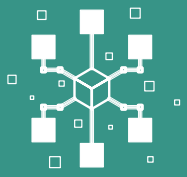
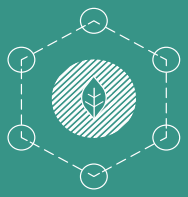






Chemistry Materials | Health Cosmetics | Food & Feed | Energy | Environment

Review

2012
2019

twb
BIOSCIENCES & BIOPRODUCTION

An original collaborative model

INTRODUCTION

Since its inception in 2012, TWB has spent the past eight years perfecting an original, unconventional model in the field of industrial biotechnology. The hallmarks of this model are:

> a flourishing public/private ecosystem that brings together all the stakeholders involved in the economic value chain (start-ups, small, medium and intermediate-sized enterprises, large groups, investors, research development bodies, research and/or higher education organisations, and local authorities), supported by a strong brand;

> a consortium agreement that simplifies and therefore facilitates the contractual relationships between public research laboratories and industrial companies, while focusing on collective intelligence and efficiency to accelerate the development of R&D projects;

> technology platforms equipped with highly automated, cutting-edge facilities, along a continuum of knowledge from gene to product, to provide alternative, innovative and sustainable biological solutions, intertwined with an ethical and responsible approach.

The results achieved so far prove that this model is a success.
In late 2019, the TWB public/private consortium had 50 members, 34 of which were companies. Over the 2012 - 2019 period, TWB devised and conducted 184 R&D projects - 128 of which involved industrial contracts - together with academic and industrial partners. These projects have resulted in significant advances, both in the form of incremental industrial applications and innovative disruptive technological building blocks. TWB covers a wide range of fields, from chemistry and materials to agri-food, via energy and cosmetics. Over the same period, TWB has supported, from the very beginning, seven start-ups hosted on its premises, enabling them to get started and grow more quickly. In late 2019, TWB directly employed 82 people, with an additional 40 staff members working for the hosted start-ups. Lastly, industrial contracts worth almost €40m have been signed since 2012, which equates to 60% of the funding for TWB each year, complementing the government grants received (including in-kind contribution such as staff members who are technically employed by the French State).

The origins of TWB must not be forgotten: it is the product of the ground-breaking ideas of Pierre Monsan, the early support of INRAE, followed by the other two founding supervisory bodies (INSA Toulouse and the CNRS), and funding from the SGPI (French general secretariat for investment) and the ANR (French national research agency), and the founding members of the consortium, both public and private. TWB is a collective effort that draws its strength from its dedicated staff members and its network of committed stakeholders who all, on their own individual level, champion the roll-out of industrial biotechnology.

2012 - 2019

HISTORY

2010

The TWB concept was conceived at the initiative of Pierre Monsan, Professor Emeritus of INSA Toulouse, with the support of Marion Guillou and Paul Colonna, at the time Chairwoman and Science Director for Bioeconomics of INRA (which became INRAE on 1 January 2020), respectively. The idea was also given the green light by local stakeholders - both academics and industrial companies - who were all determined to create an industrial biotechnology infrastructure recognised both nationally and internationally.

2011

The application of TWB was selected as part of the Investment for the Future Programme run by the French State. TWB received public funding worth €20m (€10m of investment and €10m for operations) for the 2012 - 2019 period.

> The Programme d'Investissements d'Avenir (PIA : Investment for the Future Programme), created in 2010 and steered by the Secrétariat Général Pour l'Investissement (SGPI: General Investment Secretariat), was set up by the French State to finance innovative and promising investments in the country, to enable France to increase its potential for growth and create jobs. The Agence Nationale de la Recherche (ANR: National Research Agency) was chosen to handle PIA activities for the State.

2012

TWB* was created in the form of a *Unité Mixte de Service* (UMS: joint service unit) INRAE/INSA/CNRS (UMS INRAE 1337, UMS CNRS 3582). With its ambition to establish a simplified relationship to create economic value between academic scientific research and industrial development in the field of industrial biotechnology, the aims of TWB are as follows:

Encourage the development of new sustainable production methods by using innovative biological tools (enzymes, microorganisms) and competitive ways of processing renewable carbon sources;

Develop innovative technological solutions to respond to the requirements of industrial companies and provide resources for academic research based on the problems encountered by industrial companies;

Create economic value for its industrial partners (including start-ups) and within the local community by creating jobs.

** TWB - Toulouse White Biotechnology is a registered trademark (TWB®).*

Pierre Monsan

Professor Emeritus of INSA Toulouse and **founder of TWB,** Pierre Monsan was **Managing Director of TWB until December 2018**. He earned an engineering degree in organic chemistry then a PhD in engineering, before obtaining a State Doctorate in 1977. Pierre Monsan is the joint inventor of over 60 patents and helped create several businesses, including BioEurope in 1984. While working on his career as a researcher and entrepreneur, he taught at INSA Toulouse (1969 to 2013) and at MINES Paris Tech (1993 to 2016).

In 2017, Pierre Monsan became the **first French citizen to win the international Enzyme Engineering Award**, a prize given to the best international researchers in the field of enzymology. In the same year, he was appointed Chevalier de la Légion d'Honneur - a prestigious order of merit - in acknowledgement of his unique and exemplary career as a researcher and entrepreneur in the field of biotechnology.

AN ORIGINAL CONCEPT

A public/private consortium was created at the same time in 2012 to support TWB, with 28 public and private members.
At the end of December 2019, this consortium had 50 members, all iconic figures in the industrial biotechnology sector, including 34 companies (from start-ups to large groups), 4 investment funds, 3 research valorisation companies and 9 public members (including the 3 TWB supervisory bodies).

This consortium is original for three main reasons:

It **creates an ecosystem** that unites the interests of stakeholders from all sorts of backgrounds and generates alliances that pave the way for new collaborations.

It is **based on a consortium agreement** that simplifies and facilitates contractual relationships in terms of intellectual property and licences.

It **funds innovative frontier research projects** chosen collaboratively.

INRAE
science for people, life & earth

The Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement (INRAE: the French National Institute for Agriculture, Food and Environment) was born of the merger of INRA and IRSTEA in 2020. At the crossroads of food, the environment and agriculture, INRAE's areas of research focus on day-to-day issues that are intrinsic to the challenges facing the world today, among others food security, climate change, conservation of biodiversity and resources, and quality of life. INRAE is committed to exploring the frontiers of science and performing high-calibre research that is globally relevant. Specifically, TWB is part of the TRANSFORM (characterisation and development of agricultural products) and MICA (microbiology and the food chain) divisions, closely connected to the Occitanie-Toulouse INRAE Centre.

INSA
TOULOUSE

The Institut National des Sciences Appliquées of Toulouse (INSA Toulouse), a multidisciplinary state engineering school, teaches various specialities connected to the scientific advances of its research laboratories. Of particular interest is the Biological Engineering department, which trains engineers in all fields of application of industrial biotechnology and is closely connected to the internationally renowned laboratory Toulouse Biotechnology Institute (TBI) - Bio & Chemical Engineering. INSA Toulouse also includes the Bio-Industries CRITT (French regional centre for innovation and technology transfer) which provides services to industrial companies and academics.

cnrs

The ambition of the Centre National de la Recherche Scientifique (CNRS: French National Centre for Scientific Research) - a research institute recognised internationally for the excellence of its scientific work, one of the biggest in the world - is to meet the major challenges of today and tomorrow. Its scientists explore subjects as diverse as living world, matter, the Universe and the functioning of human societies. TWB is connected to the INSIS (institute of science and systems engineering) department. To respond to challenges facing society, the INSIS leads and coordinates the activities of its units in several fields, including biotechnology, by drawing on the support of its academic and industrial partners.

AN ORIGINAL CONCEPT

Members of the consortium on 31 December 2019

Joining date

GOVERNANCE

TWB is managed by a Managing Director who is in charge of strategy and operations. In addition, as a joint service unit managed by INRAE, TWB is administered by a Unit Director and organised into support and business departments.

The Managing Director is assisted by an executive committee which includes the unit director and the directors of the following activities: business development, research & innovation, operations, administrative & financial affairs, and communication. He reports to the consortium via a **Strategic Steering Committee (SSC)** which determines the direction for TWB to take.

The SSC was chaired by Paul Colonna, INRAE's Science Director for Bioeconomics, from 2012 to 2018. Since 2018 it has been chaired by Jean-Claude Lumaret, Chief Executive Officer of Carbios. Jean-Claude Lumaret was deputy chair from 2012 to 2018, and Nicolas Seeboth (Research Director for Polymers and Chemical Additives, Michelin) and Monique Axelos (Science Director for Food and Bioeconomy, INRAE) have been deputy chairs since 2012 and 2018, respectively.

Olivier Rolland

With **over 10 years' experience in the bioeconomy**, Olivier Rolland joined TWB as **Managing Director on January 2019**. An engineer with a PhD in chemistry, he began his career at the Michelin technology centre, before joining Total's New Energies Business Unit. He lived in the United States for five years, where he was in charge of Total's strategic partnership with Amyris, a leading start-up in synthetic biology. One of his biggest achievements there was steering the development of the first green commercial aviation fuel made from sugar, for which he received the **Presidential Green Chemistry Award sponsored by the United States Environmental Protection Agency** in 2014. Olivier Rolland went on to become Sustainable Fuel Strategy Director at Boeing, where he helped develop value chains and innovative and sustainable economic models before joining TWB.

Two advisory committees help the SSC monitor frontier research projects:

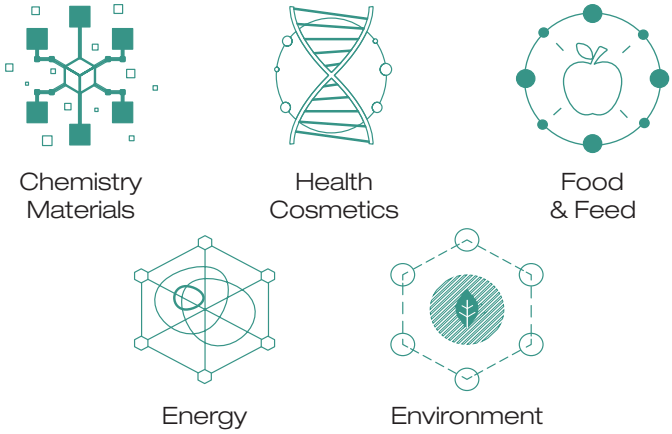
the **Scientific Advisory Board** (SAB): this board is made up of internationally renowned experts who give their opinion on the scientific quality and relevance of projects funded by TWB as well as the overarching scientific directions. Initially chaired by Prof. Rolf Schmid (University of Stuttgart, Germany), the SAB is now chaired by Prof. Merja Penttilä (VTT, Finland).

the **Ethics and Sustainable Development Committee** (ESDC): the members of this committee are asked for their input on any issue concerning economic, environmental, social and societal repercussions, and frontier research projects. It has been chaired by Dr. Thierry Magnin (Catholic University of Lille, France) since its creation.

ACTIVITIES

As a stakeholder in the bioscience and bioproduction field, TWB is involved in two main activities: **setting up and conducting R&D projects, and supporting start-ups in their development**.

Diverse applications



Fields of expertise

Specialities: synthetic biology - metabolic engineering - biocatalysis - fermentation - purification, concentration and separation processes - traditional and cutting-edge analytical techniques.

Biological tools: microorganisms (bacteria, yeasts, filamentous fungi, microalgae) and enzymes.

TWB is committed to continuously improving its services. Its quality management system is certified ISO 9001:2015.

Setting up and conducting R&D projects

By bringing together the academic and industrial worlds, TWB provides the conditions needed for research and development projects to succeed. TWB identifies the requirements of industrial companies, mobilises its teams of experts as well as scientists from the best public laboratories, and provides cutting-edge technological facilities.

In addition, TWB handles R&D contracts based on predefined intellectual property rules. Lastly, TWB combines a creative approach with ethical reasoning to steer the projects and is committed to rising to the societal and environmental challenges posed by sustainable development.

Types of R&D projects

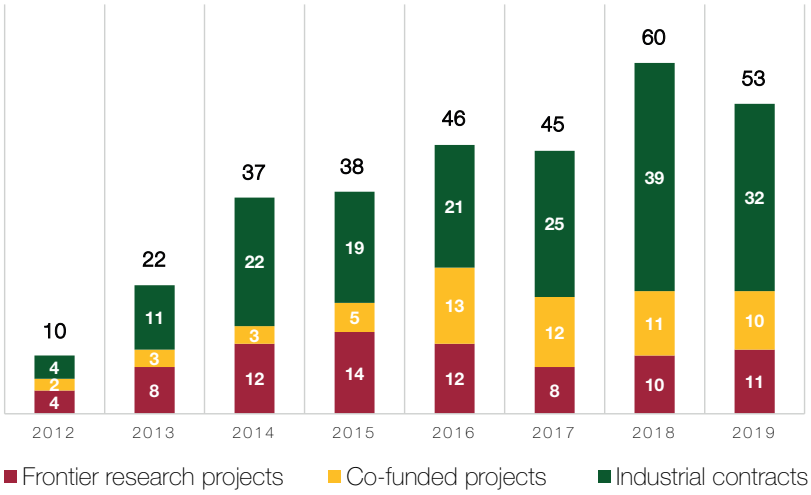
Frontier research projects: With its consortium, TWB finances projects with a high potential for innovation, likely to lead to technological breakthroughs or even the creation of start-ups. The intellectual property is 100% publicly owned. However, members of the TWB consortium have priority over the data, as well as a right of first negotiation over exploitation of the end results. A call for proposals is organised each year by TWB.

Industrial contracts (R&D, provision of services): TWB solves specific problems in complete confidentiality, under contract with industrial companies which may or may not be members of the consortium. The applied research projects open up significant possibilities for exploitation and return on investment. The intellectual property generated can belong to the industrial company. Exclusive exploitation rights are granted to industrial companies that belong to the consortium. In return, TWB collects success fees.

Co-funded projects (public/private, Europe, 3BCAR): TWB takes part, along with industrial companies and/or academics, in national and European programmes. Such projects are negotiated on a case-by-case basis when it comes to the sharing of intellectual property, depending on the funding injected.

ACTIVITIES

NUMBER OF ACTIVE R&D PROJECTS LED PER YEAR



The number of active projects (all types of projects combined) reflects the number of projects underway each year. Some projects last several years. The growth of the activity is mainly due to the increase in the number of industrial contracts.

184 R&D projects were carried out over the 2012-2019 period

- **32 frontier research projects**

TWB launched 9 calls for proposals, received 72 applications from 25 different laboratories (laboratories supervised by INRAE, CNRS or INSA and international laboratories) and funded 32 projects over the 2012-2019 period.
TWB funding for these projects represented €10.6m (total cost) for the 2012-2019 period, at a rate of €1m to €1.5m per year.

- **24 co-funded projects**

These include 3 European projects, 15 projects funded by 3BCAR and 6 public/private projects.

TWB is certified by the 3BCAR Carnot Institute, enabling it to draw on the national network of all public stakeholders in the bioeconomy and respond to internal calls for proposals.

The 3BCAR Carnot Institute (Bioenergies, Biomolecules and Biobased materials from Renewable CARbon), led by INRAE, is a network of 18 R&D entities that range from laboratory to pilot scale. It aims to encourage relationships between research structures and businesses in order to develop innovative products through the transfer of technology and contractual research.

Scientific publications

Most of the projects conducted by TWB are subject to confidentiality agreements. However, **22 patent families** were filed, and **46 articles** were published in science journals or books between 2012 and 2019.

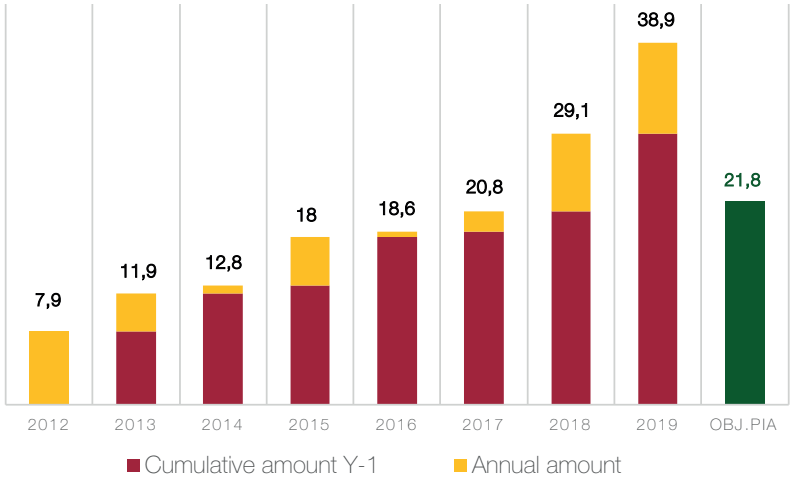
ACTIVITIES

- **128 industrial projects**

The cumulated value of industrial contracts signed between 2012 and 2019 reached almost €40m by late 2019. TWB went far beyond the objective set at its inception in the framework of the PIA: signing industrial contracts amounting to a minimum of €21.8m.

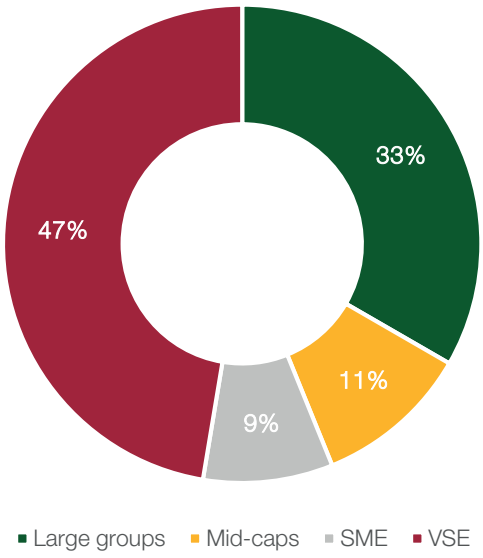
The 128 industrial contracts were signed with **58 different partners**. TWB enjoys an even diversification among its partners, as well as the loyalty of a large number of them.

VALUE OF INDUSTRIAL CONTRACTS SIGNED (€m)



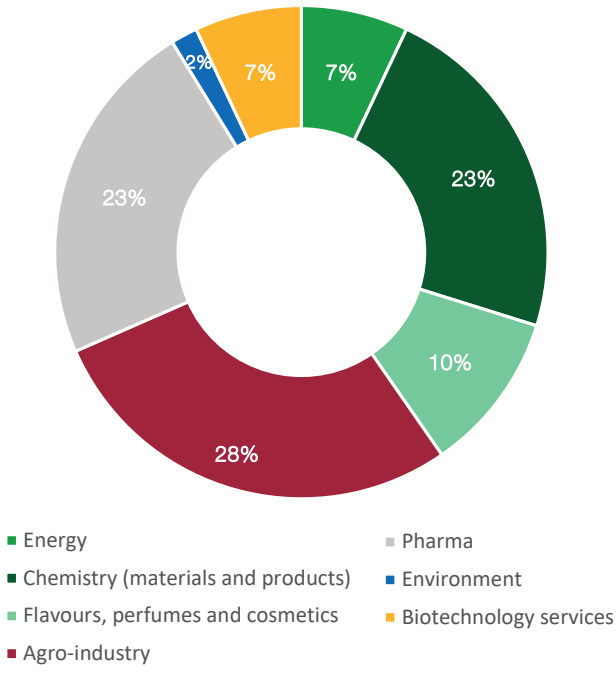
TYPOLOGY OF THE 58 INDUSTRIAL PARTNERS

BY SIZE OF BUSINESS



Almost 50% of contracts were signed with start-ups. It is worth noting that since 2012, these start-ups supported by TWB (whether hosted or otherwise) have attracted over €100m from investment funds.

BY SECTOR OF ACTIVITY



ACTIVITIES

Hosting and support for the development of start-ups

TWB supports start-ups from the very beginning, in order to get them up and running quickly and accelerate their growth by **providing premises (a laboratory, offices) and a multitude of services**, such as financial and strategic advice, provision of cutting-edge facilities, scientific and technological support, putting them in touch with the TWB ecosystem, and administrative support.

By collaborating with TWB, the hosted start-ups enjoyed various advantages. They were able to quickly:
› defer their first investments in technological facilities and optimise their cash flow;
› provide proofs of concept and consolidate a series of initial results;
› obtain, through leveraging, specific funding (Bpifrance, ADEME (French agency for the environment and energy management), the Occitanie region, etc.);
› begin fundraising campaigns, targeting private investors that are members of the TWB consortium, in particular.

Seven start-ups hosted

Tolerys (from 2013 to 2015), EnobraQ & PILI (since 2016), Micropep Technologies (since 2017), Green Spot Technologies & iMEAN (since 2018), BioC3 (since 2019).

SuperBIO

This European project led by Ghent Bio-Economy Valley (GBEV) was conducted over the 2016 - 2018 period. SuperBIO aimed to **encourage start-ups to grow** by helping them create their value chain and by giving them access to services (technical, business, marketing) at reduced costs. The project brought together a large number of technical partners and European clusters such as TWB, the Corporación Tecnológica de Andalucia (CTA) and Bio Base Europe Pilot Plant. TWB helped consolidate **50 value chains**, provided **5 service packages for European start-ups** and organised **2 days dedicated to specific themes** (biocontrol, cosmetic ingredients).

Another activity: training

TWB has taken part in **training initiatives at various education establishments** (MINES Paris Tech, INSA Toulouse, AgroParis Tech, CPE Lyon, SuP Biotech, etc.) since its creation. Each year, students and teachers visit TWB and are given a presentation on its activities. In September 2019, TWB created a **dedicated department: TWB Education**. Its goals are to improve training for students on the realities of the industrial environment and help meet the requirements of businesses when it comes to employment and continuing education in the biotechnology sector. TWB Education will also take part in internationally focused training courses in the near future.

Flash News

TWB encourages the sharing of knowledge with its 'Flash News' intelligence report, which covers the field of industrial biotechnology. Members of the consortium get priority access to this report, which is published on the TWB website at a later date. By the end of 2019, **40 issues** had been published.

RESOURCES

Human resources

TWB staff include:

› **permanent staff** (management, technology platforms, business and support positions);

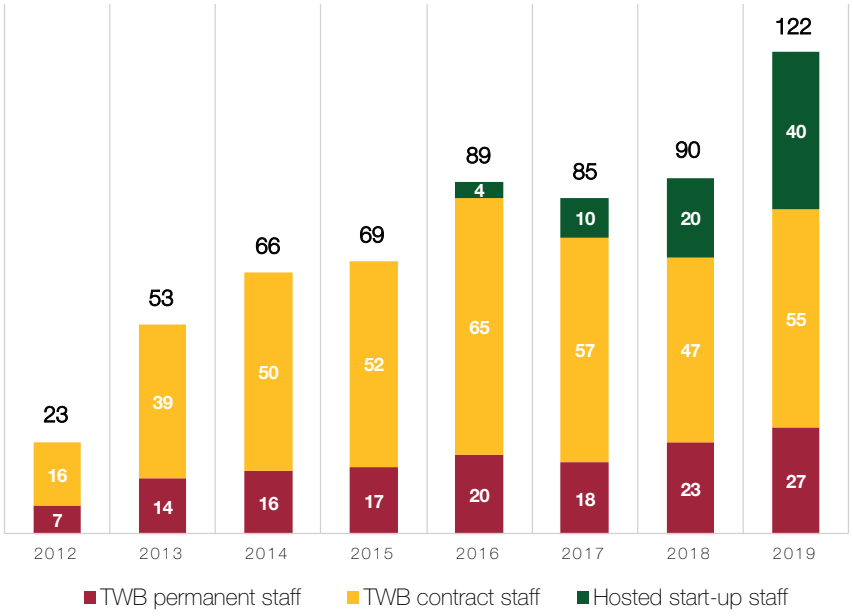
› **project staff**;

› **hosted start-up staff**.

Since the creation of TWB, INRAE has seconded staff members who are technically employed by the French State.

The number of staff has increased exponentially since 2012, and stood at **122 at the end of 2019**. The gender balance of the staff employed directly by TWB reveals a higher percentage of women. The age structure shows a very high representation of the youngest age brackets.

PERSONNEL OVERVIEW



Did you know?

Over 100 people are involved in the R&D projects conducted by TWB each year, including around forty scientists, mainly researchers and research professors working at laboratories partnered with TWB.

RESOURCES

Scientific and technological resources

The means implemented for the realisation of R&D projects consist of:

- The **direct resources** of TWB in terms of its technology platforms:
  €10m has been invested in high-tech facilities that integrate automated systems across the board. These are distributed over two platforms that work on a continuum:
  › **Microbial strain engineering** (automated molecular biology workstation, high-throughput colony picker, high-throughput dispensers);
  › **Bioprocesses** (microbial culture robot with 24 integrated mini-bioreactors (50ml), a range of 500ml to 300l reactors, flow cytometers (analyser and sorter), liquid (HPLC, U-HPLC) and gas (GC-MS) chromatography systems.

- **collaborations with cutting-edge public laboratories**:
  Among others, TWB works with Toulouse Biotechnology Institute (TBI) and its ICEO technology platform, which focuses on engineering and screening for original enzymes. Other partnerships have been developed, in a complementary fashion, in order to extend the TWB skills offer on a national (Genopole and the University of Evry, ESPCI Paris Tech, MICALIS Jouy-en-Josas, BBF Marseille, etc.) and international level.

- **partnership with the technological resource centre Midi-Pyrénées Bio-Industries CRITT**:
  this enables TWB to benefit from unit operations and processes on a pre-industrial scale.

  Lastly, depending on requirements, TWB can draw on complementary technological resources in the local area, which make up the regional network of life sciences platforms, the Toulouse Genotoul.

Innovative partnerships

The technology of the start-up Altar has been integrated into the Bioprocesses platform. Based on natural selection mechanisms, it makes it possible to develop new microbial strains that are not genetically modified. The Altar facilities can be used for services provided by TWB in return for a licence fee paid to the company.

tbi
Toulouse Biotechnology Institute
Bio & Chemical Engineering

TBI - Bio & Chemical Engineering, a research laboratory on the INSA Toulouse campus, supervised by three bodies (INSA/INRAE/CNRS) is recognised internationally for its level of expertise in the fields of biocatalysis, metabolic engineering, microbiological engineering and environmental processes. Its work covers applied, technological and fundamental research. 350 people work at this laboratory.

CRITT
BIO-INDUSTRIES

Experienced and qualified in research and innovation, the Centre Régional d'Innovation et de Transfert de Technologie Bio-Industries (CRITT: French regional centre for innovation and technology transfer), managed by INSA Toulouse, specialises in bioprocesses on a pre-industrial scale. It has a comprehensive technology centre, covering pre-processing, fermentation up to 300 litres, bio-separation and purification.

Certification

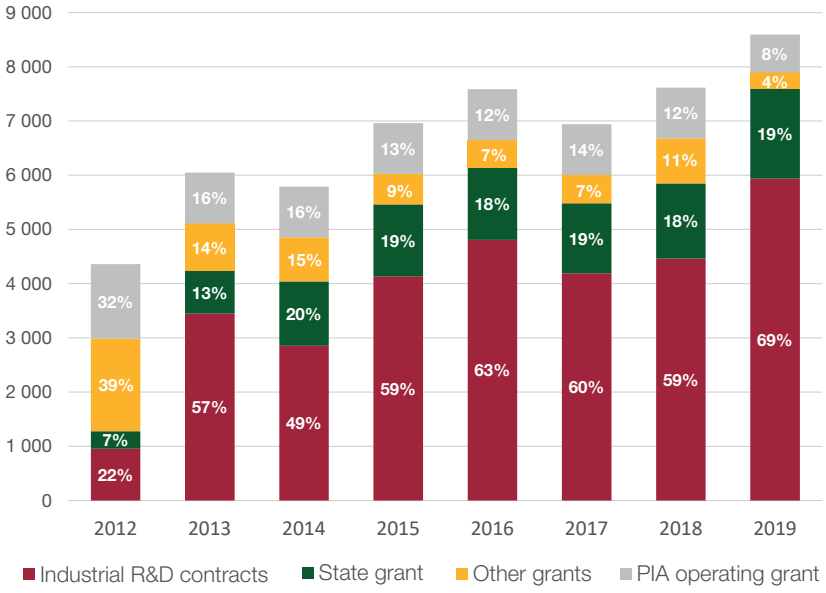
In 2019 TWB obtained the ***Infrastructure Scientifique Collective*** certification issued by INRAE. Together with TBI's Engineering and Screening for Original Enzymes (ICEO) platform, the TWB technology platforms were chosen for inclusion on the French national road map of ***Research Infrastructure*** (French Ministry of higher education, research and innovation). These acknowledgements are awarded to organisations that are leading the way on major technological and scientific issues.

RESOURCES

Financial resources

The finances of TWB stem partly from **public funds** in the form of grants (such as the PIA grant, grants from local authorities, grants for public research programmes, etc.) and the provision of staff members who are technically employed by the TWB supervisory bodies, and partly from **private funds** (industrial R&D contracts, membership fees paid by consortium members). The turnover of TWB has enabled it to remain on an even financial keel each year. Overall, it has been steadily increasing, from €4.3m in 2012 to €8.4m in 2019.

DISTRIBUTION OF RESOURCES (€K)



The share of financial resources from industrial contracts increased quickly and has provided 60% of the total since 2015. At the same time, the grant in the scope of the PIA has dropped by two thirds.

TWB received financial support from the PIA, local authorities (Occitanie/Pyrénées-Méditerranée region, Toulouse Métropole, SICOVAL) and Europe, in particular under the FEDER programme.

Sites

2012 Parc Technologique du Canal | Toulouse | **800m²**

2015 Parc Technologique du Canal | Ramonville Saint-Agne | **1,700m²**
The spaces are divided between the technology platforms, the laboratories dedicated to R&D projects and the premises set aside for hosted start-ups.

By the end of 2020 Move to the INSA campus | Toulouse | **3,300m²**
Work began in January 2019 with funding of €6.5m mainly provided under a State-Region plan.
Uniting TWB with TBI and the Bio-Industries CRITT on the same site will create a **15,000m² complex** on the INSA Toulouse university campus **100% dedicated to industrial biotechnology**, from lab to pre-industrial pilot scale.

INTERNATIONAL ACTIVITIES

Collaborations

TWB is a familiar face in the world of industrial biotechnology and is involved in European and international projects and networks with major stakeholders in the field.

In this vein, an ambitious project was unveiled in 2015: **IBISBA (Industrial Biotechnology Innovation and Synthetic Biology Acceleration)**. Launched by INRAE, this programme brings together and coordinates European research infrastructures in order to support and accelerate industrial biotechnology. The network connects 14 facilities in 9 European countries, including (in addition to TWB), VTT (Finland), RWTH Aachen University, Fraunhofer IGB/CBP (Germany) and the Manchester Institute of Biotechnology (United Kingdom). IBISBA covers the entire research process, from the design phases to the pre-industrial scale. Its purpose is to raise both the biological and technological barriers encountered during the development of an industrial bioprocess.
In August 2019, the European Commission added IBISBA to its **European Strategy Forum on Research Infrastructures (ESFRI)** road map and earmarked €4m in funding over four years for the **PREP-IBISBA** project. The goal is to set up this research infrastructure in the form of an autonomous legal entity with its own business model, business plan and scientific road map.

Events

TWB helped organise two major international events that were held in Toulouse:

- **Enzyme Engineering Conference** (24 - 25 September 2017) with the American company Engineering Conferences International (New York, USA);
- **European Forum for Industrial Biotechnology & the Bioeconomy** (16 - 18 October 2018) with Europabio (Brussels, Belgium).

TWB START-UP DAY

In 2018, TWB designed its own event, which now takes place every year: **TWB START-UP DAY**. This is a whole day dedicated to young entrepreneurs who want to expand their business activity and investors looking for new projects, as well as any international stakeholder in the field of industrial biotechnology. The 2019 TWB START-UP DAY attracted 200 professionals from 8 countries.

The event also included a **competition called 'Pitch me your biotech start-up'**. It gives start-ups, which deliver a presentation about themselves to biotech investors and industry executives, the chance to win services on the TWB technology platforms worth €50,000, with scientific support.
The prize was won by Dust BioSolutions (Germany) in 2018 and Tempeasy (Great Britain) in 2019.

TWB start-up day

Scientific activities

TWB attended **128 leading international conferences** in the biotechnology field (including WCIB, EFIB, PBS, BIOKET and SYNBIOBETA) and gave **68 spoken presentations**.

SUCCESS STORIES

AMOÉBA (2014 - 2017)

As part of an R&D contract with Amoéba, which specialises in the organic treatment of water using biocides, the TWB teams managed to optimise the culture and production of amoebae by raising several major technological barriers. This collaboration led to the development of an efficient technology to treat water containing biofilms, particularly in cooling towers, and combat legionnaires' disease, among other things. Amoéba went on to raise €50m before listing on the stock market and building a production plant in France. Amoéba has also developed a biocontrol product to protect plants.

THANAPLAST (2012 - 2017) & C.E-PET (2018 - 2021)

The THANAPLAST project, with a budget of €22m, led by the start-up Carbios, orchestrated by TWB, co-funded by Bpifrance, and mainly carried out by a TBI research team (INSA Toulouse), developed innovative technologies: incorporating enzymes into plastics to make them biodegradable. These scientific breakthroughs, which have had major economic and industrial repercussions in the bioplasturgy field, led to the production of fully biodegradable films for use in agriculture, with the creation in 2016 of a joint undertaking between Carbios and Limagrain: Carbiolice.

TWB, TBI and the Bio-Industries CRITT are currently working with Carbios on the industrialisation phase, developing a pilot to recycle plastics made from polyethylene terephthalate (PET), to support the circular economy. This new C.E-PET project, worth a total of €11.3m, is receiving financial support from the PIA via ADEME.

SYNTHACS (2011 - 2017)

Adisseo and TWB worked together on the SYNTHACs project, which had a total budget of €8m and received funding from the ANR in the scope of the PIA. Based on the use of biomass, the project involved creating a metabolic pathway to synthesise a small intermediate chemical (2,4 dihydroxybutyrate) that then made it possible to synthesise molecules with high added value (derivatives of methionine), to replace the traditional chemical process. A TBI research team worked on the project for five years and obtained convincing results, prompting Adisseo to continue with the project and expand it on an industrial scale, in the scope of a new programme - ECOMET-Bio - with funding from the PIA via ADEME. TWB is still collaborating with Adisseo on this new project by hosting the TBI research team, providing its technology platforms and performing services.

SUCCESS STORIES

The CarboYeast project leads to the creation of the start-up ENOBRAQ (since 2015)

In 2015, following three years of work, the frontier research project CarboYeast, funded by TWB and carried out by a TBI research team, led to the creation of a start-up: EnobraQ. The CarboYeast project developed a yeast strain capable of using CO_2 as a source of carbon to produce molecules of interest. This innovative technology – the foundation for the creation of EnobraQ – works towards reducing our dependency on fossil-based products and limiting our carbon footprint. The start-up 's main investors include Sofinnova Partners and Auriga Partners (now Elaia), as well as IRDI SORIDEC Gestion, all of which are members of the TWB consortium. Enobraq has been hosted on the TWB site since its creation and works with the latter on research and development projects.

PILI (since 2016)

PILI, a company specialising in the production of biobased pigments and dyes, began collaborating with TWB in 2016, on its premises, to use its cutting-edge facilities and draw on its expertise. There are many applications for its biobased colours, including but not limited to textiles, cosmetics, bioplastics and paints. The initial aim was to produce a blue pigment via microbial fermentation on a pilot scale. This objective was achieved, and the process is now being industrialised. After two fundraising campaigns, directed at members of the TWB consortium in particular, PILI is continuing to grow and is developing new colours at TWB.

BRASKEM (since 2018)

In 2018 a project was launched with Braskem, the leading South American producer of biobased plastic, to develop new sustainable solutions. This project will make it possible to use different types of sugar from biomass and increase the yield from industrial production. This project builds on a patent filed using research financed by TWB (a frontier research project) and performed by one of TBI's teams.

BIOIMPULSE (2019 - 2025)

The BioImpulse project, the purpose of which is to create a new biobased adhesive resin that does not contain any Substances of Very High Concern (SVHCs), was launched in 2019 for a six-year period, with a budget of €28m. Coordinated by Michelin via its subsidiary ResiCare, this project involves some major public and private stakeholders: FCBA institute of technology, INRAE (TWB and TBI), INSA Toulouse (Bio-Industries CRITT) and the Lesaffre group through its Leaf business unit. The global market targeted by this new material has significant potential, mainly in the automotive and construction markets. The project is supported by ADEME in the framework of the PIA. Specifically, TWB is involved in the development of biological production tools and acts as the interface between the public laboratories and industrial partners involved in the project.

LOOKING TO THE FUTURE

2020 - 2025

Over the course of 2012 - 2019 – the first stage in the TWB journey – TWB has proven itself to be a unique and original organisation that places cutting-edge technological skills and scientific excellence at the disposal of a cross-disciplinary public/private ecosystem, by simplifying transactional relationships and accelerating the realisation of R&D projects.

In October 2019, an international jury commissioned by the ANR in the framework of the PIA evaluated the actions conducted by TWB over the 2012 - 2019 period and its main strategic goals for 2020 - 2025. The board emphasised the scientific and technological excellence of TWB, its economic impact and its strong potential for development. It was awarded an additional grant of €7m to support this 2020 - 2025 phase.

TWB is now getting its teeth into a new stage to ensure it stands the test of time and continues to grow in the increasingly competitive environment of industrial biotechnologies. Its goal for 2025 is to become the European leader in innovative industrial biotechnology project management, enabling its industrial and academic partners to meet the challenges posed by climate change and food production, which will impact 10 billion inhabitants in 2050.
To do so, TWB will draw on its ability to identify, propose and implement original initiatives to develop sustainable processes that transform biobased raw materials into products of industrial interest. Simultaneously, TWB will capitalise on the things that make it stand out, which can be described in terms of these three main roles:

> it is a **unifying force** coordinating a broadly diversified ecosystem, to generate value for its members and create alliances;

> it is a **kick-starter striving** for operational performance, from the signature of a contract to delivery of a high-quality service, including the simple and effective management of intellectual property for industrialisation purposes or the provision of scientific resources;

> it is an **active player** tackling real-life issues, providing bespoke scientific and technical facilities and experts to guide the emergence of breakthrough innovations that could lead to the creation of start-ups.

TWB creation - Indika printing - Imprim'Vert Label

THANK YOU

All members of the TWB consortium between 2012 and 2019

Adisseo, Agilent, Avril, Braskem, Givaudan, L'Oréal, Michelin, Roquette, Servier, Solvay, Tereos, Total, Véolia, IFPEN, Agronutrition, AB7 Industries, ARD, Cellectis, Deinove, Eurodia, IPSB, Maguin, METabolic EXplorer, Novasep, Protéus, Affichem, Altar, BGene Genetics, BioC3, Carbios, CIMV, EnobraQ, Global Bioenergies, Green Spot Technologies, GTP, HelioScience, iMEAN, Innoval Sud-Ouest, Libragen, m2p-labs, Micropep Technologies, MilliDrop, Naturamole, PILI, Processium, Syngulon, Tolerys, Veg'Extra, Ynsect, Auriga Partners, Bpifrance, Demeter, Emertec, IRDI SORIDEC Gestion, Seventure, Sofinnova, BIOASTER, France Brevets, INRAE Transfert, Toulouse Tech Transfer, INRAE, INSA Toulouse, CNRS, Institut Catholique de Toulouse, Agri Sud-Ouest Innovation, Pôle IAR, la Région Occitanie / Pyrénées-Méditerranée, Sicoval, Toulouse Métropole.

LE GRAND PLAN D'INVESTISSEMENT
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