GREEN-LOOP

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GREEN-LOOP

Sustainable manufacture systems towards novel bio-based materials

WP7 – Business Model, Replication and Exploitation

D7.7 – Risk Analysis Report

Version 1.0

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Consortium	17 organizations. 15 EU Member States + 2 non-EU state

GREEN LOOP Consortium Partners

	Partner	Acronym	Country
1	IDENER RESEARCH & DEVELOPMENT	IDE	ES
2	NATIONAL INSTITUTE OF CHEMISTRY	NIC	SI
3	SLOVENIAN NATIONAL BUILDING AND CIVIL E. I.	ZAG	SI
4	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	FHF	DE
5	LABRENTA SRL	LBRT	IT
6	MIXCYCLING SRL	MYX	IT
7	NERO SU BIANCO	NSB	IT
8	GERACE MARIA CRISTINA - TERRE DI ZOE’	TDZ	IT
9	IRIS TECHNOLOGY SOLUTIONS, SOCIEDAD LIMITADA	IRIS	ES
10	GLOWNY INSTYTUT GORNICTWA	GIG	PL
11	AACHEN UNIVERISTY: PROCESS CONTROL ENGINEERING / AACHEN UNIVERISTY: INSTITUTE OF SOCIOLOGY	AAU	DE
12	AUSTRIAN STANDARDS INTERNATIONAL	ASI	AT
13	INSTITUTO DE SOLDADURA E QUALIDADE	ISQ	PT
14	AXIA INNOVATION UG	AXIA	DE
15	ASOCIACIÓN DE INVESTIGACIÓN METALÚRGICA DEL NOROESTE	AIMEN	ES
16	NATIONAL COMPOSITE CENTER	NCC	UK
17	UNIVERSITY OF BRISTOL	UBRIS	UK

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Executive Summary

In the current dynamic market environment, innovation plays a pivotal role in driving growth and sustainability in businesses. Nevertheless, innovation is often followed by risks, and a lack of proper risk management can lead to failure. That is why it is crucial to develop a risk management strategy to assess risk for the key exploitable results (KERs) and of the companies that will embrace new processes/products in their portfolio ensuring that obstacles are identified and will be properly monitored and handled. Effective risk management not only increases the chances of successful project outcomes but also contributes to the long-term success of GREEN-LOOP partners and future exploitation goals.

By conducting an exhaustive risk assessment, businesses can identify potential risks and barriers that could hinder the successful commercialization of their innovations. This information can then be used to develop a comprehensive risk and mitigation plan, prioritizing actions to eliminate or reduce risks. Effective risk management not only enhances the probability of successful project outcomes but also contributes to the long-term success and viability of the entire consortium.

This Deliverable D7.7 Risk analysis report discusses the importance of risk management principles in mitigating the effects of risk on business innovation within the context of GREEN-LOOP technologies.

As part of Task 7.3 Innovation Management, AXIA conducted a risk analysis of the Key exploitable results to identify those critical factors that impact project development and prioritize actions to eliminate potential risks. The assessment approach provides an overview of the risks affecting different areas of the project developments (partnership, IPR, technological, financial, market, and environmental risks) and mitigation actions to ensure the realization and exploitability of results. Evaluating the global overview of the project, KER risks will result in a customized plan for an effective exploitation strategy. Furthermore, a risk analysis for new business was also performed to analyse the main risks that a company can encounter when including a new activity within its own business. In summary, risk assessment is a critical component of project assessment and effective business exploitation planning. The use of these techniques facilitates the identification of potential risks on time, ensuring the success of the project.

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Abbreviations

KER	Key Exploitable Result
K#	KER and the respective number
VC	Value Chain
NTP	Non-thermal Plasma
WC	Wood Composite
WP	Work Package
GA	Grant Agreement

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1. Introduction

GREEN-LOOP is designing novel, bio-derived materials solutions that utilize a progressive circular-business approach, allowing the generation of novel production methods, augmentations in energy efficiency and sustainable operation for value chains (VC). Through the project, three innovative bio-based materials and components will be structured and optimized targeting sectors such as structure, packaging, food and beverage, appliances and tooling; these are multifunctional panels exhibiting fire protection, bioplastic bottle caps for oil and juice, and wood composites bearings for injection machinery.

Risk assessment is a critical step in the development of any new, innovative product. By performing a thorough risk assessment, companies can be prepared against potential risks that may arise during the development process. This includes evaluating factors such as technological feasibilities, market economics, legal and regulatory requirements, usage scenarios, and customer expectations. A complete risk assessment can help companies avoid potential obstacles and adequately prepare for the launch of their product. In the end, risk assessment can help ensure the successful market penetration of any new product and ultimately contribute to the company's overall success.

The GREEN-LOOP risk assessment was conducted using two analyses which consider two different risk perspectives. The first analysis involved discovering the potential risks and conditions that can affect the achievement and utilization of the project's main outcomes. The second analysis identifies the risks posed to the companies and institutions members of the consortium, when GREEN-LOOP innovative technologies are included within their operations.

In the first case, the analysis was developed for each Key Exploitable Result (KER) and consisted of the following steps: i) identification of the KERs risks for each value chain, ii) risk classification based on the importance and probability of the risk happening, iii) prioritization of the risks in accordance with the success of potential interventions. AXIA identified the most significant risks connected to each KER with the help of relevant partners and prioritized them. Subsequently, a risk mitigation strategy was defined. This analysis helped to identify, prioritize, and eliminate potential risks for the development of the main technologies. Factors such as partnership risks, technological risks, market risks, IPR risks, financial risks, and environmental risks and their link with each value chain were taken into consideration to define the final mitigation strategy.

Each KER was analysed individually contemplating the six before-mentioned risk areas. After the KERs grouping, KERs belonging to the same groups were analysed collectively, and the most critical ones were prioritized to determine the need for further actions. In general, there were five risks within both the wood composite value chain and the software and service group that were found to require significant attention and revaluation. These risks were characterized as high-risk, indicating a significant level of importance and/or likelihood of occurrence, while the actions currently planned were deemed insufficient to mitigate the risks adequately. On the other hand, for the bio-rubber and bio-plastic value chains, the risks obtained

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lower scores, and the actions being implemented effectively mitigate the risks, reducing their likelihood of occurrence.

To complete the assessment, a second analysis was performed to identify the risks associated with the new business. Also, in this case, a questionnaire was distributed to the partners to collect information fundamental to performing the analysis. This was conducted for the commercial-oriented organizations and companies involved in the project. The outcome revealed that the identified risks are under control, but some common aspects were detected after the analysis such as the risk to have a low volume production, low market differentiation and high competitiveness along with the low costumers' engagement. Some mitigation actions were proposed for each company including both market search and competitive analysis which are foreseen also as main tasks within WP7 and can be used to further support the partners in the mitigation of the identified risks.

2. GREEN-LOOP KERs

As reported in Deliverable 7.3 Exploitation Plan, the partners have already identified the KERs and their relative involvement. The list included in D7.3 was updated and redefined based on new outcomes and findings. The same was done for the Groups. The updated list is included in Table 1.

Table 1. Key Exploitable Results in GREEN-LOOP project

	WP	VC	KER number	Short Title of KER	Type of Exploitable Result	Main Partner Involved
GROUP 1: Software and services	WP2	all	KER 1	GREEN-LOOP Platform for Value Chain optimization	Software	IDENER
	WP2	all	KER 4	Contribution to standardization	Services	ASI
	WP1	all	KER 6	Data acquisition system	Software	IRIS
GROUP 2: Bio-Rubber	WP3	VC1	KER 5	Ultrasound enhancement for biomaterial manufacturing process	Processes	IRIS
	WP3	VC1	KER 11	Novel compositions for bio-rubber pads with lignin additives for fire-resistant and vibrational applications (rubber functionalization + lignin extraction)	Processes	UBRIS (50%), NIC (50%)
	WP3	VC1	KER 13	Novel manufacturing for bio-rubber pads with lignin additives	Products	NCC
GROUP 3: Bio-plastic	WP4	VC2	KER 9	Novel drying, and milling based on non-thermal plasma for treating vegetal residues from agro-industrial supply chains as filler for thermoplastic carriers	Processes	MYX
	WP4	VC2	KER 2	Non-intrusive microwave enhancement for moulding injection	Processes	IDENER
	WP4	VC2	KER 10	Disruptive injection moulding process for bio-plastic bottle closures production.	Processes	LBRT

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Group 4: Wood Composite	WP5	VC3	KER 7	Disruptive extrusion process for small series production of WC-based sliding bearings	Processes	FHF
	WP5	VC3	KER 8	Adapted non-destructive quality control method for WC samples and components	Processes	FHF
	WP5	VC3	KER 3	Microwave curing system for the extrusion process	Processes	IDENER
	WP5	VC3	KER 12	Design Innovative Wood Composite sliding bearing systems	Products	NCC

By far 13 KERs were identified, including the main technologies developed within the three value chains. A step further was to correlate the KERs to the VCs to which they belong. This step was fundamental to identifying the relation among the actors of the value chains and the related risks.

GROUP 1 (K1, K4 and K6) is the one related to the software and services. These KERs don't relate to one Value Chain but to all of them. GROUP 2 (K5, K11 and K13) includes the KERs related to VC1 from lignin extraction, rubber functionalization and final product compounding. GROUP 3 (K9, K2, K10) includes the KERs related to the second value chain, from raw material preparation, enhancing, extrusion and caps production. Group 4 (K7, K8, K3, K12) includes the VC3 processes starting with the preparation of wood fibres and the compounding of extrusions and the production of sliding bearings.

2.1 GREEN-LOOP Value Chain and KERs

Asa already mentioned, GREEN-LOOP is introducing a brand-new set of bio-based material solutions, rooted in a circular style of business viewpoint. This will foster the invention of novel production strategies, energy savings, and sustainable supply chains. The purpose, as mentioned before, is to design and optimize three distinct bio-based materials and components for industrial sectors like construction, packaging, food and beverage, appliances and tooling.

The next paragraphs explain briefly the three value chains, the main role of the actors involved, and the positioning of the KERs within the value chains.

GREEN-LOOP Value Chain 1 - Multifunctional rubber panels for the construction sector

Figure 1 demonstrates the entire value chain for the production of bio pads, from raw materials to end-of-life management, as well as the main companies and users involved. The process begins with the pretreatment of Kraft lignin and the lignin extraction, conducted by KEMIJSKI Institute (NIC) in collaboration with IRIS, which uses ultrasound technology to enhance the material properties. Additionally, recycled tyres are devulcanized through an ultrasound-assisted chemical process by UBRIS. After this step, a compounding

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process, hot compression, and final machining are carried out by NCC to form the bio pads. Finally, the product is packed and delivered to construction companies (e.g., ZAG) for end-use. NIC and UBRIS indicated as the main result, the production of a novel material composition for the rubber pads (K11), and they contribute to the optimization of a methodology for the extraction of lignin from kraft lignin and the rubber functionalization respectively. IRIS will contribute to enhancing the lignin extraction process thanks to the ultrasound technique (K5). Within this value chain, NCC claimed the ownership of the K13 related to the final production of the rubber pads.

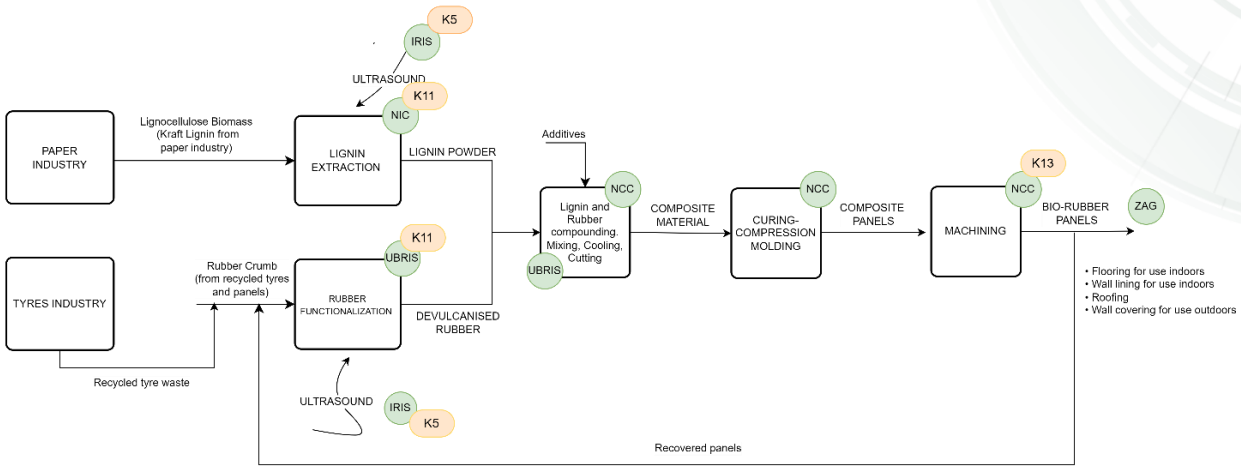

Figure 1. GREEN-LOOP Value Chain 1 - Multifunctional rubber panels for the construction sector

GREEN-LOOP Value Chain 2 - Bottle closure for the food and beverage sector

The value chain for bottles and packaging for the beverage sector involves the progression from raw materials to end-of-life management as seen in Figure 2. Several entities, including the final user of the product, are present in this chain. Vegetal residues, specifically natural fibres, are treated through NTP (Non-thermal-plasma) technology and mixed with a polymer carrier to create granules suitable for the production of caps. These resulting caps are used by the beverage and food industries (TDZ) and are then packaged and sent to their respective destinations. Natural fibers are ideal for industrial uses due to their biodegradability, cost-effectiveness, gradual strength, malleability, and ease of accessibility.

The main actors involved in the value chain are Mixcycling (MYX), Idener (IDE) Labrenta (LBRT) and Le Terre di Zoè (TDZ) as final users of the caps. MYX claimed as the main exploitable result of the innovative process used for the treatment of vegetable residues that are then used as filler for the thermoplastic carriers (K9). IDENER instead will implement a microwave enhancement (pre-heating) of the injection moulding process to improve the properties of the material (K2). LABRENTA will finally produce the caps thanks to their innovative methodology of injection moulding (K10).

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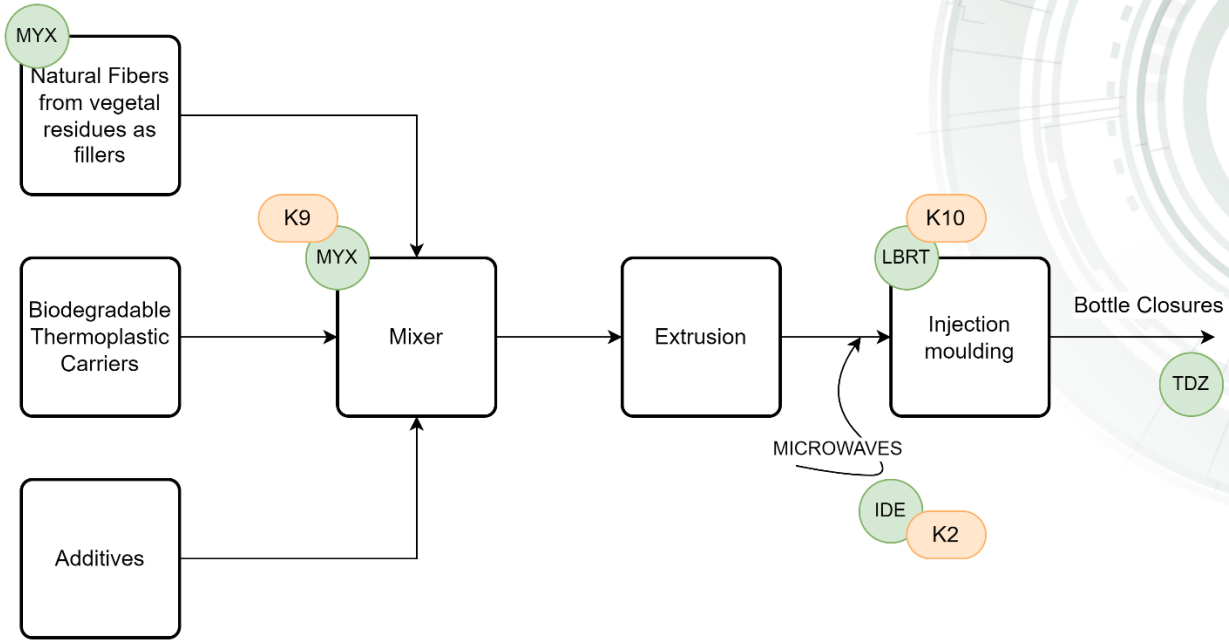

Figure 2 GREEN-LOOP Value Chain 2 - Bottle closure for the food and beverage sector

GREEN-LOOP Value Chain 3- Wood composites bearings for the tool and appliance sector

This project involves the manufacture of wood composite bearings for the appliance industry. The process consists of mixing the raw materials comprising of wood fibres, lignin (blender) and natural graphite (filler) which will then be extruded with a screw extruder and processed through a linden kneader machine to produce chopped polymer filaments. This material is then moulded, compressed, and machined to produce the finished sliding bearing. The properties of the material will be enhanced during the extrusion process with the addition of microwave curing. Figure 3 displays the block diagram of the project.

The main actors involved in the third value chain are the Fraunhofer Institute (FHF), Idener (IDE), NCC and the final user Labrenta (LBRT). Wood fibres are mixed with Bio-additives and Graphite and then extruded by FHF. The final product is formulated through compression moulding by NCC and then machined to produce the wood slide bearings that will be tested by Labrenta.

Regarding the Key Exploitable Results, FHF claimed K7 and K8 which are related to the development of the disrupting extrusion process and the method for the quality control of the wood composite samples respectively. IDE is responsible for K3 related to the microwave enhancement of the extrusion process, while NCC owns K12 related to the manufacture of the final product.

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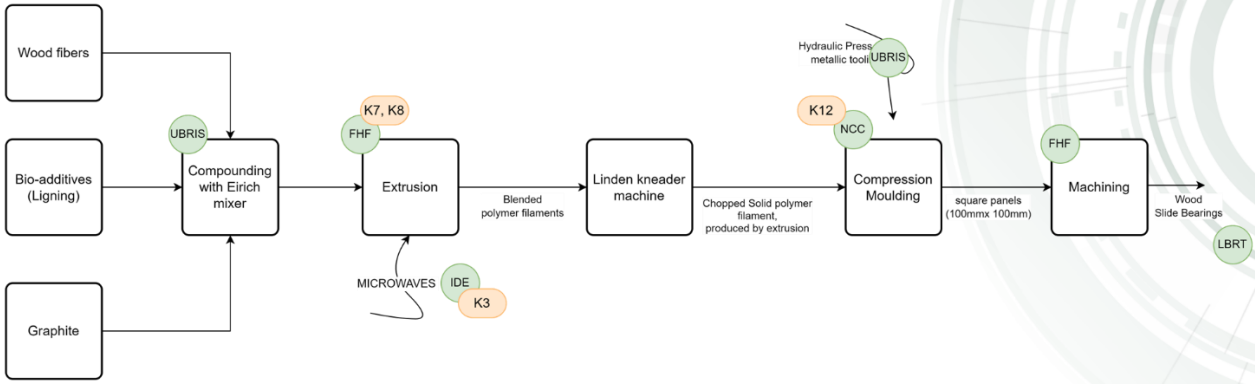

Figure 3. GREEN-LOOP Value Chain 3- Wood composites bearings for the tool and appliance sector

The exploration of the concept of KERs and their associations with value chains, which was supported by the partners, was essential for the risk assessment that will follow.

3. KERs Risk Assessment

In the previous sections, the Key Exploitable results and their connection with the three value chains were introduced. This section highlights the critical role that an effective risk analysis assessment plays in ensuring a successful implementation of the key exploitable result. In particular, it includes a comprehensive overview of the risk management process and the importance of a risk analysis assessment to boost the exploitation of the project´s results.

3.1 KERs Risk Assessment Methodology

To guarantee the successful execution of the exploitation of the Key Results, a methodological approach was employed to evaluate and classify the KERs' risks. This approach included identifying and prioritising the associated risks and offering indications of the problem areas that need to be addressed. The methodology encompassed the following factors:

- Key Exploitable Result identification (*covered in the previous section*)
- Relation with the GREEN-LOOP Value Chains (*covered in the previous section*)
- Degree of the importance of the risk related to the final achievement of this KER
- Probability of risk occurring
- Risk grade
- Scope and type of potential intervention
- Feasibility / Success of Intervention
- Priority Level

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Based on this approach a questionnaire was developed and distributed to the partners to collect the inputs related to their KERs.

In the first step of the risk analysis, the identification and evaluation of risks were conducted. The risks were divided into 6 categories: i) Partnership risks, ii) Technological risks iii) Market risks iv) IPR risks, v) Financial risks, and vi) Environmental risks. For each category, a list of possible risks was identified and suggested to the partners as supporting material for the analysis of their use case.

Subsequently, the risks were classified according to their "Degree of Importance" to the final outcome (1= low; 10= high) and the "Probability" of them happening (1= low; 10= high). The mathematical product of these two values determines the "Risk Grade" of the examined risk factor.

$$R = P \times I \quad (1)$$

Where:

- R = Risk Grade
- P = Probability of risk happening (1-10)
- I = Degree of importance (1-10)

Once the risk was identified, the partners were asked to express a "Potential Intervention Action" for each KER to mitigate the risk and associate it with a "Feasibility/Success of Intervention" score (1= low; 10= high). Using the following equations, the mathematical product of the "Risk Grade" and the "Feasibility/Success of Intervention" gives the "Priority Level" [1]

$$PL = R \times F \quad (2)$$

Where:

- R = Risk Grade
- PL = Priority Level
- F = Feasibility of Intervention

AXIA conducted a thorough review of the risks identified by each partner and compared them with the technical risk tables developed within WP3, WP4, and WP5. The risks that were included in both, AXIA 's form and the technical risk table, were merged and renamed. The highest level of importance and probability and

[1] Methodology for Industrial Exploitation & take-up. Deliverable 2.2 of the FOCUS project funded under the Union's Horizon 2020 research and innovation programme GA No: 637090. Available at: www.focusonfof.eu/results.asp

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the lowest success of the intervention were assigned to these risks, assuming the worst-case scenario. Furthermore, since some risk categories were not included by the partners, AXIA encompassed them, considering some literature reviews of similar businesses and information from the GA. This extensive work is available in Annex 1.

By plotting these data (Risk Grade and Feasibility/Success of intervention) in a scatter graph, a Priority Level Map was created, with each quadrant providing guidelines on how to effectively manage the project KERs´ risks in order to reach an optimal outcome:

i. **No Action (low-risk grade, high success of intervention)**: The risk has no influence on the exploitation of the result
ii. **Control (low-risk grade, low success of intervention):** Periodical monitoring of the risk is required
iii. **Action (high-risk grade, high success of intervention)**: Intervention and implementation of contingency plans
iv. **Warning (high-risk grade, low success of intervention)**: Critical factors

For the sake of simplicity, the following nomenclature was used to name each category on the map:

- Partnership Risk Factors: PRF#
- Technical Risk Factors: TRF#
- Market Risk Factors: MRF#
- IPR Risk Factors: IPRRF#
- Financial Risk Factor: FRF#
- Environmental Risk Factor: ERF#

In the following section, the Priority Level Map for each KER will be analysed, giving main attention to the risks included in the warning and action quadrant, since these are the ones that require more attention.

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3.2 Risk Analysis per Group and mitigation actions

In this section, the priority level maps related to each KER are reported, listing them in each belonging group.

3.2.1 Group 1: Software and Service

Risk priority map KER 1

IDENER has identified a total of seven risks for the KER1 titled "GREEN-LOOP Platform for Value Chain Optimization", with each risk field adequately addressed. For further information, please refer to Figure 4, which provides a more detailed overview of these risks.

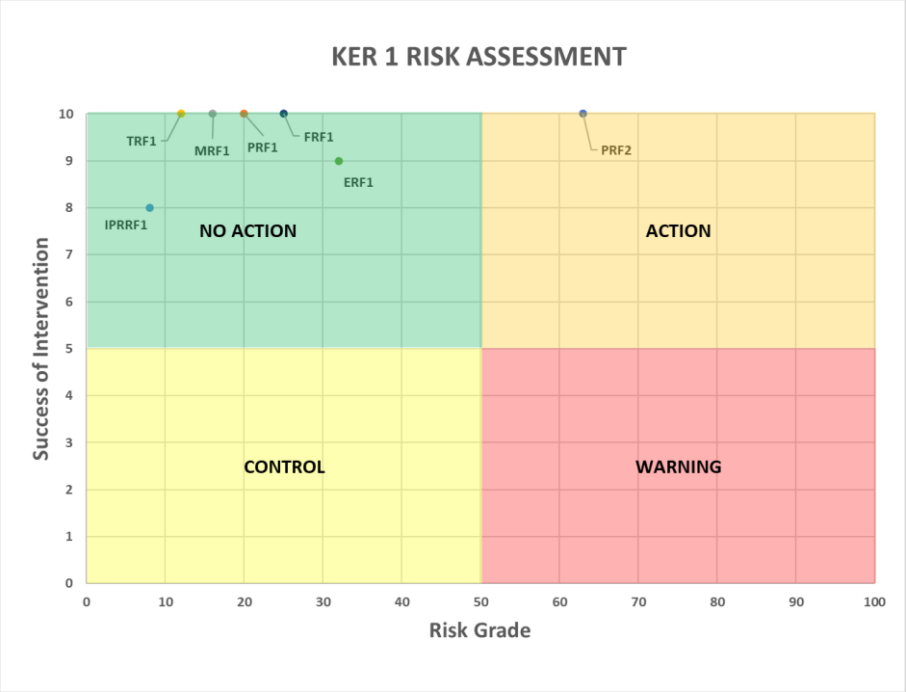

Figure 4. Risk priority map KER 1

The highest risks to remark are included in Table 2.

Table 2. KER1 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
PRF2	Disagreement about the disclosure of data required for the analysis	63
ERF1	LCA results are different from what expected	32

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The risk with the highest grade, placed in the "Action" quadrant, is PRF2. This risk refers to the potential failure to obtain the desired data due to disagreements with partners. IDENER has classified this risk as highly important and likely to occur. The mitigation action proposed by IDENER consists in securing the data system and providing access only to the owner. However, the actions outlined to mitigate this risk are expected to be highly efficient, and a heightened level of control and adherence to the ongoing actions are required.

Another notable risk is ERF1, which is related to the Life Cycle Assessment (LCA) that does not produce the desired results. Along with the other five risks, it falls within the "No Action" quadrant, as they possess lower risk grades and effective actions. However, this risk showed the highest *Risk Grade* among the six risks, due to the high degree of importance score as shown in Figure 4. In general, these risks are under control and do not require additional actions.

Risk priority map KER 4

A total of 3 risks were detected by ASI for the KER “Contribution to standardization”, two for partnership and one in the IPR as depicted in Figure 5.

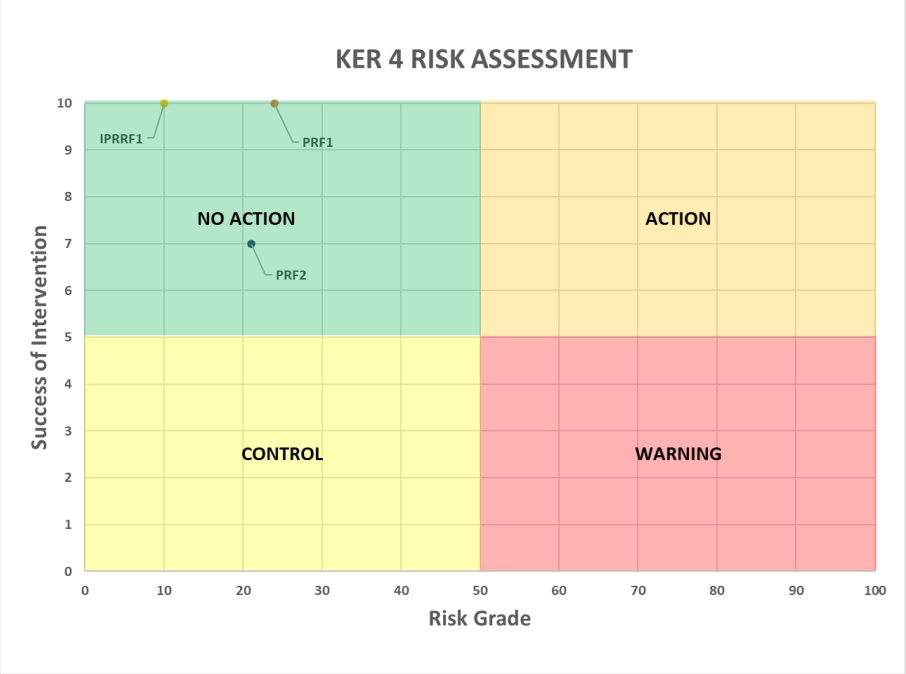

Figure 5. Risk priority map KER 4

The risk with the highest *Risk Grade* is included in Table 3.

Table 3. KER4 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
PRF1	Project partners don't identify standardization gaps and/or don't contribute to surveys/questionnaires, drafting of the proposal for a new standard(s)	24

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All the risks associated with this KER have been assigned scores below 25, indicating that they are relatively unimportant and/or unlikely to occur. Moreover, these risks have a high probability of successful intervention actions. As a result, they are effectively managed and do not require any further actions.

Risk priority map KER 6

In relation to this KER "Data acquisition system", IRIS has identified a total of 5 risks. AXIA identified and added another risk within the IPR category to provide a holistic overview of the potential obstacles that arise also from this part. The risk map is shown in Figure 6.

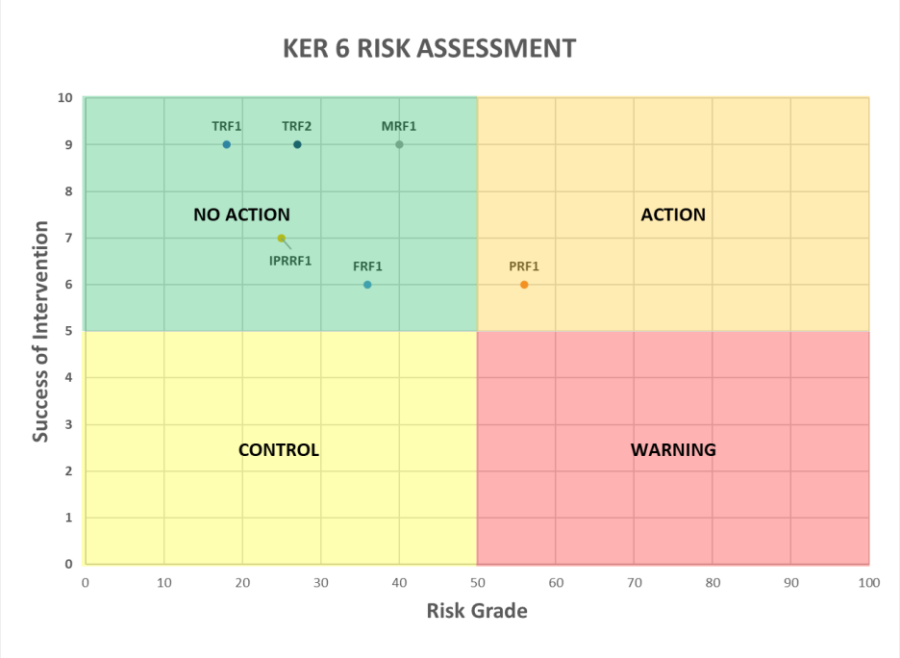

Figure 6. Risk priority map KER 6

The risks with the highest *Risks Grade* are included in Table 4

Table 4. KER 6 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
PRF1	Disagreement on the disclosure of data	56
MRF1	High market competitiveness	40
FRF1	High infrastructure costs	36

The risk with the highest grade, positioned in the "Action" quadrant, is PRF1. This risk revolves around the potential failure to obtain desired data due to disagreements with partners. IRIS has assigned a high level of

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importance to this risk, with a probability of occurrence. The success score for the intervention actions is rated medium and consists of periodic meetings and information exchange. However, the rate of the intervention indicates that this risk carries significant implications. Therefore, it is advisable to implement further actions and maintain constant control over them.

Additionally, there are other notable risks, namely MRF1 and FRF1, which are associated with low market acceptance compared to other similar existing technologies and the high final cost of the data system. However, these risks, along with the other two, fall into the "No Action" quadrant because of their lower risk grades and the effectiveness of the implemented actions.

General Group Overview:

Within the software and service group, the partnership field presents greater risks, particularly concerning disagreements regarding the disclosure of data necessary for analysis. This concern is prevalent in both KER 1 and KER 6, where data serve as the primary resource to enhance all value chains. Consequently, it is advisable to maintain regular monitoring of ongoing actions to ensure that the risk remains within manageable limits.

3.2.2 Group 2: Bio-rubber value chain

Risk priority map KER 5

A total of 5 risks were identified by IRIS for the KER “Ultrasound enhancement for biomaterial manufacturing process”, having 3 risks in the technological area, 1 for each financial and market field. With AXIA´s knowledge, other two risks in the partnership and one in the IPR factor were detected. The overall map can be visualised in Figure 7.

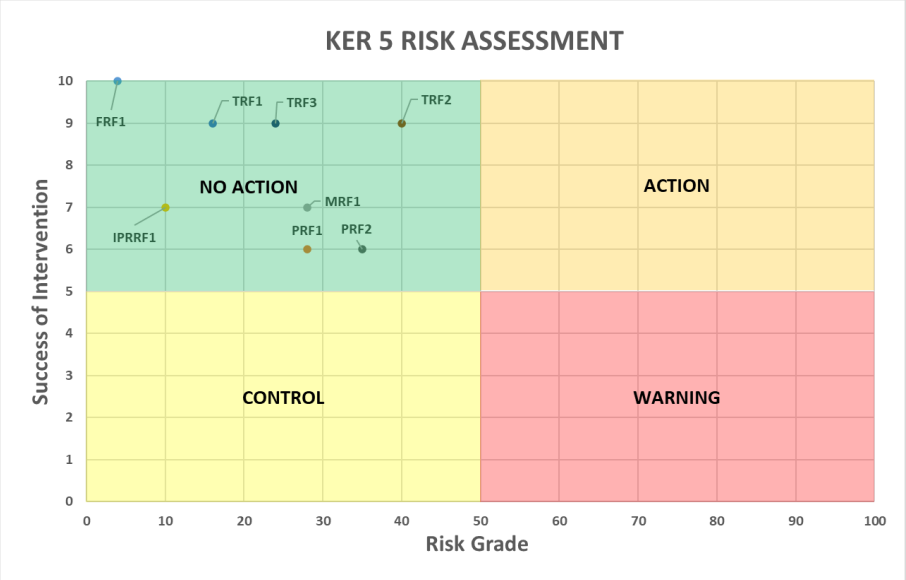

Figure 7. Risk priority map KER 5

Despite being too early to estimate a price and gauge the market's response, an analysis from a market standpoint was elaborated taking into consideration the production costs, which is represented as MRF1 in Figure 7.

The risks with the highest *Risks Grade* are included in Table 5.

Table 5. KER 5 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
TRF2	The smart manufacturing process does not guarantee the desired performances for the Lignin extraction	40
PRF2	Disagreement in complying with the requirements for the rubber functionalization (with UBRIS)	35
PRF1	Disagreement in complying with the requirements for the lignin powder (with NIC)	28
MRF1	Production costs are not competitive	28
TRF3	The smart manufacturing process does not guarantee the desired performances for the Rubber functionalization	24

TRF2 had the highest risk grade, which is associated with the challenge of achieving satisfactory performance when incorporating ultrasound technology in the processes of lignin extraction. Based on the recent updates from the WP3, it has been observed that the application of ultrasound technology has not yielded significant improvements in lignin so far. However, IRIS intends to continue conducting additional tests and exploring further possibilities. As for the improvement of the rubber functionalization, these tests have not begun yet. TRF3 include the risk associated with rubber functionalization with ultrasound enhancement. Consequently, it is advisable to take the necessary steps to address possible future problems.

An important risk worth emphasizing is PRF2, which pertains to the partnership dynamics between UBRIS and IRIS. Since UBRIS is a non-EU partner from the UK, there may be a greater risk of communication gaps due to regulatory requirements. Another risk related to the partnership field is PRF1, which includes the partnership relationship between IRIS and NIC. Nonetheless, these risks are in the “No Action” quadrant because they have been successfully mitigated, which means they are in control and do not require additional measures.

Risk priority map KER 11

In relation to this KER, “Novel compositions for bio-rubber pads with lignin additives for fire-resistant and vibrational applications (Rubber Functionalization + Lignin Extraction)”, a total of 10 risks were identified by UBRIS, NIC and AXIA, who helped to consider other factors based on their business-related experience. Five of the risks fall under the technological category, two under financial, one in the IPR, one within the partnership and one within the environmental field as shown in Figure 8.

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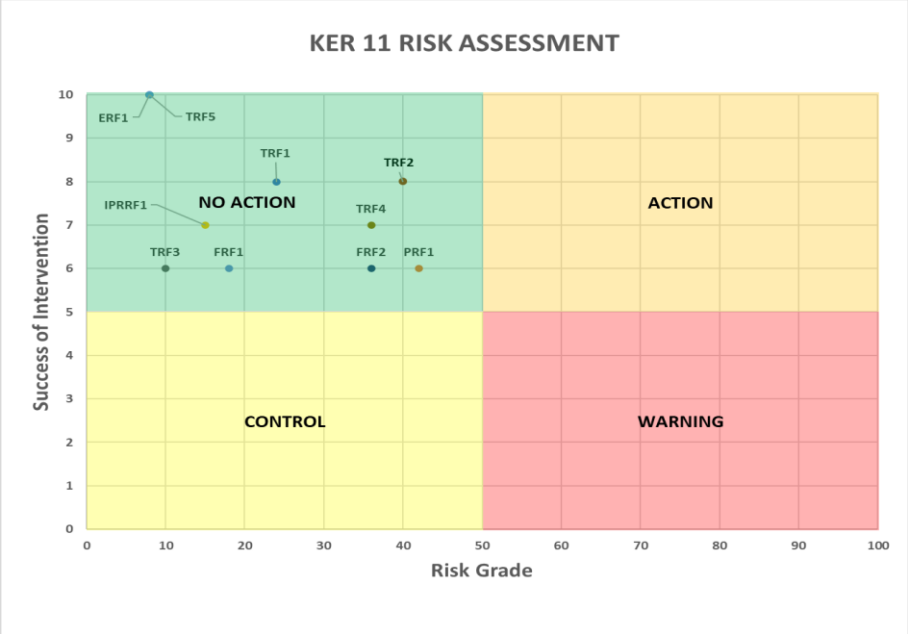

Figure 8. Risk priority map KER 11

The priority map for KER 11 shows that market factors were not considered. Based on the latest development, a risk related to not meeting the circularity principle is added as an environmental risk with the low-risk grade, as there are several options for improving the compatibility of the bio-based material (lignin) within the formulation before it's substitution with the non-biobased material. The risks with the highest *Risks Grade* are included in Table 6.

Table 6. KER11 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
PRF1	Disagreement in complying with the requirements of the lignin powder and devulcanised rubber (UBRIS and NIC with NCC)	42
TRF2	The produced material cannot be used for the foreseen purpose - Lignin compatibility (from NIC)	40
TRF4	Upscaling problems - Rubber Supply (from UBRIS)	36
FRF2	Production costs not competitive (for UBRIS in the Rubber Functionalization)	36

Although all the risks fall in the first quadrant of "no action "needed, some consideration can be made.

KER11 belongs to the VC1, where mainly three partners are involved. Therefore, the PRF1 was evaluated with the highest Risk Grade score.

On the technological side, TRF2 had the highest risk grade, which is associated with not reaching the required material standard mainly due to lignin compatibility. Actions have been considered, such as fractioning lignin

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and taking into consideration other trials, resulting in a high expected level of success, thus this risk is under control.

The third highest risk is TRF4 in the technological factor, considering failures in upscaling this process because it is not able to supply the desired amount of the customer, and FRF2 having high production costs in the rubber functionalisation, as it is more expensive compared to other renewable biomaterials process.

Nonetheless, all the hazards associated with this KER are in the "No Action" quadrant since they have adequate mitigation measures in place, indicating that they are under control and do not require additional action.

Risk priority map KER 13

The last KER belonging to the bio-rubber value chain is K13 “Novel manufacturing for bio-rubber pads with lignin additives”, referring to the final product of this value chain. NCC identified 7 risks and AXIA, based on market and strategic evaluation, added 5 other risks, having the highest concentration of risk in the market segment. This can be seen more in detail in Figure 9.

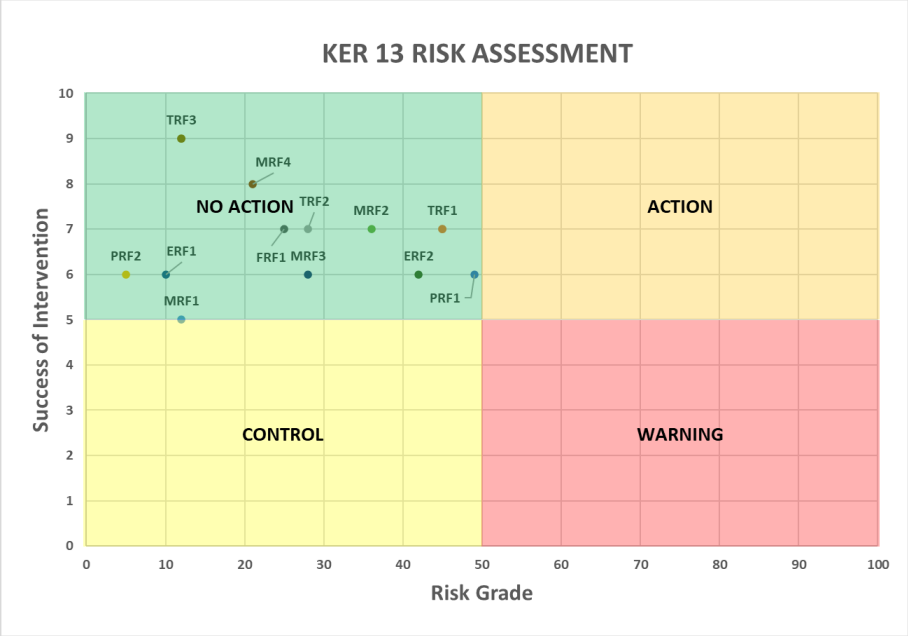

Figure 9. Risk priority map KER 13

The risks with the highest Risks Grade are included in Table 7.

Table 7. KER 13 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
PRF1	Communication problems in specifying the correct characteristics and amount of material needed (with NIC and UBRIS)	49

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TRF1	The final product does not comply with the standards - Panel manufacture	45
ERF2	Circularity principals are not met - Biodegradability % is not met	42

The highest *Risk Grade* score is related to partnership, where NCC by having the last KER of this VC, has more risk of having a communication issue with the other two partners and the final client (ZAG). Then TRF1 has the following highest grade, a technological risk linked to not being able to produce the final product with the requirements that this VC needs. This particular risk holds the highest significance within the VC, which is why it received a rating of 9. It carries a moderate probability of occurrence, as the partners express optimism about the product's potential success. However, all the other identified risks in this VC directly impact this specific risk. The third highest risk is ERF2 in the environmental factor, considering failures to meet the principles of circularity, specifically biodegradability.

All these risks mentioned above are in the "No Action" quadrant as they have effective intervention actions and will be able to mitigate the risk.

General Group Overview:

Having an overview of the whole bio-rubber VC, there is a possibility of encountering partnership issues due to the number and type of collaborating partners, as exemplified by the case of UBRIS. For this reason, a particular attention will be given to this case and eventual mitigation actions will be included in the exploitation plan. Additionally, the complexity of combining two novel materials improved by ultrasound presents a potential challenge. Another notable risk is TRF1 from KER 13, which pertains to the manufactured panels not meeting the required standards. However, it should be noted that these risks are currently under control and do not require further action.

Overall, the risks associated with this VC have been evaluated with low ratings, indicating a relatively low level of importance and/or likelihood of occurrence. The mentioned actions are anticipated to effectively mitigate the identified risks.

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3.2.3 Group 3: Bio-plastic value chain

Risk priority map KER 9

In relation to KER 9, "Novel drying, and milling based on non-thermal plasma for treating vegetal residues from agro-industrial supply chains as filler for thermoplastic carriers", a total of 6 risks were identified by Mixcycling and 2 were added by AXIA regarding the partnership and technological field. Six of the eight risks fall under the technological category, as seen in Figure 10.

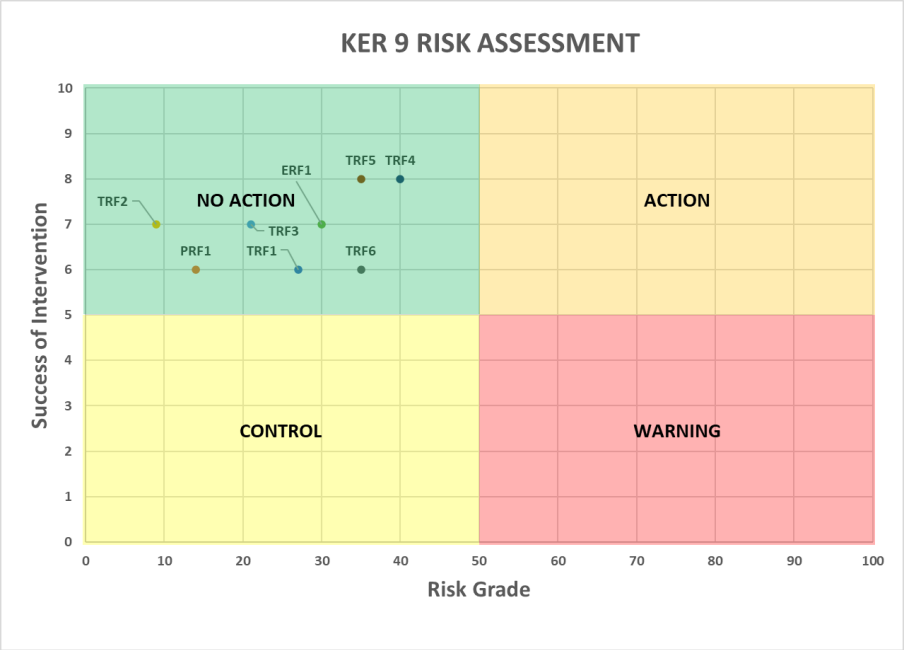

Figure 10. Risk priority map KER 9

The risks with the highest *Risks Grade* are included in Table 8.

Table 8. KER 9 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
TRF4	The produced material cannot be used for the foreseen purpose or not to meet the standards.	40
TRF5	Long time required for some tests/ redo some tests (ex. permeability)	35
TRF6	Upscaling problems - Mixer capability	35

TRF4 had the highest *Risk Grade* and is associated with not matching the required material standard mainly due to the raw material. Nevertheless, all risks are in the "No Action" quadrant as they have effective actions to mitigate them, meaning they are under control and do not need further actions.

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Risk priority map KER 2

A total of 8 risks were identified by IDENER for the KER "Non-intrusive microwave enhancement for moulding injection", and categories were covered with at least one risk. Based on the last project outcomes, AXIA added one more risk in the technological field and the another in the partnership field. See Figure 11 for more details.

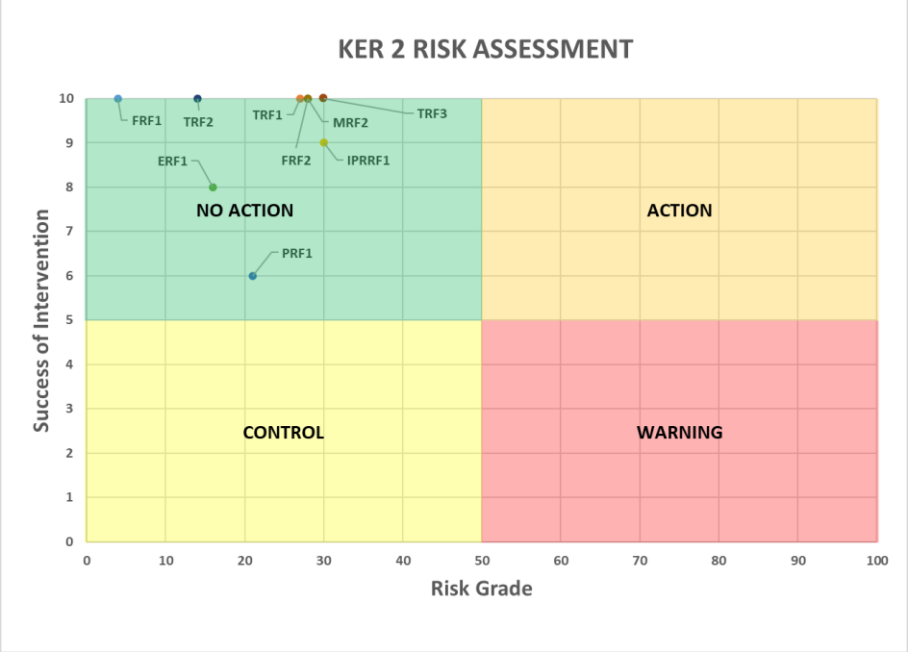

Figure 11. Risk priority map KER 2

The risks with the highest *Risks Grade* are included in Table 9.

Table 9. KER 2 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
TRF3	Upscaling problems - Low production capacity of Microwaves technology	30
IPRRF1	Patent already exist	30
FRF1	High technology cost	28
MRF2	High market competitiveness	28

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Regarding KER 2, IDENER expressed some concern in upscaling microwave technology and in finding other similar existing patents on the market. However, the actions for potential intervention will be very successful, with a 9 and 10 scores respectively, meaning no other actions will be needed to prevent the risk from happening.

An analysis of market risk pertaining to the utilisation of microwaves in injection moulding entails the evaluation of diverse aspects that could potentially influence the triumph and acceptance of this technological advancement. A noteworthy factor to take into account, is the substantial cost of technology connected with the use of microwave systems in industrial operations (FRF1). The initial capital required for acquiring specialised microwave equipment and integrating it into current injection systems might be significant, potentially becoming a hindrance for certain enterprises seeking to enter the market.

Moreover, the industrial microwave market within the injection industries may have difficulties stemming from reduced customer distinctiveness. MRF2 represents the presence of many companies offering comparable microwave solutions that may result in heightened competition and subsequent pricing pressure. In the given circumstance, firms may encounter difficulties in formulating a distinctive value proposition that distinguishes them from their rivals.

The task of determining the ultimate cost of microwave systems at this juncture presents difficulties owing to a multitude of aspects, encompassing the intricate nature of the technology, economies of scale, and prevailing market demand. The selection of a price plan will have a substantial influence on the market penetration and overall success of the product.

Gaining insight into the market's response to this emerging technology is crucial for achieving successful implementation. In order to ascertain the requirements, preferences, and propensity to invest in microwave-based solutions, it is imperative for companies to engage in market research. Conducting market testing in the early stages and engaging with key industry stakeholders can yield useful data regarding the market's inclination and preparedness to embrace novel technology.

In general, the utilisation of microwaves in injection processes exhibits considerable potential in enhancing efficiency and performance, reaching high scores near to 10. However, it is imperative for businesses to thoroughly evaluate the inherent market risks associated with the development and commercialization of this technology prior to making a full commitment. Conducting comprehensive market analysis, maintaining ongoing surveillance of industry trends, and engaging in strategic planning will be imperative in order to reduce these risks and guarantee a prosperous market entry.

Risk priority map KER 10

For KER 10, “Disruptive injection moulding process for bio-plastic bottle closures production”, Labrenta spotted a total of 6 risks, with most of them in the technological or market aspects. AXIA included other 4 risks related to the partnership, financial and environmental aspects. For more details, see Figure 12.

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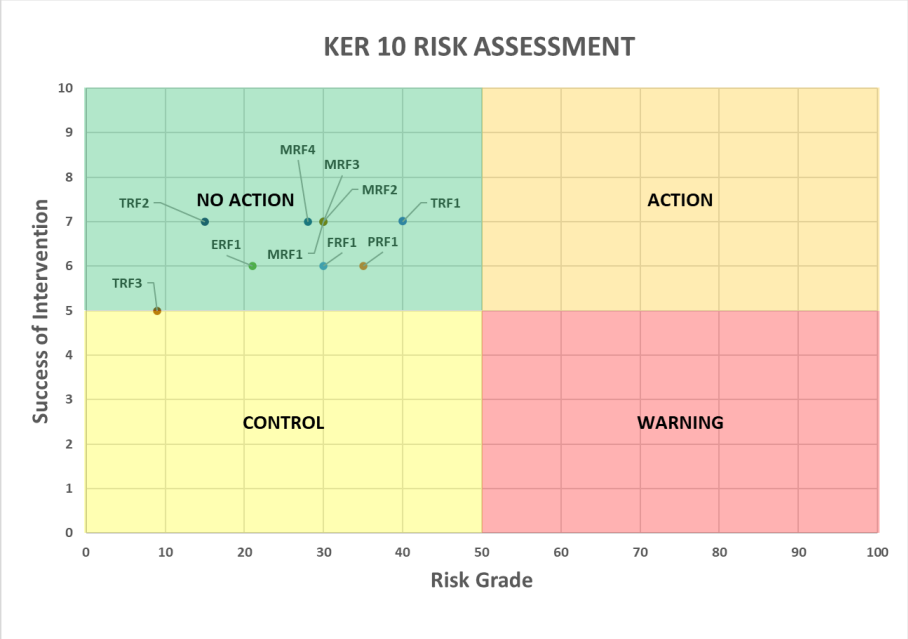

Figure 12. Risk priority map KER 10

The risks with the highest *Risks Grade* are included in Table 10.

Table 10. KER 10 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
TRF1	The final product does not comply with the standards	40
PRF1	Communication problems in specifying the correct characteristics and amount of material needed	35

The highest risk grade was assigned to TRF1 for the final composition of the materials. PRF1 also had a high-risk grade due to the possibility of having some communication problems with the partners. Though, the proposed actions for intervention will be positive, decreasing the risk of occurring.

General Group Overview:

Having an overview of the entire bio-plastic value chain, TRF4 from KER 9 and TRF1 from KER 10 should be highlighted as possible important challenges associated with the material. The main risk is that the material made of natural fibers from vegetable residues will not adapt efficiently to the process, resulting in a product with lower performance than the one the customer (TDZ) needed for their bottles. Many actions are taking place to eliminate this possible risk.

In general, these VC´s risks have been evaluated with a low rating, indicating low importance and/or low likelihood of occurrence. The actions mentioned are expected to succeed in mitigating the identified risks. As a result, additional actions are not necessary at this time, but regular monitoring of at least TRF4 from KER

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9 and TRF1 from KER 10 should be conducted to ensure the implementation of the actions and to verify that the risks have not materialised.

3.2.4 Group 4: Wood composite value chain

Risk priority map KER 7

In relation to this KER, "Disruptive extrusion process for small series production of wood composite-based sliding bearings", a total of 4 risks were identified by Fraunhofer in the technological field, and 3 were added by AXIA regarding the partnership, IPR and environmental field. Figure 13 shows the Risk priority map of KER 7.

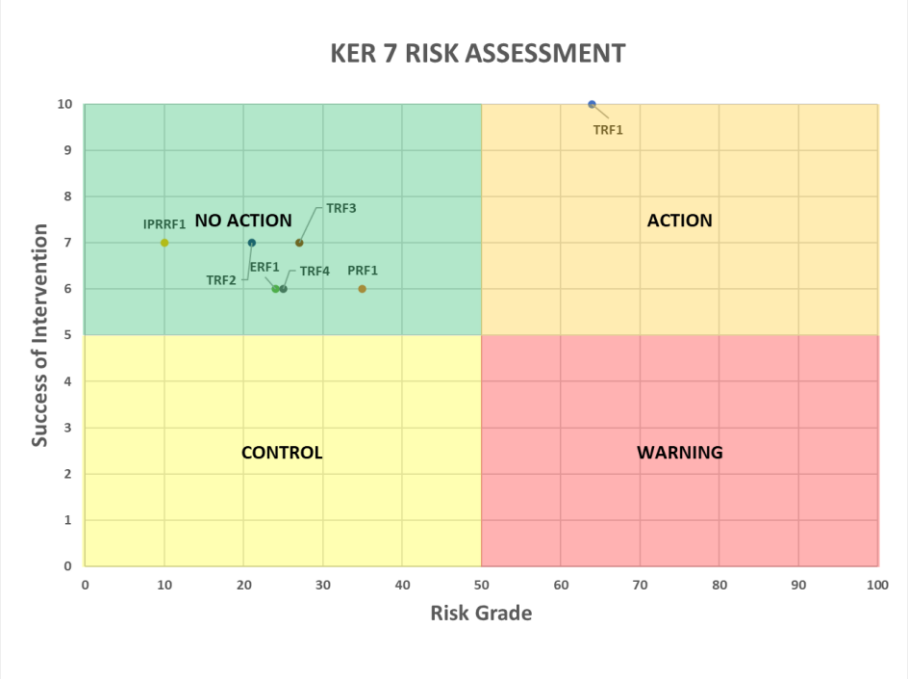

Figure 13. Risk priority map KER 7

The risks with the highest *Risks Grade* are included in Table 11.

Table 11. KER 7 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
TRF1	The process does not guarantee the achievement of expected material performances020	64
PRF1	Disagreement in complying with the requirements for blended polymers filaments (with NCC and IDE)	35

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The highest risk grade placed in the quadrant "Action" is TRF1. This risk is related to not obtaining the desired material that will be useful for further processes in the VC. Here, FHF stated a high level of importance and a high level of probability of the risk-taking place. On the other hand, the actions proposed to implement will be very efficient in mitigating the risk. They consist of detecting possible process deviations and controlling extrusion parameters or compounds. Therefore, it is suggested to maintain consistent monitoring of the actions being taken to ensure that the risk remains manageable.

All the other risks are in the "No Action" quadrant as they have lower risk grades and effective actions, meaning those risks are under control and do not need further actions.

Risk priority map KER 8

A total of 2 risks were detected by Fraunhofer for the KER 8 "Adapted non-destructive quality control method for Wood Composite (WC) samples and components", one in the financial and another in the technological area. AXIA recognized 1 more risk in the partnership field. See Figure 14 for more details.

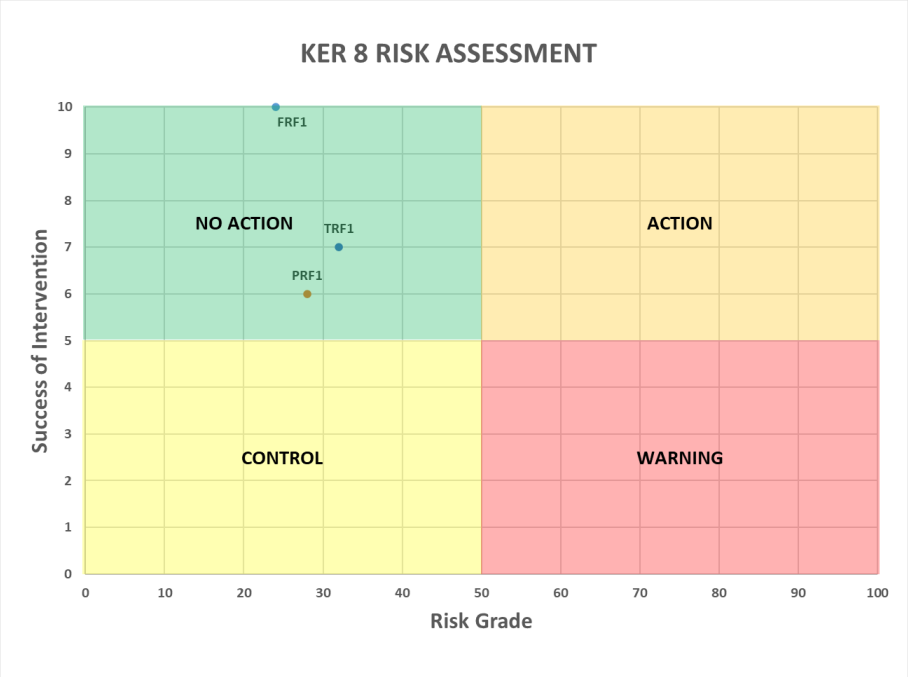

Figure 14. Risk priority map KER 8

The risks with the highest *Risks Grade* are included in Table 12.

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Table 12. KER 8 Risks with the highest Risk Grade

Nomenclature	Description	Risk Grade
TRF1	The smart manufacturing process does not guarantee the desired performance - non-destructive quality control method for samples fails, or does not reach the desired performance	32

For this KER, all risks are in the "No Action" quadrant and with a low-risk score. However, only to mention the highest risk is TRF1 which is the failure of the quality control method, having a high importance but a low probability to happen, resulting in a low-risk grade.

Risk priority map KER 3

For KER 3, "Microwave curing system for the extrusion process", IDENER spotted a total of 3 risks, with most of them in the technological area, and one risk for each of the following factors: IPR, financial and environmental. With AXIA´s experience in the field, other 3 risks were added related to the partnership, technological and IPR aspects. For more details, see Figure 15.

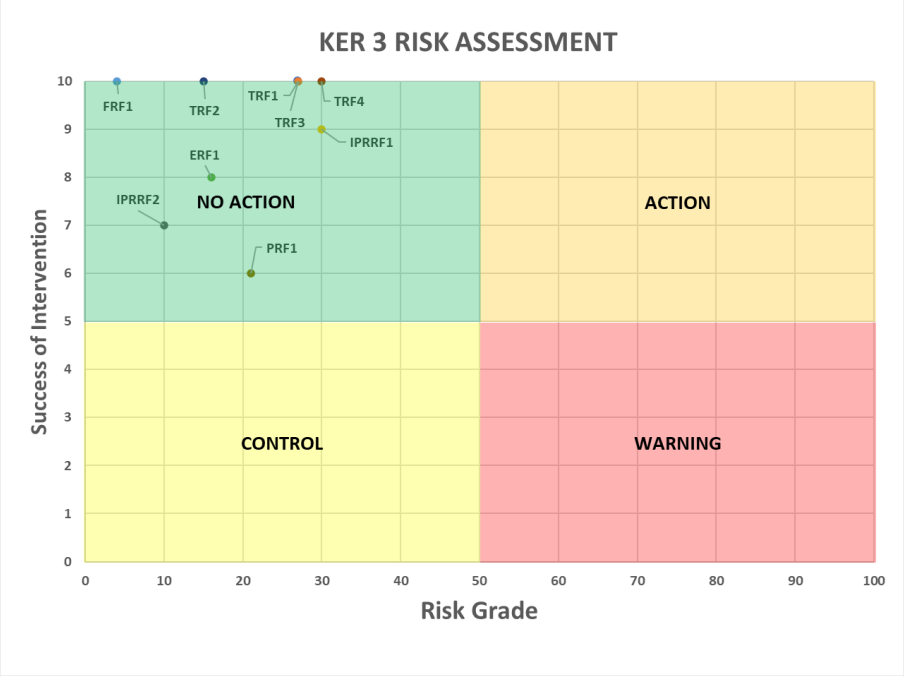

Figure 15. Risk priority map KER 3

The risks with the highest *Risks Grade* are included in Table 13.

Table 13. KER 3 Risks with the highest Risk Grade

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Nomenclature	Description	Risk Grade
TRF4	Upscaling problems - Microwaves capability	30
IPRRF1	Patent already exist	30

Regarding this KER, all its risks fall within the "No Action" quadrant, exhibiting a low-risk score and with high potential intervention actions.

Risk priority map KER 12

The final KER for the wood composite value chain is "Design Innovative Wood Composite sliding bearing systems". NCC identified four risks in the technological factor, and AXIA has contributed other 5 risks five risks based on literature review and participation in WP meetings. These additional risks cover areas such as partnership, market, and environmental considerations. For a more comprehensive understanding, please refer to Figure 16, which provides a detailed overview.

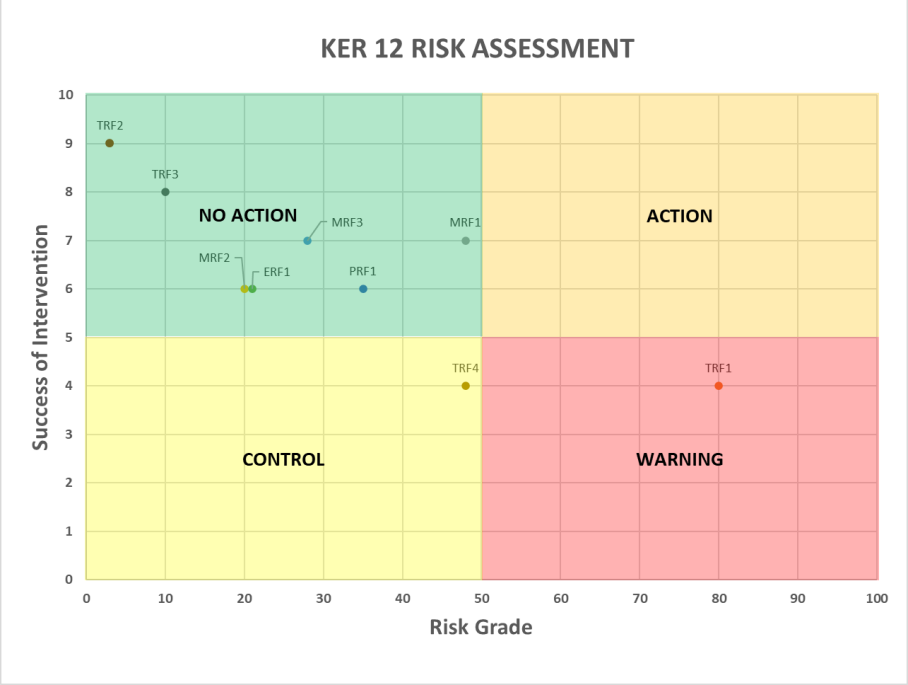

Figure 16. Risk priority map KER 12

-The risks with the highest *Risks Grade* are included in Table 14.

Table 14. KER 12 Risks with the highest Risk Grade

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Nomenclature	Description	Risk Grade
TRF1	The final product does not comply with the standards - Insufficient information to inform design activity	80
TRF4	Timeframe of design does not align with manufacturing timescales	48
MRF1	Product rejected by the end-users	48

The risk with the highest score is associated with the technological aspect, referred to as TRF1, which carries the greatest significance and likelihood of occurrence. This risk is attributed to the inability to produce the final product according to the requirements of the value chain, primarily due to a lack of knowledge during the design phase. To mitigate the risk, actions such as the direct engagement with machine tool suppliers and alternative manufacturers that supply similar machines, re-design of the slidings were proposed, but it was noted that they may not be effective, leading to its placement in the "Warning" quadrant. Given the circumstances, special attention and a sense of urgency are required to implement the necessary actions and explore alternative, more impactful measures.

TRF4 and MRF1, which are closely linked to TRF1, hold the second-highest risk rating. These risks stem from insufficient knowledge during the design phase and can lead to potential delays in the project timeline and the risk of product rejection by the end-user. Of particular concern is TRF4, as it exhibits a low success rate for intervention actions, warranting its placement in the "Control" quadrant. Therefore, it is crucial to closely monitor the actions taken and their impact on the project.

General group overview:

Taking an overview of the entire wood composite value chain, it is important to highlight TRF1 from KER 7, which falls within the "Action" quadrant. Additionally, for KER 12, the risks TRF4 and TRF1 are positioned in the "Control" and "Warning" quadrants, respectively. These risks carry the highest risk grades and offer limited potential for intervention actions.

Essentially, these risks are associated with the inability to produce the final wood composite bearings according to the required specifications due to a lack of knowledge during the design phase and the low performance of the extruded blended polymer filaments.

To address these challenges, actions such as direct engagement with machine tool suppliers, exploring alternative manufacturers that provide similar machines, and redesigning the sliding bearing are possible measures to be implemented. Additionally, alternative manufacturing techniques like net-shape press moulding or machining will be considered. However, due to the high-risk grades, it is crucial to prioritize these risks, reanalyse the proposed actions, and closely monitor their implementation.

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4. Risk Analysis for New Business

4.1 Risk analysis Methodology

To have a complete analysis the risk assessment for new business was conducted by AXIA. A risk assessment methodology that is usually modelled on start-ups was applied to integrate new components/processes into the existing business models of the partners' companies. Indeed, since the partners are working with innovative products, some of the aspects which are common for the start-up are valid also when a new product is included in the business strategy of a company.

The analysis was conducted for the main project partners and a questionnaire was distributed to collect main inputs. A list of possible situations related to new businesses (market fit, team, recruiting, sales, funding, market and competition) was drafted and the partners were asked to picture their current situation and rate the risk level from 1 (low risk) to 5 (high risk). Afterwards, they identified the risks related to their current situation as well as the likelihood of this risk having a significant impact ranging from 1 (very little) to 5 (very high). A risk heat map and the methodology were adapted from a use case found in the literature[2]. Some modifications were made to the approach to fit the particular requirements of this project. The questionnaire can be found in the Annex 2.

Once the main hotspots were identified, some mitigation actions were proposed by AXIA to take the main risks under control.

4.2 Risk assessment for new business cases

4.2.1 IDENER Risk Assessment

Institute overview

IDENER is a Spanish research organisation involved in the creation of creative approaches to energy and sustainability. The institute is actively engaged in partnerships with universities, research centres, businesses, governments, and other organisations. Its main focus is on promoting and planning applied research in the areas of energy, the environment, and the built environment. With a team of over 150 people, IDENER is a sizable research facility that develops solutions for renewable energy and energy efficiency in order to create a sustainable future. By engaging in partnerships and providing meaningful results, IDENER helps all of its stakeholders to grow and thrive, while helping to create a better future for our planet.

As coordinator of the GREEN-LOOP project, IDENER will be responsible for overseeing the various activities, but they will also lead some important tasks. They will create a platform for the value chain optimization making sure that all the algorithms created for tasks like LCA, business, policy, social etc. are in line with one another. They will also create a microwave system to improve the moulding injection process of bottle closures for the food and beverage industry (VC2) that will be produced at the Labrenta facility and then sent

[2] https://www.codingvc.com/how-to-de-risk-a-startup

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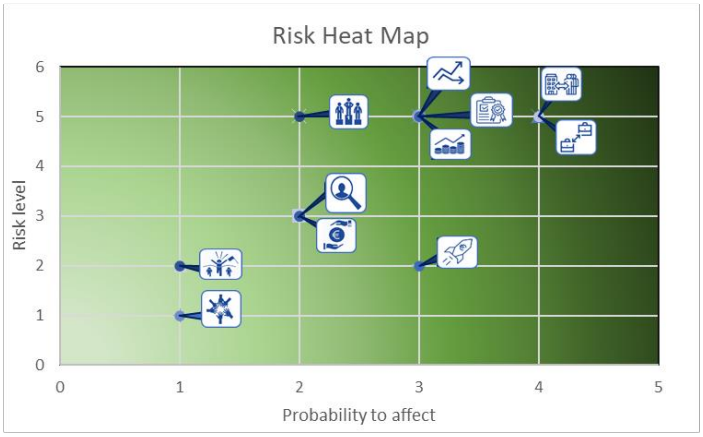
to TDZ for testing. Additionally, they will design and build a microwave curing system to specifically support the extrusion process of wood sliding bearings that will be then tested in Labrenta machines.

Risk heat map

In the vision of introducing these new processes within the institute strategy, a risk heat map was created to visualise the main risks associated with the new business.

Based on the answers to the questionnaire, it was possible to make some relevant conclusions. Despite the current low customer engagement and high churn, IDENER affirmed that based on their experience they can build a successful product/process. The full-time workforce covers all areas, and they have extensive management and recruiting experience in addition to a potent and knowledgeable sales team. In the current cycle, there are funds accessible for investment, and the market has few rivals. There could be a number of risks, though, including late product/process launches or failure to meet customer expectations, difficulty hiring the ideal candidate, a lack of customers, failure to reach the desired market size, and failure to distinguish oneself from rivals and establish oneself as a player in the market. Figure 17 reports a graphical view of the answers, highlighting the main risks to be taken under control in the next period.

Area of Risk
Product/Market Fit (B2B)
Product/Market Fit (B2C)
Product/Market Fit (Churn)
Product Quality
Team
Recruiting
Sales
Market
Funding
Short-Term Competition
Long-Term Competition



Hotspots that require risk reduction:

Figure 17 Risk heat map IDENER

Based on the results, some actions could be undertaken in the next future to reduce the main risks, such as:

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- Engaging customers through marketing activity to increase their engagement with the product/process;
- The prototype should be extensively tested before production to ensure it meets expectations.
- Improving customer retention through incentives and loyalty rewards once the product is ready to be placed into the market.
- Ensuring that the product/process meets customer requirements with rigorous testing;
- Performing market research to gain insight into the target market size and customer needs;
- Evaluating competitors and creating a strategy for gaining a competitive advantage;

4.2.2 Labrenta Risk Assessment

Company Overview

Labrenta (LBR) is a medium-sized Italian company with a workforce of approximately 200 scientifically trained employees. The company specializes in the production of closures for bottles, cans, and a wide variety of other containers including bag-in-box applications. With the help of innovative and sustainable technologies, Labrenta is committed to providing high-quality and reliable solutions, preserving the aroma, freshness, and flavour of the contents of its packaging. Their most popular products include corks, crowns, caps, spouts, and taps. Leveraging superior quality and efficient processes, Labrenta is able to consistently deliver top-notch solutions and commitment to excellence.

In GREEN-LOOP, Labrenta will produce bioplastic bottle closures for Terre di Zoe-TDZ (final user) using biobased material supplied by Mixcycling. The process is implemented by IDENER microwave technology as explained in the previous paragraph.

Risk heat map

Labrenta is an already affirmed company and the results of the analysis confirmed the average low risk when a new product/process is started.

Despite the great potential of the company to succeed in this new technology, the risk of not seeing growth in the customer base could potentially lead to customer disengagement and churn. Furthermore, despite having a fully functional product, the risk of the prototype not complying with specifications or protocols for production still exists. Labrenta highlighted the importance of ensuring that the team covers all areas of product creation to prevent the production of defective products and to recruit the appropriate talent for the team. Additionally, there is the risk of not achieving the anticipated sales goal or the target market expanding slower than expected. With few competitors but little to no differentiation, there is also the risk for Labrenta of not being competitive or differentiating from the existing market. Nonetheless, several competitive advantages may be leveraged as the company grows. Figure 18 reports a graphical view of the answers, highlighting the main risks to be taken under control in the next period.

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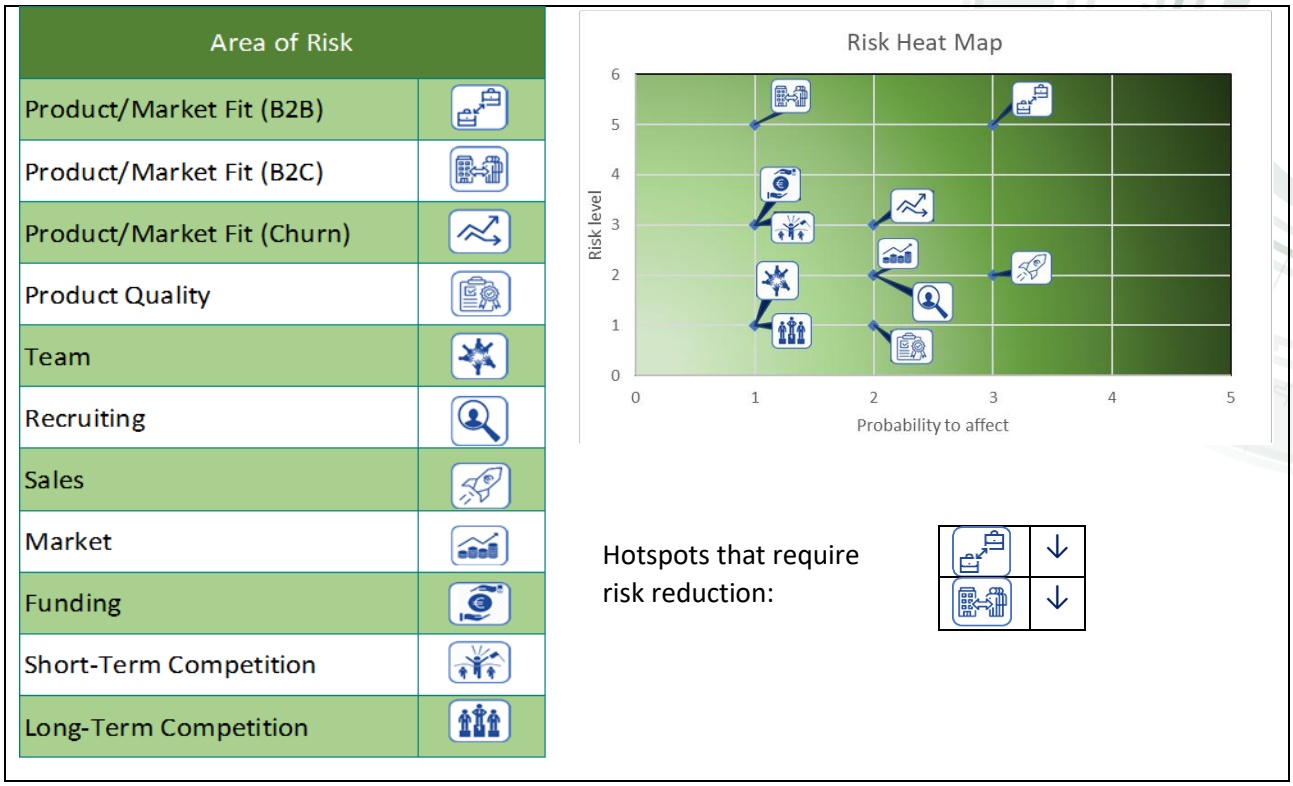

Figure 18 Risk heat map Labrenta

Some solutions for overcoming the risks posed include:

- Having an engaged customer base by offering incentives such as discounts, loyalty rewards and timely customer service;
- The prototype should be extensively tested before production to ensure it meets expectations. To prevent the production of defective products, rigorous quality assurance should be implemented alongside robust procedures such as continuous inspection, regular audits, and utilization of quality control tools;

4.2.3 Mixcycling Risk Assessment

Company Overview

The Italian company called Mixcycling (MYX) creates and manufactures inventive material blends produced from byproducts and leftovers of industrial and agricultural activities. The business blends various waste materials to produce one-of-a-kind blends, improving efficiency and yields. This cutting-edge recycling strategy was established in 2000, and for its dedication to sustainability it has won multiple honours

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internationally. Their product line comprises biocomposites, lignocellulosic elements, biofilms, and other safe materials for a range of uses in manufacturing, packaging, and engineering. Additionally, they offer consultancy services for utilising their materials in various applications, from testing to design.

In the GREEN-LOOP project, the company will develop thermoplastic biocomposites with low carbon emissions, biobased and biodegradable properties by revaluing and ennobling residues/by-products from agro-industrial supply chains as filler for thermoplastic carriers. Mixcycling will develop a novel food-packaging material as an alternative to non-renewable solutions. The strength of biobased composite material lies in its usage of vegetal/animal residues/by-product filler(s), making it a viable option for certain applications such as closures. Its potential drawbacks, however, include less performance than existing solutions and a potentially higher cost.

Risk heat map

Based on the answers to the questionnaire it was possible to make some conclusions about Mixcycling risk analysis. MYX stated to have a track record of building strong teams and sales experience in a similar field, but by introducing the new process, there is a risk to have problems growing their customer base, attracting enough funding, developing an effective product prototype, and remaining competitive in the marketplace. The customer base is growing at a moderate rate, and it might not reach the desired volume. Despite the interest of potential customers in innovative products, there is uncertainty in the volume of revenues generated from sales. Furthermore, churn can increase due to lower competitor prices, so the cost competition could be quite high. MYX possess some competitive advantages, such as good brand perception, better unit economics, and a strong patent portfolio, but additional funds are required to cover expenses and conduct pilots, and recruiting procedures can cause delays in the team-building process.

Figure 19 shows the risk heat map of MYX highlighting the main hotspot.

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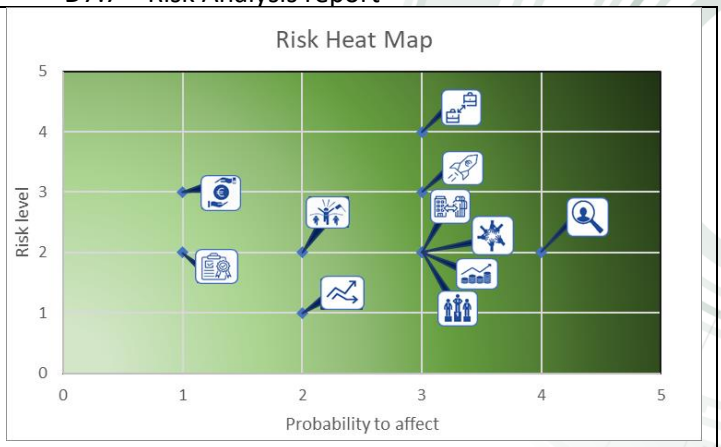
Area of Risk
Product/Market Fit (B2B)
Product/Market Fit (B2C)
Product/Market Fit (Churn)
Product Quality
Team
Recruiting
Sales
Market
Funding
Short-Term Competition
Long-Term Competition



Hotspots that require risk reduction:

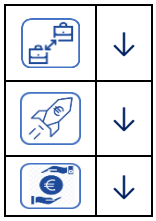


Figure 19 Risk heat map Mixcycling

Below are some mitigation actions that can be considered to reduce the mentioned risks:

- Conduct customer surveys to better understand their needs and preferences better;
- Develop personalized marketing and sales strategies to increase customer retention;
- Analyze competitor pricing strategies and adjust the pricing accordingly to remain competitive;
- Prepare a detailed business plan and financial projections to attract potential investors;

4.2.4 NIC Risk Assessment

Institute Overview

The Kemijski Institut (NIC), also known as the Chemical Institute, is a research institut located in Slovenia. The institute's main activities include organic chemistry, materials science, environmental chemistry, analytical chemistry, and biochemistry. It engages in fundamental and applied research with the objective of developing novel chemical compounds, materials, and technologies. The institute places collaboration at the centre of its efforts, working closely with domestic and foreign academic institutions, business partners, and governmental organisations to promote knowledge sharing, technological development, and the practical application of scientific discoveries. NIC plays a pivotal role in driving scientific progress and addressing societal challenges through its multidisciplinary research efforts and collaborative initiatives.

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Within GREEN-LOOP, NIC will provide lignin additives for bio-rubber formulation development. Lignin to be used in formulation will be of several types, namely sample without pretreatment, fractionated or functionalized. NIC activity provides a novel solution to the development of bio-based rubber combining renewable material (lignin) and recycled rubber tires used in the bio-rubber pads for fire and vibration-resistant applications in the construction sector. The bio-based rubber formulation, which contains recycled material (rubber tires), contributes to a sustainable solution in the construction sector and replaces the petroleum-based materials traditionally used.

Risk heat map

Based on the questionnaire answers, it is possible to conclude that generally, the organization's full-time team covers most of the areas required by the product. However, the departure of a senior researcher could pose a potential risk of delays in delivery if team members choose to pursue opportunities elsewhere. The market NIC aims to enter is quite competitive, with a multitude of players, including large incumbents, young startups, and well-funded ventures, all competing for a share. Despite these challenges, the institute can explore strategies such as customer-centric approaches, continuous innovation, strategic partnerships, and effective marketing to overcome obstacles and secure a successful position in the competitive landscape.

Figure 20 shows the risk heat map for NIC.

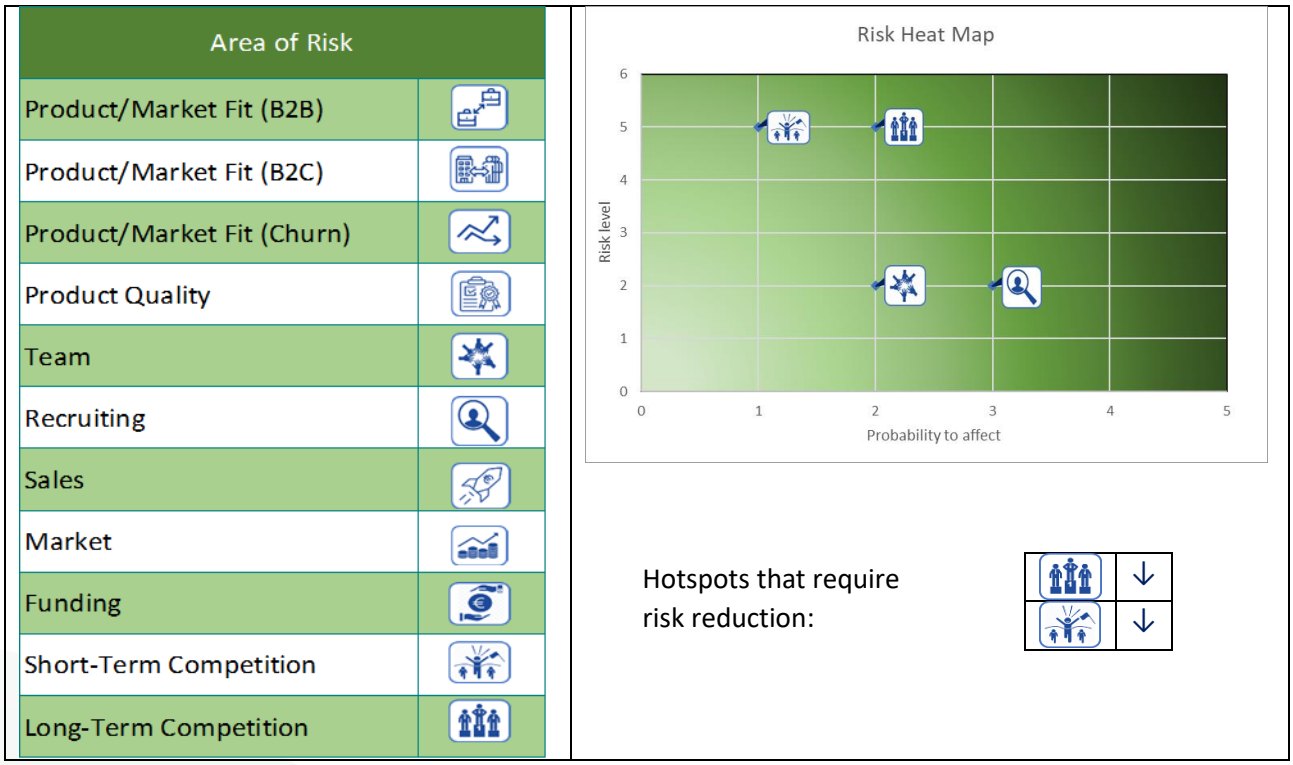

Figure 20 Risk heat map NIC

Based on the analysis of the results, some mitigation actions can be proposed for the main problems.

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- While the market is fiercely competitive, the organization can identify niche segments or unique customer needs that are currently underserved. The product can be tailored to address these specific requirements, the organization can differentiate itself from competitors and obtain a distinct position in the market;
- Develop a compelling brand identity and marketing strategy to differentiate the product in the market. Develop a target social media campaign to build brand awareness and engage with potential customers;

4.2.5 TDZ Risk Assessment

Company Overview

Terre di Zoe (TDZ) is a renowned company that has made a significant impact in the agricultural industry. With its substantial size and strong market presence, TDZ has established itself as a leading player in the field. The company's main activities revolve around sustainable farming practices, organic food production, and environmental conservation. TDZ is dedicated to promoting environmentally responsible methods and ensuring the highest quality of their products. In order to promote innovation, share knowledge, and work together towards a more sustainable future for agriculture, the company also actively interacts with nearby farmers, research institutions, and environmental organisations. Their combined efforts have helped in the invention of novel techniques and a strong network of associates who share similar points of view.

In GREEN-LOOP, TDZ aims to provide a comprehensive analysis of the requirements for bottle closures used in fruit juice packaging (VC2). TDZ will conduct a meticulous evaluation encompassing various aspects, including physical parameters such as sealing temperature and pressure, as well as chemical considerations such as toxicity and food-contact safety. To ensure sustainability and circularity in the bottling process, TDZ will test the bottle closures on recycled plastic bottles, thus contributing to the overall goal of a circular economy. The bioplastic bottle closures will undergo extensive testing under different conditions, including pasteurization, hot and cold filling, and varying storage environments. These rigorous tests will ensure the reliability and performance of bottle closures, guaranteeing the highest quality standards for fruit juice packaging.

Risk heat map

TDZ reported that based on their experience, the potential customers are interested in trying the product once it's developed, but there could not be enough customers to sell to. The user base is growing at a moderate rate, but customers have limited economic availability. Engagement and churn are moderate, but there is a risk that the churn will suddenly increase due to lower competitor prices. The product/process is fully functioning and impressive, but there is the risk that it will be launched at the wrong time. The full-time team covers most areas, but people can leave the company due to workload, lack of training, poor environment, or lack of motivation. Sales tasks can be delayed due to time constraints. The target market is expanding slower than expected and many competitors are attacking the market from various directions.

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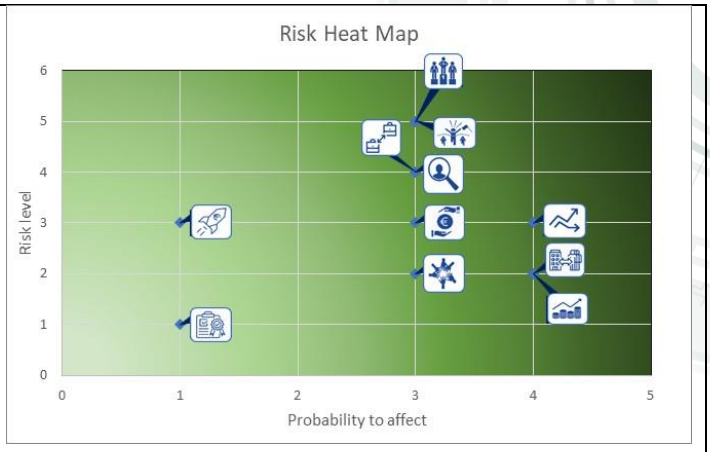
Funding is limited, and there's only a short period of financial security. Figure 21 shows the main risks associated with the introduction of innovative caps within TDZ business.

Area of Risk
Product/Market Fit (B2B)
Product/Market Fit (B2C)
Product/Market Fit (Churn)
Product Quality
Team
Recruiting
Sales
Market
Funding
Short-Term Competition
Long-Term Competition



Hotspots that require risk reduction:

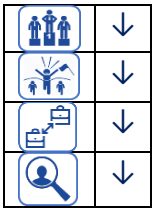


Figure 21 Risk heat map TDZ

On the basis of the main hotspot detected, some solutions are proposed:

- Consider implementing a strategy to attract more customers, such as targeted marketing campaigns, referral programs, or partnerships with complementary businesses. Offer incentives to encourage them to try the product and provide feedback;
- Reassess the target market and explore adjacent markets or customer segments that show potential for faster growth. Continuously monitor market trends and adapt the product to meet evolving customer needs ;
- Conduct a thorough competitor analysis to identify gaps or opportunities for differentiation. Emphasise unique features or benefits that distinguish the product from competitors;
- Refine the job description and requirements to attract a more specific pool of candidates. Consider offering competitive compensation packages and emphasizing the unique opportunities available at the company.

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4.2.6 IRIS Risk Assessment

Company Overview

IRIS Technology is a company with a focus on providing cutting-edge solutions to various industries. Their main activities include the manufacture of photonic and artificial intelligence solutions for the control of industrial and production processes in real time. Through collaborations with industry leaders and academic institutions, the company stays at the forefront of technological advancements to deliver the best solutions to its clients.

In GREEN-LOOP IRIS will implement the ultrasound enhancement for the biomaterial manufacturing process. Particularly, IRIS is going to develop two ultrasound enhancements for process improvement: (i) ultrasound system for the lignin treatment process (VC1) and (ii) an ultrasound system for the extrusion process in the bio-rubber value chain (VC2). IRIS is also going to develop the Data Acquisition System to coordinate the data gathering and managing for the demo cases.

Risk heat map

Based on the questionnaire answers, the introduction of a new business in the IRIS business portfolio presents an overall low-rate risk. IRIS has secured paid contracts, but it could face the challenge of limited customer availability. While its user base is growing organically at a moderate rate, engagement could be a risk, and there could be a high churn rate, especially with the emergence of new competitors. Despite having a fully functioning and impressive process, there is the risk of a delayed launch, potentially leading to increased costs. The company's full-time team covers most areas required for the product, but the budget is stretched due to training programs, and the recruitment process could take longer than anticipated, causing further delays. Despite moderate competitive advantages, including brand perception, better unit economics, and a strong patent portfolio, market share could be eroded, potentially due to new entrants, disruptive products/processes, effective competitor marketing campaigns, or weaknesses in the company's IP strategy. Figure 22 shows the heat map from IRIS.

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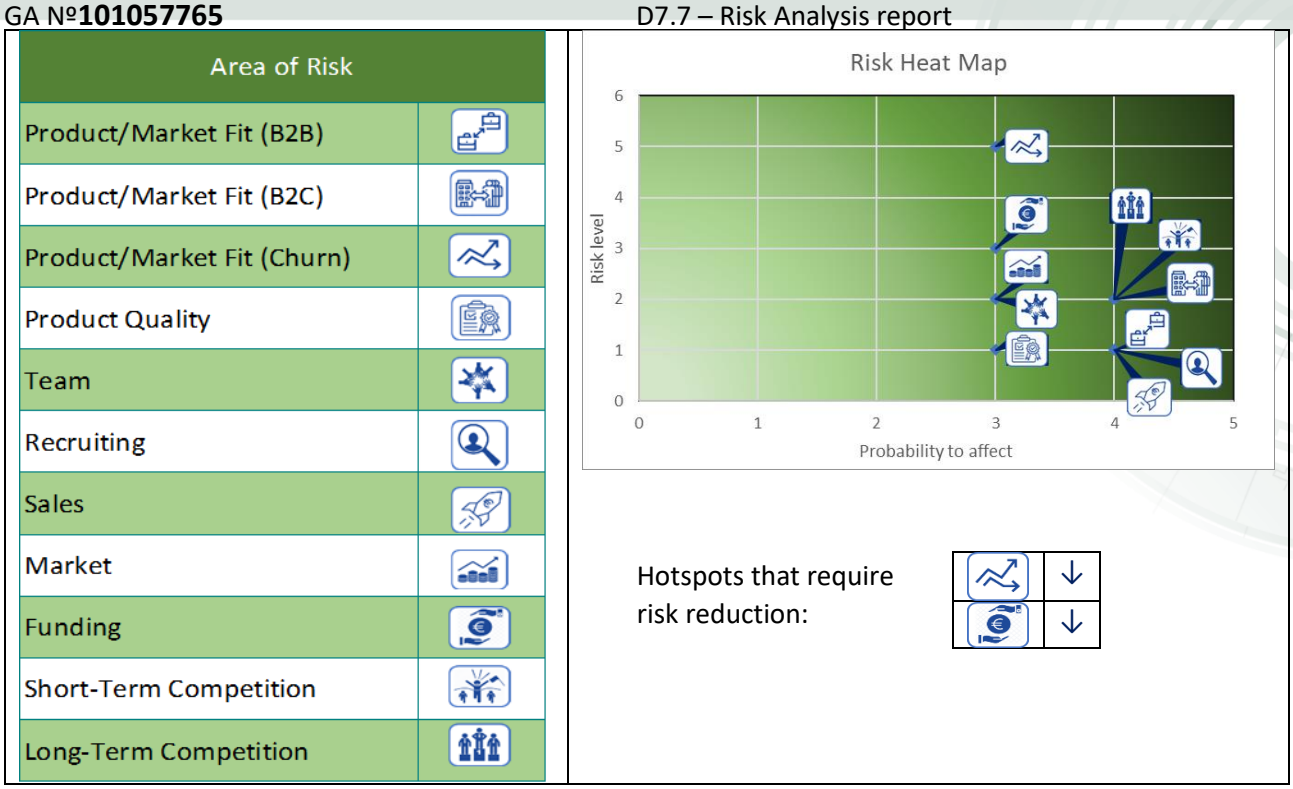

Figure 22 Risk heat map IRIS

Based on the main hotspot detected, some solutions are proposed:

- Improve customer engagement by investing in enhancing its customer support and communication channels, providing personalized experiences, and addressing customer needs. Analysing churn reasons and implementing customer retention programs can help reduce churn;
- Conducting a thorough budget review can help identify areas where costs can be optimized without compromising quality. Seek partnerships or collaborations with established companies that can provide financial support or resources.

4.2.7 NCC Risk Assessment

Company Overview

The National Composite Centre (NCC) is a well-known company renowned for its established experience in composite materials and manufacturing. The NCC's main activities focus on improving composite manufacturing technology, carrying out research and development initiatives, and offering technical assistance and support to various businesses. The NCC works in collaboration with academic institutions, business partners and government organisations to promote innovation, improve knowledge exchange, and increase the adoption of composite materials in industries such as construction, automotive, renewable energy, and aerospace.

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In GEEN-LOOP NCC is responsible for the production and finishing of the rubber pads (VC1). In VC3, they will follow the lab scale and upscale trials from the material formulation until the composite production.

Risk heat map

NCC highlighted the interest of customers in trying the product once it is built, although cost and quality concerns remain. The formulation of materials is limited to a specific application, and the sector's slow adoption of sustainability objectives could affect engagement and churn rates. Overcoming technical challenges is crucial for creating a viable product. While the full-time team covers most areas, the departure of a senior research engineer may impact project delivery, and recruitment delays could occur if staff members leave. Although there are few competitors, the lack of strong differentiation can be a challenge. Figure 23 shows the risk map for NCC and the relative hotspots.

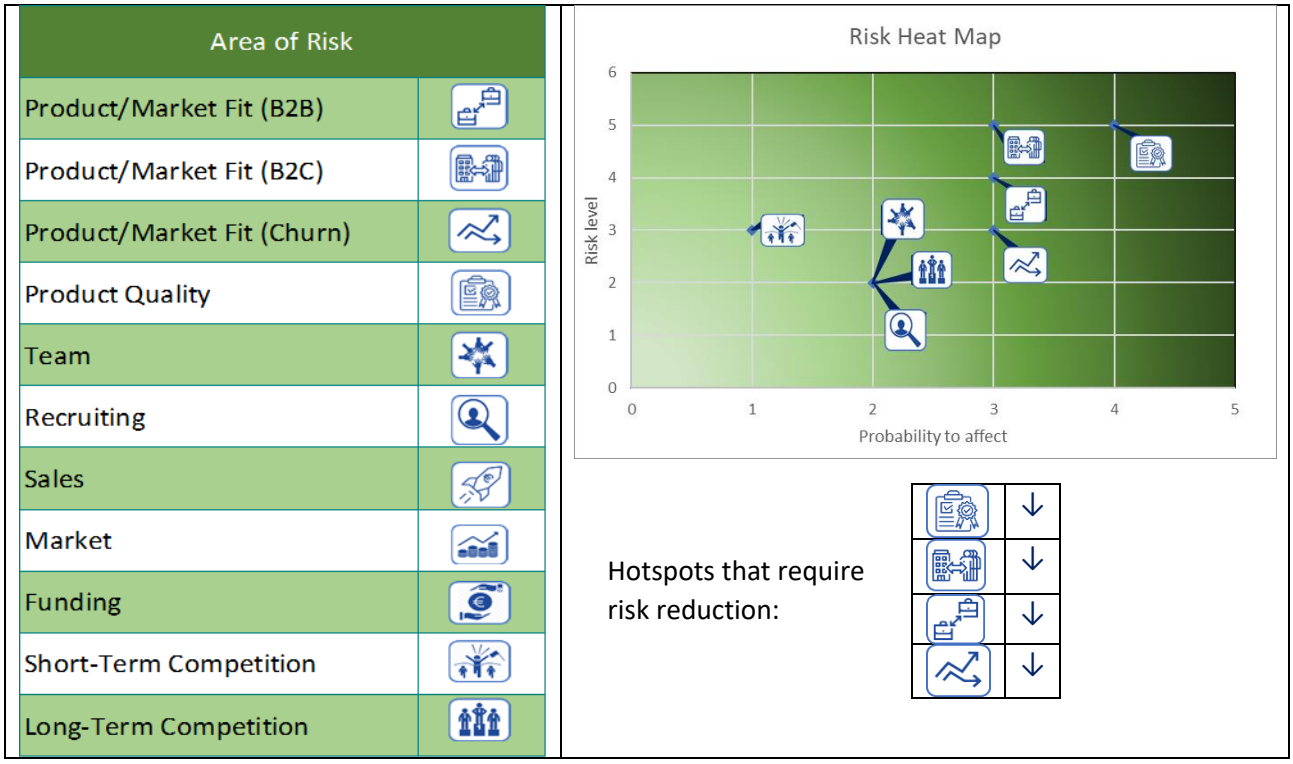

Figure 23 Risk heat map NCC

Some mitigation solutions to the main risks are reported below:

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- Cost and quality concerns: Conduct market research to determine a competitive and profitable pricing strategy. Focus on improving the quality of the product by conducting thorough testing and incorporating customer feedback into the development process;
- Limited material formulation: Explore opportunities to expand the material's application potential by conducting research and development efforts. Identify new use cases and adapt the formulation accordingly to increase versatility;
- Slow adoption of sustainability objectives: Educate the sector about the importance and benefits of sustainability and circularity. Collaborate with industry associations and organizations to promote sustainable practices and create awareness. Highlight the positive environmental and social impacts of adopting sustainable solutions.

4.2.8 ZAG Risk Assessment

Institute Overview

Zavod za Gradbeništvo Slovenije (ZAG), also known as the Institute of Construction Slovenia, is a prominent company dedicated to providing comprehensive services and expertise in the field of construction in Slovenia. With a rich history and vast experience, the company excels in various main activities, including research and development, testing and certification, standardization, and training within the construction industry. ZAG collaborates extensively with governmental bodies, industry stakeholders, and international partners to promote innovation, quality, and safety in construction practices. Through its collaborative efforts, the company plays a crucial role in shaping the construction sector in Slovenia and ensuring the highest standards of construction excellence are achieved.

In GREEN-LOOP, ZAG is the main end user of VC1. They will perform fire resistance testing in the ship-building industry, and will prepare the technical assessment of the multifunctional panels. ZAG will provide the first parameters for optimisation and will perform the fire test in a building structure.

Risk heat map

ZAG experience suggests that the product/process may not attract businesses or individuals due to its incomplete nature and lack of recognition from customers. Despite moderate engagement and churn levels, competitors appear to be active in developing lower-priced alternatives. ZAG has previous experience in successfully building products/processes, but the quality of this new product could be compromised by procedure failures. While the full-time team covers most areas, high fluctuation could lead to a lack of knowledge. The target market's growth potential appears limited due to low demand. Despite having few competitors, specialized alternatives are emerging without strong differentiation. Figure 24Figure 23 shows the risk map for NCC and the relative hotspots.

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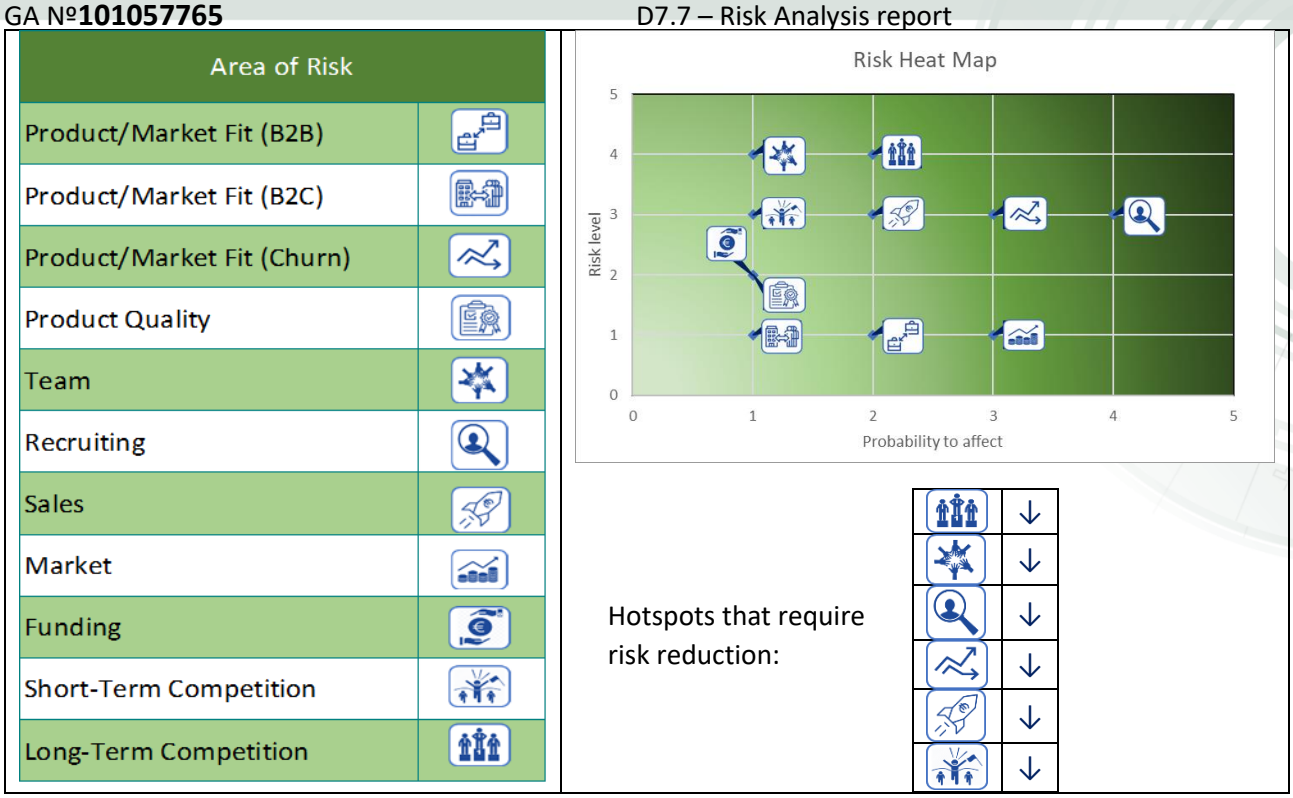

Figure 24 Risk heat map ZAG

Based on the main risks detected, some mitigation actions are proposed:

- Enhance Differentiation: Conduct a thorough analysis of the emerging specialized competitors and identify areas where differentiation can be achieved. This may involve leveraging the existing competitive advantages or developing unique value propositions that set the product/process apart from competitors;
- Improve Team Stability and Knowledge: Take steps to reduce team fluctuation and increase knowledge retention. This can be achieved by offering competitive compensation packages, providing opportunities for professional development and growth, fostering a positive and inclusive work culture, and implementing knowledge-sharing platforms or training programs;
- Expand Talent Pool: Explore different recruitment strategies to expand the pool of potential candidates. This can include leveraging professional networks, attending industry events and job fairs, partnering with educational institutions, and utilizing online job platforms or specialized recruitment agencies;
- Improve Product/Process Completion: Focus on addressing the incompleteness of the product/process by identifying the missing components and prioritizing their development. Conduct market research to understand customer expectations and incorporate their feedback into the product/process design;
- Optimize Selling Channels: Evaluate the effectiveness of current selling channels and make necessary adjustments to reach the right customers. This may involve identifying new distribution channels, improving digital marketing strategies, or conducting targeted outreach campaigns.

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4.2.9 Fraunhofer Risk Assessment

Institute Overview

The Fraunhofer Institute, known also as Fraunhofer-Gesellschaft, consists of 74 Fraunhofer Institutes located throughout Germany and is the largest application-oriented research organisation in Europe. They primarily engage in contract research projects, applied research, partnerships with industry, technology transfer, international collaborations, education and training, and contract research projects. The Fraunhofer Institutes collaborate closely with businesses, academic institutions, governmental organisations, and global partners to create cutting-edge technologies, solve specific problems, and advance useful applications. With over 29,000 employees, they have a substantial presence and considerable knowledge in a variety of scientific sectors.

In GREEN-LOOP Fraunhofer is responsible for the development of the disrupting extrusion process and the method for the quality control of the WC samples.

Risk heat map

The answers to the questionnaire provided by Fraunhofer highlighted some important points. Despite their extensive sales experience, they expressed the warning of struggling with a scarcity of customers to sell to. The expansion of their target market might also be slower than desired, and their business's sustainability relies heavily on raising multiple rounds of venture funding, as it won't be self-sustaining for a significant period. Moreover, as the other partners, they affirmed the risk of facing fierce competition from companies of all sizes, including major incumbents, young startups, and well-funded ventures, all aggressively targeting their market. They lack a distinctive competitive advantage, and this can result in losing the market share even though they are the first mover. Figure 22 shows the heat map from Fraunhofer.

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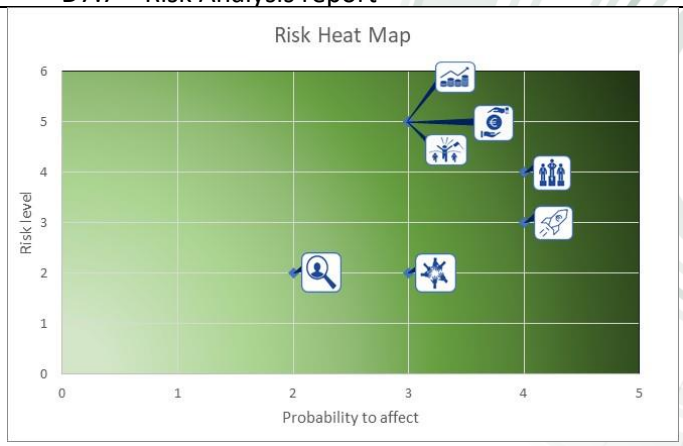
Area of Risk
Product/Market Fit (B2B)
Product/Market Fit (B2C)
Product/Market Fit (Churn)
Product Quality
Team
Recruiting
Sales
Market
Funding
Short-Term Competition
Long-Term Competition



Hotspots that require risk reduction:

Figure 25 Risk heat map FHF

Based on the main hotspot detected, some solutions are proposed

- One potential solution to the challenge of struggling with a scarcity of customers is to implement targeted marketing and advertising strategies. This can be achieved by conducting thorough market research, identifying ideal customer profiles, and tailoring messaging and promotions to reach those specific segments;
- Exploring strategic partnerships, joint ventures, or licensing agreements can provide access to additional resources, expertise, and funding. Diversifying revenue streams and exploring alternative funding sources can help reduce dependency on venture funding and improve the business's sustainability in the long term;
- To overcome the short- and long-term competition and the lack of a distinctive competitive advantage, focusing on innovation and product differentiation is crucial. Offering and introducing unique features or functionalities can set the business apart from competitors. Building strong customer relationships through excellent service and personalized experiences can foster loyalty and provide an edge. Collaborating with industry experts, or thought leaders can also enhance brand reputation and establish the business as a trusted choice within the target market.

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5. Conclusions

This deliverable D7.7 Risk analysis report discusses the importance of risk management principles in mitigating the effects of risk on business innovation in the context of GREEN-LOOP technologies. The report provided an overview of the main value chains implemented within the project, the actors involved and the related Key Exploitable Results. An updated KER ownership list was included in this deliverable to further support the risk analysis. Two analyses were conducted to have a complete overview of the risks that could be faced within the project.

The first analysis was related to the **KERs risks**. Technological, IPR, Partners, Market, Financial and Environmental risks were considered to develop the heat maps that allowed us to identify the main hotspots to take under control within the project lifetime. A comprehensive summary table has been created to outline the most notable risks. These risks have been prioritized, with particular emphasis placed on the ones requiring greater attention and action:

Group	KER	Nomenclature	Description	Risk Grade	Quadrant
4	12	TRF1	The final product does not comply with the standards - Insufficient information to inform design activity	80	WARNING
	12	TRF4	Timeframe of design does not align with manufacturing timescales	48	CONTROL
	7	TRF1	The process does not guarantee the performance of the material	64	ACTION
1	1	PRF2	Disagreement about the disclosure of data required for the analysis	63	ACTION
	6	PRF1	Disagreement on the disclosure of data	56	ACTION

Group 4, which represents the wood composite value chain, faces the highest risks and has fewer available mitigation actions. KER 12 specifically involves the risks TRF1 and TRF4, which are positioned in the "Warning" and "Control" quadrants, respectively. These risks arise from the challenges associated with meeting specifications due to a lack of knowledge during the design phase and subpar performance of the extruded blended polymer filaments. Some actions have been proposed to address these challenges and will need to be further develop in the next period.

To mitigate the risks within this value chain, it is suggested to consider several actions. Firstly, analyzing to determine the feasibility, both economically and technically, of different types of prototypes with varying wood concentrations. Secondly, adopting a user-centric design approach that involves the user throughout the entire design process. By implementing these suggested actions, the wood composite value chain can better navigate the identified risks and improve its overall performance.

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Within Group 1, the software and service group, the partnership field poses significant risks and is positioned within the "Action" quadrant. These risks mainly revolve around disagreements about the disclosure of crucial data for analysis. This concern is particularly pronounced in both KER 1 and KER 6, where data plays a pivotal role in improving all value chains. As a result, it is recommended to maintain consistent monitoring of the ongoing actions to ensure that the risks remain manageable and do not escalate beyond controllable limits.

Regarding the bio-rubber and bio-plastic value chains, the associated risks have been assessed with low ratings, suggesting a low level of importance and/or likelihood of occurrence. The actions proposed are expected to effectively mitigate the identified risks. Therefore, no further actions are currently required.

Following the **risk analysis for new business** was also performed to identify the main hotspot related to the implementation of new technology in the already existing business portfolio of the selected organizations. Also, in this case, risks related to several aspects were analysed such as: Product/Market fit, Product/process quality, Team, Recruiting, Sales, Market, Funding, Short term and Long term competitions.

The answers were variegated, but it was possible to detect some common aspects such as i) risks and challenges associated with introducing new processes, technologies, or products ii) low costume engagement and failure to meet customers' expectations ii) risk of low volume production iv) lack of market differentiation and high competition. To overcome these risks some mitigation actions were proposed such as a) Engaging customers through market activities, b) Performing a market search to understand the target market and customer needs, c) Perform a competitive landscape analysis d) Ensuring that the products/processes/ meet customer requirements through rigorous testing.

Market search and competitive analysis will be performed within Task 7.1 and Task 7.3 to support the partners in the mitigation actions. Regarding the technological aspect and production volume, some actions were mentioned in the risk analysis of the KERs.

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6. Annexes

6.1 Annex 1

Group 1 – KER 1

Type of Risk	Value Chain	KER 1 GREEN-LOOP Platform for Value Chain Optimization	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	all VCs	Disagreement on ownership rules	5	4	20	Conectivity will be adapted to users requirements	10	200
PRF2	all VCs	Disagreement about the disclosure of data required for the analysis	9	7	63	Secure data system to be included. Only the data owner will have access	10	630
Technological Risk Factors								
TRF1	all VCs	Significant dependency on other technologies	3	4	12	Constant review of emerging technologies and analysis of how to implement it considering economical and technical feasibility	10	120
Market Risk Factors								
MRF1	All VCs	Product rejected by the end-users	8	2	16	Addapt the platform to each user needs	10	160
IPR Risk Factors								
IPRRF1	All VCs	Lack of IPR strategy	2	4	8	Analyze and understand how to protect better protect the software and build a strategy for it	8	64
Financial Risk Factors								
FRF1	All VCs	High infrastructure costs	5	5	25	Analyze different environments at different companies and define how the platform should operateand the costs associated to it.	10	250
Environmental Risk Factors								
ERF1	All VCs	LCA results different from what expected	8	4	32	Identify all the processes and where should data be provided. Identify the areas where data is not available and understand how to improve this situation.	9	288

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Group 1 – KER 4

Type of Risk	Value Chain	KER 4 Contribution to standardization	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	all VCs	Project partners don't identify standardization gaps and/or don't contribute to surveys/questionnaires, drafting of proposal for new standard(s)	8	3	24	Raise awareness among project partners about how standardization works and what are the benefits of standardization/standards for the project and/or remind on their committment according to the Grant Agreement	10	240
PRF2	all VCs	External partnerships: Standardization communities are reluctant to take up the feedback on their standards and/or proposal for new standards	7	3	21	According to the Grant Agreement only the submission of feedback and/or new work item proposal(s) is contractually required. Going beyond that a closer liaison between the project and the standardization community might be necessary to foster the uptake.	7	147
Technological Risk Factors								
TRF1	all VCs				0			0
Market Risk Factors								
MRF1	all VCs				0			0
IPR Risk Factors								
IPRRF1	all VCs	IPR issues might be barrier for developing an open standard (SEP, Standard's essential Patent)	5	2	10	Comply with the patent policy of standardization and/or follow the performance approach of standardization (i.e. requirements shall be expressed in terms of performance rather than design or descriptive characteristics)	10	100
Financial Risk Factors								
FRF1	all VCs				0			0
Environmental Risk Factors								
ERF1	all VCs				0			0

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Group 1 – KER 6

Type of Risk	Value Chain	KER 6 Data acquisition system	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	all VCs	Disagreement on the disclosure of data	8	7	56	Periodical meetings and sharing of information in teams	6	336
Technological Risk Factors								
TRF1	all VCs	Significant dependency on other technologies	6	3	18	Look for alternative technologies (e.g sensor) to be compatible	9	162
TRF2	all VCs	Bag in the softwares	9	3	27	Available protocols and information to prevent system failure due to bags	9	243
Market Risk Factors								
MRF1	all VCs	High market competitiveness	8	5	40	Fostering the selling	9	360
IPR Risk Factors								
IPRRF1	all VCs	Copyright ownership among partners	5	5	25	Review and assess whether a more defined process is necessary for handling situations where partners with shared technology need to reach an agreement.	7	175
Financial Risk Factors								
FRF1	all VCs	High infrastructure costs	6	6	36	Control the budget and analyze other alternatives	6	216
Environmental Risk Factors								
ERF1	all VCs				0			0

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Group 2 – KER 5

Type of Risk	Value Chain	KER 5 Ultrasound enhancement for biomaterial manufacturing process	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probabilily of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC1	Disagreement in complying with the requirements for the lignin powder (with NIC)	7	4	28	Periodical meetings and sharing of information in teams	6	168
PRF2	VC1	Disagreement in complying with the requirements for the rubber functionalization (with UBRIS)	7	5	35	Periodical meetings and sharing of information in teams	6	210
Technological Risk Factors								
TRF1	VC1	Material does not complies with the standards	8	2	16	Explore other supplies of devulcanized rubber. Understand how can the design be improved.	9	144
TRF2	VC1	The smart manufacturing process does not guarantee the desired performances for the Lignin extraction	8	5	40	Study alternative operation modes. Tailored solutions to decrease problems during its integration.	9	360
TRF3	VC1	The smart manufacturing process does not guarantee the desired performances for the Rubber functionalization	8	3	24	Study alternative operation modes. Tailored solutions to decrease problems during its integration.	9	216
Market Risk Factors								
MRF1	VC1	Production costs not competitive	7	4	28	Understand where can the process be optimized.	7	196
IPR Risk Factors								
IPRRF1	VC1	Disagreement on IP ownership among partners	5	2	10	Review and assess whether a more defined process is necessary for handling situations where partners with shared technology need to reach an agreement.	7	70
Financial Risk Factors								
FRF1	VC1	Credit risk : expenses higher than project finances	2	2	4	The cost of prototypes will be controlled by selecting commercial equipments	10	40
Environmental Risk Factors								
ERF1	VC1				0			0

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Group 2 – KER 11

Type of Risk	Value Chain	KER 11 Novel compositions for bio-rubber pads with lignin additives for fire-resistant and vibrational applications (RUBBER FUNCTIONALIZATION + LIGNIN EXTRACTION)	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC1	Disagreement in complying with the requirements of the lignin powder and devulcanised rubber (UBRIS and NIC with NCC)	7	6	42	Periodical meetings and sharing of information in teams	6	252
Technological Risk Factors								
TRF1	VC1	Formulated material does not guarantee the desired performances (from UBRIS)	8	3	24	Gated test plan & lab scale trials Various methods to perform	8	192
TRF2	VC1	The produced material cannot be used for the foreseen purpose - Lignin compatibility (from NIC)	8	5	40	Lignin fractionation/modification will be performed	8	320
TRF3	VC1	Lab-scale equipment fail (from UBRIS)	5	2	10	Links with other manufacturing/testing facilities	6	60
TRF4	VC1	Upscaling problems - Rubber Supply (from UBRIS)	6	6	36	Gated test plan & lab scale trials Dual sourcing of material	7	252
TRF5	VC1	Upscaling problems - Lignin supply (from NIC)	8	1	8	Dual sourcing of material	10	80
Market Risk Factors								
MRF1	VC1				0			0
IPR Risk Factors								
IPRRF1	VC1	Disagreement on IP ownership among NIC, UBRIS and NCC	5	3	15	Review and assess whether a more defined process is necessary for handling situations where partners with shared technology need to reach an agreement.	7	105
Financial Risk Factors								
FRF1	VC1	Production costs not competitive (for NIC in the Lignin Extraction)	6	3	18	Technology assessment and innovation: Explore new technologies and innovations in lignin extraction that can potentially lower production costs. Raw material sourcing and cost management: Analyze the cost and availability, and explore alternative feedstocks.	6	108
FRF2	VC1	Production costs not competitive (for UBRIS in the Rubber Functionalization)	6	6	36	Technology assessment and innovation: Explore new technologies and innovations in rubber functionalization that can potentially lower production costs. Raw material sourcing and cost management: Analyze the cost and availability, and explore alternative feedstocks.	6	216
Environmental Risk Factors								
ERF1	VC1	lignin substitution with non-biobased material	8	1	8	Selection of non-biobased material with the lowest impact to the environment	10	80

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Group 2 – KER 13

Type of Risk	Value Chain	KER 13 Novel manufacturing for bio-rubber pads with lignin additives	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC1	Communication problems in specifying the correct characteristics and amount of material needed (with NIC and UBRIS)	7	7	49	Periodical meetings and sharing of information in teams	6	294
PRF2	VC1	Losing a partner or suitable engagement within the WP	5	1	5	Monthly drumbeats	6	30
Technological Risk Factors								
TRF1	VC1	The final product does not complies with the standards - Panel manufacture	9	5	45	Gated test plan & lab scale trials Various methods to perform	7	315
TRF2	VC1	Upscaling problems - Extrusion capability	7	4	28	Minimise equipment modifications, links with other manufacturing centres, hire of suitable capability	7	196
TRF3	VC1	Not able to deliver to Grant Agreement	6	2	12	Keeping options and applications in mind through material formulation stage	9	108
Market Risk Factors								
MRF1	VC1	Product formulation is not suitable for a saleable/viable product	4	3	12	Engagement with C&I and other external stakeholders	5	60
MRF2	VC1	Product rejected by the end-users	6	6	36	Update the market research, user-centric design keeping the user involved in all the design process, and usability testing (testing the usability of the product before launching it)	7	252
MRF3	VC1	High product price	4	7	28	Price estimation, production control, analyze areas for optimization and cost reduction.	6	168
MRF4	VC1	Low production capacity	7	3	21	Understand where can the process be optimized, link with other manufacturing centers for help if needed, hire more staff to speed up the production, and develop a demand forcasting and planning.	8	168
IPR Risk Factors								
IPRRF1					0			0
Financial Risk Factors								
FRF1	VC1	Credit risk: expenses higher than project finances - subcontract of extruder capability leading to overspend (from UBRIS)	5	5	25	Replanning, rescoping & engagement with other partners	7	175
Environmental Risk Factors								
ERF1	VC1	Conflict between LCA & performance considerations	5	2	10	KPI's to drive decisions and sustainability focus and performance requirements	6	60
ERF2	VC1	Circularity principals are not met - Biodegradability % is not met	7	6	42	Analyze other feasible adaptation (consider other feedstocks, other formulations, increasing a certain material)	6	252

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Group 3 – KER 9

Type of Risk	Value Chain	KER 9 Novel drying, and milling based on non-thermal plasma for treating vegetal residues from agro-industrial supply chains as filler for thermoplastic carriers	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC2	Disagreement in complying with the requirements for the mixed fibers (with LBRT)	7	2	14	Periodical meetings and sharing of information in teams.	6	84
Technological Risk Factors								
TRF1	VC2	The raw materials used do not guarantee best performances of the final material - Bio material with lower performance caracteristics than expected (ex.	9	3	27	Analyze and build other formulations to have it as a second option. Investigate how to improve the current process and raw material for a better performance.	6	162
TRF2	VC2	Polymers or fillers are not available in the time expected due to shortage of supply	3	3	9	Provide alternative materials	7	63
TRF3	VC2	The smart manufacturing process does not guarantee the desired performances - Compounding process is not possible	7	3	21	Analyze and build different mold process scenarios. Identify a possible innovative solution.	7	147
TRF4	VC2	The produced material cannot be used for the foreseen purpose or not matches with the standards	8	5	40	Develop a special coating / Reformulate the composition of bioplastic and reperform the essential analysis	8	320
TRF5	VC2	Long time required for some tests/ redo some tests (ex. permeability)	7	5	35	Search for equivaent alternative tests, change laboratory to run test	8	280
TRF6	VC2	Upscaling problems - Mixer capability	7	5	35	Evaluate the existing processes and identify areas for optimization. Understand which other others infrastructures, technologies and knowledge can be used for support in case the demand increases	6	210
Market Risk Factors								
MRF1	VC2				0			0
IPR Risk Factors								
IPRRF1	VC2				0			0
Financial Risk Factors								
FRF1	VC2				0			0
Environmental Risk Factors								
ERF1	VC2	LCA results different from what expected	6	5	30	Prioritize more "functional" suppliers/l ess orderers but more material	7	210

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Group 3 – KER 2

Type of Risk	Value Chain	KER 2 Non-intrusive microwave enhancement for moulding injection	Degree of importance of the risk related to the final achievement of this KER.	Probability of risk happening	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention	Priority Level
			Please rate (1 low- 10 high)	Please rate (1 low- 10 high)			Please rate (1 low- 10 high)	
Partnership Risk								
PRF1	VC2	Disagreement in complying with the requirements for the enhancement of the material (with MYX)	7	3	21	Periodical meetings and sharing of information in teams	6	126
Technological Risk Factors								
TRF1	VC2	The produced material does not meet the desired requirements	9	3	27	Periodical meetings and sharing of information in teams	10	270
TRF2	VC2	Non adequate infrastructures	7	2	14	Analyze other methods instead of MW Identify other possible improvements in the process	10	140
TRF3	VC2	Upscaling problems - Low production capacity of Microwaves technology	5	6	30	Analyze how and what is needed for a future upgrade of this technology in bigger scale.	10	300
Market Risk Factors								
MRF2	VC2	High market competitiveness	4	7	28	Conducting comprehensive market analysis, maintaining ongoing surveillance of industry trends, and engaging in strategic planning.	10	280
IPR Risk Factors								
IPRRF1	VC2	Patent already exist	10	3	30	Do a patent analysis and understand if there are similar techs in the market.	9	270
Financial Risk Factors								
FRF1	VC2	Credit risk : expenses higher than project finances	2	2	4	The cost of prototypes will be controlled by selecting commercial equipments	10	40
FRF2	VC2	High technology cost	4	7	28	Conducting market testing in the early stages and engaging with key industry stakeholders can yield useful data regarding the market's inclination and preparedness to embrace novel technology.	10	280
Environmental Risk Factors								
ERF1	VC2	Circularity principles not met	8	2	16	Control the properties of the dielectric material to see if it has changed	8	128

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Group 3 – KER 10

Type of Risk	Value Chain	KER 10 Disruptive injection molding process for bio-plastic bottle closures production.	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC1	Communication problems in specifying the correct characteristics and amount of material needed	7	5	35	Periodical meetings and sharing of information in teams.	6	210
Technological Risk Factors								
TRF1	VC2	The final product does not complies with the standards	8	5	40	Build several scenarios, considering different Bioplastic prototypes composition	7	280
TRF2	VC2	Microwave integration is not fully non-invasive process	3	5	15	Detailed study and advanced simulations to find different and innovative solutions	7	105
TRF3	VC2	Samples produced present some defects	3	3	9	Analyze all possible non-conformities that the product could have and understand that is the cause route, to futher put actions to mitigate any possible defect.	5	45
Market Risk Factors								
MRF1	VC2	Product rejected by the end-users	6	5	30	Update the market research, user-centric design keeping the user involved in all the design process, and usability testing (testing the usability of the product before launching it).	7	210
MRF2	VC2	The product quality doesn't comply with the market demand and necessity	6	5	30	Intervention should be made on the bioplastic or invest in a special coating. Identify other options of coating.	7	210
MRF3	VC2	High product price	6	5	30	Research of recources at lower costs/need to produce more volumes to better exploit production costs/ change final usage of material	7	210
MRF4	VC2	Low production capacity	4	7	28	Understand where can the process be optimized, link with other manufacturing centers for help if needed, hire more staff to speed up the production, and develop a demand forcasting and planning.	7	196
IPR Risk Factors								
IPRRF1	VC2				0			0
Financial Risk Factors								
FRF1	VC2	Production costs not competitive	6	5	30	Technology assessment and innovation: Explore new technologies and innovations in injection molding that can potentially lower production costs. Raw material sourcing and cost management: Analyze the cost and availability, and explore alternative feedstocks	6	180
Environmental Risk Factors								
ERF1	VC2	Circularity principals are not met - Biodegradability % is not met	7	3	21	Analyze other feasible adaptation (consider other feedstocks, other formulations, increasing a certain material)	6	126

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Group 4 – KER 7

Type of Risk	Value Chain	KER 7 Disruptive extrusion process for small series production of WC-based sliding bearings	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC3	Disagreement in complying with the requirements for blended polymers filaments (with NCC and IDE)	7	5	35	Periodical meetings and sharing of information in teams.	6	210
Technological Risk Factors								
TRF1	VC3	The process does not guarantee the performance of the material	8	8	64	Detect possible process deviations, and control extrusion parameters or compounds	10	640
TRF2	VC3	Properties such as sliding behaviour cannot be reached	7	3	21	Find new formulation (additives) to achieve required tribo properties	7	147
TRF3	VC3	Required lignin properties are not available	9	3	27	Deeper analytics of lignin, modify lignin, search for coupling agents	7	189
TRF4	VC3	Effort for set-up extruder with MW enhancement	5	5	25	Shift of resources from WP6 to WP5	6	150
Market Risk Factors								
MRF1	VC3				0			0
IPR Risk Factors								
IPRRF1	VC3	Disagreement on IP ownership among partners	5	2	10	Review and assess whether a more defined process is necessary for handling situations where partners with shared technology need to reach an agreement.	7	70
Financial Risk Factors								
FRF1	VC3				0			0
Environmental Risk Factors								
ERF1	VC3	Raw materials are not secondary material but virgin ones or not bio-based	8	3	24	Analyze other feasible adaptation (consider other feedstocks, other recycled materials as second option)	6	144

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Group 4 – KER 8

Type of Risk	Value Chain	KER 8 Adapted non-destructive quality control method for WC samples and components	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of Intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC3	Disagreement in complying with the non-destructive quality requirements (with NCC)	7	4	28	Periodical meetings and sharing of information in teams.	6	168
Technological Risk Factors								
TRF1	VC3	The smart manufacturing process does not guarantee the desired performance - non-destructive quality control method for samples fails, or does not reach the desired performance	8	4	32	Training and Skill Development: Ensure that the personnel responsible for conducting the non-destructive quality control are adequately trained and possess the necessary skills. Error Analysis and Root Cause Investigation: Perform in-depth error analysis and investigation when failures occur in the non-destructive quality control method.	7	224
Market Risk Factors								
MRF1	VC3				0			0
IPR Risk Factors								
IPRRF1	VC3				0			0
Financial Risk Factors								
FRF1	VC3	NDE (Nondestructive evaluation) methods are too expensive	4	6	24	Use of standard and approved quality testing method	10	240
Environmental Risk Factors								
ERF1	VC3				0			0

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Group 4 – KER 3

Type of Risk	Value Chain	KER 3 Microwave curing system for the extrusion process	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC3	Disagreement in complying with the requirements for the enhancement of the material (with MYX)	7	3	21	Periodical meetings and sharing of information in teams	6	126
Technological Risk Factors								
TRF1	VC3	The produced material does not meet the desired requirements	9	3	27	Periodical meetings and sharing of information in teams	10	270
TRF2	VC3	Non adequate infrastructures - Microwave integration is not fully non invasive process	3	5	15	Search for alternative susceptors, vary concentration	10	150
TRF3	VC3	Non adequate infrastructures - MW coupling to compound is not possible	9	3	27	Detailed study and advanced simulations to find different and innovative solutions	10	270
TRF4	VC3	Upscaling problems - Microwaves capability	5	6	30	Analyze how and what is needed for a future upgrade of this technology in bigger scale.	10	300
Market Risk Factors								
MRF1	VC3				0			0
IPR Risk Factors								
IPRRF1	VC3	Patent already exist	10	3	30	Do a patent analysis and understand if there are similar techs in the market.	9	270
IPRRF2	VC3	Disagreement on IP ownership among partners	5	2	10	Review and assess whether a more defined process is necessary for handling situations where partners with shared technology need to reach an agreement	7	70
Financial Risk Factors								
FRF1	VC3	Credit risk : expenses higher than project finances	2	2	4	The cost of prototypes will be controlled by selecting commercial equipments	10	40
Environmental Risk Factors								
ERF1	VC3	Circularity principles not met	8	2	16	Control the properties of the dielectric material to see if it has changed	8	128

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Group 4 – KER 12

Type of Risk	Value Chain	KER 12 Design Innovative Wood Composite sliding bearing systems	Degree of importance of the risk related to the final achievement of this KER. Please rate (1 low- 10 high)	Probability of risk happening Please rate (1 low- 10 high)	Risk grade	Scope and type of potential intervention	Feasibility/ Success of intervention Please rate (1 low- 10 high)	Priority Level
Partnership Risk								
PRF1	VC3	Communication problems in specifying the correct characteristics and amount of material needed	7	5	35	Periodical meetings and sharing of information in teams.	6	210
Technological Risk Factors								
TRF1	VC3	The final product does not comply with the standards - Insufficient information to inform design activity. Design of specific bearing for Labrent a cannot be manufactured by extrusion.	10	8	80	Direct engagement with machine tool suppliers and alternative manufacturers that supply similar machines. Re-design sliding bearing, alterantive manufacturing by net-shape press moulding or machining.	4	320
TRF2	VC3	Inexperience in working with wood composites	3	1	3	Full engagement within WP, leaning on literature informaiton	9	27
TRF3	VC3	Bearing does not require a press stage	2	5	10	Have a direct comparison of pressed material to extruded to understand impact of manufacturing process implications	8	80
TRF4	VC3	Timeframe of design does not align with manufacturing timescales	6	8	48	Design activity can be compressed with relevant resource, potential to have to assume dimensions to inform design	4	192
Market Risk Factors								
MRF1	VC3	Product rejected by the end-users	6	8	48	Update the market research, user-centric design keeping the user involved in all the design process, and usability testing (testing the usability of the product before launching it).	7	336
MRF2	VC3	High product price	4	5	20	Price estimation, production control, analyze areas for optimization and cost reduction.	6	120
MRF3	VC3	Low production capacity	4	7	28	Understand where can the process be optimized, link with other manufacturing centers for help if needed, hire more staff to speed up the production, and develop a demand forcasting and planning.	7	196
IPR Risk Factors								
IPRRF1					0			0
Financial Risk Factors								
FRF1					0			0
Environmental Risk Factors								
ERF1	VC3	Circularity principals are not met - Biodegradability % is not met	7	3	21	Analyze other feasible adaptation (consider other feedstocks, other formulations, increasing a certain material)	6	126

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6.2 Annex 2

Idener

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	You think businesses will not use your product/process.	Very high	Businesses not wanting your product	Very Likely
Product/Market Fit (B2C)		You think people will use your product/process.	Very High	Customers don't have great economic availability	Very Likely
Product/Market Fit (Churn)		Engagement is very low, churn is very high.	Very High	Losing customers because they are not engaged	Some chance
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	You are sure you can build a great product/ process, but haven't built one before.	Very High	Launching the product/process with a delay and/or at higher cost	Some chance
Team	Prove that you have a great team in relevant areas.	Your full-time team covers all the areas required by your product	Very Low	Product do not meet requierements	Very Little
Recruiting	Prove that you can grow your team.	You have prior recruiting and management experience.	Medium	Not finding a person that fit the position	Small Chance
Sales	Prove that your team can sell the product.	You have a strong, experienced sales team.	Low	Not enough customers to sell to	Some chance
Market	Prove that you can make enough money to become a huge company.	You have no idea how large your target market might be.	Very High	Not reaching the desired market size	Some chance
Funding	Prove that you have enough capital to reach your milestones.	You have good funds investing in your current round, and they will help guide you to your next round.	Medium	Having funds only for a short period	Small Chance
Short-Term Competition	Prove that your business is differentiated from existing players.	There are very few competitors but with a strong differentiation between you and them.	Low	Not being able to become a differentiated player in the market	Very Little
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You're not the first mover and you don't have a real competitive advantage.	Very High	Struggling to remain competitive in the marketplace.	Small Chance

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Labrenta

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	You think businesses will not use your product/process.	Very High	Businesses not wanting your product	Some chance
Product/Market Fit (B2C)		You think people will use your product/process.	Very High	Customers base not growing	Very Little
Product/Market Fit (Churn)		Engagement and churn are both moderate.	Medium	Losing customers because they are not engaged	Small Chance
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	You have a live, fully-functioning product/process and it's amazing.	Very Low	Prototype not meeting the expected requirements / Not being able to apply the existing protocol to the production of this product	Small Chance
Team	Prove that you have a great team in relevant areas.	Your full-time team covers all the areas required by your product	Very Low	Producing defectous products	Very Little
Recruiting	Prove that you can grow your team.	Your team already includes several great hires.	Low	Hiring the wrong talent for the position (person not meeting the necessary skills and habilities for that specific position)	Small Chance
Sales	Prove that your team can sell the product.	You have a strong, experienced sales team.	Low	Failing to reach the sales goal	Some chance
Market	Prove that you can make enough money to become a huge company.	You have a plausible bottom-up analysis of market size ("We think we can capture 10% of users in group A and 20% of users in group B, and we plan to charge those users $X and $Y, respectively.")	Low	Target market expanding slower than desired	Small Chance
Funding	Prove that you have enough capital to reach your milestones.	You are self-funded with a decent likelihood of future funds or more than 35% of your time generating funds.	Medium	Sales are not covering the expenses	Very Little
Short-Term Competition	Prove that your business is differentiated from existing players.	There are very few competitors, but no strong differentiation between you and them.	Medium	Not being able to become a differentiated player in the market	Very Little
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You have strong competitive advantages, like network effects or a proprietary datasets, that get stronger as you grow	Very Low	Struggling to remain competitive in the marketplace.	Very Little

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Mixcycling

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	You talked to potential customers, and they said they wanted to try the product once it was built.	High	Not enough customers to sell to, Needing more funds to pay the pilots	Some chance
Product/Market Fit (B2C)		Your user base is growing organically at a moderate rate.	Low	Customers base not growing Not enough customers to sell to	Some chance
Product/Market Fit (Churn)		Engagement is very high, churn is very low.	Very Low	Churn starts to increase suddenly due to lower competitor prices	Small Chance
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	You have a prototype, and it's good.	Low	Prototype not meeting the expected requirements	Very Little
Team	Prove that you have a great team in relevant areas.	Your full-time team covers most of the areas required by your product	Low	Product do not meet requierements	Some chance
Recruiting	Prove that you can grow your team.	You've built very strong teams in the past.	Low	Not finding a person that fit the position / Recruiting procedure takes longer than expected, producing delays	Very Likely
Sales	Prove that your team can sell the product.	You've done a lot of sales work that's similar to what you'll be doing at your startup.	Medium	Not enough customers to sell to	Some chance
Market	Prove that you can make enough money to become a huge company.	You have a plausible top-down analysis of market size ("People spend $X per year on this problem, and we think we can capture 15% of that with our solution.")	Low	Not reaching the target market volume / Target market expanding slower than desired	Some chance
Funding	Prove that you have enough capital to reach your milestones.	You have good funds investing in your current round, and they will help guide you to your next round.	Medium	Sales are not covering the expenses	Very Little
Short-Term Competition	Prove that your business is differentiated from existing players.	There are very few competitors but with a strong differentiation between you and them.	Low	Losing your market shares (due to a new entrant, a disruptive product/process, competitors lower the price, competitors' marketing campaign are very effective, etc)	Small Chance
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You have moderate competitive advantages: good brand perception among your customers, significantly better unit economics, a strong patent portfolio, etc.	Low	Struggling to remain competitive in the marketplace.	Some chance

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NIC

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	N/A	#N/A	N/A	N/A
Product/Market Fit (B2C)		N/A	#N/A	N/A	N/A
Product/Market Fit (Churn)		N/A	#N/A	N/A	N/A
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	N/A	#N/A	N/A	N/A
Team	Prove that you have a great team in relevant areas.	Your full-time team covers most of the areas required by your product	Low	senior researcher leaving the business	Small Chance
Recruiting	Prove that you can grow your team.	Your team already includes several great hires.	Low	there might be delays to delivery if staff moves to other companies	Some chance
Sales	Prove that your team can sell the product.	N/A	#N/A	N/A	N/A
Market	Prove that you can make enough money to become a huge company.	N/A	#N/A	N/A	N/A
Funding	Prove that you have enough capital to reach your milestones.	N/A	#N/A	N/A	N/A
Short-Term Competition	Prove that your business is differentiated from existing players.	There are many competitors of all sizes (huge incumbents, young startups, well-funded startups, etc). These companies are attacking your target market from many directions.	Very High	Not being able to enter the market	Very Little
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You're not the first mover and you don't have a real competitive advantage.	Very High	Others are quicker to market with a similar product	Small Chance

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TDZ

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	You talked to potential customers, and they said they wanted to try the product once it was built.	High	Not enough customers to sell to	Some chance
Product/Market Fit (B2C)		Your user base is growing organically at a moderate rate.	Low	Customers don't have great economic availability	Very Likely
Product/Market Fit (Churn)		Engagement and churn are both moderate.	Medium	Churn starts to increase suddenly due to lower competitor prices	Very Likely
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	You have a live, fully-functioning product/process and it's amazing.	Very Low	Launching the product/process in the incorrect moment	Very Little
Team	Prove that you have a great team in relevant areas.	Your full-time team covers most of the areas required by your product	Low	People leave the company (due to an overload of work, not enough training, not a good environment, not being motivated correctly, etc)	Some chance
Recruiting	Prove that you can grow your team.	You have some interviewing experience.	High	Not finding a person that fit the position	Some chance
Sales	Prove that your team can sell the product.	You've done a lot of sales work that's similar to what you'll be doing at your startup.	Medium	Not having enough time to address the sales tasks, producing delays	Very Little
Market	Prove that you can make enough money to become a huge company.	You have a plausible top-down analysis of market size ("People spend $X per year on this problem, and we think we can capture 15% of that with our solution.")	Low	Target market expanding slower than desired	Very Likely
Funding	Prove that you have enough capital to reach your milestones.	You are self-funded with a decent likelihood of future funds or more than 35% of your time generating funds.	Medium	Having funds only for a short period	Some chance
Short-Term Competition	Prove that your business is differentiated from existing players.	There are many competitors of all sizes (huge incumbents, young startups, well-funded startups, etc). These companies are attacking your target market from many directions.	Very High	Not being able to become a differentiated player in the market	Some chance
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You're not the first mover and you don't have a real competitive advantage.	Very High	Struggling to remain competitive in the marketplace.	Some chance

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IRIS

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	You have paid contracts. Ideally prepaid.	Very Low	Not enough customers to sell to	Very Likely
Product/Market Fit (B2C)		Your user base is growing organically at a moderate rate.	Low	Customers don't have great economic availability	Very Likely
Product/Market Fit (Churn)		Engagement is very low, churn is very high.	Very High	Churn starts to increase suddenly due to new entrants	Some chance
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	You have a live, fully-functioning product/process and it's amazing.	Very Low	Launching the product/process with a delay and/or at higher cost	Some chance
Team	Prove that you have a great team in relevant areas.	Your full-time team covers most of the areas required by your product	Low	Going over budget due to training programs	Some chance
Recruiting	Prove that you can grow your team.	You're currently able to reliably recruit in-demand candidates through personal charisma, a strong company mission, an amazing company culture, or something similar.	Very Low	Recruiting procedure takes longer than expected, producing delays	Very Likely
Sales	Prove that your team can sell the product.	You're successfully selling your product at a good price and with reasonable sales cycles.	Very Low	Not enough customers to sell to	Very Likely
Market	Prove that you can make enough money to become a huge company.	You have a plausible bottom-up analysis of market size ("We think we can capture 10% of users in group A and 20% of users in group B, and we plan to charge those users $X and $Y, respectively.")	Low	Not reaching the target market volume	Some chance
Funding	Prove that you have enough capital to reach your milestones.	You have good funds investing in your current round, and they will help guide you to your next round.	Medium	Having funds only for a short period	Some chance
Short-Term Competition	Prove that your business is differentiated from existing players.	There are very few competitors but with a strong differentiation between you and them.	Low	Losing your market shares (due to a new entrant, a disruptive product/process, competitors lower the price, competitors´ marketing campaign are very effective, etc)	Very Likely
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You have moderate competitive advantages: good brand perception among your customers, significantly better unit economics, a strong patent portfolio, etc.	Low	Losing your market shares (due to a new entrant, a disruptive product/process, bad reputation, competitors´ marketing campaign are very effective, not considering customers' interest (as sustainability aspects), weak IP strategy, etc)	Very Likely

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NCC

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	You talked to potential customers, and they said they wanted to try the product once it was built.	High	Cost not yet determined of product when compared with market available options. Quality of product/material may not hit key requirements	Some chance
Product/Market Fit (B2C)		You think people will use your product/process.	Very High	Material formulation only suited to one application	Some chance
Product/Market Fit (Churn)		Engagement and churn are both moderate.	Medium	Sector too slow to adopt sustainability and circularity objectives	Some chance
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	You are sure you can build a great product/ process, but haven't built one before.	Very High	Technical challenges need to be overcome to formulate a viable product	Very Likely
Team	Prove that you have a great team in relevant areas.	Your full-time team covers most of the areas required by your product	Low	Senior research engineer leaving business impacts delivery of project	Small Chance
Recruiting	Prove that you can grow your team.	Your team already includes several great hires.	Low	Should staff move on from the company, recruitment may cause delays to delivery	Small Chance
Sales	Prove that your team can sell the product.	N/A	#N/A	N/A	N/A
Market	Prove that you can make enough money to become a huge company.	N/A	#N/A	N/A	N/A
Funding	Prove that you have enough capital to reach your milestones.	N/A	#N/A	N/A	N/A
Short-Term Competition	Prove that your business is differentiated from existing players.	There are very few competitors, but no strong differentiation between you and them.	Medium	Others are quicker to market with a similar product	Very Little
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You have moderate competitive advantages: good brand perception among your customers, significantly better unit economics, a strong patent portfolio, etc.	Low	Others are quicker to market with a similar product	Small Chance

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ZAG

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	You think businesses will use your product/process.	Very High	The service is incomplete and needs additional procedures	Small Chance
Product/Market Fit (B2C)		You think people will use your product/process.	Very High	Customers do not recognise the result	Very Little
Product/Market Fit (Churn)		Engagement and churn are both moderate.	Medium	Competitors develop lower priced services	Some chance
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	You've previously been on a team that built great products/ processes.	High	Failures in procedure compromise the quality	Very Little
Team	Prove that you have a great team in relevant areas.	Your full-time team covers most of the areas required by your product	Low	Very high fluctuation cause lack of knowledge	Very Little
Recruiting	Prove that you can grow your team.	You have prior recruiting and management experience.	Medium	Small basin of appropriate people	Very Likely
Sales	Prove that your team can sell the product.	You've built and led successful sales teams in the past.	Medium	Selling channels not reaching the right customers	Small Chance
Market	Prove that you can make enough money to become a huge company.	Your target market is small and unlikely to grow quickly.	Very High	Demant is growth limiting factor	Some chance
Funding	Prove that you have enough capital to reach your milestones.	You've successfully raised some venture capital before.	High	Unforseen procedures requires very high investment	Very Little
Short-Term Competition	Prove that your business is differentiated from existing players.	There are very few competitors, but no strong differentiation between you and them.	Medium	Specialised competitors emerge	Very Little
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You have moderate competitive advantages: good brand perception among your customers, significantly better unit economics, a strong patent portfolio, etc.	Low	Specialised competitors emerge	Small Chance

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Franhofer

Area Possible Areas of Risk	Goal	Current Situation Where your process/project stands today	Risk Level Very low to very high	Risk related to your Current Situation (Check the examples in the "Risks Examples Tab")	Probability of Risk happening Very low to very high
Product/Market Fit (B2B)	Prove that you are building something that people want	N/A	#N/A	N/A	N/A
Product/Market Fit (B2C)		N/A	#N/A	N/A	N/A
Product/Market Fit (Churn)		N/A	#N/A	N/A	N/A
Product/ Process Quality	Prove that you can build a great, high-quality product/process.	N/A	#N/A	N/A	N/A
Team	Prove that you have a great team in relevant areas.	Your full-time team covers most of the areas required by your product	Low	People leave the company	Some chance
Recruiting	Prove that you can grow your team.	Your team already includes several great hires.	Low	People do not want to enter the company	Small Chance
Sales	Prove that your team can sell the product.	You've done a lot of sales work that's similar to what you'll be doing at your startup.	Medium	Not enough customers to sell to	Very Likely
Market	Prove that you can make enough money to become a huge company.	You have no idea how large your target market might be.	Very High	Target market expanding slower than desired	Some chance
Funding	Prove that you have enough capital to reach your milestones.	Your business will not be self-sustaining for a long time, and you're completely dependent on raising many rounds of venture funding.	Very High	Having funds only for a short period	Some chance
Short-Term Competition	Prove that your business is differentiated from existing players.	There are many competitors of all sizes (huge incumbents, young startups, well-funded startups, etc). These companies are attacking your target market from many directions.	Very High	Not being able to become a differanted plyer in the market	Some chance
Long-Term Competition	Prove that you can maintain your strong position against similar companies	You don't have a real competitive advantage, but at least you're the first mover.	High	Losing your market shares	Very Likely

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