FUTUREbio

Project Management Plan

Project Acronym:	FutureBio
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REVISION SHEET

Version	Date	Author (Partner/Person)	The revision reason
0.1	19.01.2022	Arzum IŞITAN (PAU)	First draft that forms the plan
0.2	19.02.2022	Arzum IŞITAN (PAU)	Final form of the plan

Table of Contents

1. Executive Summary

This Project Management Plan (PMP) aims to provide key information and guidelines for the implementation of the FutureBio Project so that all stakeholders have a common understanding on what must be achieved, what must be delivered, who will be involved, when to deliver during the Project term. In the preparation of this plan, some parts of the Management and Communication Plan of the MSIE 4.0 project were utilized[1].

FutureBio is a two-year KA220-HED-Cooperation Partnerships in Higher Education project supported by Turkish National Agency, on biopolymers between eleven partners from Turkey and EU. The FutureBio project which provides information about bioplastics and production methods and is carried out awareness studies with new innovative training materials is the first project in the field. FutureBio has five work packages/phases categorized into four management levels for the purpose of to benefit from innovative practices among university students, academic staff, industry workers and the society, and to increase the competencies of academics and students with on-site training:

- Management Level- Phase1: Management
- Operation Level- Phase2 and Phase3: Curriculum preparation including needs analysis, company visits and survey applications, report preparation; creation of interactive open-access education modules, lecture guidebook, and VR exercises.
- Dissemination Level- Phase 4: Dissemination and sustainable implementation of the products
- Monitoring and Control Level- Phase5: Quality Control and Monitoring

Contained in this document are

- FutureBio Consortium covering list of partners, organization structure, and roles and responsibilities,
- Project Operations Management outlining tasks, deliverables, resource allocations, work plans and operations procedure,
- Project Financial Management providing general provision, financial reporting, eligible costs, procedures and supporting documentation for reimbursement and budget transfer,
- Project Risk Management highlighting risk management procedure and risk assessment form.

This document is prepared based on information obtained from the following documents:

1. Erasmus+ KA220-HED Project Proposal for “Let's use biodegradable plastic for the future”,
2. Partnership Agreement,
3. Guideline for the Use of the Grant for Grants Awarded in 2021 under Call — EAC/A09/2021.

[1] Curriculum Development of Master’s Degree Program in Industrial Engineering for Thailand Sustainable Smart Industry, Project Management and Communication Plan. https://msie4.ait.ac.th/

2. Introduction

2.1 Purpose of Project Management Plan

"Project Management and Implementation" is the framework of the project where all the activities, correct timing, project quality, functioning, all materials to be used from project results to dissemination activities are planned and checked during the entire project. The main purpose of this FutureBio Project Management Plan (PMP) is to create a common understanding of what must be achieved, what must be delivered, who will be involved, and when to deliver during the project duration. The intended audience of this document is all project stakeholders, including the project team members, university teachers and students, industrial institutions and their workers, high school students and teachers, public and private institutions, associations, individuals, and general society.

2.2 Project Introduction

Modern world has met with plastic/polymeric materials for the first time in the 1400s after Columbus encountered a natural rubber ball in Haiti. Today, polymers have found a wide range of applications thanks to their lightness, easy formability, and find a wide range of uses, from kitchenware to artificial heart valves. Many polymers are used in packaging of food, textiles, and machinery, and they are important parts of solid waste disposed of in solid waste landfills.

According to EU reports, PM packaging parts represent about 8% of the overall refuse in landfills. Besides all, microplastics, which are tiny fragments below 5 mm in size, are a big problem for leakage of rivers, lakes, seas and oceans. They can remain intact for many years. Reuse in manufacturing, incineration for energy generation, biodegradation in compost or in soil can be counted as disposal processes for plastic wastes. To reduce all negativities caused by polymers, "A EU Strategy for Plastics in a Circular Economy" and “Plastic Waste: a EU strategy to protect the planet, defend our citizens and empower our industries” has been developed. In the EU, around 25.8 million tons of plastic waste are produced every year. EU reports also state that only 6% of plastic products are demanded in the EU as recycled plastics. Polymeric waste is frightfully increased with ‘single use’ plastics each year. Reusability and nature degradable polymer production are important parts of these strategies. According to the European Green Deal Communication, reducing wastes, compensating carbon footprint emissions, saving resources, and sustainability are key priorities for the EU now and in the future. For a more livable and GREENER world, biopolymers should be developed and used. The FutureBio project was carried out to contribute to these basic priorities. Project aims to make the use of innovative practices among university students, academic staff, industry employees, and the community and to increase the competencies of academics and students with in-place training. This project has been prepared in accordance with the European Union's strategy of developing cooperation, increasing quality and encouraging innovation in the learning activities of individuals and groups in the field of education and training. In the preparation of the project, especially the difficulties and crisis caused by Covid-19, the importance of digital education for digital transformation in accordance with the Digital Education Action Plan was taken into consideration. Considering these issues, it is our priority to develop a high-performance digital technology for university students and industrial workers within the scope of the project. In this way, we aim to develop high quality digital technologies for education of universities and industrial institutions providing information about polymer and biopolymer and their manufacturing technologies all over Europe. We aimed to improve capacity and flexibility in education by making digital tools. The project applied the most innovative training technologies based on E-LEARNING tools with LABORATORY VIDEOS and animation applications in

game format and VIRTUAL REALITY tools that contribute to improve the trainees' motivation and engagement. The learning material is structured according to a competency-based learning approach. The use of e-learning and other related technologies in the FutureBio project can provide new opportunities for learners increasing flexibility, motivation and engagement. Students can take control of their own learning and be an active part of the learning process. In addition, online learning offers several new opportunities for learners and teachers, including the relatively low cost of technologies.

2.3 Project Objectives

The target group of the FutureBio project is all project stakeholders, including the project team members, university teachers and students, industrial institutions and their workers, high school students and teachers, public and private institutions, associations, individuals, and general society. The results of the project are to develop a curriculum, to prepare a guidebook, and to produce education materials with innovative and interactive tools for university students. The project applies innovative technologies based on e-learning, mobile learning, and VR tools with interactive videos and animations in game format. The learning materials are structured according to a competency-based learning approach.

FutureBio is aimed at determining the basic knowledge level of target groups on biopolymers by preparing a short survey during the preparation phase of the project.

The objectives of FutureBio are classified depending on target groups of the project as follows:

For ACADEMICIANS and university STUDENTS

- To create an innovative curriculum, open education resources (OERs), virtual reality (VR) tools, laboratory videos, a lecture guidebook,
- To encourage the development of biodegradable polymers (BDPs) and products via courses and outputs
- To guide them to prioritize in their academic career planning
- To increase the scientific competencies with in-place trainings

For INDUSTRY

- To create an industrial needs report, a value chain extending from lab to industry, from industry to environment and economy

For SOCIETY

- To raise social awareness that plastic pollution is an issue that needs urgent action
- To obtain awareness about BDP products

For PROJECT PARTNER

- To increase digital skills
- Developing new projects

2.4 Project Focus

With game-based animations, videos, and interactive presentations, distance learning tools have been prepared for those who are interested in polymers from all age groups and want to learn about

biopolymers. The interest in the subject increased with the online webinars that will be held during the project process, as expected. Our project team consists of experts in the fields of polymers and biopolymers, development of training methodologies, and innovative education materials. During the project, mutual information transfer, know-how, and brainstorming were carried out, and the partnership was more efficient. The project staff's scientific knowledge related to the BDP through the training activity (C1) was increased. Therefore, we aimed for the project partnership to develop itself in innovative education technologies. Thus, the potential of using these technologies in new projects will also increase.

Sustainable environment, green, and reduction of harmful waste are among the needs of the EU. For this reason, it is of great importance to raise awareness on BDP among industrial institutions and employees, to research production methods, and to develop university-industry collaborations.

FutureBio acted as a bridge in this regard. The needs of the industry were investigated in partner countries, and a guiding road map was created. FutureBio acted as a bridge in this regard. The needs of the industry were investigated in partner countries, and a guiding road map was created. Thus, to contribute to the sustainable economy and to be beneficial for the creation of a qualified workforce, along with the contribution to the sustainable environment, was aimed. In the project's detailed awareness/needs analysis and dissemination activities (E1-E8), collaboration with public and private sectors were done. We planned to spread project results faster by taking the opinions of these institutions. In this way, new projects created new project ideas.

3. FutureBio Consortium

3.1 Consortium Members

The FutureBio Consortium consists of 10 partners and 1 associated partner, of whom 3 are from Turkey and 8 are from EU partner universities, institutions, and SMEs. The 11 partners, in the same order as in the project proposal are as follows:

1. Pamukkale University - PAU - TR (Coordinator)
2. Kırklareli University - KLU - TR (Partner)
3. Selçuk University - SU - TR (Partner)
4. Fondazione Bruno Kessler - FBK - IT - (Partner)
5. Cosvitec Societa Consortile Arl - COSV - IT - (Partner)
6. Università Degli Studi Di Trento - UNITN - IT - (Partner)
7. Universitatea Technica Cluj-Napoca - UTCluj - RO - (Partner)
8. CTRL Reality Oy - CTRL - FI - (Partner)
9. Indivenire srl - IND - IT - (Partner)
10. Ostbayerische Technische Hochschule Regensburg - OTH - DE - (Partner)
11. University of Applied Sciences of Southern Switzerland - SUPSI - CH - (Associated Partner)

Besides, there are also associated partners from various sectors, including government agencies, non-profit organizations, private companies, associations, and foundations. The prominent institutions among these are PAGDER and PAGEV, and they will be involved in the creation, promotion, and dissemination of the results of the project.

3.2 Organization Structure

The consortium is structured as illustrated in Figure 1. It is composed of a project management team (PMT), including project quality board (QB), project coordinator (PC), work package leaders (WPLs), project result leaders (PRLs), and members.

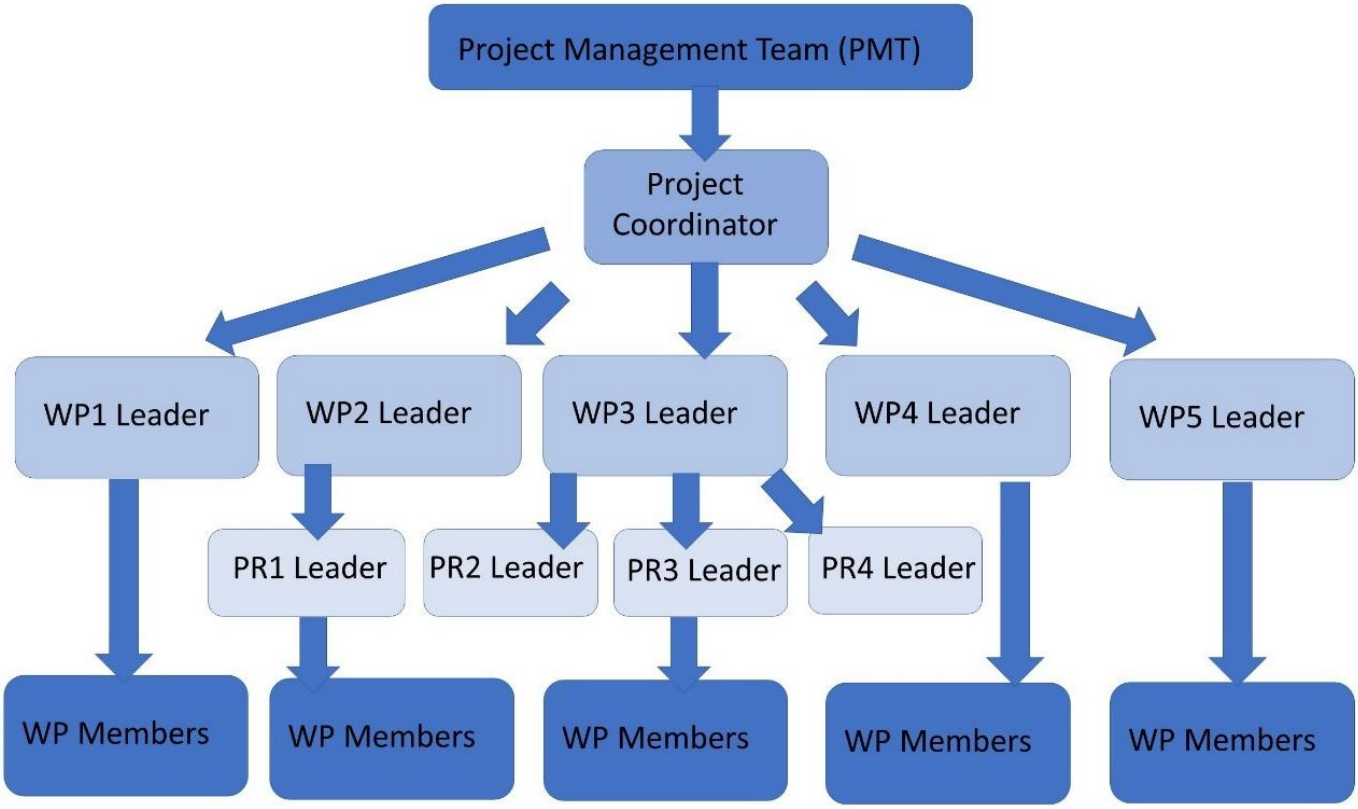


Figure 1. FutureBio management model

The relationship between work packages and project results is shown in Figure 2.

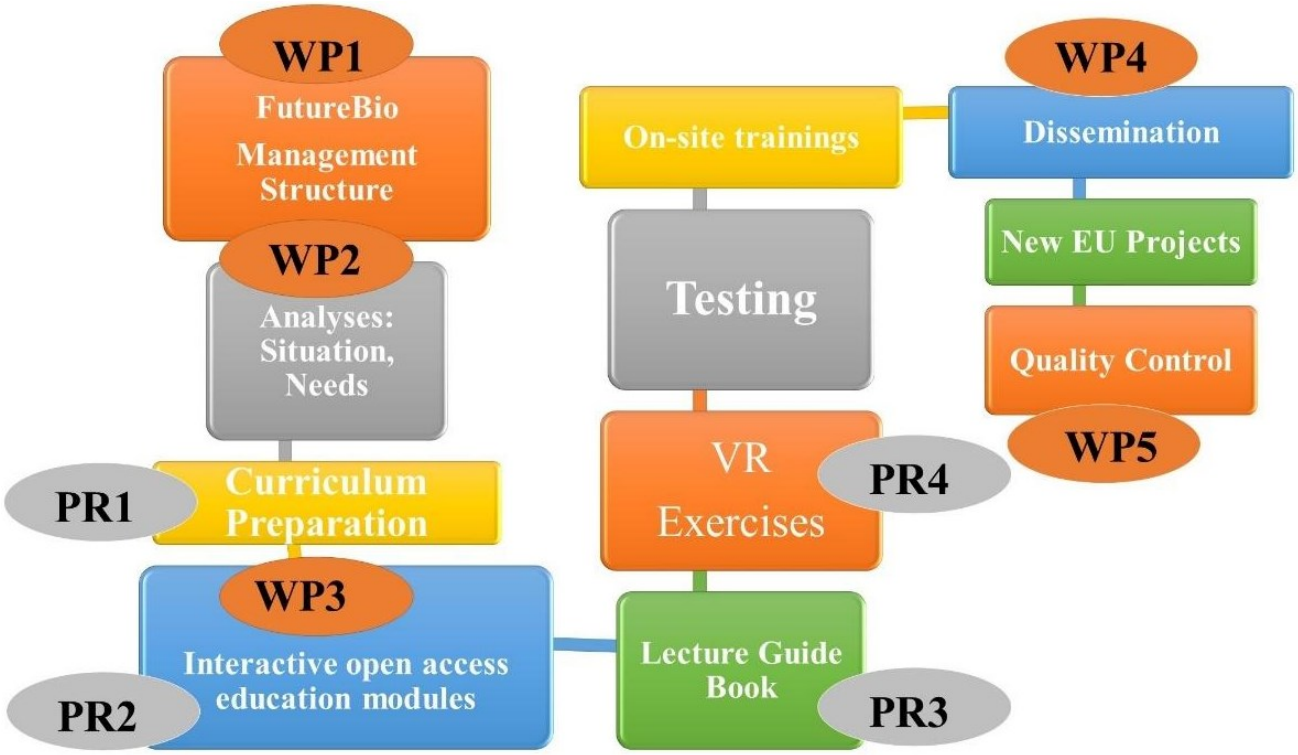


Figure 2. FutureBio work packages and project results relationship

3.3 Roles and Responsibilities

3.3.1 Project Management Team (PMT)

A management team was formed by choosing one person from each of the project partners: Arzum Işıtan from PAU, Evren Çağlarer from KLU, Yasemin Öztekin from SU, Gratiela Boca Dana from UTCluj, Massimo Bersani from FBK, Aniello Gervasio from COSVITEC, Alessandro Pegoretti from UNITN, Teijo Lehtonen from CTRL, Laura Pasquardini from INDIVENIRE, Charlotte Thiel

from OTH, and Nadia Catenazzi from SUPSI. PMT was responsible for management, implementation, monitoring, and quality on behalf of their organization. This team was also responsible for the communication and decision-making points between their institutions and the consortium. All project results and activities of the project (including surveys, pilots, dissemination, impact, and sustainability) were monitored by the PMT during the preparation phase for a proper and fair budget sharing. In addition, all risks that might arise in the realization of these activities, especially COVID19, have been taken into consideration. The PMT overseed fulfilling the following duties:

- Establishing Quality Control Board (QB);
- Analyzing reports, communication issues, and dissemination of the project results among the partners and external project partners;
- Resolving problems and taking corrective actions;
- Resolving conflicts that may arise among the consortium members;

- Deciding on withdrawal of partnership.

The QB checked that the project results and activities were produced and performed in accordance with the indicators specified in the project quality plan (QP). It was formed by PMT at the kick-off meeting by determining a responsible person from each partner. In each TPM, the QB has reported to the project consortium to ensure quality assurance.

3.3.2 Project Coordinator (PC)

The project coordinator has been responsible for coordination of activities in compliance with the contract with the Turkish National Agency (TNA) and third parties in relation to the project.

The PC has total responsibility for the overall project activities and results and their successful completion. To succeed in this responsibility, the PC has worked closely with TNA and its assigned project expert to ensure that adequate resources were applied. The PC also has responsibility for planning, ensuring, and realizing that the project is successfully completed on time, within the project budget, and at a high level of quality.

The PC has overseen and fulfilled the following duties:

- Contacting between the Project consortium and the Turkish National Agency;
- Formalizing Partnership Agreements, legal activities, tasks, and networking among the project partners;
- Establishing Project Management Team (PMT);
- Creating a consortium communication structure;
- Monitoring the compliance of the Grant Agreement, assessment, evaluation, and control of any deviation in the progress of the project;
- Monitoring the executions of the project plans;
- Coordination of project activities;
- Resolving conflicts of interest and putting in place corrective actions whenever required;
- Managing risks by identifying and classifying them and by putting them in contingency plans, establishing, and assessing success criteria;
- Planning transnational and online project meetings;
- Preparing and submitting mid-term and final project reports;
- Implementing project policies and procedures;
- Archiving all project data;
- Managing the project team.

3.3.3 Work Package Leaders (WPLs), Co-Work Package Leaders (Co-WPLs), Project Result Leaders (PRLs) and Co-Project Result Leaders (Co-PRLs)

FutureBio has 5 WPs and 4 Project Results (PRs). PAU was the leader of all WPs.

- In WP1 and WP4, support all partners;
- In WP2 with Co-WPLs (UTCluj and COSVITEC) and all partners;
- In WP3 with Co-WPLs (SU, FBK, and CTRL) and all partners;

- In WP5 with Co-WPL (UTCluj).

Work package leaders and co-work package leaders were responsible for the proper execution of WP activities and the delivery of WP outputs as promised in the awarded proposal on time. WPLs and co-WPLs have worked closely with the PMT and QB.

In WP2 and WP3, FutureBio has 4 PRs, 7 Informative Meetings (IMs), 1 International Workshop, and 2 training activities:

- UTCluj and COSVITEC are PRLs of PR1. All partners have tasks.
- PAU is PRL of PR2. All partners have tasks.
- SU is PRL of PR3. All partners have tasks.
- CTRL is PRL of PR4. All partners have tasks.
- FBK was responsible for organizing the C1 and C2 training activities with UNITN and IND.
- PAU, UTCluj, CTRL, COSVITEC, SU, UNITN, and OTH were responsible for IMs (E1-E7).
- KLU was responsible for the International Workshop (E8) which was organized with the final TPM.

3.3.4 Project Members

All members of the project partners specified in the project proposal are project members. During the project lifecycle, new team members were added by the partners as needed. Project members have responsibility for conducting project activities. The members assisted the PC, WPLs, and PRLs in planning the development effort and helped construct commitments to complete the project within established schedule and budget constraints.

3.3.5 Project Administrative Team

The technical and administrative activities of the project have been assured by the PC supported with the administrative team from PAU. The duties were as follows:

- Daily administrative/financial management of the project, reporting, financial accounting/cost claiming and budgeting;
- Establishment of a budget and schedule-controlling system;
- Collection and storage of data for monitoring;
- Control of the use of resources and budgetary execution.

3.4 Lists of PMT and Administrative Team Members

Table 1: Project Management Team

Partner	Role	Name	Email
PAU	Chair	Arzum Işıtan	aisitan@pau.edu.tr
KLU	Member	Evren Çağlarer	ecaglarer@gmail.com
SU	Member	Yasemin Öztekin	yoztekin@gmail.com
UTCLUJ	Member	Gratiela Boca Dana	bocagratiela@yahoo.com
FBK	Member	Massimo Bersani	bersani@fbk.eu
COSVITEC	Member	Aniello Gervasio	nellogervasio@cosvitec.eu
UNITN	Member	Alessandro Pegoretti	alessandro.pegoretti@unitn.it
CTRL	Member	Teijo Lehtonen	teijo@ctrlreality.fi
IND	Member	Laura Pasquardini	l.pasquardini@gmail.com
OTHR	Member	Charlotte Thiel	charlotte.thiel@oth-regensburg.de
SUPSI	Member	Nadia Catenazzi	nadia.catenazzi@gmail.com

Table 2. Administrative Members

WP	Partner	Role	Name	Email
1	PAU	PC	Arzum Işıtan	aisitan@pau.edu.tr
2	PAU	WPL-2	Cem Gök	cemgok@pau.edu.tr
	UTCLUJ	PRL-1	Gratiela Boca Dana	bocagratiela@yahoo.com
	COS	Co-PRL-1	Aniello Gervasio	nellogervasio@cosvitec.eu
	PAU	Co-PRL-1	Fatma Susar	fatmas_30@yahoo.com
3	PAU	WPL-3	Mine Sulak	msulak@pau.edu.tr
	PAU	PRL-2	Ramazan Çağrı Kutlubay	rckutlubay@pau.edu.tr
	SUPSI	Co-PRL-2	Lorenzo Sommaruga	lorenzosommarug@gmail.com
	SU	PRL-3	Yasemin Öztekin	yoztekin@gmail.com
	CTRL	PRL-4	Teijo Lehtonen	teijo@ctrlreality.fi
	FBK	C1, C2	Massimo Bersani	bersani@fbk.eu
	UNITN	Co-C1, C2	Alessandro Pegoretti	alessandro.pegoretti@unitn.it
	IND	Co-C1, C2	Laura Pasquardini	l.pasquardini@gmail.com
4	PAU	WPL-4	Volkan Onar	vonar@pau.edu.tr
	KLU	Co- WPL-4	Evren Çağlarer	ecaglarer@gmail.com
	SU	Co- WPL-4	Ülkü Sayın	ulkusayin@gmail.com
	OTHR	Co- WPL-4	Charlotte Thiel	charlotte.thiel@oth-regensburg.de
	UNITN	Co- WPL-4	Alessandro Pegoretti	alessandro.pegoretti@unitn.it
	CTRL	Co- WPL-4	Teijo Lehtonen	teijo@ctrlreality.fi
	COS	Co- WPL-4	Aniello Gervasio	nellogervasio@cosvitec.eu
	UTCLUJ	Co- WPL-4	Gratiela Boca Dana	bocagratiela@yahoo.com
5	PAU	WPL-5	Fatma Susar	fatmas_30@yahoo.com
	UTCLUJ	Co- WPL-5	Gratiela Boca Dana	bocagratiela@yahoo.com

3.5 Decision-Making

All main project decisions were made in TPMs by PMT. PMT decisions were consensual. All PMT members have one vote. However, when urgent cases occurred, PC communicated with all PMT members via email and/or WhatsApp application to reach the decision. Country level decisions, when applicable, were made by the partners with informing the PC, when necessary. All decisions have been documented and saved in a project archive.

4 Project Management Stages

4.1 Project Activities and Deliverables

FutureBio has 5 WPs, 4 Project Results (PRs), 7 Informative Meetings (IMs), 1 International Workshop, and 2 training activities.

The FutureBio project implementation has been set up to be 5 work packages/phases.

- WP1/P1: Project management (1-24th m)
- WP2/P2: Curriculum Preparation (1st-6th m) (PR1)
- WP3/P3: Preparation of Interactive open access education modules (6th-23rd m, PR2), Lecture Guidebook (6th-23rd m, PR3), and VR Exercises (4th-23rd m, PR4)
- WP4/P4: Dissemination and sustainable implementation of the products (1st-24th m)
- WP5/P5: Quality assurance of the products (1st-24th m)

Each phase has been characterized by tasks, milestones, and products foreseen as shown below:

4.1.1 WP1 Management

Project Management and Implementation is the framework of the project where all the activities, correct timing, project quality, functioning, all materials to be used from project results to dissemination activities are planned and checked during the entire project. It has been done by the WP1 leader - PC, PMT, and the other members of the consortium.

Activities have been carried out within the scope of WP1 and foreseen time periods:

- Set up management and communication platforms (1st m),
- Preparation of project's contracts (1-3rd m),
- Establishment of the project management team and quality board (1st m),
- Preparation of Management Plan, Dissemination and Communication Plan, and Quality Plan as draft (1st m),
- Finalization of Management Plan, Dissemination and Communication Plan, and Quality Plan (3rd m),
- Assuring of project coordination and organization of activities by Transnational Project Meetings (TPMs) (1st -24th m)
- Ensuring the provision of project documents (1st -24th m)
- Organizing technical trips to local plastic companies (1st -24th m)
- Evaluation of the satisfaction of the project partners and the progress of the project in each 6-month period of the project

The planned activities that have been carried out with the "Project Management and Implementation" budget are as follows:

- Preparing and printing all promotional materials for the project (banner, brochure, etc)
- Getting the website and hosting services of the project
- Obtaining translation services for project results
- Preparing videos for OERs
- Congress participation fees
- Open access fee for scientific publications
- Local company visits by the project team
- Webinars organizing

WP1's products were

- Management plan and platform,
- Interim report,
- Final report,
- Minutes of Meetings.

The quality indicators that have been used in this work package are as follows:

- Partnership evaluation surveys,
- Meeting evaluation surveys,
- Number of activities,
- Number of activities attended by project partners.

4.1.2 WP2 Curriculum Preparation

Research conducted during the preparation phase of the project has shown that although plastics and biodegradable polymers (BDPs) are very important for the future of the world, it was determined that training and educational materials are not enough at the undergraduate and graduate levels. This point was the main idea of FutureBio. For this reason, an innovative curriculum (PR1) has been created to develop the knowledge and skills needed to gain undergraduate and associate degrees within the scope of BDP applications. While creating this curriculum, the situation and needs analysis for companies in the sector, employees working in these companies, university students, and academicians close to this field have been made.

This WP included the creation of the first project result (PR1). UTCluj was the PRL with COSVITEC's co-leadership. All partners have contributed to the creation of this output. PR1 has been prepared for university students. But in detail, the awareness work carried out during the project preparation period has been detailed and the awareness and training needs of students, academicians, industry employees, and companies on the subject have been determined. For this reason, academics, companies, and employees are also the target groups of this project. This result guided and influenced the content and quality of PR2 and PR3, which have been prepared for all target groups. Because of the determined lack of training and

educational materials based on biopolymers at the undergraduate and graduate levels, an innovative curriculum (PR1) has been created to develop the knowledge and skills and to gain the ability of undergraduate and associate degrees.

The PR1's tasks have been summarized below:

- Detailed needs analysis for academics and students (PR1-1/1-2nd month);
- Determination of firms and institutions (PR1-2/2nd month); Company visits and survey applications (PR1-3/3rd month); National reports (PR1-4/4th month);
- International reports (PR1-5/5th month);
- Final curricula (PR1-6/6th month).

While creating this curriculum, the detailed situation and needs analysis of companies producing in the sector, employees working in these companies, university-level students, and academicians close to the field have been made. The project team prepared national and international reports that included situations and needs analysis for academics, students, and companies. At the same time, these analyses have been used to reveal awareness situations for individuals and institutions. For this purpose, each university has applied the survey studies prepared at the beginning of the project to its academicians and graduate and undergraduate students. Each university applied these surveys to at least 5 academicians and 10 students. Since the consortium has 6 universities, it was intended to apply these surveys to 30 academicians and 60 students in total. Each university decided on the people to be surveyed.

Each project partner searched for companies that produce plastics and bioplastics and their products locally and nationally and created a portfolio. The managers and employees of these companies have been asked to fill out the survey prepared at the beginning of the project, in line with the opportunities, by contacting and visiting the company. By contacting at least 3 companies for each partner, they were expected to complete these needs analysis surveys. In this way, it has been expected to be in contact with at least 24 companies.

A total of 589 students were involved in a specially designed questionnaire through face-to-face interviews and online interviews between June and July 2022 at Technical University of Cluj-Napoca, Romania; Pamukkale University, Selcuk University, and Kirklareli University from Turkey; the University of Trento and Cosvitec from Italy; SUPSI from Switzerland; and OTH from Regensburg, Germany.

A total of 221 academic staff were involved from the Technical University of Cluj-Napoca, Maramures County from Transylvania Region, Romania, Pamukkale University, Selcuk University, and Kirklareli University from Turkey, University of Trento and Cosvitec from Italy, SUPSI from Switzerland, and OTH Regensburg, Germany.

271 industrial employers were involved in small and medium enterprises or individual activities from Romania, Turkey, Italy, and Finland.

All national reports have been made into a single international report by UTCluj. The draft curriculum prepared by PAU has been compared with the needs emerging as a result of the surveys and field studies conducted. After the survey results have been made into an international report, the necessary updates have been made with the participation and

approval of all partners during TPM2. The draft curriculum has been compared with the needs emerging as a result of the surveys and field studies conducted. After the creation of an international report, the necessary updates have been made with the participation and approval of all partners during TPM2 and a curriculum as educational material across Europe has been prepared.

The draft curriculum study and the final curricula are given below:

A- DRAFT

1. Basic polymer knowledge: polymer chemistry and polymerization
2. Basic biopolymer knowledge: Chemical structure, understanding and prediction of certain physical properties of a BDP, and how these are influenced by external factors (pH, I, T)
3. Know the structure and properties of important polysaccharides, including alginates, zein, etc.
4. Know the principles behind experimental determination of physical properties (solubility, mechanical properties, etc.)
5. Use simple methods for polymerization and depolymerization of biodegradable plastics: kinetics and reaction mechanisms
6. Preparation of biopolymeric materials (alginate film or beads, polymerization of zein, soya, etc.)
7. Production of natural aliphatic polyesters such as PLA, PHA, bio-polyethylene, etc. Chemical modifications of biopolymers (chitosan, alginate, and PLA) aimed at enhancing the biological properties of the polymer and increasing its water solubility
8. Preparation biopolymeric composites, reaction and investigation of bio composite films
9. Determine the shape and extension in solution of a biopolymer based on physical data
10. Characterization of biopolymers by FTIR, SEM, X-ray techniques, DLS, etc.
11. Environmental and biomedical applications (adsorption of toxic materials, controlled drug delivery systems, etc.)
12. Decarbonization and biopolymers
13. Sustainable environment and biopolymers

B- FINAL

CHAPTER 1. POLYMERS

- 1.1 Definition of Polymers
- 1.2 Nomenclature of Polymers
- 1.3 Mechanisms of Polymerization
- 1.4 Modification of Polymers
- 1.5 Types of Polymers
- 1.6 Applications of Polymers
- 1.7 Biopolymeric Materials
- 1.8 Preparation of Biopolymers

CHAPTER 2. INDISPENSABLE POLYMERS OF LIFE: PLASTICS

- 2.1 Polymeric Structures of Plastics
- 2.2 Types of Plastics

8.2 Plastic Impact on Society and Culture

For each topic of the curriculum, a competence map has been created which includes the learning outcomes, knowledge, and skills of the students by COSVITEC supported by SUPSI and all partners.

This result guided PR2 and PR3. There are so many course materials and books about biopolymers in EN. But the topics of these are specific themes such as biopolymer chemistry, nanocomposites, application in medical or environmental areas, and physical properties. Moreover, there are very few materials/books on biodegradable plastics and their applications. There was no book written on experiments in the laboratory that could be used as a textbook at the university level, but it also contained basic information. This result formed the backbone of the materials prepared in PR2 and the book (PR3). The impact and transferability of the curriculum with the contribution of real field data and analysis are very high.

The products have been created in TR, EN, IT, RO, GE, and FI.

- National Analysis reports (internal)
- International Analysis Report
- Industry Needs Report
- Curriculum
- Competence map

The quality indicators for PR1 selected as:

- Number of students and academicians who answered surveys
- Number of industrial workers and firms that answered surveys
- Providing 90% and above satisfaction from the results of the inter-partnership surveys regarding the quality of the project result (thus determining the problems and collecting the solution suggestion)

4.1.3 WP3: Preparation of Open Access Training and Education Materials

Three project results preparation have been included in WP3:

- Interactive open-access education modules (PR2).
- Lecture Guidebook (PR3).
- VR exercises (PR4).

A task leader, co-leader, sub-tasks, activities, responsibilities, and timeframes were determined for each project result.

PR2: Interactive open access education modules

PAU was the PRL supporter with SUPSI. All partners contributed to the creation of this result. University students, academicians, and the community were our target groups, respectively. Since the project partner institutions created this online platform together, the digital competence and capacities of the project staff have also increased.

Since the main target group for this result is students, it was planned to open 2 courses on biopolymers in Technology Faculty of PAU and within the scope of The Graduate School of Natural and Applied Science In accordance with the prepared curriculum (PR1). A total of 6 courses were offered in two graduate degrees at departments at PAU (Mechanical and Manufacturing).

Engineering and Metallurgy and Materials Engineering) and 3 of these courses were actively conducted. In the second year of the project, educational activities have been carried out in these courses:

MMLM 509: BIOPOLYMERS AND BIONANO COMPOSITE MATERIALS

MMLM 512: MECHANICAL TESTS OF POLYMER MATERIALS

MAIM 502: MANUFACTURING TECHNOLOGIES

MAIM 529: NANOSCIENCE AND NANOTECHNOLOGY

MAIM 531: POLYMER PRODUCTION AND TECHNOLOGY

MAIM 533: BIOPOLYMER AND BIOCOMPOSITE ENGINEERING

In addition, at the undergraduate level, the following courses were opened:

MBM 201 MATERIAL SCIENCE 1

MBM 202 MATERIAL SCIENCE 2

Similar work was done at all other partner universities.

Pilot applications between the 17th and 18th months of the project were performed by 250 students and 50 academics in total. Students who took the courses had the opportunity to utilize interactive learning materials, laboratory videos, and a lecture guidebook. The feedback requested and, thus, necessary revisions have applied to the modules, tools, and chapters.

In addition to these 250 students and 50 academic staff, VR tools were introduced to 40 students during the C2 activity and 140 high school students through multiplier events, and feedback was received. It was also introduced at EGEKAF2024, hosted by PAU, and 250 more people from all educational backgrounds tried and evaluated the VR applications.

The studies of BPs are interdisciplinary research, including different kinds of experts from material science, biotechnology, physics, chemistry, and engineering, from environment to manufacturing and medical technologies. The required competencies for these areas can be put together around the concept of biopolymer engineering, which provides novel concepts, materials, enzyme technology, experimental protocols, reference substances, and inventions. There have been no online modules prepared on experiments for the LABORATORY APPLICATIONS at university level. However, laboratory work is especially helpful to gain the knowledge and skills to make scientific evaluations about the synthesis, properties, and applications of biodegradable polymers. Within the scope of laboratory videos (including production, analysis, and testing), ***16 videos*** were prepared.

FutureBio aimed to create innovative technologies based on E-LEARNING and mobile learning tools with interactive videos and animations in game format. The materials have been structured according

to a competency-based learning approach (PR1). The use of e-learning technologies in the FutureBio project can provide new opportunities for learners, increasing flexibility, motivation, and engagement. Students can take control of their own learning and become an active part of the learning process.

All students, academicians, scientists, and sector workers need new teaching methods and tools to match modern implementation. Mobile learning offers new opportunities for learners and teachers. including the relatively low cost of technologies. With game-based animations, videos, and interactive presentations, distance learning tools were prepared for those who are interested in PMs from all age groups and want to learn about BDPs. Increasing digital competencies, enhancing the quality of education, making it interesting, and developing environmental awareness to encourage biodegradable polymers to be included in the study and research topics of students, academicians, and industrial companies raising awareness about sustainable environment and decarbonization are among the aims of this result. With the creation of the laboratory videos and the interactive platform targeting game-based learning, this project result is highly impactful on all target groups, and it has high potential for dissemination and transferability.

During and after the preparation of these modules with the support of SUPSI, we have received feedback from our project partners that they will use these learned practices, especially in the preparation of course materials. Therefore, we have achieved another objective of this project outcome, which is to increase the digital capacities of the project partners.

METHODOLOGY: At the 2nd TPM in Finland, in the 6th month of the project, the results of PR1 at the national and international levels have been discussed and analyzed. The partnership provided the curriculum's final form and created a competence map. These analyses, curriculum, and competence map were used to form the basis of PR2 and PR3. Critical thinking related to PR2 has been done, and online modules have been shared between all partners. Providing preliminary information to the project staff about the creation and use of online materials and videos has been done by PAU and SUPSI.

At the 3rd and 4th transnational meetings (TPM3 and TPM4), the progress of PR2 was discussed. First, an online course platform using free material creation tools, h5p, has been created on the website. The primary role of the platform was to enable the students to learn on their own and encourage them to evaluate themselves. Content preparation for tools and videos has been done through PR1.

During TPM2, the sections and topics were negotiated and shared by all partners. Until the 14th month, the draft EN versions have been prepared. At TPM3, the progress of this result has been evaluated. Encountered problems and suggestions with the project partners were discussed, and the modules prepared in EN were reviewed. After the 14th month of 14th, project partners translated those materials into their own languages. Pilot applications between the 17th and 18th months of the Project have been performed by 250 students and 50 academics in total for interactive materials and the book chapters. In addition to these 250 students and 50 academic staff, VR tools were introduced to 40 students during the C2 activity and 140 high school students through multiplier events, and feedback was received. It was also introduced at EEGEKAF 2024, hosted by PAU, and 250 more people from all educational backgrounds tried and evaluated the VR applications. After testing all educational materials with an evaluation questionnaire, their missing parts or needs have been determined. After completion of all pilot implementations, the results have been compared and evaluated between partners during TPM4. After the necessary parts were corrected, the materials and the platform were finalized.

The tasks were summarized below:

- Content preparation (PR2-1st/6th months).
- Laboratory video preparation (PR2-2/6th–14th months). Interactive modules preparation in EN (PR2-3/6th–14th months) and in TR (PR2-4/15th–16th months).
- Pilot testing (PR2-5/17th–18th months).
- Revision and finalization (PR2-6/18th–23rd months).

The products are in EN, FI, GE, TR, RO, and IT.

1. Online platform
2. Laboratory videos
3. Online OERs

The quality indicators for this project result are:

- Number of students attending the pilot application
- Number of academics attending the pilot application
- Number of online tools
- Number of created videos
- number of tools to be changed Providing 90% and above satisfaction from the results of the inter-partnership surveys regarding the quality of the project result (thus determining the problems and collecting the solution suggestions)

PR3: Lecture Guidebook

SU was the PRL. All partners have contributed to the creation of this output. University students, academicians, and industrial firms and employees are FutureBio's target groups, respectively. For a better world, biodegradable polymers should be developed and used. Although research on biodegradable polymers is increasing day by day, their usage is not at the desired level. However, teaching programs, including applications, can be performed to gain knowledge and skills about the synthesis, properties, and applications of biopolymers. A common innovative course curriculum was created (PR1) to develop knowledge and skills, revealing the gaps in current education. Most of the current English books are focused on medical or food applications of biopolymers. Moreover, there are very few books on biodegradable plastics and their applications.

As the book filled a gap in the literature, it is one of the basic works in the related field. On the other hand, there are not any course books in TURKISH related to biopolymer technology. In this area, a scientific resource that can be taught in Turkish universities has been obtained. Since the book is also in English, it can be used all over Europe and the world. The guidebook, which contains examples from the project partners' works and industry applications, is innovative in this respect. It is a book that people from different disciplines can use according to their interests.

Pilot applications between the 17th and 18th months of the Project have been performed by 250 students and 50 academics in total for interactive materials and the book chapters.

To close an important interdisciplinary course material gap in Turkey and Europe, to contribute to the literature, to of envirodevelopental awareness, to encourage biodegradable polymers to be included in the study and research topics of students, academicians, and industrial

companies, raising awareness about sustainable environments and decarbonization is among the aims of this work package. This project result has a high impact on all target groups, and it has high potential for dissemination and transferability.

At the 2nd TPM2 in Finland, in the 6th month of the project, the result of PR1 was discussed. The national reports have also been discussed and analyzed. The partnership gave the curriculum its final form. These analyses and curriculum formed the basis of PR2 and PR3. Critical thinking related to PR3 has been done. At the 3rd and 4th TPMs, the progress of PR3 was discussed.

The partners stated which topics they could contribute to. Below is the distribution of tasks for each chapter:

CHAPTER 1. POLYMERS					
1.1	Definition of Polymers				PAU
1.2	Nomenclature of Polymers (PAU)				
1.3	Mechanisms of Polymerization				PAU
1.4	Modification of Polymers (PAU)				
1.5	Types of Polymers				PAU
1.6	Applications of Polymers				PAU
1.7	Biopolymeric Materials				PAU
1.8	Preparation of Biopolymers		PAU		
CHAPTER 2. INDISPENSABLE POLYMERS OF LIFE: PLASTICS					KLU
2.1	Polymeric Structures of Plastics				KLU
2.2	Types of Plastics				KLU
2.3	Production Methods of Plastics				KLU
2.4	Usage Areas of Plastics				KLU
2.5	End of Life of Plastics				OTH
CHAPTER 3. BIOPLASTICS					
3.1	Definition and Classification of Bioplastics				SU
3.2	The Usage and Importance of Bioplastics		SU		
3.3	Sources and Production Methods of Bioplastics		SU		
3.4	Formation Mechanisms of Bioplastics			SU	
3.5	Recycling Mechanism of Bioplastics			SU	
3.6	Daily Examples for Bioplastics			SU	
CHAPTER 4. PROPERTIES OF BIODEGRADABLE PLASTICS					
4.1	Chemical Structures		COS		
4.2	Chemical Properties		COS		
4.3	Physical Properties				COS
4.4	Preparation Methods		COS		
4.5	Recycling Mechanism of Biodegradable Plastics		UNITN		
CHAPTER 5. CHARACTERIZATION OF BIODEGRADABLE PLASTICS					

The output's tasks are summarized below:

- PR3-1: Draft versions in EN (6th -16th months)
- PR3-2: Pilot testing (17th -18th months)
- PR3-3: Final version (18th -20th months)
- PR3-4: Translation in TR (21st -23rd months)

The products are Lecture Guidebook in TR and EN. The books are in pdf formats and were uploaded to the website. Only a limited number of paper prints were made. These printing costs were added to management costs.

- The quality indicators for this project result are:
- number of students attend the pilot application
- number of academics attend the pilot application

- number of book chapters Providing 90% and above satisfaction from the results of the inter-partnership surveys regarding the quality of the project result (thus determining the problems and collecting the solution suggestions)

PR4- Virtual Reality Exercises

CTRL Reality was the PRL. All partners contributed to this output creation. University students, academicians, project staff, and the community were our target groups. respectively. An innovative course curriculum was created (PR1) to develop the knowledge and skills, revealing the gaps in current education.

The VR training solutions complement the innovative curriculum, guidebook, and online material. There have been no VR tools prepared on manufacturing and using of BDPs. Production from different materials, characterization methods, polymer pollution, and the environmental sustainability are the main topics.

VR as a technology has the power to take the user into another place. This was utilized in making more immersive, interactive, and illustrative training materials which complement the more traditional books and online materials. Furthermore, virtual reality solution makes the training more motivating for all the target groups. The created VR application consisted of a set of 360-degree images and videos with added informative (such as text. photos. audio. video) and gamified content (such as quiz. finding hidden information). The best user experience was gained by using mobile VR glasses (such as Oculus Go / Quest / Quest 2) where the user gets a stereo view of the training content. Some of the university partners had these devices, and devices were available for a reasonable price. The project university partners who had no VR headsets provided them with their management budget. VR glasses were used when presenting the material in the events of the project. The VR content is also provided through a web browser, which makes it available to those users who are not in possession of compatible VR glasses.

The content of the VR application is targeted to three use cases:

1. For the university teachers: An immersive view to a lab exercise for setting up a similar exercise. The purpose is to ease the starting of necessary exercises by providing an immersive view to a model exercise.

2. For the university students:

a) An immersive view to a lab demonstration which is not possible to implement due to safety, equipment, or cost reasons.

b) A tour to a chemistry plant for viewing on industry scale the process done in the exercise as a lab size.

3. For the public: For viewing the impact of unprocessed plastic waste to the environment and the choices one can make in everyday life.

METHODOLOGY: During TPM2, basic training was provided to the project team on the use of VR equipment. After the basic information, each institution that carried out the pilot applications bought one pair of VR glasses from the project management budget that can be used alone without the need for a computer. During TPM2, the content of scenarios has been discussed and determined, and a

division of work has been made for the preparation of the scenarios. The scenarios prepared in English were shared with CTRL. Since FBK and UNITN have unique laboratories, CTRL has gotten 360-degree images from FBK and UNITN for characterization and laboratory applications. In this regard, CTRL has closely cooperated with FBK, UNITN, and IND.

Developed VR tools in accordance with the scenarios reviewed at every TPM. With the feedback received after the pilots, the parts that needed to be developed in the tools were advanced. The tools were first prepared in EN and then translated into all partner country languages, and new, modern, and interesting training modules that can be used all over the EU were prepared. Increasing digital competencies (students, academics, and project staff), enhancing the quality of distance education, making it interesting, developing environmental awareness, encouraging BDP to be included in the study and research topics of students, academicians, and industrial companies, and raising awareness about sustainable environment and decarbonization are among the aims of this project.

With the creation of the laboratory videos and the interactive platform targeting game-based learning,. This project result has a high impact on all target groups, and it has high potential for dissemination and transferability.

The virtual reality content is also provided through a web browser, which makes it available to those users who are not in possession of compatible VR glasses.

In essence, the materials created in FutureBio are 360 images taken in several different bioplastic research laboratories in the partner organizations: University of Trento and FBK. The photographs are presented in a VR application for an immersive viewing experience, but they can also be viewed through a website.

The images allow users to get a virtual tour in the laboratories while learning about the technology and methodologies utilized there. Several types of materials have been created using the same 360 imagery: some of the materials are aimed for bioplastic professionals, some for teachers and some for students. Even though the 360 images don't change, all the attached information changes depending on the context.

The materials created in FutureBio have been published in the Meta Store for VR, and on a webpage for more traditional access. Below are the instructions for accessing the material on both technologies:

- For VR, the FutureBio 360 materials can be accessed on Meta Quest 2, Meta Vision Pro and Meta Quest 3 goggles through the Meta Store.
- For desktop and mobile use, the FutureBio 360 materials can be found by visiting the link at: https://ctrl.studio/play/futurebio or by embedding the content using an iframe to any web page.

The PR4's tasks were summarized below:

1. PR4-1: Study of existing VR applications (4th4th–5th months)

2.PR4-2: Determining content for VR exercises (6th -8th months)

3. PR4-3: Implementation of the first versions of the VR exercises in English (9th -16th months)

4. PR4-4: Testing and gathering feedback on the VR exercises (17th -18th months)
5. PR4-5: Final version of the VR exercises in all partner languages (18th -20th months)
6. PR4-6: Preparing the transferability guide (21st -22nd months)
7. PR4-7: Evaluation (23rd months)

Its products are the VR tools in all partner languages and Transferability guide.

The quality indicators for this project result were

- Number of students attending the pilot application
- Number of academics attending the pilot application

4.1.4 WP4: Dissemination and sustainable implementation of the products

Dissemination and sustainable implementation of the products are the 4th WP of FutureBio during the whole project life cycle. dissemination plan, as a draft version was prepared by PAU, and at 1st TPM, it was discussed by all partners. Necessary arrangements were made on the plan in line with the opinions and suggestions of the partners. This plan included all activities carried out during the project period for dissemination and sustainability.

Dissemination materials, activities, the number of people to reach, and their expected impact are the following:

- Website was set up in all partner languages and constantly updated.
- 6 webinars were organized through the project YouTube account. Other broadcasts, including congress presentations, have also been added to the YouTube channel.
- Establishment of social media platforms was made by PAU.
- Newsletters were prepared every six months.
- 7 National Informative Meetings and 1 Workshop/Panel (E1-E8) were organized.
- Announcement of the activities was performed on local and national platforms. The results of the FutureBio project were presented in relevant seminars/conferences, and news.
- Some review and research papers were published in highly ranked international journals.
- FutureBio consortium has formed competent institutions in the scientific and technological fields. Dozens of congresses are organized or attended by our partners every year. Within the participation in various conferences and seminars, we distributed approx. 1000 leaflet by PAU and all partners, and via website, social media, press/media we reached over the 20000 people (For example, the news on the PAU official twitter page for the C2 (student training) activity of the project, received 1,494 views (https://twitter.com/pauedutr/status/1724700933508989235), and a Linkedin post about the C2 activity received 2485 views (https://www.linkedin.com/feed/update/urn:li:activity:7129262393120948224/).
- Project partners have attended various congress/symposium related for the BDPs.
- A master thesis has been completed in the context of the FutureBio.
- A patent application was filed for one of the ideas developed by the PAU team within the scope of the FutureBio project. This patent idea was awarded a silver medal at ISIF2023.

- The PAU team participated in Teknofest 2022 and Teknofest 2023 with the ideas developed by the FutureBio project. In both years, the project made it to the finals in the Environment and Energy and Technologies for the Benefit of Humanity / Disaster categories. In Teknofest 2022, the best presentation award was won. a patent application was made for one of these ideas.
- Within the scope of TÜBİTAK 2209-A University Students Research Projects Support Program, student projects on the use of bioplastics were supported in 2022 and 2023 under the supervision of FutureBio PAU team.
- FutureBio's main target group was the university students and academicians. With the dissemination activities, additionally it was reached to industry, high school students, and society using visual and printed materials, website, social media, webinars, and informative meetings.
- At least 285 people were expected to attend national informative meetings. People who work on polymer and its production from the public and private sector. and Municipality was invited. We reached 600 people with those activities directly.
- FutureBio had a workshop/panel held by KLU. This event has been organized to present all the outcomes of the project. 70 local participants attended this activity including the Vice Governor of Kırklareli.
- Within the scope of the project, the consortium carried out various promotional activities in high schools and secondary schools to increase impact: in high schools and secondary schools, activities have been organized such as art competition and poster presentation. Earth day STEM challenge activities were organized to reach at least 350 young people
- with activities at the secondary and high school level, which was held locally in especially Italy, Romania, and Turkey.
- For university students, various activities were organized: A poster competition was organized by OTH. Social responsibility movements such as collecting plastics etc. were initiated.
- The number of people we directly reached among university students was planned to be 500. With the events organized, press reports, lectures given at university level, and project outputs, we have reached more than this number of university students. Thus, we expect awareness raising efforts to continue locally and across countries.
- One of the expected effects of the project was to combine the theoretical knowledge of universities with industry and to create an environment for joint work. In this context, information was exchanged with PAGEV on many issues.
- Above all, it was expected that educational materials produced using high technology would be met with great interest, especially by Generation Z, and this has happened.
- eTwinnig, Erasmus+ Project Results Platform, and EPALE platforms are used for the dissemination, also.
- Within the dissemination activities for the public, the Layman's Report is provided a general and brief overview of the project and its outcomes, such as the challenges faced by the project, the proposed solutions, the innovative aspects of such solutions, the main achievements and outputs, the main results of the implemented pilots or recommendations for future. The Layman's Report was the final dissemination activity within the project's duration. The Layman's report

summarizes the work of a LIFE FutureBio project for a general audience. They are a means of extending the impact of the project beyond the area of implementation.

- Beyond all this, the web platform which contains all project outputs, will be kept up to date for at least 5 years by the project team.

All partners have agreed on dissemination and all partners hold one informative meeting within the project, except IND and FBK. However, leading FBK, UNITN and IND have attended some dissemination activities, additionally. They worked to disseminate project results using their local and national links.

Creation of website and leaflet and opening of social media accounts (Instagram and YouTube) have been done by PAU at the beginning of the project. All partners shared project news and announcements on their official website. In addition, since all partner institutions have very strong local press relations, the project activities are promoted in the local and national press.

For the project logo, PAU, COSVITEC, and CTRL prepared a draft before TPM1, and the project logo was selected during TPM1. After the logo selection, a leaflet as a draft has been prepared by PAU and after the approval of the partners, all project partners translated into languages and used in all promotion and dissemination activities.

E-Newsletters have been issued to promote the project and its outputs, and translated for disseminating to national training organizations, stakeholders, and media. For this purpose, the partnership used its National Informal Networks. Newsletters were foreseen, 1 every 6 months of the project. Additionally, partners took advantage of their own networks and of the existing platforms and tools for promotion on European level, to maximize the publicity effect. The

dissemination plan at the beginning of the project has been prepared by all partners to widespread the products and have a vast outreach.

All documented activities collected in a final dissemination report which were made available to the national agency and the public. Arzum Işıtan from PAU, Yasemin Öztekin from SU, Evren Çağlarer from KLU, Gratiela Dana Boca from UTCLUJ, Massimo Bersani from FBK, Alessandro Pegoretti from UNITN, Aniello Gervasio from COSVITEC, Teijo Lehtonen from CTRL, Charlotte Thiel from OTH, and Laura Pasquardini from IND were responsible dissemination activities as team leaders. COSVITEC and FBK supported the dissemination plan and activities due to the solid experience in several former European projects. They have experts in managing project advertising, plan and advertising campaigns, considering especially dissemination purposes, and structuring main paths for main goals and objectives promotion, involving stakeholders, press, and effectively using 2.0 web tools. They also have extensive stakeholders' network, that include local, national, and International SMEs, Public Entities, NGOs, schools, and Universities, that benefited from the outputs of FutureBio and helped in the dissemination of the project results.

SU and KLU are in industrial areas, so they also contributed not only web-based dissemination activities but also to provide industrial cooperation to raise awareness.

Before TPM5, PAU prepared a sustainability plan and shared it with all partners. During TPM5, the plan was discussed, and its final form created, and the activities planned to be attended in the next 3 years and the activities planned to be organized were discussed.

PRODUCTS are:

1. Dissemination plan.
2. Sustainability plan
3. Dissemination materials and activities
4. Website and social media platforms
5. Project logo.
6. Newsletters
7. Brochure

QUALITY INDICATORS:

- Number of participants attend seminars/informative meetings/workshop/webinars.
- Number of websites visiting.
- Number of distributed newsletters/brochures.
- Number of audience of seminar/congress/webinars

4.1.5 WP5 Quality assurance of the products

FutureBio has "Quality assurance of the products" phase which included

- Quality plan.
- Quality report.
- Meeting evaluations.
- Interim Evaluation.
- Testing evaluation.
- Final evaluation.

A Quality Plan has been prepared and shared before starting the project by the coordinator. At the first TPM, it has been discussed, and necessary corrections have been made. The Quality Plan included detailing procedures, criteria, and resources that were agreed by all partners.

The indicators used by the Partners:

- to measure on a regular basis the rate of success of foreseen results using quality plan
- to ensure that the project outputs follow the specified standards
- to enrich all training and testing activities with quality standards
- to provide a final project validation report

QUALITATIVE and QUANTITATIVE INDICATORS have been used in overall project management:

- Quality of Project management arrangements - no more than 20% rate of delays in delivering results throughout the project

- Effectiveness of coordination by the project coordinator - no more than 20% rate of issues and problems detected in coordination
- Effectiveness of the monitoring and evaluation processes -100% of partners and coordinator compliance with quality monitoring process tasks.
- Effectiveness of quality arrangements – 100% rate of compliance with recommendations and amendment according to the problems detected.

QUALITATIVE AND QUANTITATIVE INDICATORS have been used to see the effectiveness of developed online modules. The pilot study was added to the Project. With this regard, the project team and the users were in constant contact and feedback provided.

- To achieve expectations, the definition/monitoring of specific project indicators will be used.
- To be more useful for the book, literature work and interviews will be made.
- To measure the quality and progress of the project as well as its success.

Quality indicators have been determined for each work package of the project and summarized below:

- Phase 1: Partnership evaluation surveys. Meeting evaluation surveys, number of activities, number of activities attended by project partners
- Phase 2: number of students. Academicians, industrial workers. firms answered surveys
- Phase 3: number of students and academics attend the pilot applications, number of online tools and videos, number of tools to be changed, number of book chapters
- Phase 4: number of participants attend seminars / informative meetings / workshop / webinars. number of websites visiting. number of distributed newsletters / brochures. number of audiences of seminar / congress
- Phase 5: covers all the above-mentioned indicators to ensure the quality of the whole project, Providing 90% and above satisfaction from the results of the inter-partnership surveys regarding the quality of the project result (thus determining the problems and collecting the solution suggestions).

Quality assurance of the products was valid for the whole project term. All partners took part in the organization of one of the webinars to be held on the project website. They also made local company visits. Various promotional activities and poster competitions have been organized in high schools and secondary schools.

4.2 Responsibilities and Resources Allocations of Partners

FutureBio has been coordinated by PAU; SU, KLU, UTCLUJ, FBK, UNITN, COSVITEC, INDIVENIRE, OTH, and CTRL were the partners, and SUPSI was the associated partner. All the partners contributed to all of the tasks. The project has 4 project results, 5 transnational meetings (TPM), 7 informative meetings (IM), 2 training activities, and a workshop/panel. All the activities and outputs have been done under 5 phases explained above. In these phases. the tasks of the partners can be summarized as follows:

- PAU was the leader of PR2. PAU contributed to the PR1, PR3, and PR4. All evaluation and testing materials have been developed, draft quality and dissemination plans have been prepared by PAU. PAU supported and attended the C1 and C2 with 12 people. Additionally, PAU supported the organization of Dissemination activities and prepared E1, since PAU has strong partnerships with both private sector and public bodies. PAU organized the TPM1.
- KLU organized the TPM5 and E8. KLU contributed all of the outputs, especially PR2. KLU attended C1 and C2 activities with 9 people. The evaluation reports at national and international level have been published as a manuscript in the scientific journal. KLU keep in touch with PAGDER & ASLAN and PAGEV which were helpful during the preparation of industry needs reports and dissemination activities because of its role in the plastic sector.
- SU was the task leader of PR3. SU contributed all the outputs, especially scientific manners. SU attended C1 and C2 activities with 9 people and organized an IM (E5). Additionally, it has a good dialogue with the plastic producers in Konya, they were a bridge to the university-industry practices and collaborations.
- UTCLUJ was the task leader of PR1 with COSVITEC. UTCLUJ organized E2. UTCLUJ contributed to all the outputs. UTCLUJ attended C1 and C2 activities with 8 people. The evaluation reports at national and international level have been published as a manuscript in the scientific journal, and UTCluj was the team leader.
- CTRL prepared the TPM2 and E3. CTRL was the output leader of PR4 and contributed to all outputs. CTRL attended C1 activity with 1 person. Due to the wide range of digital material development experiences, CTRL also contributed to the preparation of online materials.
- FBK organized the C1 and C2 training activities. FBK contributed all the outputs. Since FBK has a strong relationship with industry, FBK was a bridge between university and industry in the point of practices and collaborations. Due to the wide range of scientific research opportunities, FBK contributed to the preparation of PR3 and online materials. FBK attended several dissemination activities, also.
- UNITN supported FBK for training activities and UNITN prepared E6. UNITN contributed all the outputs. Since it has huge scientific research experiences, UNITN also contributed to the preparation of books and online materials.
- COSVITEC was the task co-leader of PR1 with UTCLUJ due to a wide range of experience on training, testing, and evaluation tools. COSVITEC attended the C1 activity with 2 people. COSVITEC was the host institution of the TPM3 and organized E4. COSVITEC also contributed all of the outputs, especially PR2 and PR3.
- INDIVENIRE contributed all results. especially industry needs reports. IND supported the FBK in training activities. IND also contributed to the preparation of books and online materials, and preparation of dissemination activities.
- OTH contributed all the outputs, especially scientific manners. OTHR attended C1 and C2 with 18 people and organized E7 and TPM4. Additionally, it has a good dialogue with the plastic producers in GE, OTHR was a bridge to the university-industry practices and collaborations.
- SUPSI contributed to the preparation of curriculum, competence map, and online materials. SUPSI supported the partnership about the platforms and programs that can be used especially in the preparation of online materials.

All partners took part in the organization of one of the webinars. They also made local company visits.

The details of human resource allocated to different categories are presented in Table 3.

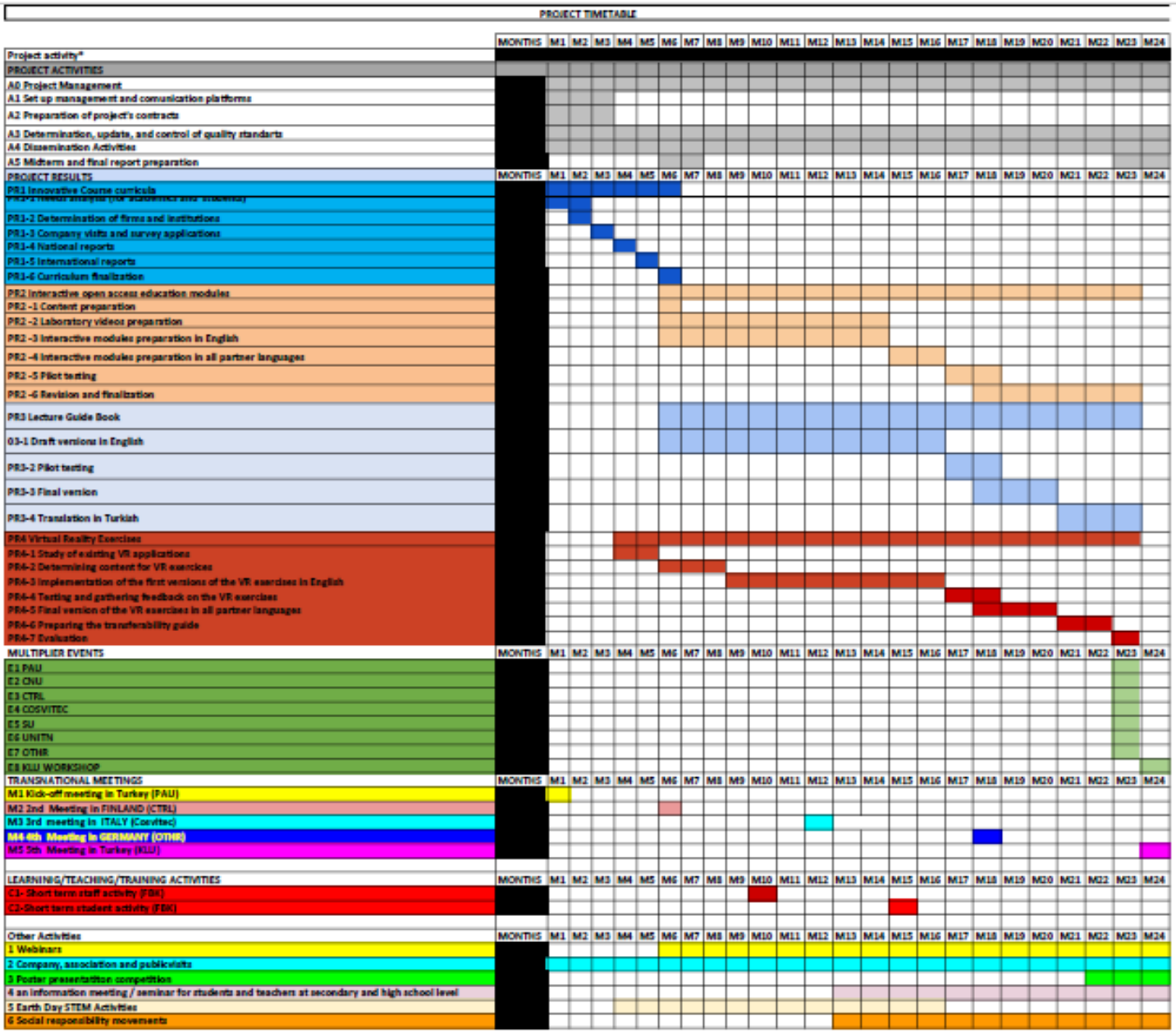
Table 3. Human resources allocated to different categories

Partner	Number of working days			
	Project Result1	Project Result2	Project Result3	Project Result4
PAU	20	90	70	15
KLU	15	40	30	10
SU	15	40	90	10
COSVITEC	30	40	20	10
FBK	15	40	73	10
OTHR	15	40	30	10
INDIVENIRE	5	30	30	10
UTCLUJ	50	40	30	10
UNITN	15	40	65	10
CTRL	5	40	5	85

4.3 Project Work Plan

To control the operation and progress of the project, the work plan, which was prepared during the project writing phase, was created in the form of a Gantt-chart (Table 4). During the project, this work plan has been followed and revised when necessary.

Table 4. Work Plan for Project



5 Project Financial Management

All project results and activities of the project (including surveys, pilots, dissemination, impact, and sustainability) were determined by the project consortium during the preparation phase for a proper and fair budget sharing. In addition, all risks that may arise in the realization of these activities, especially COVID19, have been taken into consideration. The project aimed to achieve 4 project results.

In accordance with FutureBio project objectives, assignments were made according to the expertise of the institutions. A team leader identified for each output and the roles in the project were distributed. The PR1, PR2, PR3, and PR4 have been led by the UTCLUJ with COSVITEC, PAU, SU, and CTRL

respectively. The budget issues were discussed for each output and activities. The required working days for all outputs were calculated and added to the budget. All

partners agreed on these issues. The coordinator and the other partners have many European Union projects. Those experiences guided the project. The number of project activities including transnational project meetings (TPM1, TPM2, TPM3, TPM4, and TPM5), workshop/panel (E8), training activities (C1 and C2), Information Meetings (E1-E7) were determined during writing process of the project with all partners. The number of participants were foreseen, and the required costs were added to the budget for both national and international partners.

The project coordinator prepared individual partnership agreements developed based on the grant agreement between the coordinator and the national agency. With these agreements, rights, tasks, budget, amounts of payments, timetable, and obligations for each partner will be defined. And, before the kick-off meeting, all agreements were sent to all the partners.

Transnational project meetings were very important to ensure project implementation and budget control. Before each meeting, the coordinator requested both progress and budget reports from the partners, including expenditure amounts in the last 6 months. During the kick-off meeting of the project, the purpose and objectives of the project were clearly laid out to ensure that tasks are shared properly throughout the project. In the transnational meetings especially, the time management was handled with care. Project phases, including start and end dates were predetermined and reached consensus with partners.

All partners made local company visits. Various promotional activities and poster competitions have been organized in high schools and secondary schools. No extra budget was requested for the budgets required for these activities, and they were carried out within the framework of project management and dissemination activities.

5.1 Unit Costs for Eligible Staff Costs

The entire project team worked in the Teachers /Trainers / Researchers category. Table 5 shows the daily working wages determined by the EU for each partner country.

Table 5. Unit costs for daily staff costs (EUR)

Country	Teachers /Trainers / Researchers
Turkey	74
Romania	74
Italy	214
Germany	214
Finland	214

A Monthly Time Sheet (MTS) ("diary of activities within the project for each task type") has been prepared for all project employees, apart from a document detailing their work on a daily basis. These documents are shared by the coordinator to the partners and delivered by the partners to the coordinator before the interim report and before TPM5.

Employees of the project and the personnel who benefited from the grant support must be employees of the institution.

5.2 Travel Costs and Individual support

Eligible travel costs and costs of stay cover the costs of travel and subsistence allowances of staff and students participating in activities directly related to the achievement of the Project.

Travels have been intended for the following activities:

- Transnational Project meetings.
- Teaching/training assignments.
- Updating programs and courses.
- Practical placements in companies. industries and institutions
- Workshop and visits for result dissemination purposes.

Furthermore, travel for research activities was not eligible.

5.2.1 Unit Costs for Travels

For project staff and students involved in the applicable activities mentioned above, the grant contributed to the travel of them from their place of origin (home institution) to the venue of the activity and return. It included visa fees and related obligatory insurance, travel insurance, and cancellation costs if justified (Table 6 and Table 7). The travel costs were calculated based on the travel distance of a one-way from their home institution to the venue of the activity. The distance has been determined at http://ec.europa.eu/programmes/erasmus-plus/tools/distance_en.htm . Since the reduction of the carbon footprint has become a horizontal priority for all Erasmus+ mobility activities, participants have been given the choice between regular travel support, with the same amounts as defined in decision C(2017)6864, and "green travel support" with increased levels of contribution when traveling by a low-emissions means of transport such as train or bus.

Table 6. Travel support (EUR)

Travel support- standard	
Travel distances	**Amount**
Between 10 and 99 KM	23 EUR per participant
Between 100 and 499 KM	180 EUR per participant
Between 500 and 1999 KM	275 EUR per participant
Between 2000 and 2999 KM	360 EUR per participant
Between 3000 and 3999 KM	530 EUR per participant
Between 4000 and 7999 KM	820 EUR per participant
8000 KM or more	1500 EUR per participant

Table 7. Green travel support (EUR)

Green travel support	
Travel distances	**Amount**
Between 100 and 499 KM	210 EUR per participant
Between 500 and 1999 KM	320 EUR per participant
Between 2000 and 2999 KM	410 EUR per participant
Between 3000 and 3999 KM	610 EUR per participant

5.2.2 Unit Costs for Individual support

For Transnational Project meetings, it is EUR 300 per person (575 EUR in total: 275 for travel+300 + 300 for individual support).

In C1, which was a short term staff training activity, there was individual support of 106 EURO per person per day, with a total of 5 days of grant in the form of 3 days of training.

In C2, which was a short term student training activity, there was 58 euros of individual support per person per day, with a total of 7 days of grant in the form of 5 days of training. The daily grant amount for Accompanying Persons who participated in this activity will be 106 EURO.

5.3 Procedures for Reimbursement and Budget Transfer

After the first 40% of the budget transfer has been transferred from the Turkish National Agency to the coordinator, the coordinator performed the first 40% of the money transfer of the partners, adhering to the bilateral agreements made between each partner and the coordinator.

After the interim report was accepted by the Turkish National Agency, the second 40% budget transfer reached the coordinator. After the completion of the expenditure reports and staff cost documents requested by the coordinator and sent by the partners, the coordinator sent the 40% transfer to the accounts of the partners as two parts.

The final report will be uploaded to the system by the coordinator within 2 months after the project period is completed. After the final report is accepted by the Turkish National Agency, the remaining 20% of the budget will be transferred to the coordinator. The coordinator will send 20% of all partners' budgets to all partners in accordance with the finalized and approved expenditure items.

6. Project Internal Communication

The partnership has good communication among all project partners, PAU, SU, and KLU from TR; UTCLUJ from RO; UNITN, FBK, INDIVENIRE, and COSVITEC from IT, OTH from GE, and CTRL Reality from FI took place in this partnership.

Scientific and academic knowledge, industry experience, and institutions producing innovative educational technologies were brought together at FutureBio. PAU, KLU, SU, FBK, UNITN, OTH, and UTCLUJ formed the scientific basis. INDIVENIRE contributed by sharing industry practices and field experiences, and CTRL Reality guided the team in preparing digital training materials.

The partner selection has been completed, taking into account the past and present project execution and completion experiences: A KA203 project has been completed successfully by PAU, SU, FBK, UTCLUJ, and COSVITEC. A KA202 project has been completed by PAU and SUPSI (as associated partner). A KA204 project has been completed successfully by PAU, KLU, UTCLUJ, and COSVITEC. Student and staff lecturing and internship activities between PAU and OTH, which have been continuing effectively for many years, are carried out without any problems.

A management team was formed by choosing one person from each of the project partners: Arzum Işıtan, Evren Çağlarer, Yasemin Öztekin, Gratiela Dana Boca, Aniello Gervasio, Alessandro Pegoretti, Massimo Bersani, Laura Pasquardini, Teijo Lehtonen, Charlotte Thieland Nadia Catenazzi. These people were responsible for management, implementation, monitoring, and quality on behalf of their organization.

A Google Group and Google Drive folder named "FutureBio" was created by PAU to write the project proposal and to share information among partners. The partnership has also Whatsapp and Skype communication.

PMT ensured the control and coordination of the project in terms of time and outcomes through 5 transnational meetings, which were held during the project (TPM1-TPM5). In order to maintain this good communication in the following processes, we used Google Group, Google Drive, Whatsapp, and Skype. In this sense, the division of labor decided by the entire project team, with the opinion and approval of each partner, is important. Each task leader and all partners in charge knew the responsibility, duty, and rights they have in the realization of the project results and activities. Apart from the project partners' qualifications to execute and complete projects together, all partners have good communication. This communication helped us to do preliminary needs analysis together during the project preparation and implementation phases and continued throughout the project. In this context, after the consensus in the project preparation phase, when the project was awarded a grant, bilateral agreements have been prepared between the coordinator and the partners, which included the tasks and responsibilities and the budget of each partner. All processes have been carried out transparently.

7. Project Risk Management

The partnership did not foresee the separation of our partners since it has already completed EU projects together. For eliminating the risks, project partners who work on polymers, biopolymers, online training material creation, and training material development took part in our project. However, during the Project's coordination and implementation phases, undesirable disruptions did not occur.

In addition, progress regarding Covid19 will be followed closely during the entire project period. All the problems and risks that may occur due to Covid19 were discussed by the partners during the project preparation period and the necessary measures were added to the project. A strong online communication network has been established, especially in case of non-realization of transnational meetings. These measures were not needed during the project period.

5 transnational meetings (M1- M5) in every 6 months have been organized by attending all partners' coordinators of the project. The partnership established procedures to identify potential risks and to handle these effectively. We have created the necessary online infrastructures.

The potential risks for FutureBio project have been foreseen: conflict between partners, slippage on timetable, failures by one or more partners to deliver agreed activities, being unable to provide expected audiences in project events. PAU before the Kick-off meeting (TPM1) prepared a risk analysis and presented it at TPM1: to determine possible risks to evaluate the risks to identify preventive or corrective measures. Then the partnership identified and agreed further action to resolve or acted on risk situations if necessary. Risks that may arise from COVID19 are also anticipated and all project partners have agreed on the measures to be taken against these risks:

- Transnational meetings not being held on time: All TPMs were done.

- Failure to hold information meetings face to face: all information meetings have been done face-to-face.

In any case, at the beginning of the project, two separate plans have been considered:

1. Reaching the total number of people by doing more than one activity with very few people

2. Online participants have been added to the budget of the informative meetings. If not done face to face. These activities can be completed online.

8. The Deliverable Templates

The templates developed for serving the purpose of the project results were described in the following table and could be found as annexes:

1. Work Package Monthly Report: monthly reports from Task leaders compiled into a single report by the work package officer in the coordinating institution and shared with PC.

2. Project Result Monthly Report: monthly reports from task leaders compiled into a single report by PROJECT RESULT leaders and shared with the coordinator.

3. Monthly Time Sheets: it has been filled in on a monthly basis for each staff member involved in the project and shared with the coordinator.

4. Staff Time Sheet: the project results for each personnel involved in the project completed and shared with the coordinator after they are completed and approved by the legal representative.

5. Meeting Minutes Report

6. Meeting Attendance Sheet

ANNEXES

Annex 1: Work Package Monthly Report

Work Package Monthly Report

Title and reference number of the work package (WP)		
WPL:	Reporting period:	Completion date:

Activities carried out since last report to date:

Task No*	Task Description	Start date	Due date	Place/Partners involved	Description of the activity carried out	Specific and measurable indicators of achievement	Implementing status (done. partially–? [%])
Task x.x							
Sub Task							
x.x.y							

*If a task contains several activities. please divide it to subtasks and report the progress of both the task and its subtasks.

Corrective Actions **

Task No*	Task Description	Details
Task x.x		
Sub Task		
x.x.y		

*If a task contains several activities. please divide it to subtasks and report the progress of both the task and its subtasks.
**Only when corrective actions are needed.

Activities to be carried out for the next month:

Task No*	Task Description	Start date	Due date	Place/Partners involved	Description of the activity carried out	Specific and measurable indicators of achievement	Implementing status (done. partially–? [%])
Task x.x							
Sub Task							
x.x.y							

*If a task contains several activities. please divide it to subtasks and report the progress of both the task and its subtasks.

Complete Activities to date:

Task No*	Task Description	Start date	Due date	Place/Partners involved	Description of the activity carried out	Specific and measurable indicators of achievement

Task x.x						
Sub Task x.x.y						

** For a completed task containing subtasks. please report only the task.

Progress of Deliverables

Deliverable No	Deliverable Description	Status (Y/N)		
		Prepare	Submit to EC	Officially Complete

Indicators

Indicator of achievement and or/performance as indicated in the project proposal	Target	Sources of information on indicators	Measured Results	Measured Date	Observation

Changes that have occurred in this result since the original proposal:

Annex 2: Project Result Monthly Report

Project Result Monthly Report

Title and reference number of the Project result (PR)		
PRL:	Reporting period:	Completion date:

Activities carried out since last report to date:

Task No*	Task Description	Start date	Due date	Place/Partners involved	Description of the activity carried out	Specific and measurable indicators of achievement	Implementing status (done. partially–? [%])
Task x.x							
Sub Task							
x.x.y							

*If a task contains several activities. please divide it to subtasks and report the progress of both the task and its subtasks.

Corrective Actions **

Task No*	Task Description	Details
Task x.x		
Sub Task		
x.x.y		

*If a task contains several activities. please divide it to subtasks and report the progress of both the task and its subtasks.
**Only when corrective actions are needed.

Activities to be carried out for the next month:

Task No*	Task Description	Start date	Due date	Place/Partners involved	Description of the activity carried out	Specific and measurable indicators of achievement	Implementing status (done. partially–? [%])
Task x.x							
Sub Task							
x.x.y							

*If a task contains several activities. please divide it to subtasks and report the progress of both the task and its subtasks.

Complete Activities to date:

Task No*	Task Description	Start date	Due date	Place/Partners involved	Description of the activity carried out	Specific and measurable indicators of achievement

Task x.x						
Sub Task x.x.y						

** For a completed task containing subtasks. please report only the task.

Progress of Deliverables

Deliverable No	Deliverable Description	Status (Y/N)		
		Prepare	Submit to EC	Officially Complete

Indicators

Indicator of achievement and or/performance as indicated in the project proposal	Target	Sources of information on indicators	Measured Results	Measured Date	Observation

Changes that have occurred in this result since the original proposal:

Annex 3: Monthly Time Sheet

	2021-1-TR01-KA220-HED-000032160																												
	Let's use biodegradable plastic for the future																												
Month/Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Toplam
08.00-09.00																																0
09.00-10.00																																0
10.00-11.00																																0
11.00-12.00																																0
13.00-14.00																																0
14.00-15.00																																0
15.00-16.00																																0
16.00-17.00																																0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Institution Project Coordinator Staff Legal Representative

Annex 4: Staff Time Sheet

Staff Time Sheet

Project Number	
Project Title	
Institution	
Name of employee	
Staff Category*	
Period** (Start date of PR – End date of PR)	

Month / Year	Description of Activities	Days
	PR1:	
	Total Days	

Employee Signature: …… Date: ……

Employer Signature: …… Date: ……

Employer Name: ……

***Staff Category:** The applicant will estimate the staff workload required on the basis of the category of staff concerned and the number of days to be worked on the project. in relation to the outputs. Working days might include week-end. obligation and bank holidays. For the sake of estimating the budget. working days per indi-vidual will not exceed 20 days per month or 240 days per year. The estimation of the budget results from applying Eras-mus+ contribution to unit costs for staff. It is independent from the actual remuneration modalities that will be defined in the partnership agreement and implemented by the beneficiairies.
The profile of staff involved in projects is grouped in four categories:
Managers (staff category 1) (including legislators. senior officials and managers) carry out top managerial activities related to the administration and coordination of project outputs.

Researchers. teachers and trainers (RTT) (staff category 2) typically carry out academic activities related to curriculum/training programme development. development and adaptation of teaching/training materials. preparation and teaching of courses or trainings.

Technical staff (staff category 3) (including technicians and associate professionals) carries out technical tasks such as book-keeping. accountancy and translation activities. External translation services and external language courses provided by sub-contracted non-consortium members should be classified as “Sub-contracting costs”.

Administrative staff (staff category 4) (including office and customer service clerks) carries out administrative tasks such as secretarial duties.

** **Period:** The creation of the output date-range

Annex 5 Meeting Minutes Report

Meeting Minutes Report

Meeting Subject:			
Date of Meeting:		Time:	
Minutes Prepared by:		Location:	
1. Attendance at Meeting			
Name		Institution	
1.			
2.			
3.			
2. Purpose of Meeting			
3. Meeting Agenda			
4. Meeting Notes. Decisions. Issues			
5. Action Items			
Action		Assigned to	Due Date
6. Attachments (documents/handouts to bring. reading material. etc.)			
Description		Prepared by	
7. Next Scheduled Meeting			

Annex 6 Meeting Attendance Sheet

FUTUREbio

……MEETING ATTENDANCE LIST

Meeting Host Institution:

Meeting Location:

Meeting Date:

Name and Surname	Institution	e-mail	National ID	Date