CUBIC

NOVEL BIOBASED MATERIALS TO IMPROVE CIRCULARITY

Improving the circularity
of complex plastic multi-material composites
using novel biobased materials
in B2B semi-finished products

Research and Innovation Action (RIA)
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D5.3 "Definition of the Training Plan"

Work Package 5

Responsible Partner: Aitiip

Circular Bio-based Europe Joint Undertaking

Bio-based Industries Consortium

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D5.3: Training plan

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Abbreviations

bioPA	Bio-polyamide
LCA	Life Cycle Assessment
PDR	Post-Doctoral Researchers
PhD	Doctor of Philosophy
RTO	Research and Technology Organisations
SSbD	Safe and Sustainable by Design
STEM	Science, technology, engineering, and math
T-RTM	Thermoplastic-Resin Transfer Moulding
WP	Work package

1. Introduction

1.1 Scope

This plan focuses on describing the methodologies that will be used to identify and define relevant themes, partners, tools, and channels, since, at this stage, no significant project research results are yet available in relation to the planned development.

Once those developments have progressed far enough to make the knowledge and data about these processes and technologies available, the plan could be defined and specified according in the forthcoming editions.

The Training Plan has been defined by Aitiip, the lead partner for this deliverable, with the peer evaluation of the rest of the consortium. This plan is a public deliverable.

1.2 About CUBIC

The general objective of CUBIC project is to improve the sustainability and circularity of complex products made of high-tech advanced multi-material composite thermoset and thermoplastic structures, by developing novel circular biobased alternative materials. These materials are thought to be manufactured as B2B intermediate semi-finished products that once combined or assembled into final end-user products can contribute to the increase of the renewable carbon-based flows uptake. These novel materials which are easily adaptable to new market products and demands are enabling the decentralisation in the European manufacturing industry and boosting a twin green and digital transformation. The participation of leading industry players maximises the consortium's ability to transfer the results of the project to enable post project further demonstration/qualification into broadly available market ready solutions.

This training plan will make sure that the know-how will be shared between the members of the consortium.

1.3 Outline of this training plan

Our training plan has been constructed on the below sections:

Section 1 – It is an introduction to the document, including its scope and a summary of the project.

Section 2 – It outlines the strategy for the planned training and educational activities within the CUBIC project, including the overall objectives of the training, as well as indicators for measuring the success of the planned training activities, the themes and topics that shall be trained, the methodology, the various training types to be applied, the training materials, and the targeted groups.

Section 3 – It outlines the overall timeline for the planned activities.

2. Strategy for training sessions

Knowledge sharing is the process of exchanging knowledge, including research data, processes, and findings, skills, experience, and understanding, among different target groups. The purpose of this training plan is to clearly define the themes, actions, and outcomes, target groups, and tools which will be implemented to support effective knowledge-sharing through targeted training activities and educational sessions as agreed in the project's Grant Agreement.

2.1 Objectives and related activities

The goal of the CUBIC training activities is to support further research (by expanding the European knowledge base for R&D projects) and development of novel biobased materials and manufacturing of (bio)plastics value chain (related to B2B and end-user products) for complex materials, either thermosets or thermoplastics. To achieve this goal, several activities have been identified that will be covered in this Training Plan deliverable:

- To identify and collect knowledge and research results generated within the CUBIC project that can be shared with relevant stakeholders that might benefit from these findings,
- To identify and specify stakeholder groups that are relevant to, and that have an interest in the progress and outcomes of the project and that will be targeted by the knowledge-sharing activities,
- To define suitable knowledge transfer activities tailored towards specific themes and stakeholder groups that result in the further use and development of the findings, and eventually in an uptake of the new materials and applications,
- To carry out knowledge exchange of CUBIC results via events, conferences, workshops, training materials, stakeholder platforms, and other training activities,
- To promote the project and its objectives, research activities, and results.

To make sure these activities are synchronised, the following action points will have to be considered, too:

- Identify consortium partners that will lead the training activities,
- Prepare (and regularly update) a training plan that provides a timeline for all planned training partners,
- Provide internal templates for training purposes,
- Define project specific training materials and tools,
- Establish collaborations with other relevant projects and networks for the purpose of sharing training activities and reach a larger target audience.

2.2 Training activities

CUBIC aims to improve the sustainability and circularity of complex products made of high tech advanced multi-material composite thermoset and thermoplastic structures, by developing novel circular biobased alternative materials. The project partners will actively pursue training activities to exchange the knowledge reached during the project duration to support further research (and expand the European knowledge base for R&D projects) and support the development of new standards and regulation in the field of sustainable upcycling of bio-based packaging and polymers.

In CUBIC, 2 training programmes will be created for upskilling professionals in circular economy and smart & green manufacturing practices: one for industrial workforce and one for young generations of scientists & engineers. Both are described in the following lines.

1. **Industry workforce:** to create and transfer knowledge to the European industry about circular economy and sustainable manufacturing, generating skilled workforce capable of using and implementing biomaterial-based and digital manufacturing activities.

This in-house training of workforce and open training (workshops) to new staff/workers (staff or workers that do not have previous training in these areas) will be carried out. This transfer of knowledge will be done hand-by-hand between the lead RTO and the industrial manufacturer for main unconventional technologies and methodologies so that new skills are openly spread, always guaranteeing the confidentiality conditions clearly defined in Grant and Consortium Agreement and other project deliverables. This includes the following themes:

- 3 technology-to-product oriented trainings:
  - Bio-polyamide (bioPA) thermoplastic-resin transfer moulding (T-RTM) & rotomoulding
  - Thermoset thermoforming
  - Thermoplastic thermoforming,
- 1 training dedicated to digitalisation.
- 1 training including safe and sustainable by design (SSbD), Life Cycle Assessment (LCA) and Circular models.

Training sessions will identify potential stakeholders and vocational training of professionals (e.g. Fundación San Valero within their Centre for Continuing and Occupational Training), and other potential end-users that can replicate and multiply the applications of the technologies, products and end-of-life practices.

2. **Academic students** (scientists and engineers): the goal is the development of a training programme to provide knowledge to European students in the main disciplines involved in the project, namely: materials science, engineering, and chemical fields (STEM) teaching them new skills for new arising demand in technical jobs (to boost the breeding ground of new talents).

CUBIC will train young generations of scientists and engineers, by training emerging and upskilling established researchers in new technologies in the field of biocomposites:

- materials,
- products,
- processing,
- characterisation,
- digitalization.

Across all WPs, approximately 5 postdoctoral researchers (PDR) will be involved in the research who will in turn help mentor 5 PhD students (attracting talent that may be uptake by the industry and public institutions as new workforce for the jobs to be created). PhD students and PDRs will visit partner institutions and companies, not only to develop skills required for composite manufacture, but also to broaden and enhance their career options. This will deliver different experiences across knowledge-driven public laboratories and customer-centric industrial environments.

2.2.1 Industrial workforce

The training provided to industry workforce will be both internal (in house training) and external (open training).

2.2.1.1 In house training. Workshops

To facilitate the access to learning, training pills will be used. A training pill is a short but intense way of learning that provides the most important information in an appealing form. They are fast to produce and accessible from almost all devices with an internet connection. These pills may also provide new educational content in graphic, presentation, recording or video format. Their main advantage is allowing users to **learn a lot within a couple of minutes**.

The partners responsible for each workshop will prepare the content for these pills, that will be created by Aitiip.

2.2.1.2 Open training. Workshops

In the open training, the audience of the training activities is wider and is not limited to the CUBIC partners.

The workshops developed will be the following:

Table 1 – Workshops.

Organization name	Topic	Date	Duration	Number of attendants
AIT-NOV-MOS	BioPA T-RTM & rotomoulding	M38	1-2 days	Min. 20
CTB-COM	Thermoplastic thermoforming	M40	1-2 days	Min. 20
CID-DITF-CBP	Thermoset thermoforming	M42	1-2 days	Min. 20
IDE	Digitalization	M30	1-2 days	Min. 20
CIR	SSbD, LCA and Circular models	M36	1-2 days	Min. 20

The timing, type of training, target groups, and training material will be defined further in collaboration with the partners involved in each one.

Training sessions will identify potential stakeholders and vocational training professionals (e.g. Fundación San Valero within their Centre for Continuing and Occupational Training), and other potential end-users that can replicate and multiply the applications of the technologies, products and end-of-life practices. Anyway, the protection of confidential information expressed in the Agreements and other deliverables will be always guaranteed.

2.2.2 Academic training

Among the different proposed activities, the project will create training programmes for upskilling professionals in circular economy and smart & green manufacturing practices.

2.2.2.1 Training meetings

Within the CUBIC project, at least 5 PhDs and 5 PDRs (Post-Doctoral Researchers) will learn the techniques developed in the project. To facilitate this, the selected individuals will have a general meeting at M5 where the following issues will be specified:

- Which aspects of the techniques each PDR will learn.

- Contents to be developed considering:
  - Theoretical and practical level of training.
  - Level of the student.
  - Learning methodology.
  - Materials to be used.
- PhD assigned as a mentor to each PDR. A tentative list of this is proposed in the following table.

Table 2. Tentative table of assignments of researchers.

Senior Researchers		Mentor		Trainee	
Name	**Partner**	**Name**	**Partner**	**Name**	**Partner**
Lidia García	AIT	Leyre Hernández	AIT	Julio Vidal	MOS
		Birgit Stubbe	CTB	Susanne K. Lang	COM
Zeliha Ates	NOV	Cecilia Chaine	CIR	Andrea Carrascosa	CIR
		Ignacio Julián	CIR	Alejandro Fresneda	CIR
Maurice Collins	LIM	Fiona Magliozzi	SP	Virginie Boucher	CID
		Frank Schmidt	DITF	Sabrina Boumad	DITF

Mentors and trainees will also meet periodically (**every 6 months)** to monitor the evolution of the learning process. PDRs and their respective mentors will meet **annually** to monitor their progress.

2.2.2.2 Technology visits

During the visits, mentors and trainees not only know the equipment and facilities of the visited partners, but also will develop demonstration workshops on the pilot lines of the hosting partner. In the cases that demonstration activities cannot develop on the pilot lines due to safety and insurance issues, will be substituted by labs tours and conceptual lessons.

The tentative list of the visits is the following:

Table 3 – Tentative list of technology visits.

Number of visit	Date	Location	Duration
1	M6	Novamont facilities (Italy)	1 day max
2	M12	Cidetec facilities (Spain)	1 day max
3	M18	Limerick facilities (Ireland)	1 day max
4	M24	Centexbel facilities (Belgium)	1 day max
5	M30	DITF facilities (Germany)	1 day max
6	M36	Comfil facilities (Denmark)	1 day max

The participants will complete at the end of the training activities an evaluation questionnaire, to check if the activity is effective or must be improved. The evaluation questionnaire will be designed by Aitiip.

2.3 Target indicators

The effectiveness of the defined training activities will be measured against several target indicators. The number of training activities that shall be organised during the project lifetime (42 months) has been defined in the Grant Agreement, including at least the following:

- From the ***industrial*** point of view, at least **5 intensive sessions will be organized**.
- From the ***academic*** point of view CUBIC will train young generations of scientists and engineers (at least **10** people: approximately **5** postdoctoral researchers (PDR) will be involved in the research who will in turn help **mentor** **5** PhD students.

Table 4. Internal and external transfer of knowledge.

What	How	KPI	Target
Scientific internal transfer of knowledge: • Research and innovation programmes: Tutoring PDR & PhD by senior IPs & researchers to start project's innovation lines. • Training transfer: Demo Workshops on pilot lines, classrooms and short conceptual lessons. Promote Learning-by-doing. Inhouse & Open training sessions on manufacturing technologies: experimental and digital uses *(in the cases that due to safety and insurance issues this would not to be possible will be substituted by similar activities as lab tours).*	Creating talent, integrating multidisciplinary profiles Training researchers and workforce in circular bioeconomy & digitalisation	R&D lines initiated	3
		Nº young researchers	10
		Nº workshops	5
		Nº trained workers	30
		Nº attendants in workshops	20

Whereas mentoring will be used to exchange specific knowledge to researchers (academia), the CUBIC workshops will be used as means to share overall project objectives (as long as the confidential conditions allow this) and findings with a larger audience in the industrial area and to raise awareness for the research advances and application solutions made within the project to wider audiences.

The training for industry will be organised as hands-on workshops with a target of 20 registered participants per event. The main indicator of success, however, shall not only be the number of participants and effective reach-out, but the quality and accessibility of the training materials. Therefore, each **open training activity (workshops)**

shall result in specific training materials and resources that will be made shareable and accessible publicly on dedicated training spaces and the availability of which will be communicated and advertised on all available online channels. Aspects covers by confidentiality protection will not use.

2.4 Learning methodology

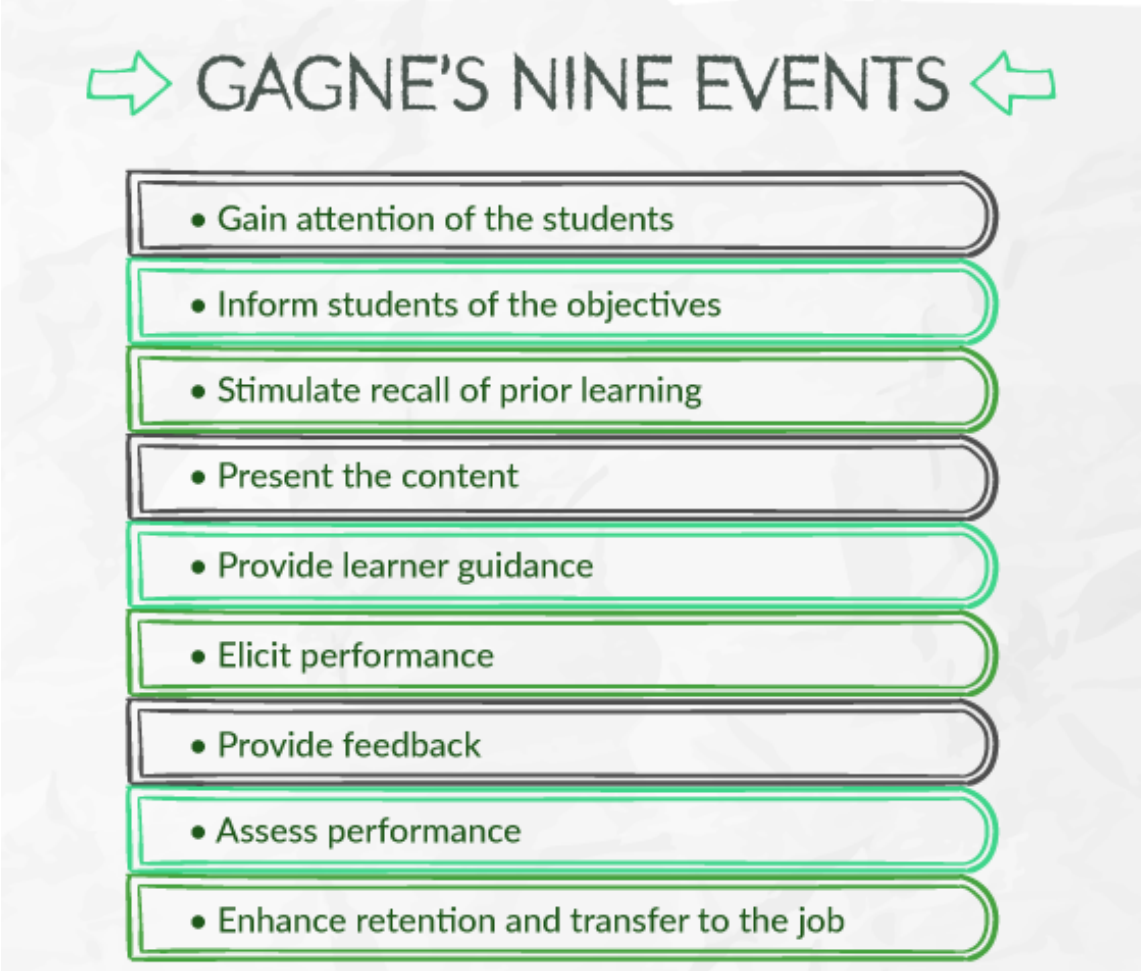

Figure 1 – Gagne's nine events

Robert Gagne proposed a framework comprising of a series of events based on the behaviourist approach to learning. These events follow a systematic instructional design process, creating a flexible model where events can be adapted to cater to different learning situations.

It is, in fact, one of the most used instructional design models as it provides a sound structure for developing effective eLearning.

The **nine steps** are:

- **Gain attention of the students** with stimuli that catch and engage their brain (novel ideas or thought-provoking question, etc.)
- **Inform students of the objectives.** Establish the expected outcomes and criteria for measuring achievement.
- **Stimulate recall of prior learning.** Leverage existing knowledge before introducing new knowledge and build on it.

- **Present the content.** Deliver the content in easily consumable chunks.
- **Provide learner guidance.** Guide them with examples, case studies, and other instructional support to supplement the content.
- **Elicit performance.** Engage them with different activities that recall, utilize, and evaluate knowledge.
- **Provide feedback.** Reinforce knowledge with immediate feedback (informative, remedial, corrective, etc.)
- **Assess performance.** Test their knowledge with established (and transparent) criteria.
- **Enhance retention and transfer to the job.** Use content retention strategies (concept maps, rephrasing, summarizing, job aids, etc.).

Gagne's model will serve as guidelines to creating a result-oriented e-learning instructional design. Below are the Nine Events of Instruction and the Do's and Don'ts that must be kept in mind:

STEP 1: GAIN ATTENTION

Gaining attention is inevitable for a training to take off successfully. Unless something within the training really grabs the mind of the learners, they will not glean much out of it even though they may sit through it.

Table 5 – Do's and Don't step 1.

DO's
Beginning training with storytelling or presenting an interesting animation is a good way to kick off the activity without making it too formal and boring from the start.
DON'Ts
Do not make it formal. Learners may unconsciously perceive the first exposure to the training as a sort of preamble to the whole training and if it's boring or too formal from the start, the trainee will lose his/her attention by the time he/she is presented the key knowledge or information.

STEP 2: PROVIDE A LEARNING OBJECTIVE

It is important to set expectations. Why are the learners here for a classroom training? What would they gain from the e-learning tutorial? Unless they see value in the course, they will take it half-heartedly.

Table 6 – Do's and Don't step 2.

DO's
Learning objectives must be concise and specific. Try to present 4-5 small objectives out of each training activity if possible. The idea is to get them to prepare a mental checklist of the things to learn which they can mentally keep checking off as they go on with the training.
DON'Ts
Do not make objective statements that are too wide, too general or too technical sounding. For example, chunking content into smaller modules is very important.

STEP 3: STIMULATE RECALL OF PRIOR KNOWLEDGE

This step is all about building a connection between what learners already know and what they will add to that.

Table 7 – Do's and Don't step 3.

DO's
Use small, objective assessments that test learners' existing knowledge and also serve as a recap before they are exposed to new information. Create 'mind maps' and graphic representations to illustrate how the e-learning course will help them connect the dots between their existing level of knowledge and the desired new level.
DON'Ts
Do not make the assessments too lengthy or too difficult. Remember, these are not assessments for testing core knowledge, but the goal is to recapitulate relevant information only.

STEP 4: PRESENT THE MATERIAL

The actual learning begins at this stage when learners get exposed to new information.

Table 8 – Do's and Don't step 4.

DO's
Use a variety of resources such as videos, audios and multimedia to create engaging training. Chunk information into small portions in a logical manner.
DON'Ts
Do not bombard learners with too much information as it leads to cognitive overload. Keep the learning experience neat and controllable from the learners' perspective.

STEP 5: PROVIDE GUIDANCE FOR LEARNING

This step isn't about presenting them with new information, rather it is about helping them how to learn and retain information better.

Table 9 – Do's and Don't step 5.

DO's
Using techniques like mnemonics, case studies, storyboarding, analogies and observational learning can help learners acquire the desired skills and knowledge.
DON'Ts

This step isn't about presenting them new information, rather it is about helping them " learn to learn" and retain information better.

STEP 6: ELICIT PERFORMANCE

Now is the time to make sure that learners have acquired the skill or knowledge the way it was meant to. Allow learners practice, demonstrate and apply their learning in electronic or real-life mock sessions (which will depend on the context).

Table 10 – Do's and Don't step 6.

DO's
Use role playing or gamification to allow learners to practice and enhance the newly gained knowledge. Give space for corrective learning and reduce fear by observing a model's behavior go unpunished in a feared activity. If you've taught them new information, ask questions to test the understanding and maintain learner attention.
DON'Ts
Do not ask learners to always 'imitate' what they have learnt, especially in case of observational learning. Instead, use modeling and allow them to identify the mistakes in the case you presented and demonstrate the correct course of action.

STEP 7: PROVIDE FEEDBACK

Learners must develop the trust that what efforts they are putting are being noticed and evaluated sincerely.

Table 11 – Do's and Don't step 7.

DO's
Use tests, quizzes or verbal comments to give detailed feedback about how learners demonstrated their knowledge and how they could do it better.
DON'Ts
Giving negative feedback is a critical task as you might completely lose learners' motivation and faith if you just point out mistakes and do not suggest ways to correct them. Also, do not delay the feedback process so much that it loses relevance and learners forget how or what they had done.

STEP 8: ASSESS PERFORMANCE

This step calls for proper assessment to evaluate learners as well as to improve the effectiveness of the learning activity based on learners' performance. Good scores mean learners are able to learn what they must, and general poor performance might have trainers rethinking about the instructional design.

Table 12 – Do's and Don't step 8.

DO's
Try making assessments as much fun to do as possible, while reinforcing the learning objectives. Use essays, short questionnaires and open questions to test their learning.
DON'Ts
While making assessments fun, do not lose relevance of the subject or use language which is confusing. It is also a good idea to give feedback after this step.

STEP 9: ENHANCE RETENTION AND TRANSFER

There is an old saying about making effective presentations, to tell them what you're going to tell them, tell them, and finally tell them what you told them. This enhances retention of knowledge by helping the learner to cue himself on the goals of the e-learning course.

Table 13 – Do's and Don't step 9.

DO's
Inform learners about similar problem situations, provide additional practice and review the lesson.
DON'Ts
Do not introduce new terminologies or concepts at this stage as you must focus on closing and completing the information transferred.

The following picture suggests possible instructional approaches for each step:

Figure 2 – Gagne's nine events with instructional approaches.

2.5 Training materials and resources

Training materials and resources will be provided for each training activity (prepared and compiled by the assigned partner) to support the effectiveness of the training (during the activity) and make the shared knowledge and data available publicly after the training event.

Training materials can include:

- Speaker/trainer presentations that were used during the training activity
- Poster presentation
- Visual and audio recordings of the training activity
- Illustration/graphic or photographic images (instructional/educational)
- Video (instructional/educational)
- Case study
- Briefing paper or recommendations
- Consultations
- Tutorials or simulations
- Material portfolios
- Other course materials (assignments, assessments, etc.)

2.5.1 Availability and accessibility

To gather and offer all training materials in one single location and make them accessible publicly, the training materials are being made available on the project website. A dedicated space will be implemented by Q-PLAN (the partner in charge of the project website). Access to all training materials is enabled for everyone (without password/login restrictions) inside and outside the project consortium. At the end of the project, Aitiip, together with Q-PLAN, will consolidate and share selected training contents on the project website.

3. Training plan

3.1 Overall timeline

CUBIC is a 42-month project running from 2023 till 2027. Education and training activities will take place throughout the project lifetime, although a larger share of these will be planned for much later towards the end of the project.

Initial activities, commencing towards the end of the first half of the project (around **M20**), will focus on sharing knowledge between the partners within the project consortium, while the requirements for the product demonstrators are defined and first prototypes are being developed and tested. This initial phase will mainly focus on network building with external stakeholders (mainly through the CUBIC Roadshow) and creating awareness for the project and the research that is carried out within CUBIC.

Once initial results have been achieved and the first significant achievements, that first knowledge will also be made available to external stakeholders through dedicated CUBIC workshops (starting around **M30**). The last phase (**M36-42**) will be devoted to the exchange of the results and research findings with industrial end-users and the wider interested public, in order to validate their interest in the developed materials and products. The timeline and detailed training plan will be reviewed and updated regularly as the project progresses. More details will be available depending on the project's advances, the identification of relevant stakeholders, or the collaboration with other projects and networks.