images and text, by who) ii. Updated ideas (what was changed and how in the layers, by who) iii. Discarded ideas (which layers were discarded)”												
Must-be Quality	Usability	Basic game	037 (CryX)	5	“CryptoSpaceX is a fusion of Open Universe and Blockchain based Collectible Games. Collect planets and starships, attack planets and scavenge for Stardust. Engage in several unique arenas in the CryptoSpaceX universe like the Vegastar and build and monetise your own mini-games inside the Universe.”												
Must-be Quality	Usability	concept	037 (CryX)	5	“CryptoSpaceX is a unique concept centred around the goal of building a Virtual Universe. The Universe would be able to provide a platform for others to build games within it as well. Blockchain enables us to guarantee ownership of assets to our users in the virtual world, removing control of any centralised authority.”												
Must-be Quality	Usability	category	037 (CryX)	13	<table><tr><td>P</td><td>Card Games</td><td>P</td><td>Casinos</td></tr><tr><td>P</td><td>Idle Games</td><td>P</td><td>Fishing Games</td></tr><tr><td>P</td><td>Farm Games</td><td>P</td><td>Sci-fi Games</td></tr></table>	P	Card Games	P	Casinos	P	Idle Games	P	Fishing Games	P	Farm Games	P	Sci-fi Games
P	Card Games	P	Casinos														
P	Idle Games	P	Fishing Games														
P	Farm Games	P	Sci-fi Games														
Must-be Quality	Usability	Game Rules	037 (CryX)	14	“The SpaceX token acts as a lifetime membership, as a player and as an investor, to the CryptoSpaceX project. At the launch of every episode, SpaceX token holders shall receive unique launch assets in their ethereum wallets. Not												

					only are these presale tokens important to build a strong community, they enable us to reward early adopters of the game. Whenever stardust is purchased, 30% of the ethereum collected is distributed proportionally among all SpaceX token holders. In addition, they also get a chance to get rare game assets like Stars and The Death Ray in Episode I.”
Must-be Quality	Usability	Game Rules	037 (CryX)	14	<ul style="list-style-type: none"> P Membership Token to all Episodes. P Investor Tokens. Revenue shared among token holders. P Several Game Assets for every Episode. P Exclusive Rare Assets-Stars and Death Ray in Episode I. P All access pass to Vegastar.
Must-be Quality	Usability	Game Rules	037 (CryX)	14	“PlanetGet 1 of 4000 planets for each token”
Must-be Quality	Usability	Game Rules	037 (CryX)	14	“Starships - Get 3 random starships per token of the CryptoSpaceX Universe.”
Must-be Quality	Usability	Game Rules	037 (CryX)	14	“Vegastar PassAll access pass to Vegastar”
Must-be Quality	Usability	Game Rules	037 (CryX)	14	‘Revenue Share - Your share of 30% revenue generated from Stars.
Must-be Quality	Usability	Game Rules	037 (CryX)	14	“StarsA 25% chance to get ownership to one of the 1000 Stars of Fabula

Must-be Quality	Usability	Game Rules	037 (CryX)	14	"The Death RayThe Death Ray is the most powerful starship of the Universe. There are only 20 such ships which will be randomly allocated among token holders."
Must-be Quality	Usability	Game Rules	039 (TH)	5	"Work on clever, integral menu Choice of trainer (commercial only, has own WAD)"
Must-be Quality	Security	access privileges	043 (NSCK)	11	The database of statistical units is accessible in a uniform way for users and applications,according to their access privileges (see paragraph 2.10 about different kinds of users). Usersaccess system by means of a standard web browser, while applications access database use a setof dedicated web services.
Must-be Quality	Usability	attributes	043 (NSCK)	11	"To create a unified methodology of accounting of statistical unit attributes."
Must-be Quality	Usability	informati on	043 (NSCK)	12	"To provide centralized actual information for divisions of NSO on statistical units engaged in economic and social activities."
Must-be Quality	Usability	informati on	043 (NSCK)	12	"To receive up-to-date information for statistical investigations/research at various divisions of NSO."
One-dimensional Quality	Security	verificatio n	043 (NSCK)	12	"To automate verification of data and statistical unit attributes from different data sources."
One-dimensional Quality	UI/Interaction	tools	043 (NSCK)	12	"To create tools for analysis of statistical units"

One-dimensional Quality	UI/Interaction	frames	043 (NSCK)	12	"To create sample frames"
Excitement Quality	Usability	efficiency	043 (NSCK)	12	"Increase efficiency of technological processes inside NSO and consequently to lower operational expenses."
One-dimensional Quality	Usability	data management	043 (NSCK)	12	"Provisioning of centralized registration, storage and data management on statistical entities those engaged in activities"
Excitement Quality	Usability	tools	043 (NSCK)	12	"Provisioning of flexible and convenient tools to create and analyze lists of statistical units based on specified criteria."
Must-be Quality	Usability	samples	043 (NSCK)	12	"Provisioning for drawing samples for business surveys."
Excitement Quality	Usability	tools	043 (NSCK)	12	"Provisioning of sophisticated integration tools for external applications and subsystems."
Excitement Quality	Security	security	043 (NSCK)	12	"Provisioning of online and secure access to information for both external and internal users and subsystems."
Must-be Quality	Usability	Game rules	043 (NSCK)	12	"Track the economic activities of the country over time (including mortality rate of businesses)"
Excitement Quality	Security	Authentication	043 (NSCK)	13	"Authentication and identification of users and external applications;"

Must-be Quality	Security	authoriza tion	043 (NSCK)	13	"Separation of privileges and access rights of users to functions and data (authorization);"
Excitement Quality	Security	security	043 (NSCK)	13	"Ensure the data transfer is confidential by the means of cryptographic technology;"
Excitement Quality	Usability	Logging	043 (NSCK)	13	"Logging of user and subsystem activity;"
One-dimensional Quality	Security	security	043 (NSCK)	14	"Data exchange must be made confidential with the use of cryptographic means based on digital certificates and the TLS protocol."
Must-be Quality	Usability	log	043 (NSCK)	14	"The audit log must include the system date and time, the information about the user or application, the code of an event and additional data that is specific to the particular event being logged."
One-dimensional Quality	Security	authentic ation	043 (NSCK)	14	"The access to web services must be made with the use of SSL/TLS protocol and with mandatory authentication procedure based on client digital certificates"
Must-be Quality	Usability	interface	043 (NSCK)	14	"The user interface must be implemented as a web interface and support the most commonly used versions of the most common browsers."
Excitement Quality	UI/Interaction	interface	043 (NSCK)	14	"The user interface should be simple, intuitive and comfortable. The AJAX technology should be used in order to minimize response times and frequent page reloads."
Excitement Quality	UI/Interaction	interface	043 (NSCK)	14	"The user interface must support switching between at least two languages. The switching of user interface between languages must occur dynamically at any navigation level and without changing of current page (see more about

					multiple language support in chapter 6.6).”
One-dimensional Quality	Usability	data	043 (NSCK)	16	“The system must be able to perform accounting and store data of all four types of statistical units (Legal Units, Enterprises, Local Units and Enterprise groups) as well as the derived units KAUs and LKAUs (3.2)”
One-dimensional Quality	Usability	history	043 (NSCK)	17	“The Classifications package could be external to the system – if the NSO has a functioning metadata system. The DBExtras package is mostly for user maintenance while the history is to keep the history of the system.”
Must-be Quality	Security	integrity	043 (NSCK)	33	<p>“The system must automatically perform data integrity checks on each data modification. The data integrity checks should be based on the following information from metadata:</p> <ul style="list-style-type: none"> • Information on data types and allowed values of attributes; • Integrity checks within a statistical unit;”
Must-be Quality	Security	integrity	043 (NSCK)	33	“Each rule must contain a set of logical expressions and error level (critical error or warning) triggered if a condition is not met. Data can be updated in the presence of warnings. In case of critical errors updates must not be allowed.”
Must-be Quality	Usability	Logical expression	043 (NSCK)	33	“A logical expression is a set of simple expressions, joined with logical functions "AND", "OR", "NOT" and priority operators (parentheses)”
Must-be Quality	Security	expression	043 (NSCK)	33	“A simple expression is an operation where an attribute of a statistical unit is compared with a constant or another attribute of the same unit or it is an operation that verifies existence of a plain, compound or list attribute.”
Must-be Quality	Security	rules	043 (NSCK)	33	“These rules are to be decided during the development process, but it is important to keep in mind that the rules must not be so strict that data cannot be loaded. It is important to expect data quality being everything from good to

					f poor.”
Must-be Quality	Security	Security	043 (NSCK)	33	‘Information on statistical unit includes both attributes that are public accessible and protected attributes that are accessible only for users with a certain access rights.’
Must-be Quality	Security	Security	043 (NSCK)	33	“The access to some of the attributes can be open for all statistical units (standard access level) whereas a few attributes can be available only for a certain subset of statistical units (extended access).”
Must-be Quality	Security	authoriza tion	043 (NSCK)	34	“For the NSO employee, the authorization to add or modify units, are also given as roles and is either based on geographical codes (an employee in a regional office can edit the units in his/her area) or on activity codes (the employee can edit units belonging to his or her statistical area)”
One-dimensional Quality	Security	authoriza tion	043 (NSCK)	35	“The functions of browsing and detailed views of statistical units must automatically exclude inaccessible attributes according to the current user's rights as configured in standard and extended authorization levels for the current user.”
Must-be Quality	Security	automatic ally	043 (NSCK)	35	“The system must automatically track all changes on attributes that have a corresponding metadata flag to maintain the history of changes. The system must track changes when a new value of an attribute differs from its old value”
Excitement Quality	Usability	data	043 (NSCK)	35	“The number and types of data sources and their configuration can change with time. This should be taken into account during the design of system architecture. All changes must be localized via development of specialized adapters, which perform conversion and normalization of data from external sources into unified format for import of actualized data into the register”

Excitement Quality	Usability	database	043 (NSCK)	35	<p>Each external source that can be of use must be registered in the database. The description of a data source must include the following parameters:</p> <ul style="list-style-type: none"> • Name and description of the data source; • Priority of source (1 = Trusted. Good data quality, 2 = OK, quality probably acceptable. New units are accepted while updates should be checked manually, 3 = Not trusted. Data quality is bad. All units have to be checked manually) • List of attributes that needs to be checked along with rules for checking for each attribute. (see section below)Software Requirements Specification for Generic Business Register Page 36 • Allowed operations that can be performed on statistical units: create new, alter existing ones; • Restrictions on the statistical units from the registry: i.e. the list of units that are accessible for this data source; • Mapping of variable in source with variables in register (see 4.7.3.1)
Must-be Quality	Usability	log	043 (NSCK)	35	<p>“The system must keep a data upload log. The log must include the following information:</p> <ul style="list-style-type: none"> • Date and time when import procedure started; • Date and time when import procedure ended; • Import file; • Information on data source • Information on the user who initiated the procedure; • For every statistical unit from the import file there must be: <ul style="list-style-type: none"> o A list of errors and warnings; o Flag if information was updated in the register (“yes” or “no”);”

One-dimensional Quality	Usability	priority	043 (NSCK)	36	<p>“In the case when an attribute is to be loaded from several data sources, the following rules must be applied by the system during the update of its value:</p> <ul style="list-style-type: none"> • According the priority of a particular data source for this attribute; • In case of an actual change of the attribute in one of data sources, without considering priority; In the latter case the system needs to automatically track changes of attributes per source (only applies if the flag to track change history is set)”
One-dimensional Quality	Security	validation	043 (NSCK)	43	“The validation of data must be performed using the specific rules for the selected type of statistical unit according to Section 4.24.1”
One-dimensional Quality	Security	validation	043 (NSCK)	43	“When creating a new statistical unit the system automatically verifies that all the IDs are unique and issues a warning if not.”
One-dimensional Quality	Security	validation	043 (NSCK)	43	“If a unit with the same name and address already exists, the system should issue a warning (including some kind of wild card search to cover for typos)”
One-dimensional Quality	Security	validation	043 (NSCK)	43	“If a unit with the same name and GPS coordinates already exists, the system should issue a warning”
One-dimensional Quality	Security	validation	043 (NSCK)	43	“Verification of the entered data must be performed in accordance with the rules for the specific type of the selected statistical unit”
Excitement Quality	Usability	validation	043 (NSCK)	44	“On modification of statistical units the system automatically verifies all ID numbers are unique”
Excitement Quality	Usability	validation	043 (NSCK)	44	“The combination of the name and address should not already exist in the register”

One-dimensional Quality	Usability	validation	043 (NSCK)	44	"If a unit with the same name and GPS coordinates exists, the unit should be rejected"
One-dimensional Quality	Usability	modifications	043 (NSCK)	44	"The information on modification, including the information on the user that performed modifications must be included in the change history of the current statistical unit as described"
One-dimensional Quality	Usability	functions	043 (NSCK)	44	"Instead of the physical removal of a statistical unit from the register it is marked as deleted. As a result, this unit becomes "invisible" and inaccessible for other business functions of the system."
Must-be Quality	Usability	integrity	043 (NSCK)	46	"The logic integrity of the database design is fulfilled (an enterprise can have several local units, but not the opposite etc)"
Must-be Quality	Usability	Rules	043 (NSCK)	46	"The link is created in the system by adding the ID of the "mother" unit as a foreign key to the "child" table
Must-be Quality	Security	modification	043 (NSCK)	46	"The information on modification, including the information on the user that performed modifications must be included in the change history of the current statistical unit"
One-dimensional Quality	Usability	Rules	043 (NSCK)	47	"A local unit can't exist without an enterprise etc."
One-dimensional Quality	Usability	modification	043 (NSCK)	47	"The information on modification, including the information on the user that performed modifications must be included in the change history of the current statistical unit"
Must-be Quality	Usability	limitation	043 (NSCK)	48	"There should be a limitation on what changes are allowed for the activities that are already registered: The activity itself cannot be changed – only the values belonging to it. If an activity has changed, this should be taken care of by

					deleting the old one and create a new"
Must-be Quality	UI/Interaction	limitation	043 (NSCK)	48	"Any unit has to have at least one activity: the main activity"
Must-be Quality	Usability	modification	043 (NSCK)	48	"The information on modification, including the information on the user that performed modifications must be included in the change history of the current statistical unit"
Must-be Quality	Usability	requirements	043 (NSCK)	50	"The system must store registration information according to the requirements"
Must-be Quality	Usability	limitation	043 (NSCK)	50	"All mandatory columns must be covered for"
Must-be Quality	Usability	format	043 (NSCK)	51	"The data file format must be either csv or xml file formats"
One-dimensional Quality	Security	validation	043 (NSCK)	52	"The system must verify the possibility of performing data modification in accordance with requirements from Sect 4.4.1 If an attribute from this data source cannot be used for data modification then it must be ignored"
One-dimensional Quality	Security	integrity	043 (NSCK)	52	"Verify logical data integrity as per Section 4.1"
Must-be Quality	Usability integrity	Track	043 (NSCK)	52	"Track history of changes"

Excitement Quality	Usability	limitation	043 (NSCK)	53	<p>“The status report must include the following information:</p> <ul style="list-style-type: none"> • Data file name • Data source • Date of upload request submittal • The user who submitted the request • The current status of the request and date of the status change: <ul style="list-style-type: none"> o “in queue” - data load process not yet started o “loading” - data load process is active o “data load completed” - when no errors or warnings encountered o “data load completed partially” - when warnings or errors occurred”
One-dimensional Quality	UI/Interaction	filter	043 (NSCK)	53	“The user must be able to set filter on request status and dates”
One-dimensional Quality	Security	verification	043 (NSCK)	54	“The verification log view must include information according to requirements”
One-dimensional Quality	Security	verification	043 (NSCK)	54	“A user can force verification for units with completion code “warning””
Must-be Quality	Usability	templates	043 (NSCK)	54	“List of templates must be stored separately for each user”
Excitement Quality	Usability	automatically excluding	043 (NSCK)	55	“The system must be able to take into account the extended access rules for the current user (Sect.4.2), by automatically excluding inaccessible attributes from the form.”

Excitement Quality	Usability	template	043 (NSCK)	55	"The name of the template must be given by the user, and it must be unique for that user"
Excitement Quality	Usability	template	043 (NSCK)	55	"Template lists must be kept separate for each user"
Excitement Quality	Usability	automatic ally	043 (NSCK)	55	"The system must be able to take into account the extended access rules for the current user (Sect 4.2), by automatically excluding inaccessible attributes.
One-dimensional Quality	Usability	template	043 (NSCK)	55	"The system must allow to store the template under a new name"
One-dimensional Quality	Usability	template	043 (NSCK)	56	"The list of templates must be kept separate for each user"
One-dimensional Quality	Usability	template	043 (NSCK)	56	"Each user must have his/her own list of templates"
One-dimensional Quality	Security	automatic ally	043 (NSCK)	56	"The system must be able to take into account the extended access rules for the current user (Sect.4.2), by automatically excluding inaccessible attributes from both criteria and result"
Must-be Quality	Usability	automatic ally	043 (NSCK)	57	"If the user specified registry status date that is different from the current date then the system must automatically take into account historical data for both criteria and output attributes. Also, it is necessary to take into account liquidation flag (demography) for the date the user specified."
Must-be Quality	Usability	Statistics	043 (NSCK)	58	"Statistics on Number of establishments Number of employees"

					Turnover Mortality of businesses Sex of owner by Unit types Range of turnover per year Range of average number of employees List of NACE/ISIC codes for main type of business activity List of types of entity List of types of Legal form List of geographical codes Sector Sex of owner Age of business Also: Time series Growth of sectors Multiple criteria are joined by an implicit logical "AND"
Must-be Quality	Usability	Rules	043 (NSCK)	58	"The system must account for information"
Must-be Quality	Usability	report	043 (NSCK)	60	"The user must be able to clear the list of legal unit for the current report"
Must-be Quality	Usability	report	043 (NSCK)	60	"The user must be able to export the list of legal unit for the current report form in the format"

Must-be Quality	Usability	printable	043 (NSCK)	60	"The form must be printable"
Must-be Quality	Usability	report	043 (NSCK)	60	'Send report by email to other users
Must-be Quality	Security	authentication	043 (NSCK)	61	"User's authentication and identification must be performed with user's name (login) and password"
Must-be Quality	UI/Interaction	Rules	043 (NSCK)	61	"The search must be performed against the full list of statistical units, including those liquidated"
Must-be Quality	Usability	combination	043 (NSCK)	61	"Data on statistical unit must include data according to the combination of standard and extended access rights for the current user"
Must-be Quality	Security	authentication	043 (NSCK)	62	"User's authentication and identification must be performed using login/password"
Must-be Quality	Usability	search	043 (NSCK)	62	"The search must be performed against the full list of statistical units, including those liquidated"
One-dimensional Quality	Usability	permissions	043 (NSCK)	62	"The search criteria must match the standard access permissions for the current user (Sect. 4.2) Multiple criteria are joined by a logical "AND"
Must-be Quality	Usability	Rules	043 (NSCK)	63	<p>"The list of statistical units must include the following ID codes and short information on the statistical unit:</p> <ul style="list-style-type: none"> • Statistical unit type • ID


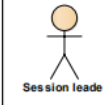
					<ul style="list-style-type: none"> • Name • Legal address/Contact information • Tax ID number”
Must-be Quality	Usability	verification	043 (NSCK)	63	“The system must ensure account name (login) is unique”
Must-be Quality	Usability	verification	043 (NSCK)	63	“Account name only can contain characters from the code page ISO 8859-1 in the range 33 to 126”
One-dimensional Quality	Usability	Account	043 (NSCK)	63	“Account can have one or more roles assigned to it”
One-dimensional Quality	Usability	Rules	043 (NSCK)	63	“The system must allow to enter and store the following account attributes: Login Password Name Phone E-mail Description List of roles Extended access attributes (Geographical codes, activity codes, list of accessible attributes) status (active/suspended)”
One-dimensional Quality	Security	security	043 (NSCK)	64	“Password must conform to the security requirements (minimal length)”
Must-be Quality	Usability	Rules	043 (NSCK)	64	‘The system must allow to enter and store the following account attributes: Login

					Password Name Phone E-mail Description List of roles Extended access attributes O List of geographical codes O List of NACE codes o List of accessible attributes Status (active/suspended)
One-dimensional Quality	Usability	Rules	043 (NSCK)	64	“If the user owns this account but does not have access to user administration functionality then this user can only edit the following attributes: Password Name Phone E-mail”
One-dimensional Quality	Usability	Rules	043 (NSCK)	64	“Account can have one or more assigned roles”
One-dimensional Quality	Usability	verification	043 (NSCK)	65	“When deleting an account with administrative privileges the systems verifies that at least one more such account exists”
One-dimensional Quality	Usability	log	043 (NSCK)	65	“Instead of physical deletion the account is marked as suspended and becomes “invisible” for all other business functions of the system except the audit log.”


Must-be Quality	Usability	verification	043 (NSCK)	66	"The role name must be unique in the system"
Must-be Quality	Usability	verification	043 (NSCK)	66	"The system must allow to enter and store the following role attributes: Role name Description Standard data access parameters Access to system functions"
Must-be Quality	Usability	verification	043 (NSCK)	66	"Standard data access parameters are specified for each attribute of within each type of statistical units as a flag "yes" (access allowed to this attribute) or "no". By default all attributes must be marked as "no" (access not allowed)"
Must-be Quality	Usability	Rules	043 (NSCK)	67	"Block deletion if this role is assigned to one or more user accounts"
Must-be Quality	Usability	Rules	043 (NSCK)	67	"If this role is assigned to user accounts then the system must be able to produce the list of such accounts upon a request"
Must-be Quality	Usability	Rules	043 (NSCK)	68	"The user must be able to specify one of the following export formats: • Microsoft Word • Microsoft Excel • Adobe PDF"
Must-be Quality	Security	verification	043 (NSCK)	69	"The system must validate the data that reference the dictionary element and notify the user in case of validation errors"
Must-be Quality	Usability	rules	043 (NSCK)	69	"The format of the data file must adhere to the standard format (xml or csv)"


One-dimensional Quality	Usability	modifications	043 (NSCK)	69	"The system must automatically verify the integrity of the data that refer to dictionary records when making modifications to the dictionary and notify the user of such"
Must-be Quality	Usability	Actors	010 (SPARK)	17	"Actors are divided into two groups: · Primary actors: actors that initiate an interaction with the system. The functions performed by a primary actor can be inherited (check definition sect. 2.1.4) by a different primary actor. · Secondary actors: actors that will be requested to interact with the system"
Must-be Quality	Usability	Actors	010 (SPARK)	17	"Actors are divided into two groups: · Primary actors: actors that initiate an interaction with the system. The functions performed by a primary actor can be inherited (check definition sect. 2.1.4) by a different primary actor. · Secondary actors: actors that will be requested to interact with the system"
Must-be Quality	Usability	Actors	010 (SPARK)	19	"Secondary actors are mainly external devices that will interact with the system. They are not part of the system but part of the execution environment; that means the system is capable to interact with those actors, or the actors will be influenced by the usage of the system"
Must-be Quality	Usability	module	010 (SPARK)	21	"One module manages the contents for Spatial Augmented Reality (called SAR module). It manages the interaction with the projecting device(s) and receives the information coming from the tracking devices. This includes both the position of the prototypes and, in case, the hands of the person that is interacting with it (prototype handling and gestures)"
Must-be Quality	Usability	module	010 (SPARK)	21	"The other module (called Information System –IS- module) is in charge of storing resources and the manipulation history made during the co-creative design session."

Must-be Quality	Usability	validation	010 (SPARK)	21	"Potentially the SAR module can work as a standalone application running in the same place where the co-creative design session is placed, while the IS module is a web application that can be accessed anywhere using valid account credentials."
Must-be Quality	Usability	Rules	010 (SPARK)	23	"It is possible that some of the represented actors will not be mentioned in the tables describing the use cases because of the logic of inheritance. For instance, if a "Participant" carries out specific action in a use case, it means that also the other actors inheriting the "Participant"'s functions are allowed to carry them out. This applies also for the other primary actors according to inheritance relationships mentioned in section 5."

Must-be Quality	Usability	general function	010 (SPARK)	17	<div> <div> uc Actors  Administrator </div> <div> Session Leader (Admin/designer hybrid) </div> <div> uc Primary Us...  Session leader </div> </div> <div> <p>Administrator's role (performed functions)</p> <p><u>Before the design session:</u></p> <ul style="list-style-type: none"> • To configure the space for the session • To create users for the session • To assign a profile to users • To hide profile characteristics to other users • Inherits the functions of the Designer <p><u>During the design session:</u></p> <ul style="list-style-type: none"> • To start recording the actions performed during the sessions • To end recording the actions performed during the sessions <p><u>After the design session:</u></p> <ul style="list-style-type: none"> • Inherits the function of the designer </div> <div> <p>Session Leader's role (performed functions)</p> <p><u>Before the design session:</u></p> <ul style="list-style-type: none"> • Inherits the whole set of functions of the Administrator <p><u>During the design session:</u></p> <ul style="list-style-type: none"> • Inherits the set of functions of the Administrator • Inherits the set of functions of the designer <p><u>After the design session:</u></p> <ul style="list-style-type: none"> • Inherits the function from the designer </div>
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Must-be Quality	Usability	general function	010 (SPARK)	18	<div data-bbox="1093 252 1198 422"> </div> <div data-bbox="1361 252 2027 1024"> <p>Designer role (performed functions)</p> <p><u>Before the design session:</u></p> <ul style="list-style-type: none"> • To Upload/Download/Delete files (images, textures, text/font; 3D models;) • To manage (Upload/Download/Retrieve/Delete) information for the session (as post-its, notes, sketches, ...) • To manage (create/retrieve/delete) connections (or organization in clusters) between the information/notes • To prepare files on personal devices (PC, laptop, tablets) and share them in the session space <p><u>During the design session:</u></p> <ul style="list-style-type: none"> • Inherits the functions from the Participant/Client • To Upload files to the session space (images, textures, text/font; 3D models;) • To include files having textual or graphical content into layers • To choose one or more layers of images to be used for the projection • To superimpose layers with an appropriate order to obtain the desired results for the projection <p><u>After the design session:</u></p> <ul style="list-style-type: none"> • To ask the system for (automatically) gathering the information (textual or graphical) the platform was exposed to and organizing them according to a timeline. </div>
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Must-be Quality	Usability	general function	010 (SPARK)	19	<div data-bbox="1093 252 1196 421">  </div> <div data-bbox="1357 252 2011 1018"> <p>Participant role (performed functions)</p> <p><u>Before the design session:</u></p> <ul style="list-style-type: none"> • NONE <p><u>During the design session:</u></p> <ul style="list-style-type: none"> • To move (turn, flip,...) a prototype during the session in order to look at it more carefully • To upload information for the session (as post-its, notes, sketches, ...) To prepare files on personal devices (PC, laptop, tablets) and share them in the session space • To visualize a virtual prototype with structured light projected on it • To interact with the prototype through gestures in order to change one or more of its layers. Expected changes: <ul style="list-style-type: none"> ◦ To change its position ◦ To change its orientation ◦ To change its size (keeping or modifying the aspect ratio) ◦ To change number of items on it (adding and removing items) ◦ To change the colour of the items on it ◦ To change its content (mainly textual) • To visualize on screen (room TV or personal devices as PC, laptop, tablets) what is projected on the prototype <p><u>After the design session:</u></p> <ul style="list-style-type: none"> • NONE </div>
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Must-be Quality	UI/Interaction	UI	039 (TH)	11	<p>These actors appear on episode one:</p> 
Must-be Quality	Format		043 (NSCK)	57	<p>"The user must be able to save the list of statistical units in one of the following formats:</p> <ul style="list-style-type: none"> Microsoft Excel CSV XML"

APPENDIX N: Non-functional Requirements - SRS ITEMS

Category:	Subcategory:	Pre-code:	Spec:	Page:	Example:																									
Modeling	Use case		010 (SPARK)		<table><tr><th>Case Study</th><th>End Users' Client</th><th>Topic</th><th>Context</th><th>Goal of the session – Nature of the project</th></tr><tr><td>1</td><td>Alce Nero</td><td>Organic biscuits</td><td>Packaging</td><td>Definition of visual identity</td></tr><tr><td>2</td><td>G7</td><td>Ice cream</td><td>Packaging</td><td>Definition of brand identity</td></tr><tr><td>3</td><td>Viuho</td><td>GPS rescue device</td><td>Product</td><td>Refinement for first generation product, (UI, colour, material and finish)</td></tr><tr><td>4</td><td>Garth</td><td>Barbecue</td><td>Product</td><td>Idea refinement interaction between barbecues different parts/elements proposals</td></tr></table> <p>Table 1: The 4 selected case studies from the list of D1.1, whose observation has been recorded within T1.3 and T1.</p>	Case Study	End Users' Client	Topic	Context	Goal of the session – Nature of the project	1	Alce Nero	Organic biscuits	Packaging	Definition of visual identity	2	G7	Ice cream	Packaging	Definition of brand identity	3	Viuho	GPS rescue device	Product	Refinement for first generation product, (UI, colour, material and finish)	4	Garth	Barbecue	Product	Idea refinement interaction between barbecues different parts/elements proposals
Case Study	End Users' Client	Topic	Context	Goal of the session – Nature of the project																										
1	Alce Nero	Organic biscuits	Packaging	Definition of visual identity																										
2	G7	Ice cream	Packaging	Definition of brand identity																										
3	Viuho	GPS rescue device	Product	Refinement for first generation product, (UI, colour, material and finish)																										
4	Garth	Barbecue	Product	Idea refinement interaction between barbecues different parts/elements proposals																										
Modeling	Use case		010 (SPARK)	25	<p>Creation of users</p> <table><tr><td>Name of the use case</td><td>Creation of users</td></tr><tr><td>Primary Actor</td><td>Administrator</td></tr><tr><td>Pre-conditions</td><td>The user must be authenticated.</td></tr><tr><td>Invariants</td><td></td></tr><tr><td>Post-conditions</td><td>New user will be added to the platform</td></tr><tr><td>Summary</td><td>The administrator creates new users to allow them to connect on the platform</td></tr></table>	Name of the use case	Creation of users	Primary Actor	Administrator	Pre-conditions	The user must be authenticated.	Invariants		Post-conditions	New user will be added to the platform	Summary	The administrator creates new users to allow them to connect on the platform													
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Post-conditions	New user will be added to the platform																													
Summary	The administrator creates new users to allow them to connect on the platform																													

Modeling	Use case		010 (SPAR K)	27	8.1.2. Use case diagram: Level 1- Preparation of a design session	
					Name	Diagram: Preparation of a design session
					Primary Actor	Designer
					Summary	Uses cases in this diagram are performed before the execution of a co-creative design session
Modeling	Use case		010 (SPAR K)	27	Use case: Import resources	
					Name	Import resources from previous co-creative design session
					Primary Actor	Designer
					Pre-conditions	The user must be authenticated. The session must not be initialized. The user must have permission to access to the design session Contents for the co-creative design session are available from computer folders or other design session spaces
					Invariants	
					Post-conditions	The design session will contain a copy resources prepared in advance

Modeling	Use case		010 (SPAR K)	27	Use case: Creation of a co-creative design session	
					Name	Creation of a co-creative design session
					Primary Actor	Administrator
					Pre-conditions	The user must be authenticated.
					Invariants	
					Post-conditions	A new design session is created
					Summary	The administrator creates a new design session

Modeling	Diagram		010 (SPARK)	22	<pre> sequenceDiagram actor Participant actor Designer actor Administrator participant SPARK_platform as SPARK platform actor Displaying_device as «actor» Displaying device actor Projecting_device as «actor» Projecting device actor Tracking_device as «actor» Tracking device Participant-->>SPARK_platform: Prototype interaction Participant-->>SPARK_platform: Context data Designer-->>SPARK_platform: Co-creative design resources Designer-->>SPARK_platform: Layer parameters Administrator-->>SPARK_platform: Co-creative design space information Administrator-->>SPARK_platform: User information SPARK_platform-->>Displaying_device: shows video SPARK_platform-->>Projecting_device: Image to render Tracking_device-->>SPARK_platform: Track object </pre> <p>The diagram is a UML Use Case Diagram titled "uc static context". It features a central blue rectangular box labeled "SPARK platform". To the left, three actor icons are stacked vertically: "Participant" at the top, "Designer" in the middle, and "Administrator" at the bottom. They are connected by upward-pointing hollow triangles, indicating a generalization relationship. To the right of the platform, three orange rectangular boxes represent devices, each preceded by the stereotype «actor»: "Displaying device", "Projecting device", and "Tracking device". Dashed arrows indicate the following interactions: "Participant" sends "Prototype interaction" and "Context data" to the platform; "Designer" sends "Co-creative design resources" and "Layer parameters" to the platform; "Administrator" sends "Co-creative design space information" and "User information" to the platform; the platform sends "shows video" to the "Displaying device"; the platform sends "Image to render" to the "Projecting device"; and the "Tracking device" sends "Track object" to the platform.</p>
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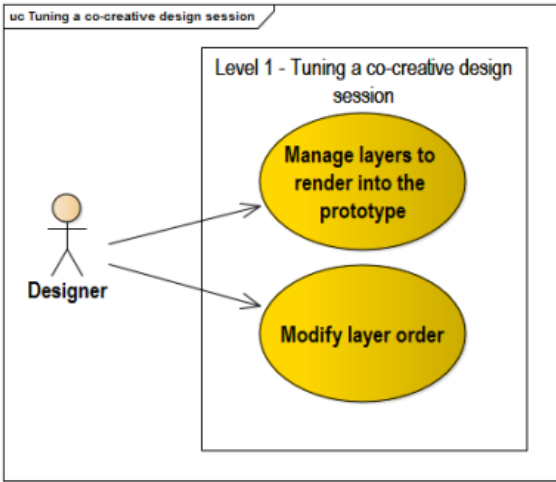
Figure 2 The SPARK platform seen as a black box in a static context

Modeling	Diagram		010 (SPARK)	24	<div data-bbox="983 240 1977 1292"> <pre> graph LR subgraph Level0 [Level 0 - SPARK platform] direction TB UC1((Execute a co-creative design session)) UC2((Tune a co-creative design session)) UC3((Prepare a co-creative design session)) UC4((Wrap-up a co-creative design session)) UC5((System administration)) end Participant --> UC1 Designer --> UC2 Designer --> UC3 Designer --> UC4 Administrator --> UC5 UC1 --- PD[«actor» Projecting device] UC1 --- TD[«actor» Tracking device] UC1 --- DD[«actor» Displaying device] </pre> </div> <p>Figure 3 Use case diagram level 0</p>
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Modeling	Diagram		010 (SPAR K)	25	<div><div>uc System administration</div><div><div>Level 1 - System administration</div><div><pre>graph LR; Admin[Administrator] --> UC1((Create users)); Admin --> UC2((Set-up user profiles));</pre></div></div></div> <div>Figure 4 Use case diagram for system administration</div>												
Modeling	Use case		010 (SPAR K)		<div><div>Use case: Set user roles for a co-creative design session</div><table><tr><td>Name</td><td>Set user roles for a design session</td></tr><tr><td>Primary Actor</td><td>Administrator</td></tr><tr><td>Pre-conditions</td><td>The user must be authenticated.</td></tr><tr><td>Invariants</td><td></td></tr><tr><td>Post-conditions</td><td>Users roles will be modified for a design session</td></tr><tr><td>Summary</td><td>The administrator gives access to users to a design session</td></tr></table></div>	Name	Set user roles for a design session	Primary Actor	Administrator	Pre-conditions	The user must be authenticated.	Invariants		Post-conditions	Users roles will be modified for a design session	Summary	The administrator gives access to users to a design session
Name	Set user roles for a design session																
Primary Actor	Administrator																
Pre-conditions	The user must be authenticated.																
Invariants																	
Post-conditions	Users roles will be modified for a design session																
Summary	The administrator gives access to users to a design session																

Modeling	Use case		010 (SPAR K)	31	8.1.3. Use case diagram: Level 1- Tuning co-creative design session	
					Name	Diagram: Tuning design session
					Primary Actor	Designer
					Summary	Uses cases in this diagram could be performed during the preparation of a co-creative design session or while the session is executed.
Modeling	Use case		010 (SPAR K)		8.1.4. Use case diagram: Level 1 - Execution of a co-creative design session	
					Name	Execution of a co-creative design session
					Primary Actor	Participant, Administrator, Designer
					Secondary Actors	Projector device

Modeling	Diagram		010 (SPAR K)	27	<div data-bbox="987 264 1872 1070"> <pre> graph TD subgraph UC [uc Preparation of a co-creative design session] subgraph Level1 [Level 1 - Preparation of a co-creative design session] U1([Import resources from previous co-creative design session]) U2([Create a co-creative design space]) U3([Set user roles for a co-creative design session]) end Designer((Designer)) Administrator((Administrator)) Designer --> U1 Administrator --> U2 Administrator --> U3 Administrator -- > Designer end </pre> </div> <p>Figure 5 Use case diagram for preparation of a co-creative design session</p>
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Modeling	Use case		010 (SPAR K)	32	<div>Use Case: Modify layer order</div> <table><tr><td>Name</td><td>Modify layer order</td></tr><tr><td>Primary Actor</td><td>Designer</td></tr><tr><td>Pre-conditions</td><td>The user must be authenticated. The user must have permission to access to the co-creative design session</td></tr><tr><td>Invariants</td><td>The status of a co-creative design session will not change, it remains running or not running.</td></tr><tr><td>Post-conditions</td><td>The order of layer will be modified and saved in the system</td></tr><tr><td>Summary</td><td>The designer change the order of the existing layers to render on the prototype</td></tr></table>	Name	Modify layer order	Primary Actor	Designer	Pre-conditions	The user must be authenticated. The user must have permission to access to the co-creative design session	Invariants	The status of a co-creative design session will not change, it remains running or not running.	Post-conditions	The order of layer will be modified and saved in the system	Summary	The designer change the order of the existing layers to render on the prototype
Name	Modify layer order																
Primary Actor	Designer																
Pre-conditions	The user must be authenticated. The user must have permission to access to the co-creative design session																
Invariants	The status of a co-creative design session will not change, it remains running or not running.																
Post-conditions	The order of layer will be modified and saved in the system																
Summary	The designer change the order of the existing layers to render on the prototype																
Modeling	Diagram		010 (SPAR K)	31	<div><div>uc Tuning a co-creative design session</div><div><div>Level 1 - Tuning a co-creative design session</div><div></div></div></div> <div>Figure 6 Use case diagram for tuning co-creative design session</div>												

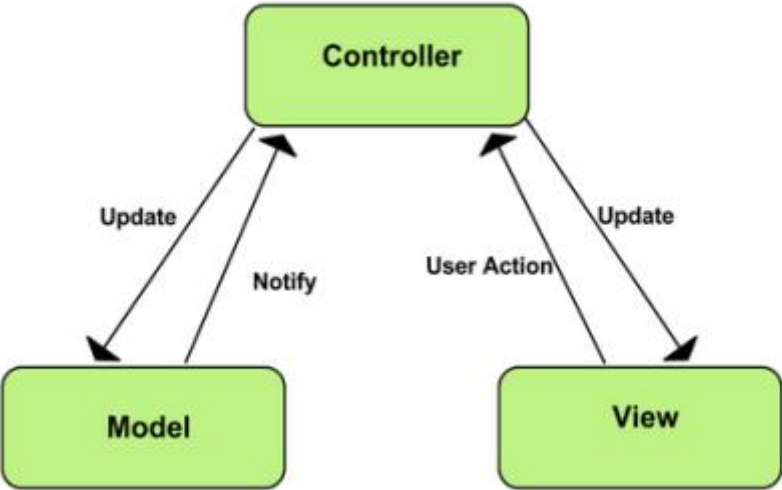
Modeling	Diagram		010 (SPAR K)	34	<pre> graph TD subgraph UC [uc Execution of a co-creative design session] subgraph Level1 [Level 1 - Execution of a co-creative design session] direction TB UC1((Manage contextual content)) UC2((Interact with the prototype)) UC3((End co-creative design session)) UC4((Start co-creative design session)) UC4 -.-> «include» UC5((«fragment» Start activity recording)) UC4 -.-> «include» UC6((«fragment» Start image projection on the prototype)) UC4 -.-> «include» UC7((«fragment» Start gesture recognition)) end end Participant --> UC1 Participant --> UC2 Designer --> UC3 Administrator --> UC4 UC2 --- DD[«actor» Displaying device] UC2 --- TD[«actor» Tracking device] UC2 --- PD[«actor» Projecting device] UC3 --- DD UC3 --- TD UC3 --- PD UC5 --- DD UC5 --- TD UC5 --- PD UC6 --- DD UC6 --- TD UC6 --- PD UC7 --- DD UC7 --- TD UC7 --- PD </pre> <p>Figure 7 Use case diagram for execution of a co-creative design session</p>
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Modeling	Use case		010 (SPAR K)	36	<div>Use case: Interact with the prototype</div> <table><tr><td>Name</td><td>Interact with the prototype</td></tr><tr><td>Primary Actor</td><td>Participant</td></tr><tr><td>Pre-conditions</td><td>Is not mandatory to be authenticated into the platform The co-creative design session must be initialized The user must have permission to access to the co-creative design session</td></tr><tr><td>Invariants</td><td>The session remains initialized</td></tr><tr><td>Post-conditions</td><td>The interactions performed by the participant will be recorded as activities in the system for further reporting The recognized gestures will impact the rendered image on the prototype.</td></tr><tr><td>Summary</td><td>The participant can manipulate the prototype by performing gestures Expected changes to be done to prototype layers:<ul style="list-style-type: none">To change its positionTo change its orientationTo change its size (keeping or modifying the aspect ratio)To change number of items on it (adding and removing items)To change the colour of the items on itTo change its content (mainly textual)</td></tr></table>	Name	Interact with the prototype	Primary Actor	Participant	Pre-conditions	Is not mandatory to be authenticated into the platform The co-creative design session must be initialized The user must have permission to access to the co-creative design session	Invariants	The session remains initialized	Post-conditions	The interactions performed by the participant will be recorded as activities in the system for further reporting The recognized gestures will impact the rendered image on the prototype.	Summary	The participant can manipulate the prototype by performing gestures Expected changes to be done to prototype layers: <ul style="list-style-type: none">To change its positionTo change its orientationTo change its size (keeping or modifying the aspect ratio)To change number of items on it (adding and removing items)To change the colour of the items on itTo change its content (mainly textual)
Name	Interact with the prototype																
Primary Actor	Participant																
Pre-conditions	Is not mandatory to be authenticated into the platform The co-creative design session must be initialized The user must have permission to access to the co-creative design session																
Invariants	The session remains initialized																
Post-conditions	The interactions performed by the participant will be recorded as activities in the system for further reporting The recognized gestures will impact the rendered image on the prototype.																
Summary	The participant can manipulate the prototype by performing gestures Expected changes to be done to prototype layers: <ul style="list-style-type: none">To change its positionTo change its orientationTo change its size (keeping or modifying the aspect ratio)To change number of items on it (adding and removing items)To change the colour of the items on itTo change its content (mainly textual)																

Modeling	Use case		010 (SPAR K)	39	Use case: End co-creative design session	
					Name	End co-creative design session
					Primary Actor	Administrator
					Pre-conditions	The user must be authenticated. The co-creative design session must be initialized.
					Invariants	
					Post-conditions	The system stops to record activities, stops to perform gesture recognition and stops to render image on the prototype
					Summary	The administrator stops the execution a co-creative design session.
Modeling	Use case		010 (SPAR K)	40	Use case: Start activity recording	
					Name	Start activity recording
					Primary Actor	Administrator, triggered by "Start co-creative design session" use case
					Pre-conditions	The user must be authenticated
					Invariants	
					Post-conditions	Each modification to the model will be stored in the system for further use or reporting
					Summary	The system starts recording events coming from the gesture recognition, the interaction with the prototype, and from the use case of tuning the co-creative design session

Modeling	Use case		010 (SPAR K)	41	Use case: Start image projection on the prototype	
					Name	Start image projection on the prototype
					Primary Actor	Administrator, triggered by "Start creative design session" use case
					Pre-conditions	The user must be authenticated.
					Invariants	
					Post-conditions	The new calculated images will be rendered on the prototype
					Summary	Each modification performed to the prototype or the layer and/or resolution will be analysed by the system in order to produce new images to render on the prototype
Modeling	Use case		010 (SPAR K)	42	Use case: Start gesture recognition	
					Name	Start gesture recognition
					Primary Actor	Administrator, triggered by "Start co-creative session" use case
					Pre-conditions	The user must be authenticated.
					Invariants	
					Post-conditions	Detected gestures modifies the images to render on the prototype
					Summary	Gesture recognition is the interpretation of user movements manipulating the prototype with the aim of recognizing modifications or new images to render on the prototype.

Modeling	Use case		010 (SPARK)	44	<div>8.1.5. Use case description: Level 1 - Wrap-up of the co-creative design session</div> <table><tr><td>Name</td><td>Wrap-up of the co-creative design session</td></tr><tr><td>Primary Actor</td><td>Designer</td></tr><tr><td>Pre-conditions</td><td>The user must be authenticated</td></tr><tr><td>Invariants</td><td></td></tr><tr><td>Post-conditions</td><td></td></tr><tr><td>Summary</td><td>The user sees record activities of the co-creative design session</td></tr></table>	Name	Wrap-up of the co-creative design session	Primary Actor	Designer	Pre-conditions	The user must be authenticated	Invariants		Post-conditions		Summary	The user sees record activities of the co-creative design session
Name	Wrap-up of the co-creative design session																
Primary Actor	Designer																
Pre-conditions	The user must be authenticated																
Invariants																	
Post-conditions																	
Summary	The user sees record activities of the co-creative design session																
Modeling	Diagram		043 (NSCK)	16	<div>The full class diagram with an overview of the database is to be found in paragraph 3.1.</div> <pre>classDiagram class Enterprise class Enterprise_group class Legal_Unit class Address class Local_Unit class Local_Unit_Activities class Role class Founder class Enterprise_Activities Enterprise --> Enterprise_group Enterprise --> Legal_Unit Enterprise_group --> Address Founder --> Legal_Unit Founder --> Address Role --> Legal_Unit Role --> Local_Unit Legal_Unit --> Address Legal_Unit --> Local_Unit Local_Unit --> Local_Unit_Activities Enterprise_Activities --> Enterprise</pre>												

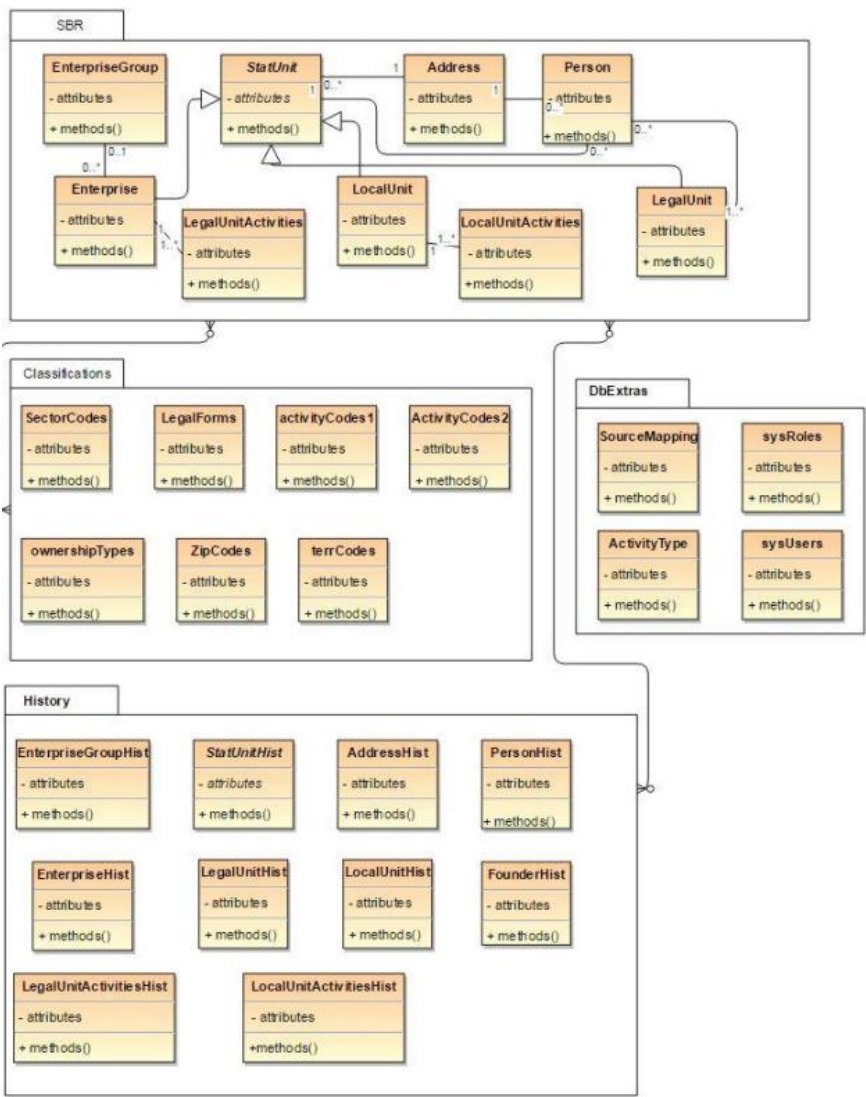
Modeling	Diagram		043 (NSCK)	17	 <pre>graph TD; Controller[Controller] -- Update --> Model[Model]; Model -- Notify --> Controller; Controller -- Update --> View[View]; View -- "User Action" --> Controller;</pre> <p>The diagram illustrates the Model-View-Controller (MVC) pattern. It consists of three components: Controller, Model, and View, each represented by a light green rounded rectangle. The Controller is positioned at the top, the Model at the bottom left, and the View at the bottom right. The interactions are as follows: an arrow labeled 'Update' points from the Controller to the Model; an arrow labeled 'Notify' points from the Model to the Controller; an arrow labeled 'Update' points from the Controller to the View; and an arrow labeled 'User Action' points from the View to the Controller.</p>
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Modeling

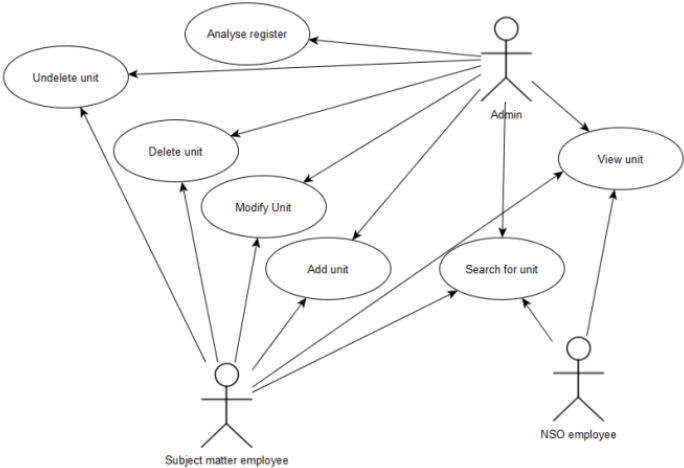
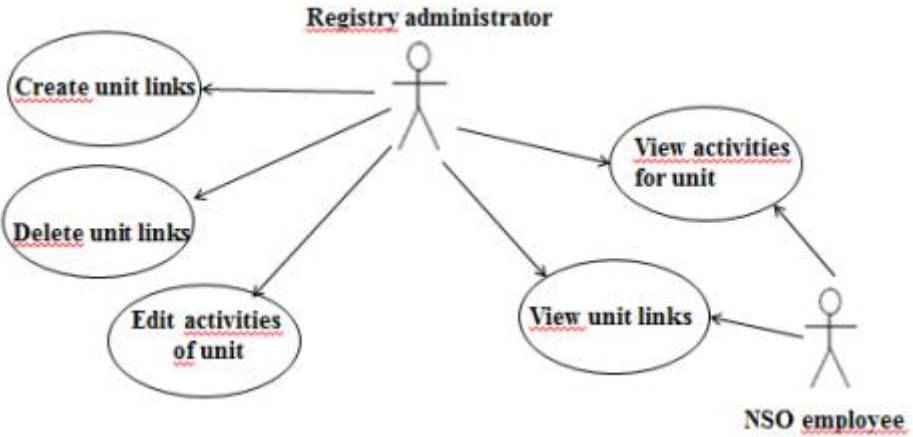
Diagram

043
(NSCK)

18



Modeling	Diagram		043 (NSCK)	19	<p>3.1.2 Example of MVC class diagrams: The Manage units diagram</p> <pre> classDiagram class SBR { EnterpriseGroup StatUnit Address Person Enterprise LegalUnit LocalUnit LegalUnitActivities LocalUnitActivities } class ManageUnits { -attributes +search(searchTerm: String) List IDs +search(unitType: string, searchTerm: String) List of IDs +getUnit(unitID: Int) UnitDTO +createUnit(see chapter XX for details) Bool +saveUnit(unit: UnitBus) Bool +deleteUnit(unitID: Integer) Bool } class UnitDTO { -attributes +UnitDTO(constructor) +getters for all attributes } class EnterpriseGroup { - attributes + methods() } class Enterprise { - attributes + methods() } class LegalUnit { - attributes + methods() } class LocalUnit { - attributes + methods() } class StatUnit { - attributes + methods() } class Address { - attributes + methods() } class Person { - attributes + methods() } class LegalUnitActivities { - attributes + methods() } class LocalUnitActivities { - attributes + methods() } class Classifications class DbExtras class History SBR "0..1" -- "0..1" EnterpriseGroup SBR "0..1" -- "0..1" StatUnit SBR "1" -- "0..1" Address SBR "0..1" -- "0..1" Person SBR "0..1" -- "1" Enterprise SBR "1..*" -- "1" LegalUnit SBR "1..*" -- "1" LocalUnit SBR "1..*" -- "1" LegalUnitActivities SBR "1..*" -- "1" LocalUnitActivities ManageUnits --> UnitDTO UnitDTO --> viewStatUnit UnitDTO --> viewSearchResult viewStatUnit --> ManageUnits viewSearchResult --> ManageUnits </pre> <p>The diagram illustrates the MVC pattern for managing units. It features a SBR (Service Boundary) containing several domain classes: EnterpriseGroup, Enterprise, LegalUnit, LocalUnit, StatUnit, Address, Person, LegalUnitActivities, and LocalUnitActivities. StatUnit is a base class for LegalUnit and LocalUnit. EnterpriseGroup has a 0..1 association with Enterprise. StatUnit has a 0..1 association with Address. Address has a 1 association with Person. LegalUnit has a 1..* association with LegalUnitActivities, and LocalUnit has a 1..* association with LocalUnitActivities. Classifications, DbExtras, and History are also shown as separate components.</p> <p>The ManageUnits class (Control) interacts with the UnitDTO class (Domain). ManageUnits provides methods for searching, retrieving, creating, saving, and deleting units. UnitDTO provides a constructor and getters for all attributes. ManageUnits also interacts with viewStatUnit and viewSearchResult (Views) to display unit information.</p>
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Modeling	Diagram		043 (NSCK)	39	 <pre> graph TD Admin((Admin)) SME((Subject matter employee)) NSE((NSO employee)) Admin --> Analyse[Analyse register] Admin --> Undelete[Undelete unit] Admin --> Delete[Delete unit] Admin --> Modify[Modify Unit] Admin --> Add[Add unit] Admin --> Search[Search for unit] Admin --> View[View unit] SME --> Undelete SME --> Delete SME --> Modify SME --> Add SME --> Search NSE --> Search NSE --> View </pre> <p>UML Use Case Diagram for Unit Management. Actors: Admin, Subject matter employee, NSO employee. Use Cases: Analyse register, Undelete unit, Delete unit, Modify Unit, Add unit, Search for unit, View unit. Relationships: Admin is associated with all use cases. Subject matter employee is associated with Undelete unit, Delete unit, Modify Unit, Add unit, and Search for unit. NSO employee is associated with Search for unit and View unit.</p>
Modeling	Diagram		043 (NSCK)	46	 <pre> graph TD RA((Registry administrator)) NSE((NSO employee)) RA --> Create[Create unit links] RA --> Delete[Delete unit links] RA --> Edit[Edit activities of unit] RA --> ViewLinks[View unit links] RA --> ViewActivities[View activities for unit] NSE --> ViewLinks </pre> <p>UML Use Case Diagram for Registry Administration. Actors: Registry administrator, NSO employee. Use Cases: Create unit links, Delete unit links, Edit activities of unit, View unit links, View activities for unit. Relationships: Registry administrator is associated with all use cases. NSO employee is associated with View unit links.</p>

Modeling	Diagram		043 (NSCK)	7	<p>The diagram illustrates the architecture of the SBR system, divided into three main sections: External data sources, SBR system, and Users.</p> <ul style="list-style-type: none"> External data sources: Includes External source 1, External source 2, and External source n. Adapters: Each external source connects to an Adapter. SBR system: <ul style="list-style-type: none"> Data checking/cleaning: Receives data from all adapters. Metadata: A cylinder icon representing metadata storage, connected to the data checking/cleaning module. SBR database: A cylinder icon representing the main data storage, connected to the data checking/cleaning module. Processing Modules: A vertical stack of modules including Draw samples, Management of units, Search, Reports, and Management of users. These are connected to the SBR database. Access control: A large vertical rectangle that receives input from the processing modules and manages access. Users: Includes Internal users, NSO employee, and IS NSO application. These are connected to the Access control module via Web services.
Development Requirements	Availability		010 (SPARK)	15	"The system must handle simultaneously 12 users."
Development Requirements	Availability		010 (SPARK)	15	"In case the system will be used from distance (say 2 locations geographically located far from each other) the data transfer should ensure the security of data and the capability to keep them confidential."

Development Requirements	Availability		010 (SPARK)	14	"The system should be able of storing the contents managed and discussed during the design session"
Development Requirements	Availability		010 (SPARK)	14	"The system should be able of storing, opening and at least provide simple. modifications to text- and graphics- based files used by creative industries."
Development Requirements	Availability		010 (SPARK)	15	"Platform a. User friendly interface b. Maximum response display time 3 sec"
Development Requirements	Availability		010 (SPARK)	15	"SAR projection a. User friendly interface"
Development Requirements	Availability		010 (SPARK)	15	"b. Low latency (hopefully in the range of tens of milliseconds; the smaller the better)"
Development Requirements	Availability		010 (SPARK)	15	"c. Gesture based interaction"

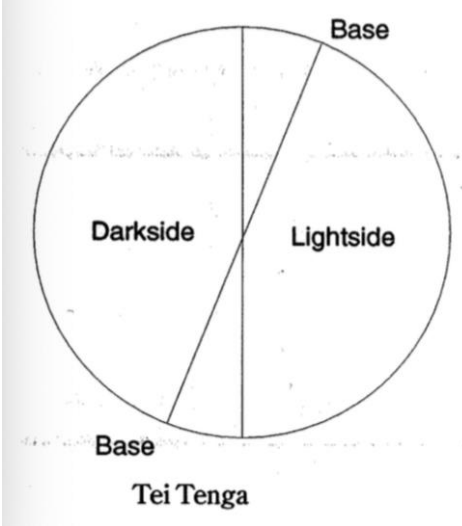
Development Requirements	Availability		010 (SPARK)	15	"d. Colour rendering (also as material and finishes) of excellent quality (real-like, as much as achievable with reference to hardware cost)"
Development Requirements	Availability		010 (SPARK)	15	"e. Resolution of the projected visual content of high quality (real-like, as much as achievable with reference to hardware cost)"
Development Requirements	Availability		010 (SPARK)	16	"f. Ability to track within a limited volume space"
Development Requirements	Availability		010 (SPARK)	16	"g. Viewing angle sufficient for 1-2 people to view the prototype from one side"
Development Requirements	Availability		010 (SPARK)	16	"h. Excellent brightness (without having to darken the room too much, as much as achievable with reference to hardware cost)"
Development Requirements	Availability		010 (SPARK)	16	"i. The projection should be capable of adapting content to completely cover the external surface of prototypes of small/medium dimensions (i.e. 400x400x400mm max volume)."

Development Requirements	Background		039 (TH)	7	“Each game can end three ways: User Abort, player death with no lives left, and player victory. Each is covered here. Where the episodes differ (like the cinematics), you will find the necessary information in the “Unique Bits” section of each episode. “
Development Requirements	Background		039 (TH)	7	“END OF GAME: USER ABORT When the user invokes the during-game Abort, a prompt window appears asking them to verify. If they say yes, the guy dies in maze and control panel appears. “
Development Requirements	Background		039 (TH)	7	“END OF GAME: DEATH Pull back to see self die, view remains in maze. Window over view of dead guy – choice to continue If you don’t Control Panel over view. ”
Development Requirements	Background		039 (TH)	7	“END OF GAME: WIN Cinematic (see “Unique Bits” for graphic details) will be very similar for all characters, but will show how player’s character reacts – in one of two small face reaction shots plus individual text. ”
Development Requirements	Background		039 (TH)	8	“Physical Description: Muscular, tall woman, attractive, but has strangely too-intense eyes. Oriental featured in the brown eyes and black hair, which is drawn back into a large knot. Scar on left shoulder from rock-climbing accident. Character Description: Fiercely competitive, Lorelei intimidates most people. She won her troop boxing championship. Lost a bet that meant she had to pull her application for a glory post. Too late to reapply, she got this post. Married for six months once, husband divorced her for irreconcilable differences. From European Alliance. No one calls her Lorelei.”

Development Requirements	Background		039 (TH)	8	<p>“Advantages: Fast. Crack shot with pistol.</p> <p>Disadvantages: Once wounded, she still tends to push herself to compensate, so wounds can keep ticking off more. Not used to bayonet. ”</p>
Development Requirements	Background		039 (TH)	8	<p>“Physical Description: Black balding man with thick eyebrows. Missing last joint of right ring finger. Brown eyes.</p> <p>Character Description: Former head of security at AWR (Advanced Weapons Research) Labs, Petro grew tired of the overwhelming bureaucracy of the UAAF. His insubordination cost him his rank, and his assignment on Tei Tenga was his request, made to get away from the epicenter of annoyance while finishing out his term of duty. ”</p>
Development Requirements	Background		039 (TH)	8	<p>“Advantages: Good with standard shell weapons. Can take damage.</p> <p>Disadvantages: Average speed. Not used to missile weapons. ”</p>
Development Requirements	Background		039 (TH)	8	<p>“Physical Description: Bulky, slightly overweight greek-spaniard with swarthy but unkempt looks. Frizzly dark brown hair explodes and falls off his head.</p> <p>Character Description: Dimitri is basically stuck in the low ranks of the military, but that suits him just fine. He wants nothing more from life: give him a clear objective and the chance to release aggression through the freely available high-powered firearms, and he’s happy.”</p>
Development Requirements	Background		039 (TH)	8	<p>“Advantages: Very good with a ll weapons. Can take a lot of damage.</p> <p>Disadvantages: Slow. ”</p>

Development Requirements	Background		039 (TH)	9	<p>“Physical Description: Red-haired and trim, Thi (Pronounced “Tee”) has piercing blue eyes, and is stout but gorgeous. A toss of hair tends to fall over her forehead. She holds a bewitching dimpled smile in reserve until it proves useful.</p> <p>Character Description: Thi has a friendly, if straight-laced, disposition. Father was a sargeant in the UAAF, a career soldier that gave Thi a strong sense of duty and honor. Medalist in unarmed combat competition. She volunteered for this post because no one wanted it, and with a desire to have a variety of experience in her military life. ”</p>
Development Requirements	Background		039 (TH)	9	<p>“Advantages: Faster than Average. Hard to hit. Does incredible damage with bayonet. Disadvantages: Low hit points. ”</p>
Development Requirements	Background		039 (TH)	9	<p>“Physical Description: Very fit and powerful, Buddy always wears a hat that says “BEOS” which stands for “Butt End of Space.” Caucasian with brown/Blond hair and green eyes. Character Description: Popular and courageous, Buddy got sent to Tei Tenga Darkside for showing up a superior officer. His stay here is just temporary though – he was sent here as a security advisor. Buddy has a good sense of humor. Inside Info: Dacote stands for “Dies at conclusion of this episode.”</p>
Development Requirements	Background		039 (TH)	10	<p>“This must be kept small and powerful. It is limited to a 700K download size. ”</p>

Development Requirements	Background		039 (TH)	11	“Other players will look similar, but their suits will be of different colors. Other color changes will reflect different weapons and in the commercial game, helmets. ”
Development Requirements	Background		039 (TH)	11	“Once human, these poor folks were possessed in their sleep. Their uniforms can be palette changed to reflect different behavior. ”
Development Requirements	Background		039 (TH)	11	“Annoying little bastards, the imps come in different flavors, with later ones firing spikes and fire. ”
Development Requirements	Background		039 (TH)	11	“These guys do a lot of damage up close. Later Troops cast magic. ”
Development Requirements	Background		039 (TH)	11	“These guys do a lot more damage up close. Later sargeant cast floor-boiling magic. ”
Development Requirements	Background		039 (TH)	11	“Twin terrors at the end of episode one, these guys do the following: (Insert interesting description of behavior and how they are beat here.) ”

Development Requirements	Background		039 (TH)	12	<p>"The bases on the planet Tei Tenga used to be the glory posts, but lack of progress with the research has cased money to be funneled away to the point of its current staff – a group of dedicated, almost messianic scientists and a skeleton crew of security people. The two bases are Lightside and darkside: the planet does not rotate, so there is no day or night. The anomalies being studied are on the planet's magnetic poles. "</p> 
Development Requirements	Background		039 (TH)	12	<p>"Intro Cinematic The intro cinematic goes like this (a lot of pictures are repeated, so don't worry): View from space of planet (ballmapped): Military research base, moon Tei Tenga (rotates) (shows "Lightside" and "darkside", then rotates to darkside and zooms in and fades out) Zoom into room with live guys playing cards. Small pictures of each of their eyes blinking, looking to other side. Back to main view."</p>

Development Requirements	Background		039 (TH)	13	<p>“End Cinematic</p> <p>The end cinematic shows the dead twin demons. Cut to close up of player, then comment from other live players. (Actually, probably just shot of them atop cliff, and just drawing the ones left.)</p> <p>Show parallaxing pan of Hell.</p> <p>Cut to player close-up: "Oh, hell...</p> <p>Short credit-like roll hyping Doom 2 over scary demon lord's face. Eyes open and big word "Doom" appears masked over it. Fade to black. Go to high scores, then Demo Loop. ”</p>
Development Requirements	Background		039 (TH)	13	<p>“Solution Go through Depot 2, Mess toOfficers' Quarters. Get a Colonel's Hand. Use the Colonel's Hand to get into the control center. Get through Power Plant maze and trip the breakers. Power turns on. Use the Colonel's hand to gain access to the Lab (though monorail system, which is dangerous, because there's a lot of demons and not a lot of health) or through main lab entrance. Fight your way through the lab to the Anomaly passage, using the Colonel's Hand. Go down there, and kick some twin demon butt. ”</p>
Development Requirements	Background		043 (NSCK)	71	“Vendor independent DBSM”
Development Requirements	Availability		043 (NSCK)	71	“Use of an application server to execute application business logic;”

Development Requirements	Availability		043 (NSCK)	71	"Operating system windows server"
Development Requirements	Availability		043 (NSCK)	71	"Use of technologies and programming languages that allow execution on both open source and commercial application servers that ensure high level of accessibility and fault tolerance;"
Development Requirements	Availability		043 (NSCK)	71	<p>"The architecture system must be based on the following principles:</p> <ul style="list-style-type: none"> • Modularity - capability to gradually grow the functionality via addition of new functional modules; • Adaptivity - ability to add changes into the system with the minimal need or none of extra development; • Scalability – the system must increase productivity when adding new hardware; • Openness – the use of open standards, protocols and technologies;"
Development Requirements	Availability		043 (NSCK)	71	<p>"performance and uptime Capacity: 50 concurrent users Uptime: 95% Response time: max 3000 ms In case of failure: The system should be up and running maximum 5 minutes after failure fixed. Deployment must be automatized and should take less than 10 minutes"</p>
Development Requirements	Availability		043 (NSCK)	72	"Authentication and identification of users and external applications; if the institution uses Active Directory or other directory service, this should be used for authentication."
Development Requirements	Availability		043 (NSCK)	72	"Separation of privileges and access rights of users to functions and data (authorization)"

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Development Requirements	Availability		043 (NSCK)	72	"Ensure the data transfer is confidential by the means of cryptographic technology;"
Development Requirements	Availability		043 (NSCK)	72	"Logging of user and subsystem activity;"
Development Requirements	Availability		043 (NSCK)	72	"Access must be allowed only after a mandatory procedure of successful authentication and identification of a user or an external application. The procedure of authentication and identification must be performed by specifying the login and password by user. If the institution uses Active Directory or other directory service, this should be used for authentication in the database."
Development Requirements	Availability		043 (NSCK)	72	"Authentication of external applications must be performed with the use of digital certificates and mutual authentication protected TLS connection. The result of successful authentication procedure is a unique user or application identifier which is used to authorize access to system functions and data and for audit as well"
Development Requirements	Availability		043 (NSCK)	72	"Authorization of access must be based on identification information about the user which is obtained at authentication stage and on the list of roles assigned to the user. Each role contains a certain set of privileges in order to access functions and data. The list of standard roles and privileges of access to system functions is shown in the table below."

Development Requirements	Availability		043 (NSCK)	73	"Data exchange must be made confidential with the use of cryptographic means based on digital certificates and a TLS protocol"
Development Requirements	Availability		043 (NSCK)	73	"Authentication and identification of users and external applications;"
Development Requirements	Availability		043 (NSCK)	73	"Authorization of access to system functions;"
Development Requirements	Availability		043 (NSCK)	73	"Retrieval of data on statistical unit;"
Development Requirements	Availability		043 (NSCK)	73	"Modification of statistical unit;"
Development Requirements	Availability		043 (NSCK)	74	"Creation of sample lists;"

Development Requirements	Availability		043 (NSCK)	74	'In order to integrate with external systems, the system must expose a set of integration interfaces
Development Requirements	Availability		043 (NSCK)	74	"To support heterogeneous and distributed environments web services must conform to WS-I Basic Profile 2.0 and WSIT
Development Requirements	Availability		043 (NSCK)	74	"The access to web services must be made with the use of TLS protocol and with mandatory authentication procedure based on client digital certificates.
Development Requirements	Availability		043 (NSCK)	74	"When the system is up and running, it must be possible to switch between two languages runtime"
Development Requirements	Availability		043 (NSCK)	74	"At installation time, it is decided which two languages to make available for this installation"
Development Requirements	Availability		043 (NSCK)	74	"The user interface must be implemented as a web interface using HTML5 and CSS3. Also a JavaScript framework like Angular.js or Facebook's React is to be used."

Development Requirements	Availability		043 (NSCK)	74	“The user interface should be simple, intuitive and comfortable. The AJAX technique should be used in order to minimize response times and frequent page reloads. The switching of user interface between languages must occur dynamically at any navigation level and without changing of current page”
Development Requirements	Background	story	037 (CryX)	5	“The entire story revolves around the Rebellion against the Evil Lords in the virtual CryptoSpaceX Universe. You begin as a Rebellion leader in the mystical Fabula galaxy where your goal is to build a huge fleet of ships for the upcoming battle against the Evil to restore peace in the Universe. Which side will win? Nobody knows the answer.”
Development Requirements	Background	abilities	037 (CryX)	5	“You are a Rebellion leader sent to the Fabula galaxy with a map to a unique planet. As a member of the Rebellion you have taken an oath to protect the Universe from the Evil. Rebellion leaders have several special abilities and have mastered the art of space combats. They are trained to build destructive and powerful starships.”
Development Requirements	Background	purpose	037 (CryX)	5	“As a Rebellion leader, you have been sent with one sole purpose—to build a large fleet of starships for the battle that must be. There are others around you, but you must not trust anybody—for many have already been consumed by the Evil Forces. There must be no stones left unturned because the fate of the Universe lies in the hands of a few leaders like you.”
Development Requirements	Background	features	037 (CryX)	5	“The gameplay in Episode I features PvP strategic battles where the attacker commands his ships to attack and steal stardust from neighbouring planets. There will also be plenty of opportunities for player interactions and multiplayer gameplay in tournaments, and Vegastar mini-games”
Development Requirements	Background	goals	037 (CryX)	6	“The game features a Story mode where your progress goes in line with your set objectives and goals as a Rebellion Leader. There is also a Casual mode where you can explore the Universe and the Vegastar, engage in several minigames or even

ts					choose to build one for yourself.”
Development Requirements	Background	goals	037 (CryX)	6	“Episode I is just a small step towards our goal of building a Virtual Universe. It presents the endless possibilities that the CryptoSpaceX Universe will have. There are several Episodes planned for the game and we will also keep upgrading the game in between different Episodes.”
Development Requirements	Background	goals	037 (CryX)	6	“Your sole purpose in the game, as a Rebellion leader, is to create a large and strong fleet of ships. The number of hours of gameplay is directly related to your dedication to the Rebellion, unless, of course, you get a rare Death Ray, that can really make things simpler”
Development Requirements	Background	goals	037 (CryX)	6	“To build a Blockchain Game that is decentralised in it’s true essence, it is important to include community inputs in our game as well. For this, we plan to have game mechanics and bug bounty contests, several community built games on Vegastar plots, and voting among all token holders before making any big changes.”
Development Requirements	Background	goals	037 (CryX)	10	“This is the in-game currency in our game Universe. It will be used for almost everything you do, from upgrading your planet, spaceships, battle stations to being used as fuel for attacking, Stardust funds it all. Where can you get it from? Stars, obviously. No, you cannot buy it from the marketplace. Vegastar? Well, you’ll read about it soon enough.”
Development Requirements	Background	goals	037 (CryX)	10	“Spaceships are the main attacking units. They have various types, Bombers, Raiders, Troop Carriers, Healers, Destroyers and Cruisers. Using various types of spaceships in attack will be one of the main strategic points of the game. They will have their respective strengths and weaknesses.”
Development Requirements	Background	feature	037 (CryX)	11	“Starships feature a range of attacking turrets, all of which have different abilities and powers. These turrets determine the overall strength of your starship. Some turrets like the Radar Deflectors give stealth ability to Raider class ships. As starships are

ts					upgraded, more turrets get attached to the ships increasing their attack and defense abilities.”
Development Requirements	Background	formation	037 (CryX)	12	“You devise the formation comprising of wave(s) of starship(s). This formation is important as it will decide the effectiveness of your attack. Certain types of ships combine well and with the right choice you might be able to penetrate the defences of the enemy planet. On the other hand, senseless combinations can decimate your attack against the right defence.”
Development Requirements	Background	tournaments	037 (CryX)	12	“Take part in several in-game tournaments to win special prizes and game assets. There are several tournaments like knockout tournaments and starcraft racing. You can build alliances with other players, rent your starships, and race your way to the top of our weekly leaderboards.”
Development Requirements	Background	feature	037 (CryX)	12	“Tournaments feature special prizes which can be anything from a rare starship to a loot box containing a large amount of Stardust. Some tournaments will also feature a participation fee in ETH, which would be distributed among the winners.”
Development Requirements	Background	feature	037 (CryX)	13	“Vegastar will feature several plots, each of which can be owned by a user. Every plot can hold upto one building which have a unique mini-game associated with them. Users may choose to build a mini-game of their own on these spaces or use one that we made. Vegastar has different towns like the Gambling town, Blockchain Gamers town and Space Exploration town all of which have their own unique features and game types.”