



ENABLING AN OPEN INNOVATION MODEL FOR EU TOY INDUSTRY SMES
 THROUGH CO-CREATION WITH FABLABS, SAFETY EXPERTS AND CUSTOMER
 COMMUNITIES
 732559

Updated ToyLabs concept Definition Stakeholders' Requirements and Validation Framework –final version

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EXECUTIVE SUMMARY

This deliverable is part of ToyLabs WP1 – Requirement Engineering and Validation Framework. More specifically, it represents the work conducted throughout WP1 and represents the updated version of the previous two deliverables of the Work Package to take into account changes in the project and the feedback generated throughout. Being the final deliverable of WP1, the present document aims to highlight the evolution of the ToyLabs' project concept, user requirements and validation framework. According to the DoA:

“D1.3 will include input from all tasks to generate an updated version of the ToyLabs concept and a revised version of stakeholders' requirements and ToyLabs Validation Framework.”

This deliverable is organised in two distinct parts. Part A – ToyLabs Updated Concept Definition & Requirements Framework, aims at updating the project's concept and the user requirements that have already been used for the definition of the methodology and the design of the platform's features.

Part B – Validation Framework Determination will work on updating and adding quantifiable goals to the criteria and indicators that will be used to measure the project's impact and validate the success of the project's results. This is a crucial step in the validation framework, as it sets the goals that will need to be validated by the project's stakeholders during the pilots implementation.

PART A: TOYLABS UPDATED CONCEPT DEFINITION & REQUIREMENTS FRAMEWORK

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The ToyLabs project aims at tackling the problems that small and medium sized industries (SMEs) are facing nowadays in Europe's toy manufacturing industry, to strengthen their position against global competitors. The ToyLabs platform will be built on the pillars of co-creation and open innovation aiming to strengthen the value network of an SME by bringing it closer to other key players of the industry such as FabLabs, Toy Safety/Environmental/Childhood Experts and end users. These stakeholders are expected to offer, apart from their services, valuable insights and feedback throughout the toy development process, validating the product at each stage. It is projected that the added value that SMEs will receive from the platform will improve their competitive position while progressing the competitiveness of the toy manufacturing industry in the EU.

The objective of WP1 is twofold; on the one hand to investigate the current landscape on methods, tools and technologies in the toy industry under the scope of creativity and collaborative design and on the other hand to elicitate user requirements that will guide all development activities of the project.

Part A of the present deliverable D1.3 "Updated ToyLabs Concept Definition, Stakeholders' Requirements and Validation Framework Determination- Final Version" aims at refining and finalising ToyLabs user requirements, while it will also incorporate a brief and concise update on the ToyLabs Concept and Innovation Perspective and a final presentation on the ToyLabs stakeholders and platform roles.

In particular, the scope of the deliverable is:

- To conclude on the ToyLabs innovation potential, its stakeholders and platform roles;
- To elaborate high-level usage scenarios that will demonstrate in a clear manner the whole ToyLabs value proposition as this resulted to be for its three different types of end users; Toy Manufacturers, FabLabs and Safety Experts;

- To capture ToyLabs generalised stakeholder requirements with respect to its four main developed components; the ToyLabs platform and the Market Analysis & Social Feedback component, the Partner Matching module and the Augmented Reality module;

It needs to be noted that the present deliverable aims to be a self-standing deliverable, meaning that it will suffice to read this deliverable to understand the advancements and final decisions on this WP.

1.2 STRUCTURE OF THE DELIVERABLE

The remainder of Part A of the present deliverable is structured as follows:

- **Chapter 2** encompasses updates on the ToyLabs Concept as this was presented in D1.1 “Exploring Progress and Innovation in ToyLabs Tackled Domains and ToyLabs Concept Definition – v1”, finalisation on the ToyLabs stakeholders and platform roles and brief presentation on the main services of the toy industry, that were presented in D1.1 and were promoted for further investigation and exploitation under the ToyLabs project.
- **Chapter 3** concludes on the final version of the ToyLabs user requirements with regard to the four main project’s developed components, updating also the high-level usage scenarios that were presented in D1.2 “Stakeholders’ Requirements Identification and Validation Framework Determination – v1” to incorporate the changes that came up in the ToyLabs concept and respective proposed workflow during these months of the project running.
- **Chapter 4** encompasses the conclusions stemming from the work performed and documents the lessons learnt from the work conducted under T1.1-T1.3 of WP1.

1.3 RELATION TO OTHER TOYLABS WPS AND TASKS

The work conducted under T1.1 –T1.3 under WP1 and presented in Part A of the present deliverable, as a follow up and update of deliverables D1.1 and D1.2, contains important information for all the project, since it sets the basis under which all following developments are generated and tested. Therefore, the results of this part of the deliverable and especially the usage scenarios and the generalised requirements will be used as input for WP3, 4 & 5, in order to cross-check and validate that the ToyLabs Integrated Platform and its components, serve the interests of its future users and that the pilots using ToyLabs developments are aligned with the ToyLabs concept and the proposed usage scenarios.

2 TOYLABS UPDATED DEFINITION

2.1 UPDATES ON THE TOYLABS CONCEPT

The scope of the ToyLabs project is to introduce a new model that will innovate the value network of EU toy manufacturing SMEs, towards the direction of changing their market positioning & prospects in the Industry, overcoming obstacles like geographical barriers and fragmented markets through the principles of co-creation and open innovation.

In this context, ToyLabs proposed the development of a unique, unified methodology that would create a multi-stakeholder network and consequently a multi-sided platform where key players in the toy industry value network (i.e. toy manufacturers, FabLabs, Toy Safety experts, childhood professionals, end customers etc.) are brought together and collaborate closely in order to come up with new, innovative toys and games, that a) will be able to quickly enter the market, b) will respond to a clear market demand, c) will be cost effective and d) will be customised in order to be able to enter also other EU markets. The project's initial concept is represented in Figure 1.

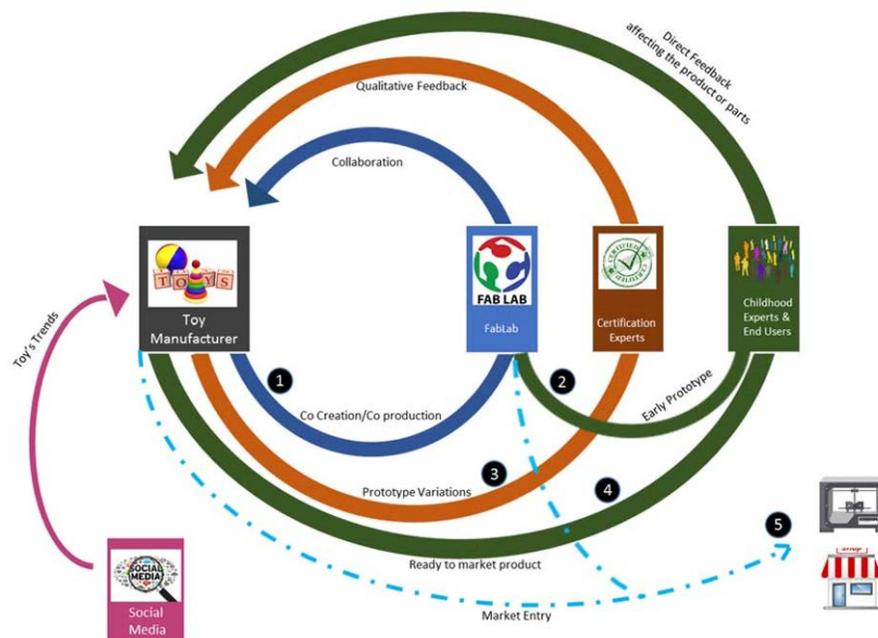


Figure 1: ToyLabs Concept

ToyLabs' main concept has not changed over the course of the project in a major way. Rather it was slightly updated in certain steps and expanded in others where necessary. Specifically:

- The consortium introduced the role of product owner (e.g. the person/organisation that initiates a new product development process), meaning that not only manufacturers but every stakeholder of the platform can initiate a toy development process.
- The methodology became more open and flexible in its early stages allowing product owners to collaborate not only with FabLabs (as seen in Figure 1) but with any organisation they desire as early as they want in the process to get feedback and optimize procedures.
- Via the use of Augmented Reality even from the Design phase, end-users are able to enter the toy development process and provide feedback from the very early phases instead of waiting for the prototype or product.
- It was realized that in the domain of physical toys, traditional social media often provide little useful information on toy trends. As such, blogs were also added as an additional choice that may yield more information leading to better analytics and more detailed visualisations.
- The collaboration approach of the platform had to be expanded to take into account IPR management issues between two partners via the exchange of legal documents, NDA agreements etc.

It can be assessed from the above that in its core, the project's concept did not undergo any major changes. What was achieved however, was to expand it based on discussions with the project's partners and the feedback received from them to make the final solution as holistic as possible.

2.2 UPDATES ON TOYLABS' GENERAL REQUIREMENTS

2.2.1 Problem Identification: Lessons Learnt

Based on D.1.1 table of sub-chapter 9.2.1 concerning the toy industry's problem identification, in this sub-chapter the aspects that the ToyLabs platform solves are presented as well as the ways that these challenges were tackled in the context of the platform development.

Those problems that ToyLabs is not prepared to solve are due to two main reasons:

- 1) They refer to creativity activities in which a non-mechanical approach is needed such as the the cases of Idea generation and concept definition as well as Marketing and content development task.
- 2) They refer to complex tasks that need inputs that have not been contemplated in the ToyLabs, as is the case with the Forecast task.

The possible contributions of the ToyLabs solution in the unresolved problems can be considered through the Partner Matching Component. This module could provide companies of the toy industry with a selection of professionals in different fields that can support said companies in various stages of the toy development process.

TOY PHASES	TOY ACTIVITIES	PROBLEM DETECTED	TOYLAB'S PROPOSAL
IMMERSION			
Strategy definition			
Empathise	<i>Market & design research</i>	<ul style="list-style-type: none"> Activity not done professionally by a considerable number of companies. Companies carried out research studies themselves, without having expertise in this activity. 	<p>A Market and Trend Analysis Component has been created. It is one of the three components that make up the core of ToyLabs. This element shows companies the importance of taking previous knowledge of the market and end-users into account. Providing this service to companies highlights the importance of the immersion phase itself.</p> <p>Companies can get information about market trends and a deeper understanding of customers' satisfaction without the need to have extensive knowledge in these research fields.</p>
		<ul style="list-style-type: none"> Time and money constraints 	<p>The Market and Trend Analysis Component provides – quickly and easily - the information that companies need, thus saving time and money. Since the task is performed faster, it also implies a reduction in investment.</p>
		<ul style="list-style-type: none"> Companies carried out research studies with incorrect users Information generated by their experiences in the toy sector and by their daily work 	<p>The Market and Trend Analysis Component guides companies in the selection of the “right target” by choosing the correct filters and considering various parameters such as competitors or influencers. This possibility gives companies the opportunity to obtain feedback from their users.</p>
		<ul style="list-style-type: none"> Companies do not know where to find trend information (both market and social trends) Companies do not know how to interpret market and social trends Companies need to improve how to interpret the information provided by experts in children's behaviour 	<p>The Market and Trend Analysis Component is intended to give the company an easy-to-use tool that provides the appropriate information through various intuitive charts. The idea is to provide the required information in way that is easy for companies to understand.</p>
Define	<i>Briefing</i>	<ul style="list-style-type: none"> No concrete briefings 	<p>The Market and Trend Analysis Component helps companies to define the target and/or strategies. In this sense, it assists in the formulation of the briefings.</p>

TOY PHASES	TOY ACTIVITIES	PROBLEM DETECTED	TOYLAB'S PROPOSAL
	<i>Price strategy¹</i>	<ul style="list-style-type: none"> Sometimes companies do not manage this task properly 	<i>This detected problem is not covered by ToyLabs</i>
	<i>Project development and management</i>	<ul style="list-style-type: none"> Sometimes companies have problems organising the schedule (time constraints) 	ToyLabs contributes towards minimising time constraints as it is a multi-stakeholder network and consequently a multi-faceted platform where key players in the toy industry value network are brought together and collaborate closely. This fact can imply a reduction of time because tasks are carried out more quickly.

CONCEPTUAL DESIGN			
	<i>Idea generation and concept definition</i>	<ul style="list-style-type: none"> Non-defined procedure established for this activity in a considerable number of companies 	<p><i>This detected problem is not covered by ToyLabs</i></p> <p>Even so, the market analysis and social feedback component can contribute towards the generation of ideas, as the obtained analysis can represent the starting point and also facilitate interaction between inventors and manufacturers.</p>
		<ul style="list-style-type: none"> Companies do not know how to come up with new ideas Some ideas come from inventors out of the company 	A Partner Matching Component has been developed. Companies can use this tool to seek collaborators inside the ToyLabs platform, allowing them to set up formal partnerships that will lead to collaborative product design and development. It provides companies with a network of various professionals where both parties can connect to request or offer services. Companies can find collaborators through the platform in order to get new ideas.
	<i>Prototype development</i>	<ul style="list-style-type: none"> Economic and time constraints 	The Augmented Reality Feedback Component has been developed. This tool allows responsive and interactive presentation of 3D models with advanced capabilities. It represents an alternative to developing physical prototypes, which takes more time and investment.

¹ Key aspect for the industry. This decision will affect the future competitors of the new idea and for this reason it is very important to get right

TOY PHASES	TOY ACTIVITIES	PROBLEM DETECTED	TOYLAB'S PROPOSAL
		<ul style="list-style-type: none"> Doll sculptors are old and there are no direct replacements for them Necessity of plush pattern design specialists 	The Partner Matching Component expands the network of contacts, thus increasing the possibility of finding specific professionals in a particular field.
	<i>Marketing and content development</i>	<ul style="list-style-type: none"> Need for definitions of the expectations and limits of this activity 	This detected problem is not covered entirely by ToyLabs because it is a creative task, which is very difficult for an ICT tool to perform. Nevertheless, the ToyLabs platform would guide the companies in this process by providing templates and steps to carry out this task.
		<ul style="list-style-type: none"> Marketing departments do not work with designers as much as they should Marketing departments are limited to sales functions and do not participate in user research (Immersion stage) Companies look for experts such as educators or designers in specific activities (e.g., art and crafts experts, mathematics experts) to provide content. 	<i>This detected problem is not covered by ToyLabs</i>

DETAILED DESIGN			
	<i>Product engineering</i>	<ul style="list-style-type: none"> Sometimes the production department receives unfeasible designs. Designers need to increase their knowledge in technical and safety aspects Designers do not have knowledge in developing design in 3D programs 	<p>FabLabs, as key stakeholders, can provide solutions during the detailed design phase. They can apply engineering requirements to companies' ideas in order to transform an unfeasible design into one that is ready for production. Furthermore, FabLabs can support companies to develop 3D models.</p> <p>In addition, the Partner Matching Component expands the network of contacts, thereby increasing the possibility of finding specific professionals in a particular field.</p>
	<i>Mould development</i>	<ul style="list-style-type: none"> Very expensive activity 	The Partner Matching Component offers companies a database of various professionals. Through this,

TOY PHASES	TOY ACTIVITIES	PROBLEM DETECTED	TOYLAB'S PROPOSAL
		<ul style="list-style-type: none"> • Difficulty of finding local suppliers • Time constraints 	companies can expand their network of contacts and find certified suppliers.

PRODUCTION			
Pre-production	<i>Supplier management</i>	<ul style="list-style-type: none"> • Difficulty of finding suppliers with specialised knowledge of some components (e.g., dolls eyes, etc.) • Sometimes, suppliers do not meet toy standards • Fabrics: when companies ask for a fabric they have bought previously, they do not always find the same fabric 	The Partner Matching Component offers companies a database of various professionals. Through this, companies can expand their network of contacts and find those they require at each step.
	<i>Raw materials and components buying</i>	<ul style="list-style-type: none"> • Difficulty of finding suppliers with specialised knowledge of some components • Sometimes, suppliers do not meet toy standards • Fabrics: when companies ask for a fabric they have bought previously, they do not always find the same fabric 	The Partner Matching Component offers companies a database of various professionals. Through this, companies can expand their network of contacts and find those they require at each step.
	<i>Manufacture of pre-series</i>		
	<i>Forecast²</i>	<ul style="list-style-type: none"> • Sometimes companies do not manage this task properly • They cannot forecast the number of units to produce or sell for innovative products, because previous data does not exist 	<i>This detected problem is not covered by ToyLabs</i>

-
- ² Very important decision. If companies produce an excess of units, the product remains on the shelves and clients (toy shops) may view the product as a failure. On the other hand, if they produce a lower number of units than that required by clients, the products are perceived as a missed opportunity to make more money, and some clients could be dissatisfied.

TOY PHASES	TOY ACTIVITIES	PROBLEM DETECTED	TOYLAB'S PROPOSAL
Production	<i>Manufacture of production</i>		
	<i>Assembly</i>	<ul style="list-style-type: none"> • Very expensive stage because it is normally based on hand-made activities that are difficult to automate • It is hard to find people with toy assembly knowledge 	<i>This detected problem is not covered by ToyLabs</i>
	<i>Half-finishing manufacturing</i>		
	<i>Quality Control</i>	<ul style="list-style-type: none"> • Difficulty of monitoring the quality of the units produced in an outsourced company in a short period 	<i>This detected problem is not covered by ToyLabs</i>

DELIVER			
Storage	<i>Storage</i>	<ul style="list-style-type: none"> • Limitation of the space, and deterioration due to heat or temperature 	<i>This detected problem is not covered by ToyLabs</i>
Distribution	<i>Transport and logistic (from manufacture stores to toy shops)</i>	<ul style="list-style-type: none"> • The distribution of SME companies in local stores is threatened by the gradual reduction of the latter 	<i>This detected problem is not covered by ToyLabs</i>
Sales	<i>Product placement</i>	<ul style="list-style-type: none"> • The location of the toy in the shop has a direct impact on its sales. However, this activity is not monitored by a large number of companies 	<i>This detected problem is not covered by ToyLabs</i>
	<i>Advertising</i>	<ul style="list-style-type: none"> • If a new product is advertised on television, it has a higher possibility of being positively evaluated by clients • Some companies express that a good advertisement can sell a not very good toy 	<i>This detected problem is not covered by ToyLabs</i>
	<i>Shop assistance</i>	<ul style="list-style-type: none"> • Very different requirements for each toy shop 	<i>This detected problem is not covered by ToyLabs</i>

EVALUATION

TOY PHASES	TOY ACTIVITIES	PROBLEM DETECTED	TOYLAB'S PROPOSAL
Desirability (people)	User appeal and suitability ³	<ul style="list-style-type: none"> Some companies carry out this activity internally with a non-representative sample (age, gender, number, etc.) and inexpert interviewers Economic and time constraints Companies require rapid or instant feedback to resolve some problems Difficulty of assisting a high number of users. It is a high-cost labour activity Representation of the users' valuations in social media of the total of the society The concepts are at a very initial stage and is very difficult to make a correct evaluation with the available information The degree of development of some ideas varies greatly, making it difficult to compare between various alternatives, due to the absence of a common template 	The presence of safety experts on the ToyLabs platform ensures that companies have access to professionals that can validate their products. These safety experts offer this type of study, taking into account the companies' specifications and offering ad-hoc solutions.
Viability (financial)	Sales analysis	<ul style="list-style-type: none"> Difficulty of comparing with competitors' products. The available data (NPD) is perceived as being expensive by some companies 	The presence of childhood experts on the ToyLabs platform ensures that companies have access to professionals that can validate their products. These childhood experts offer this type of study, taking into account the companies' specifications and offering ad-hoc solutions.
	Cost analysis ⁴	<ul style="list-style-type: none"> Sometimes companies do not manage this task properly The degree of development of some ideas varies greatly, making it difficult to compare between various alternatives, due to the 	<i>This detected problem is not covered by ToyLabs</i>

³ This is a key aspect for toy companies

⁴ Key aspect for the product. It has a direct impact on the price of the product

TOY PHASES	TOY ACTIVITIES	PROBLEM DETECTED	TOYLAB'S PROPOSAL
		absence of a common template The concepts are at a very initial stage and is very difficult to make a correct evaluation with the available information	
Feasibility (technical)	Safety certification	<ul style="list-style-type: none"> Some imported products do not certify these products even safety certifications are an essential aspect for a toy. 	The presence of safety experts on the ToyLabs platform ensures that companies have access to professionals that can analyse their products to verify that they meet safety standards.
		<ul style="list-style-type: none"> When companies consult the toy standards, they have problems understanding them 	Safety experts can also advise on safety aspects when a product is being developed.
<i>General</i>	<i>Internal presentation</i> ⁵	<ul style="list-style-type: none"> Companies need to transfer concepts, information generated, etc. in an attractive and effective way 	The A.R. module helps companies to present their new products in an attractive and effective way.
	<i>External presentation - Presentation to clients</i>	<ul style="list-style-type: none"> Commercial departments do not have enough detailed information about the products they are selling 	<i>This detected problem is not covered by ToyLabs</i>

⁵ This is a key activity. It is the moment when a manager decides whether to continue with the development of a product or not. In general, not as much effort is made at this stage as during the design phase; a very well designed product could be presented ineffectively.

2.2.2 Service Identification: Level of Service Implementation in the ToyLabs Platform

The definition of the ToyLabs concept should be linked to the needs, problems and manufacturing process of European toy companies. The manufacturing activities in which toy companies need more support in the pre-production stage are:

- User test,
- Prototype development,
- Product design,
- Idea generation and concept definition

In the pre-production stage, the current ToyLabs proposal provides services for all the previous tasks, except during the idea generation and concept definition phases, which require creative thinking. Even so, the market analysis and social feedback component can contribute towards the generation of ideas, as the obtained analysis can represent the starting point and also facilitate interaction between inventors and manufacturers. In addition, the ToyLabs platform would guide the companies in this process by providing templates and steps to carry out this task.

Regarding User tests, these can be carried out after finding a child expert in the partner-matching component. Furthermore, FabLabs can provide support during the product design process, and the Augmented Reality Module can be used to develop prototypes.

Regarding the production stage, most support is needed in:

- Certification and laboratory,
- Raw material and components buying,
- Supplier management

In the production stage, the current ToyLabs proposal assists in all the previous tasks. Companies that need to meet standards can find safety experts through the Partner Matching Component. Additionally, companies offering raw materials, components and supplier management can be found through the Partner Matching and Negotiation Component.

Concerning the post-production stage, activities which need more support are:

- Advertisement,
- User feedback collection,
- Market evolution,

- Product placement

In the post-production stage, the current ToyLabs proposal assists in gathering user feedback, and can provide information about market evolution. The presence of childhood experts in the field of user behaviour, provides companies with professionals who can detect the appeal of a product and recommend improvements, among other outputs. Services about advertisement or product placement are not considered in the ToyLabs proposal.

2.2.3 Updated Stakeholder Identification & Platform Roles

The Stakeholders included in the final version of the ToyLabs platform are listed in the following table.

PROFILE	DESCRIPTION	VALUE PROPOSITION
Manufacturers	A person, group, or company that owns or runs a manufacturing plant. Companies that are responsible of the whole process of creation a new toy, from its ideation to delivering the toy to the shops	<ul style="list-style-type: none"> • Capacity to produce other people designs, concepts or ideas • Capacity negotiate spaces in the toy stores through their contacts
Inventors	People or companies which offers new toy ideas, concepts or designs usually to manufacturers or distributors	<ul style="list-style-type: none"> • Capacity to create new toy ideas
Childhood experts	Companies or persons which are experts and have the necessary infrastructure to test concepts, designs, prototypes and final products with final users (parents and children usually). The main variables that they use to analyse are: Level of appealing, usability and trend analysis.	<ul style="list-style-type: none"> • Degree of appealing • Degree of usability • Consultancy regarding trend analysis for the generation of new concepts or ideas
Safety experts	People or companies who are experts in analysing and applying all the safety standards which affects to the toy industry	<ul style="list-style-type: none"> • Safety certification and consultancy of concepts, designs, prototypes and final products
Suppliers	Companies which provides the necessary material, components and/ or machinery required by the manufacturers	<ul style="list-style-type: none"> • Mass production • Mould creation • Components • Materials
Distributors	Companies which owns toy stores or specific spaces for selling toys	<ul style="list-style-type: none"> • Deliver the toys to the final users

PROFILE	DESCRIPTION	VALUE PROPOSITION
FabLabs	FabLab is an international concept that started at MIT. The term FabLab is an abbreviation from Fabrication Laboratory and it is defined as: a small-scale workshop offering (personal) digital fabrication.	<ul style="list-style-type: none">• Short series and prototype manufacture

When comparing the previous table with the original one, included in deliverable 1.1, some profiles had been deleted because were considered as a part of other ones. For example, designers and engineers are included as part of FabLab.

3 USERS' REQUIREMENT IDENTIFICATION: FINAL VERSION

In this chapter, the high-level usage scenarios as well as the user requirements for the ToyLabs platform will be described and updated. This chapter will take as input, the scenarios and requirements generated in the previous deliverable (D1.2), coupled with the current state of the platform and the feedback generated from the project's stakeholders and pilots to develop the final version of the user requirements that will largely represent the final ToyLabs solution in redesigning the product development process in the toy industry. In that context, it should be mentioned that most of the requirements listed in the previous deliverable have already been implemented in the platform while others were omitted or slightly changed.

3.1 UPDATED HIGH-LEVEL USAGE SCENARIOS

3.1.1 Toy Manufacturer's Perspective

Toy manufacturer's perspective in ToyLabs is presented with respect to two different high-level usage scenarios that aim to demonstrate how a toy manufacturer can leverage ToyLabs platform for new, advanced, customer-oriented toy designs, accelerating the time needed for them to come from the idea to the market.

The aim of the two different scenarios is to highlight the different starting points from which a toy manufacturer may intend to enter and use the ToyLabs platform. These starting points can be outlined in the following two: (a) a Toy Manufacturer wants to potentially improve an existing toy product and (b) a Toy Manufacturer has an idea for a totally new toy design.

It should be stressed that although the usual case is for a toy manufacturer to be the actual product owner, i.e. the one that also has the initial idea for a new product, this is not restrictive. In fact, any member of the platform, whether that is a Childhood Expert, an End User, a FabLab or someone else can have an idea for a new product. In that case, the partner matching module is used by the person/organisation that has the idea for a new toy in order to search for a toy manufacturer that can support the development of his idea into a product. After the user finds a manufacturer that can fulfil his needs, the two parties sign an agreement that irons out the details for the procedure and the final product. In this case, the process described in the next sub-chapters is fulfilled by the manufacturer under the permission of the main product owner, who monitors the process without however having the responsibility to manage it in the platform.

3.1.1.1 Toy Manufacturer's Usage Scenario #1; Improve Existing Toy Product

A toy manufacturer has realised that one of his toys that recently entered the market has not received the acceptance he was wishing for, so he has to either

withdraw the toy, something that would be really costly and damaging for the manufacturer's brand image, or to find a way to improve the existing toy and make it more appealing to its customers, if there is such an option. He decides that toy's withdrawal should be his last resort before exhausting his other options. Therefore, he goes for the second solution, namely to understand the reasons why the toy didn't manage to be a success and try to improve it.

The toy manufacturer had seen some days ago a promotional post in Facebook about a project, named ToyLabs, that promises to offer a new innovation model realised via an open ICT platform supporting the creativity processes and production cycles of the Toy Industry SMEs. He, thus, decides to give it a try and see if the platform can support him in exploring ways to improve his existing, non-successful toy and in realising the identified toy enhancements throughout the whole process of product development as advertised.

The Toy Manufacturer visits the platform's URL and signs up, following platform's instructions. He fills in the requested information, including company's name, domain, available technologies, etc., and waits for the platform's administrator approval. After his accept as a manufacturer, he signs up and finds himself at the platform's starting dashboard, where he would normally see his active/ ongoing projects and the phase/ stage of product development that each of these products is at. He selects to initiate a new product and he is directed in a following screen, where he is asked to provide a title for the Product and some general information about it (a description, a selection of the product category it belongs, a range of ages it is suitable for, an informational image and any other documents and designs that could be useful for the product).

He, then, may proceed with the "Research" step, according to which the Toy Manufacturer may use the "Market Analysis and Social Feedback" component to get feedback on his old product in question and learn what his customers are saying about it (pros, cons, things to improve etc.). From such a procedure he wishes to realise what problems consumers had with the existing product and design the new product to be developed accordingly. Therefore, he enters the "Social Feedback Analysis" option and to begin with he enters a name for his analysis, in order to be able to come back to it easily in a future time, he selects the social media/web sources that he is interested in searching and he configure the ToyLabs component to search for specific terms related to his existing product. The latter means basically that he may enter specific keywords that should be included or excluded from the analysis, in order for this way to specify and define how mentions on his product under study can be found and retrieved. He may then disables the "influencers' mode", defining that posts only from people deemed as influencers should be considered, since he is mostly interested in his customers' opinion as a whole, instead of what influential people are saying about his existing product. Then, the manufacturer determines the time settings, i.e. the period for the analysis for which social media data will be retrieved

according to the defined settings. Finally, he sees that he also has an option to define his Market Set, namely his competitors' brand name and relevant to his examined product products. He understands that this might help him in understanding what his competitors are better doing in that part and if there are relevant products in the market that are having better appeal and why.

Having concluded with all the Social Feedback Analysis settings, he initialises the "Market Analysis and Social Feedback" component and he finds himself landed in an Analytics Dashboards with various charts and aggregated analytics based on his settings for this analysis. He is able to explore and interact with these charts and he manages to understand that:

- 60% of comments are negative about his product.
- When talking about his product in negative way they also use the words "unsafe", "small", "security" and "edges".
- When talking about one of his competitors' product 65% of the comments are positive, combined with the words "soft", "safe" and "joy".
- On January, there was a 30% increase in the times his product was referenced.

The manufacturer found these insights quite alarming and he now has an idea how to proceed to improve his product and launch a better, enhanced version of it. He, therefore, has a meeting with the design team of his manufacturing company and they conclude in a new high-level design for their product that they believe it addresses the existing, identified issues. The manufacturer enters again in the ToyLabs platform, now in the "Design" stage, and uploads his new design. The design includes also an initial thought about the packaging for the final product which is also crucial in order to catch the attention of a demanding audience, that of children, ensuring safety. The manufacturer's idea about the new, improved toy encompasses, though, new technologies for its production and being a small toy manufacturer he does not have the necessary competencies to proceed with that. He realises that the ToyLabs platform gives him the solution to that too. Being in the "Design" phase, he enters the ToyLabs "Partner Matching and Negotiation" component and searches for FabLabs that may have the competencies he is searching for. A message appears informing him that he may either make an "Open Request" for a FabLab specifying his requirements or he may search himself filtering the results based on the FabLab's capabilities, skills, available equipment and materials used as well as location and qualifications/certifications. He proceeds with the 2nd option, the platform brings him back 5 different options of FabLabs and he decides to proceed with 2 of them that also have slightly better results and they conform to all his requirements. It needs to be noted that to protect the manufacturer from copyright infringement concerning his idea, stakeholders that enter the "Partner Matching and Negotiation" component will be required to sign a confidentiality agreement that will ensure that no information about the design/idea of the manufacturer is leaked. That, combined with the agreement that

every stakeholder will have to agree to when he signs up to the platform will ensure that there will be no information leakage outside of the platform.

In order for the manufacturer to proceed with the two chosen FabLabs, he makes a request for collaboration through the platform. He has chosen two different FabLabs located in other countries, since he is interested in also making different localised versions of his toy to further provide an innovative, attractive toy. The FabLabs respond quickly accepting the offer and therefore the partners sign a confidentiality agreement in order to safeguard the manufacturer's intellectual property and agree upon the terms of their collaboration (cost, time for prototype completion, quality and materials used). After the terms are agreed and all the legal documents exchanged, the manufacturer consider the FabLabs to be trusted members of the development process that can give recommendations on technical issues and related comments on the design. In other words, this is the point at which the manufacturer shares the whole design and toy idea. At this point, it must be mentioned that the whole procedure will be closed and not visible to members of the platform that the manufacturer does not cooperate with currently, unless he decides to do so in specific steps in which he might need more open feedback.

When the technical characteristics of the design are finalised with the help of the FabLabs, the manufacturer contacts safety/environmental experts for another round of feedback concerning both the product and the packaging. To contact safety/environmental experts, the manufacturer will once more use the "Partner Matching and Negotiation" component. As in the previous case when the manufacturer was searching for FabLabs, he can either make an Open Request or search himself providing his requirements to filter the results. He, now, decides to just make an "Open Request", since he does not need a Safety Expert with particular expertise, but a trustful one that is available the next days. After a while, several Safety Experts contact him requesting the contract and much like before, the manufacturer scrolls through each of the profiles and decides on the Safety Experts that he wants to collaborate with.

At this point, the safety experts provide safety recommendations based on their experience and international standards so that the toy's design can be considered safe for the age group that it is intended for. Moreover, environmental experts provide recommendations related to the toy's and the package's environmental implications that can affect, among others, the construction material and the manufacturing process.

After the above stages are complete, the design is finalised and the manufacturer requests from FabLabs to proceed with the "Prototype" phase, i.e. prototyping based on the materials and processes that were agreed upon during the previous stages. The FabLabs create the prototypes that in order to create the desired "look and feel" and provide the best approximation to the final product, they enhance the prototypes

with AR through ToyLabs “Augmented Reality Feedback” component. That means that after the prototype's construction, the manufacturer can immediately have a close-to-real 3D design of his product which he can then send to Safety/Environmental experts, but most importantly to end-users for a second round of feedback. In that respect, the Safety Experts pre-certify the prototype or provide further recommendations for ensuring compliance with EU standards, while the environmental experts provide technical advice and manufacturer-specific recommendations regarding the reduction of the environmental impact of the toy to be produced. After some back and forth communication between the manufacturer and the experts the prototype is approved.

At this point, the manufacturer through the “Partner Matching and Negotiation” component contacts Child Experts and through them also end-users in order to create focus groups that will interact with the toy prototype and provide advice about its appeal and ways to potentially improve it. In order to also provide incentives for their participation, the manufacturer announces that free samples of the final product will be given as a gift to those participating in the focus groups providing recommendations along with discount coupons on all of his products.

The actual focus group meetings may be organised (depending on the location) either by the Fablab(s), the Safety Experts or the Manufacturer himself. Therefore, the manufacturer decides to organise 3 different focus group meetings, one in his offices and the other 2 on the locations of the two FabLabs. The Child Experts and the children engaged in the focus groups seem enthusiastic about the new toy, so a very good, first impression for the product by its potential end users is gained. The main outcome of these focus groups was that localised versions of the toy may render the new toy even more appealing.

At this point, the manufacturer has the final prototype and he is ready to proceed with the latter stages of product development (production, commercialisation). Having the prototype, the manufacturer now proceeds to a sample production (Pre-series Production) of the final product that is made of the actual material that will be used later for mass-production. When the batch is ready, the manufacturer, collaborating with the FabLabs, organises again focus groups consisting of childhood experts for another round of feedback, concerning the operational assessment of the product. When this phase is complete, then another round of Safety/Environmental Assessment (on the final product and the localised versions) takes place. Finally, the manufacturer with the help of Childhood Experts organises focus groups with end-users (i.e. children). In that cases, children playing with the newly produced toy provide indirectly feedback that can be used later during the product's commercialisation. What is noteworthy during the last phase of the product development process is that feedback is gathered (through the ToyLabs platform) even after the product is ready for market.

The production cycle has now been finalised and the new toy is ready for commercialisation. The manufacturer is very glad of this service because he feels that feedback from various stakeholders in very different stages of production has been effectively analysed and incorporated to lead to an improved final product that has all potentials for a really successful entrance in the market. ToyLabs platform's role, however, has not ended; the platform retains a static page for commercialisation purposes of the new toy, in which the manufacturer can advertise his product and provide a link for his website.

3.1.1.2 Toy Manufacturer's Usage Scenario #2; Proceed with a new idea about a toy design

According to the previous scenario in 3.1.1.1, the same toy manufacturer that is now a member of the ToyLabs platform, has an idea about a new toy. Being really satisfied with the results from his previous experience with the ToyLabs platform, he decides to use the ToyLabs platform once again, but now with the purpose of launching a totally new toy and acquire useful multi-stakeholder feedback for his idea and also find partners to support him on its implementation. He, thus, logs in into the platform and he is landed in a page where he can see his ongoing projects and the stage of product development that each project is at. He selects the option that allows him to create a new project.

Being at the first stage of the ToyLabs process for new product development, the "Concept" stage, he enters a brief description about his new idea and provides any relevant material. He quickly proceeds, though, to the next stage, the "Research" stage, in order to gain a quick view of how people are currently responding to similar products or to similar concepts, if there are no similar products. As a result, he enters the ToyLabs "Market Analysis and Social Feedback" component and he configures it appropriately (time settings, social media sources to be used, keywords of interest, enabling of influencers mode, etc.) as was the case in the 1st scenario (3.1.1.1). However, he has now chosen the option of "Market Trends Analysis", since he does not need social feedback on his products and his competitors' products, but more of an insight on current and future trends in the toy industry, relevant with the domain his new idea falls into. The "Market Trends Analysis" option has also opened up a new option in the "settings"; the concept definition. Reading carefully the instructions the platform provides on that, he understands that he can "define" the toy domain and concept his new idea represents using a combination of words, forming a ToyLabs concept. He can create different concepts of interest and the platform will then provide him with analytics on these concepts and the appeal and crowd perception on them (i.e. crowd sentiment on them, timeline of relevant posts, etc.), other words that are frequently encountered along with these concepts and a comparison among them. He, also, sees that there is an option to specify "parameters", under which his concepts will be analysed and compared. The manufacturer is interested in exploring materials

that can be used for the implementation of his new, toy design idea. The manufacturer, thus, proceeds with that in order to gain insights on whether his idea has the potential to be successful. Exploring and interacting with the analytics and the visualisations, he realises that his idea, as this was described in the form of a combination of words forming a ToyLabs concept, has the potential to be really successful in the market. He also sees that it is frequently encountered with certain materials, some of which he didn't know that they could be used for such a toy. It is also frequently encountered with certain other words that he initially cannot see how they can be of any value for him. These words though along with a more extensive exploration of the analysis report made him think of certain, innovative features he can use to further improve his initial idea and also new materials to use for its implementation. Unfortunately, though, he does not have the capacity and competencies to proceed with the prototypes development using such materials. This fact does not bring him into any discomfort since he has collaborated before with FabLabs having such expertise and he knows that he can again contact them through ToyLabs and the ToyLabs "Partner Matching and Negotiation" component in particular to collaborate again to collaboratively refine, develop and bring this new idea into reality.

The following steps does not differentiate significantly from the ones described analytically in the previous scenario, in section 3.1.1.1, so there is no need to further present this scenario.

3.1.2 Fablab's Perspective

A FabLab learned about ToyLabs from other FabLabs participating in it and found in an interesting business opportunity to expand its fields of interests and expertise by supporting toy manufacturers in the design and prototyping of their products. The FabLab representative signs up for the first time into the ToyLabs platform and he is requested to edit its organisation's profile (name, address, description, url, etc.) and he also specifies that the organisation is a FabLab and provides analytical information including its technical expertise, the technologies they are using and the production techniques they can support. The FabLab representative after the configuration of his organisation, finds himself in a page where he can explore all "Open Requests" for collaboration by organisations/individuals that have a toy design idea. He, however, finds no offer appealing and he logs out of the platform for the time being.

Two days later, the FabLab representative receives an email by the ToyLabs platform informing him that a toy manufacturer has a request for collaboration for him. The FabLab representative logs in into the platform and reads about the details of the offer. He finds the offer quite good this time and he believes that the FabLab may respond well to its demands. The FabLab representative informs his colleagues and they decide to go on with this project, so they respond to the toy manufacturer and

they send him a financial offer he agrees upon and they sign a confidentiality agreement so that the information exchanged between them is legally protected.

Then the procedure follows as presented in detail in the first scenario under Toy Manufacturer's perspective, in section 3.1.1.1. In brief, the manufacturer sends the FabLab the design of the product in 3D format using the ToyLabs "Augmented Reality Feedback" component. The FabLab, using its expertise provides feedback on the parts of the design it disagrees with. After some back and forth communication between the manufacturer and the FabLab the design is finalized from a technical standpoint. That means that the two parties have agreed about the final version of the design as well as the materials and techniques used for the prototype.

In this context, the FabLab can now proceed with the prototype of the requested design. Moreover, using ToyLabs "Augmented Reality Feedback" component, the FabLab uses Augmented Reality on top of the prototype and sends a 3D representation of the prototype to the manufacturer. An exchange of feedback follows once more until the prototype is finalized. Having the final prototype, the FabLab can now leverage its contacts to support feedback gathering from Security & Childhood experts in its region. Finally, after that feedback is collected, the need for localized versions of the toy is assessed. The manufacturer decides to proceed with the creation of localized versions of the toy and the FabLab is responsible for building the new prototypes. At this point, its role in the toy development process ends.

It needs to be noted that this is not the only role envisaged for a FabLab in the platform. FabLabs can be product owners as well, meaning that a FabLab may design a new toy, prototype it and proceed by searching for a toy manufacturer that can mass produce this toy for the FabLab. In particular, since the FabLab has the expertise to handle the design and prototyping phases it will only use the "Partner Matching and Negotiation" component to locate Safety/environmental experts to provide their feedback for the prototype and a factory owner that can handle mass production. That means that in the ToyLabs platform, toy manufacturers can also act as providers of their factory's equipment for purposes of mass producing products that do not belong to the toy manufacturer.

3.1.3 Safety Expert's Perspective

An individual Safety Expert has learned from a conference he participated about the ToyLabs project and the role of Safety Experts in the toy development process this project proposes. Being a freelancer, he decides to give it a try as a new, business opportunity. So, he visits the platform and signs up, filling in all the information required (company name, role, certifications, etc.) and soon enough he is a member of the ToyLabs platform.

To find a potential collaboration opportunity, the safety expert visits the “Open Call” section of the “Partner Matching and Negotiation” component, he filters the results based on his profile and finds some projects relevant to his expertise. He sends a message through the platform to the manufacturer declaring his interest in participating on the project. He also attaches a financial offer and describes the services that he can offer to the manufacturer. After some back and forth communication the manufacturer and the safety expert agree to collaborate and they sign a confidentiality agreement to legally protect the project’s information.

The Safety Expert first enters the process during the prototyping phase, where he receives prototype of the toy to be produced enhanced with Augmented Reality. He, thus, offers his advice and feedback concerning safety matters based on his experience and official EU safety standards. After studying the prototype, he realised that some parts of the toy design may need some further thought as they might be dangerous for children of a certain age. One of his advices is that the manufacturer should avoid having detachable small parts in the toy because the age group that the product is intended for is very young. He then sends his feedback to the manufacturer and the FabLab and agrees with them on a possible solution. The FabLab then creates another prototype and sends it back for more safety testing. When the prototype conforms to safety standards the role of the safety expert at this phase is complete. Nevertheless, he remains in open communication with the rest of the stakeholders throughout the rest of the process.

The second part where the intervention of Safety Experts is required is at the “Production” stage. As mentioned above, when the manufacturer has the final prototype he creates a sample production of the final product, which unlike the prototype is built using the actual material that was agreed for the product. At this point the safety expert is called again to provide feedback for the final product. He, unfortunately, happens to find a safety flaw in the final product and so the process should go back to the prototyping phase and repeat the aforementioned steps, until the sample production of the final product conforms to the safety standards as reflected by the engaged Safety Expert. At this last step, the safety expert still has some want-to-have feedback for improving the toy design. These feedback does not oblige to go back and repeat the previous stages and so this feedback is saved in the platform to be used in another development cycle that will have the purpose of creating an improved version of the current toy.

3.2 UPDATED GENERALISED REQUIREMENTS & PHASES

In this chapter the updated user requirements for the ToyLabs platform will be listed and explained. This chapter builds on the elicited requirements of the previous deliverable (D1.2), taking into account the current state of the platform, feedback from the pilots and other members of the consortium, changes in the project’s concept and

methodology etc. In other words, this chapter aims to showcase the final user requirements that will largely represent the final ToyLabs solution. In this context, some of the older requirements in D1.2 will be subtracted (those that do not fit the updated scope of the project's solution) and some new (or updated) ones will be defined. The structure of this chapter is as follows:

First, the three key components of the platform (Trend Analysis and Social Feedback component, Partner Matching module, Augmented Reality module) will be presented along with their final key features as they can be currently seen in the platform. Following that, the updated phases of new product development will be presented along with the key user requirements for each phase.

3.2.1 Market Analysis & Social Feedback Component

3.2.1.1 General Description

The “Market Analysis & Social Feedback” component is one of the three key components of the ToyLabs platform, that is intended to give the product owner an easy-to-use tool that will provide him with insights - through various, intuitive charts- on market trends for his domain of interest and on customers' satisfaction and dissatisfaction on specific topics (either products/toys or brands) and as a result on their brand perception, campaign efficiency and competitors' position in the market.

In the scope of the ToyLabs platform, this component is used mainly in the “Research” stage to help the product owner uncover the public opinion about a product/idea. In that view, Market Analysis & Social Feedback component user will configure it appropriately with his settings in order to be provided with an analysis report and an interactive dashboard that will support him in validating the potential of a toy product or toy design idea.

3.2.1.2 Main Features/Stakeholder

The “Market Analysis & Social Feedback” component is mainly addressed towards the product owner, which is the one that has the idea about a new product and wants to further explore it with regard to social media.

In that view, the **product owner** should be able:

- A. To log in to the “Market Analysis & Social Feedback” component with his credentials;
- B. To control who can view and cannot view his analysis reports;
- C. To easily configure the settings for his analysis (e.g. time, social media sources, keywords to be used, etc.);

- D. To acquire social feedback on specified by the manufacturer products and brands (his brand along with his competitors brands);
- E. To explore visual analytics and gain insights on how trends are being generated in web and social media in the toy industry and specifically the product owner's domain of interest;
- F. To interact with the analytics and draw useful conclusions on emerging market trends for the product owner's toy domain of interest that may serve, combined with his experience, as recommendations and initial, raw ideas about future toy designs;
- G. To explore comparative visual graphs about the product owner's market position (as reflected by both the number and semantics of mentions in web) in comparison with his competitors' position.

Other stakeholders of the ToyLabs platform such as manufacturers (when they are not product owners), FabLabs and Safety/Environmental/Childhood experts should be able:

- A. To view a saved analysis report if the product owner has declared it public or if the stakeholder belongs to the same organisation and the product owner has provided access to it;
- B. To also use the "Market Analysis & Social Feedback" component for their interests if they are certified members of the ToyLabs platform and want to use the platform for the development of a new product/toy.

3.2.2 Partner Matching & Negotiation Component

3.2.2.1 General Description

The Partner Matching & Negotiation (PMN) component is a tool that can be used by users to inquire about collaborators, inside the ToyLabs Platform, allowing them to set up formal partnerships that will lead to collaborative design and development of products. In more detail, the PMN component is responsible for handling a handful of operations that range from partner searching to matchmaking between different platform users, enabling specific collaboration opportunities. The module will work by applying sophisticated criteria, and proposing the right stakeholders for the specific strategic needs of the user in question. The partner matching process, much like the trends analysis process can be repeated as many times as necessary, thus helping the user find the right partners in a timely and cost-effective manner.

3.2.2.2 Main Features/ Stakeholder

As the development of the platform is in its final stage, the features/requirements listed here represent the final form of the PMN component. Specifically, a **product owner** (usually a manufacturer) should be able to:

- A. Enter and initialise the PMN component with his credentials in specific stages of the development
- B. Seek for potential collaborators for new or existing designs/prototypes of a given product
- C. See a list of collaborators suggested by partners he already works with
- D. Search for a collaborator by providing the name of a specific company/organisation
- E. Search for a collaborator by defining specific criteria (table 3-1), that were defined in previous deliverables in the context of the partner matching methodology, and get a list of potential collaborators
- F. Review all available information on the profile of each potential collaborator
- G. Initiate a negotiation session and discuss terms through a secure messaging system
- H. Exchange files such as technical documents, financial offers, NDA agreements etc.
- I. Accept or decline a potential collaboration
- J. Exchange and safely store the contract that defines the agreement terms
- K. View a timestamp of all activities (in the context of a collaboration)
- L. Evaluate a partner based on a rating system after the collaboration ends

Partner Artefact Blueprint		Toy Artefact Blueprint
<i>Partnering Organisation Blueprint</i>		<i>Partnering Individual Blueprint</i>
Partner Type: o Manufacturer o FabLab o Experts' company	Partner Type: o Safety Expert o Environmental Expert o Childhood Expert o TSIG Member	Artifact Type: o Idea/Concept o Design o Prototype
Toy Category: o Dolls & soft-filled toys o Construction toys and puzzles o Activity toys	Area of Expertise: o Safety o Quality o Environment o Children Toys o Electronics	Toy Category: o Dolls & soft-filled toys o Construction toys and puzzles o Activity toys
Company Contact Information	Expert Contact Information	ToyLabs Methodology Phase (i.e. Immersion, Design, etc.)
Locations and Facilities	Location	Artifact Version No.
Technical Competencies / Capabilities & Related Equipment Properties:	Previous Experience	Technical Requirements

<ul style="list-style-type: none"> o 3D Printing o 3D Scanning o CAE/FEM & Structural Analysis Simulation o Circuit Production o CNC Milling 	<ul style="list-style-type: none"> o Inkjet Printing o Knitting Machine o Laser Cutting o Mould Casting o Plastic Transformation 	<ul style="list-style-type: none"> o Sewing Machine o Soldering Station o Vacuum Forming o Vinyl Cutting 		
Certifications Awarded			Expert Certifications: <ul style="list-style-type: none"> o Safety Certifications o Toy Awards 	Material Requirements
Products/Services			Acting as Representative of: <ul style="list-style-type: none"> o Educators/Schools o Families o End users 	Time and Cost Requirements
Qualifications Possessed: <ul style="list-style-type: none"> o Novelty / Innovation (e.g. patents) o Usability o Durability 			Costs of the Tests	Safety & environmental compliance requirements
<ul style="list-style-type: none"> o Accuracy o Productivity o Reputation 				
Economic Criteria (i.e. man-hour cost, product pricelist, way of charging, etc.)				Customisation Parameters: <ul style="list-style-type: none"> o Text o Look o Style o Other
SLAs undertaken (e.g. terms and conditions, IPR, reward, capacity / availability, etc.)				Related Open Issues

Table 3-1: Partner & Toy Artefact Blueprint

Other stakeholders of the ToyLabs platform such as manufacturers (when they are not product owners), FabLabs and Safety/Environmental/Childhood experts should be able to:

- A. Receive notifications for potential collaboration opportunities
- B. Negotiate terms and exchange documents with the product owner
- C. Accept or decline a collaboration proposal
- D. View all privately-shared data regarding a toy under development when introduced as a collaborator to the development process of said toy
- E. Provide feedback on a specific design/prototype

3.2.3 Augmented Reality Module

3.2.3.1 General Description

The Augmented Reality Feedback Component (ARF Component or ARFC) is a tool used by end user that allows responsive and interactive presentation of 3D models with advanced capabilities. The main goal of this tool is to obtain feedback and related recommendations for improving new product designs. The ARFC will use 3 different

modules: Questionnaire Creation to obtain feedback from user, Augmented Reality System for model presentation (rotation, modifying parameters like color, textures, etc.) and Voting System used to know specific features on an AR model on mobile devices.

3.2.3.2 Main Features/Stakeholder

Regarding the Augmented Reality (AR) module, a product owner should be able to:

- A. Create, describe and upload an AR model to a design/prototype for getting feedback on that asset
- B. Accompany the AR model with a simple questionnaire for the AR user
- C. Provide or deny access to the AR models page for a design/prototype
- D. View an overview that includes number of downloads, average rating and number of comments received for an AR model
- E. View a page with the full analysis of an AR model, including ratings for each question of the questionnaire, detailed comments etc.

On the other hand, end users (providers of feedback), FabLabs and experts should be able to:

- A. Initiate the AR module through the ToyLabs mobile app
- B. See a list of AR models belonging to:
 - Public products
 - Public designs or prototypes
 - Their own products (or their organisations')
 - Designs or prototypes they are collaborating on
- C. Sort the list by title, average rating and date
- D. View the details of an AR model, download it or delete it
- E. Activate the AR camera (e.g. the phone camera) and place the model anywhere in the screen
- F. Manipulate controls of the AR model
- G. Rate the model through a questionnaire and leave a comment

3.2.4 ToyLabs Platform

The ToyLabs Core Platform is the main infrastructure that powers the ToyLabs platform and is the host environment for all other sub-components to be integrated. In the previous deliverable, the main requirements requested from the overall ToyLabs platform which are handled by the TCP have been identified and presented. Following the development of the platform and based on the feedback received by the project partners, the main supported operations list has been expanded in order to include

presentation and management of products (either completed or under development) which are characterised by their owners as public projects.

As a result, regarding the TCP, a user (regardless of his role) should be able to:

- Browse the platform even if he has not registered to the platform yet
- Register/Log In via password, Google+ or Facebook
- Edit his/her profile
- Select the organisation that he is a member of
- Fill out information in his organisation profile
- Manage his organisation (accept/decline members etc.)
- Participate in an organisation
- Browse ToyLabs public product page
- Communicate with various stakeholders and members of the platform via a messaging system
- Provide feedback to public products
- Initiate a toy development process
- Request the construction of a prototype from a FabLab
- Manage his product at the various stages of the development
- Manage his product's design at the various stages of the development
- Manage his product's prototype at the various stages of the development
- Manage the AR models of his product by adding questionnaires, providing access etc.
- Provide feedback to a product's design if he has access
- Provide feedback to a product's prototype if he has access
- Provide feedback to a design's/prototype's AR model if he has access
- Fill basic information about his product
- Initiate the manufacturing of a product when the development process is complete
- Monitor a product and the development process
- Browse public projects
- View public designs
- View public prototypes
- Request/ Grant access to non-public elements of public projects

The above bullets encompass the basic requirements for the ToyLabs platform and its added value components. In the next sub-chapters, these requirements will be split according to the different phases of the toy development process, as it is realised via the ToyLabs platform.

3.2.5 ToyLabs Updated Phases

This sub-chapter includes the updated phases for a new product development process in the ToyLabs platform as well as the updated requirements for each phase. The main changes compared to the previous deliverable is that the “Immersion and Concept definition” phase has been split into two different phases, those of “Concept” and “Research” that will be explained in greater detail in the following sub-chapter. Moreover, the “Feasibility Study and IPR check” phase, which was an optional phase has been subtracted because it was considered more optimal to handle such matters between collaborators privately through the platform’s messaging tool. The “Market” phase has also been subtracted, given that the platform will not act as an online marketplace. Finally, it should be mentioned that in the phases where one or more of the platform’s modules are available, their full functionality will be offered to the platform users (as described in the previous sub-chapters) and will not be repeated in full detail in the following sub-chapters given that the user requirements in the context of the platform modules have been fully explained previously.

3.2.5.1 Concept

The Concept stage is the first phase in ToyLabs’ methodology for new product development in the toy industry. It includes the initial description of the toy to be developed and gives the product owner the ability to provide a title and description, toy category, age groups and additional files and documents among others. When this procedure is completed, the product owner is able to save the product information and proceed to the Research phase. It should be mentioned that the above information can be edited at any point of the toy development process.

Specifically, in this stage the product owner will be able to:

- A. Initiate a new product development process
- B. Provide a title and description for the toy
- C. Select the toy category among a list of different toy categories
- D. Provide the toy’s suitable ages
- E. Select the product owner between himself and his organisation
- F. Select if the product will be public or not
- G. Upload informational images concerning the product (if the product is public so are the images)
- H. Upload design and documents (these remain private even if the product is public)
- I. View the basic product information
- J. Update the basic product information

3.2.5.2 Research

The second phase of ToyLabs toy development process is Research. In this phase, the product owner, having filled the basic information about his concept, is

given the ability to gather relevant information from social media and online channels, analyse it and visualize it. The purpose of this procedure is to provide the product owner with the knowledge that will let him know if his idea is viable, how relevant toys faired in the past as well as gather people's feedback about the concept/domain/appearance etc. of his new idea for a toy. This is achieved via the Market Analysis and Social Feedback component, the functionality of which was described in a previous sub-chapter. In this chapter, the specific user requirements for the research phase as well as the Market Analysis and Social Feedback tool in the context of this phase will be described.

Specifically, a platform user in the Research phase should be able to:

- A. Initiate the Market Trends and Social Feedback component
- B. View previous analyses created for this specific toy
- C. Choose between a Market Trends and Social feedback analysis and provide a name for that analysis
- D. Provide the words, phrases and hashtags to be used as search terms
- E. Choose the data sources to be used for the analysis between Twitter, Facebook and blogs
- F. Choose to activate influencer mode. If influencer mode is activated only designated influencer data sources will be used for the analysis
- G. Select the time period that will be used for the analysis
- H. Provide specific meaningful concepts of interest (e.g. baby dolls) and parameters (e.g. colour, material) that will be presented and formulate the visualisations accordingly in order to be provided with useful and meaningful information customized to each user's needs.
- I. Edit the above parameters of the analysis at any point of the process
- J. View the analysis visualisations and comment on them

3.2.5.3 Design

The third phase of new toy development in the ToyLabs platform is Design. In this phase, the product owner is able to upload designs for his new product. The product owner is able to upload multiple designs for a single product, update them (in which case the previous design version is archived) or archive them. In this phase, the product owner is also able to take advantage of the Partner Matching module to find potential partners and the Augmented Reality module to upload an AR model of the design and have end-users interact with it. Specifically, the Partner Matching module can be used to find FabLabs, experts or other stakeholders that can help in the development of the product design, provide feedback and safety/environmental recommendations so that the final design is the best possible. Moreover, the Augmented Reality module can be used in this phase by end users via the ToyLabs

mobile application to observe the new toy in a virtual space and provide recommendations and ratings via a questionnaire attached to the AR model.

Specifically, in this phase a product owner should be able to:

- A. Add a design for a specific product
- B. Provide a title and a description for the design
- C. Make the design public
- D. Add images and documents
- E. Edit the design information
- F. Add an AR model for the design
- G. Create a new version of a design. In that case the old version is archived and can no longer be edited, just viewed.
- H. Search for collaborators for a design using the Partner Matching module
- I. See an overview of collaborators on a specific design
- J. See an overview of all feedback received for a specific design
- K. Archive the design
- L. Proceed to prototype creation for a specific design

3.2.5.4 Prototype

The fourth phase of new toy development in the ToyLabs platform is Prototype. In this phase, the product owner is able to develop a prototype for each design version of the product. That does not mean that the product owner is limited to a single prototype but rather a single prototype per design version. In other words, the product owner may very well choose to develop multiple prototypes for different designs and see which one suits him best. Given that this procedure will be handled by FabLabs that are able to handle short series manufacturing and prototyping much more effectively, the product owner will not be burdened by over the top prototype costs. Apart from FabLabs, the product owner can also search for experts that can provide safety and environmental recommendations for the prototype and groups of end users that will provide recommendations via the AR module much like the case of the Design phase.

In other words, in the Prototype phase the product owner should be able to:

- A. Create a prototype
- B. Provide a title and a description for said prototype
- C. Make the prototype public
- D. Add relevant images and documents
- E. Edit the basic prototype information
- F. Add an AR model for a prototype version
- G. Search for collaborators for a prototype using the Partner Matching module
- H. See an overview of collaborators on a specific prototype

- I. See an overview of all feedback received on a specific prototype
- J. Archive the prototype
- K. Move the prototype to the production phase

3.2.5.5 Production

Production is the last phase of a new product development in the ToyLabs platform following the Prototype phase. Before entering the production phase, the product owner must decide on the prototype that will be used for the final production of the toy. Given that production is handled internally by the manufacturer and that no more feedback is needed for the toy's concept, design and prototype the platform does not offer any additional functionalities in this phase. However, following production, the product owner will be able to evaluate his collaborators, view all the stages that led to the production and use the platform's dissemination channels to showcase his product.

4 CONCLUSIONS & LESSONS LEARNT

Part A of the present deliverable was responsible for providing the updates for the project concept and general requirements as well as for the high-level usage scenarios and user specific requirements concerning the ToyLabs platform. In the previous deliverable (D1.2), the initial usage scenarios and user requirements were described. In the following months, the project concept was updated as well as the user requirements and much of the platform's functionalities through technical meetings with the project's partners and feedback from the pilots. As a result, the user requirements listed in this deliverable largely represent the ToyLabs platform as it stand now, which is close to being complete. Specifically, the features of the three modules (Market Analysis & Social Feedback, partner Matching, Augmented Reality) became more specific and the different phases of new toy development were slightly changed to become more compact and efficient.

As a result, it can be concluded that the initial requirements were a great starting step that led to more specific requirements in the context of this deliverable. The project's concept was sufficiently updated to become more representative of the specific problems of the toy industry as well as the final solution of the project. Many of the problems identified in the context of D1.1 were addressed adequately to help toy industry stakeholders overcome barriers and limitations of the industry with co-creation and open innovation playing a key role in the final solution. It should be mentioned, that the ToyLabs platform does not claim to solve all of the problems that the toy industry is facing today. What was managed however, was to address the challenges relevant to the project's concept and expand the concept where necessary to provide toy industry SMEs with a holistic cooperative platform that can help them gain greater added value from their collaborations, speed up their processes, overcome common challenges and produce products of greater quality more cost-effectively.

PART B: UPDATED VALIDATION FRAMEWORK & KPIS

5 INTRODUCTION

5.1 PURPOSE AND SCOPE

This part of the deliverable is responsible for the updated definition of the ToyLabs validation framework and the criteria and performance indicators that will be used to measure the impact of the project in solving the problems identified in EU's toy manufacturing sector. In the context of this deliverable, the ECOGRAI method, which was selected as the most suitable validation framework for the project will be updated to take into account the latest developments in the platform and the feedback generated by the pilots. Taking this feedback into consideration, the KPIs that were defined in the previous deliverable will be quantified with specific goals that the consortium views as achievable in the context of the project.

5.2 STRUCTURE OF THE DELIVERABLE

Part B of this deliverable is structured in three simple chapters that provide the updated information regarding the project's validation framework and the specific objectives, success criteria and key performance indicators that will be used to evaluate the final solution.

Chapter 5 is the introduction to the document. It begins by mentioning the objectives of the deliverable and also includes the structure of the document and its relation to the other deliverables of the project.

Chapter 6 includes updates to ToyLabs validation framework and its specific objectives and KPIs.

Finally, chapter 7 includes the conclusions of the work performed in the previous chapters and the next steps that will be undertaken concerning the platform's evaluation.

5.3 RELATION TO OTHER TOYLABS WPS AND TASKS

This part of the deliverable takes as input, the validation framework and KPIs that were defined in the context of D1.2. The scope of this deliverable is to provide any updates to the frameworks and KPIs so that they can be used for the evaluation of the project's final solution. Moreover, during experimentation in WP5 the criteria and performance indicators described in this deliverable are collected and in T5.4 are interpreted to assess the research success and the innovation impact of the project.

6 TOYLABS UPDATED VALIDATION FRAMEWORK

In the previous deliverable (D1.2), an overview of different validation frameworks was given, the different methodologies were categorized and ECOGRAI was selected as the most suitable for the evaluation of the ToyLabs platform. In this chapter, a brief description of ECOGRAI will be given followed by the small updates in the different phases of ECOGRAI. However, the main objective of the present chapter is to provide quantifiable goals for the Key Performance Indicators that will be used to evaluate the system after the completion of the pilots and its success in achieving the goals that were set during the project.

6.1 ECOGRAI TO TOYLABS

The ECOGRAI method is considered a great tool that can help validate the project's results. However, it includes a lot of steps and is better suited for projects of large duration (>30 months). For the ToyLabs application, a simplified version of ECOGRAI is used, since the project is relatively small in duration and as a result, the method used for performance measurement should be simpler and less time consuming to implement. As a result, a modified version of ECOGRAI was described, with only three phases distilled from the ECOGRAI method in order to facilitate the application, and to adapt to the size of the trials and the duration of the project.

First Phase: Description of the system in which the performance indicators will be defined. Specifically, the following need to be determined:

- The elements that compose the system and the relations between these elements.
- The functions that allow the achievement of the objectives.
- The processes that support the dynamic transformations.
- The boundary that delimits the elements not belonging to the system.
- The dynamic of evolution of the system, particularly in the case of evolution from "AS IS" to "TO BE".
- The objectives assigned to the system.

Second Phase: According to the objectives of the system, the owner determines the potential actions in order to reach these objectives (called Decision Variables (DV) or Action Variables (AV)).

The **Third Phase** is responsible for defining the performance indicators that characterize the reaching of the objectives by using the DV/AV.

The implementation of the above steps in the ToyLabs project is given below:

Phase 1- Description of the system:

Elements of the System:

1) ToyLabs roles and stakeholders:

- a. Product Owners (Manufacturers, Inventors, Designers, FabLabs, User Experts)
- b. Toy Manufacturers
- c. FabLabs
- d. Safety/Environmental Experts/Lawyers
- e. Childhood Experts
- f. Market Representatives (Marketers, Researchers, Distributors)
- g. End Users
- h. Visitors

2) Platform Components/Modules

- a. ToyLabs Platform
- b. Market Analytics and Trends Analysis Component
- c. Partner Matching and Negotiation Module
- d. Augmented Reality Module

Functions and Processes

- New product development in the toy industry based on the pillars of co-creation and open innovation
 - Definition of the concept for a new toy
 - Identification of market trends and social feedback on the concept
 - Design of a new product
 - Prototype Manufacturing
 - Production of the final product

Dynamic Evolution of the System

- A web platform is being developed (the platform development is currently in its final stages) that will offer the capability to develop a new product and guide the product owner through every phase of new product development. The platform will rely heavily on the pillars of collaboration between all the stakeholders who will provide feedback and valuable insights to the process.

Boundary of the system

- The external stakeholders (partners, customers, etc.). In other words, the stakeholders that lie outside of the system's boundary are those that do not participate in any way in the platform's procedures for new product development and are also not active in the platform's other functionalities such as liking projects, giving feedback etc. However, it is difficult to exclude specific stakeholder groups

from the platform, given that the ToyLabs solution relies heavily on collaboration and stakeholder participation.

Objectives of TOYLABS

1. Manufacturer Objectives
 - a. Increased quality of final product
 - b. Reduction of issues related to the various stages of new product development
 - c. Increased opportunities for quality collaboration relationships
 - d. Reduction of time/cost for the design of a new product
 - e. Reduction of problems related to the design of a new product (design details, safety issues etc.) by receiving early feedback from collaborating organisations
 - f. Reduction of time/cost for prototype manufacturing
 - g. Increased quality of constructed prototype
 - h. New commercialisation opportunities through the platform's dissemination and social media channels
 - i. Protection of Intellectual Property Rights
 - j. Better organisational tools for improving the toy development process
2. FabLabs Objectives
 - a. Expand their customer network
 - b. Increase their potential collaboration opportunities regardless of geographical barriers
3. Expert Objectives
 - a. Expand their customer network
 - b. Increase their potential collaboration opportunities regardless of geographical barriers
 - c. Expand their range of services by participating to more stages of new product development
4. End-User Objectives
 - a. Have a meaningful participation in the toy development process
 - b. Receive incentives/prizes for participating
 - c. Be able to post ideas and comments for products

Phase 2: Definition of AV/DV, constraints and criteria:

AV/DV:

- To implement the ToyLabs platform in new product development
- To adopt the technologies related to the platform's basic modules

Criteria:

- Quality
- Time
- Cost
- Safety
- Collaboration

Phase 3: Updated KPIs

The table below takes as input the KPIs defined in the previous deliverable and provides quantifiable targets for each of them.

#	Performance Indicator	Description	Related Stakeholders	Quantification
1	Time-to-market	Lead time between the idea of the new product and the date of commercialization to the customer	Manufacturer	50% reduction
1.1	Market analysis time	Time it takes to perform a market analysis for a specific concept/idea using the platform's functionalities	Manufacturer	20-40% reduction
1.2	Time to design new product	Lead time between the start of the Design stage and the date of completion	Manufacturer	5-10% reduction
1.3	Time to construct the prototype	Lead time between the start of the Prototyping stage and the date of completion	Manufacturer	5-15% reduction
1.4	Time to find a collaborator	Lead time between a member of the platform realizing he has need of a partner and him finding the right partner	Manufacturer, FabLabs, Experts	10-30% reduction
1.5	Inquiry/feedback response time	Lead time between a partner asking for an inquiry/feedback and the response by the partner to whom the inquiry was intended	Manufacturer, FabLabs, Experts	Around 30% reduction

1.6	Time for data exchange	Time it takes for a partner to download/receive the necessary data for a specific project	Manufacturer, FabLabs, Experts	Around 30% reduction
1.7	Number of iterations in the quoting process	Number of cycles between the stakeholders to achieve the final version of the quotation	Manufacturer, FabLabs, Experts	Increased by 1-3
2	Cost for new product development	Cost for the entire process of new product development	Manufacturer	10-20% reduction
2.1	Market Analysis cost	Cost for performing market analysis	Manufacturer	100% reduction (free)
2.2	Design cost	Cost for designing a new product	Manufacturer	5-10% reduction
2.3	Prototype cost	Cost for constructing the prototype	Manufacturer	10-20% reduction
2.4	Operation margin	Reduction in the cost of the project management, by allowing remote participation	Manufacturer	5-10% reduction
3	Quality of the entire process	Overall quality of the final product and its intermediary stages	Manufacturer, FabLabs, Experts, End-Users	5-10% quality improvement
3.1	Number of issues	Number of issues/problems that appear throughout the whole process	Manufacturer	20-30% reduction
3.2	Average rating of the ToyLabs Platform	Average rating of the platform that is carried out through the platform's rating system	Manufacturer, FabLabs, Experts, End-Users	3-4/5
3.3	FabLabs Quality of Service	Mean rating of that	FabLabs	3-4/5

		participate in the platform		
3.4	Experts Quality of Service	Mean rating of experts that participate in the platform	Experts	3-4/5
4	Safety Levels	Number of safety standards performed on the design/ prototype/ product	Manufacturer	100%
5	Level of participation of stakeholders (apart from the manufacturer)	Mean number of partners participating in new product development process	Manufacturer, FabLabs, Experts, End-Users	3-6
5.1	Number of ideas	Number of ideas posted by customers for new products/product	End Users	5-10
5.2	Number of comments on toys	Number of comments when a manufacturer turns the visibility of a product on and asks for feedback	Manufacturer	>30
5.3	Number of stakeholders answering a request	Number of people/organisations that answer a manufacturer's call for collaboration	Manufacturer, FabLabs, Experts	5-10 (depending on the request)
5.4	Number of new collaborations	Number of clients that a FabLab/expert receives through the platform	FabLab, Experts	20-30% increase (relative to current collaborations)
5.5	Number of services partner	Number of services performed by a partner throughout a product development process	Manufacturer, FabLabs, Experts	2-5 (depending on the partner)

7 CONCLUSIONS & NEXT STEPS

Part B of the present deliverable was responsible for providing an update in the project's validation framework which is based in ECOGRAI. Given that the shorter version of ECOGRAI (first described in D1.2) is still considered sufficient for evaluation purposes, the aim of the present deliverable was to update specific elements in the different phases of the methodology. Updates in the first phases are minor because the project's stakeholders, objectives and platform components did not undergo major changes in the course of the project. The main contribution of this deliverable is the provision of quantifiable targets to the Key Performance Indicators that will be used with the completion of the pilots to evaluate the platform's success in redesigning new product development processes in the toy industry.