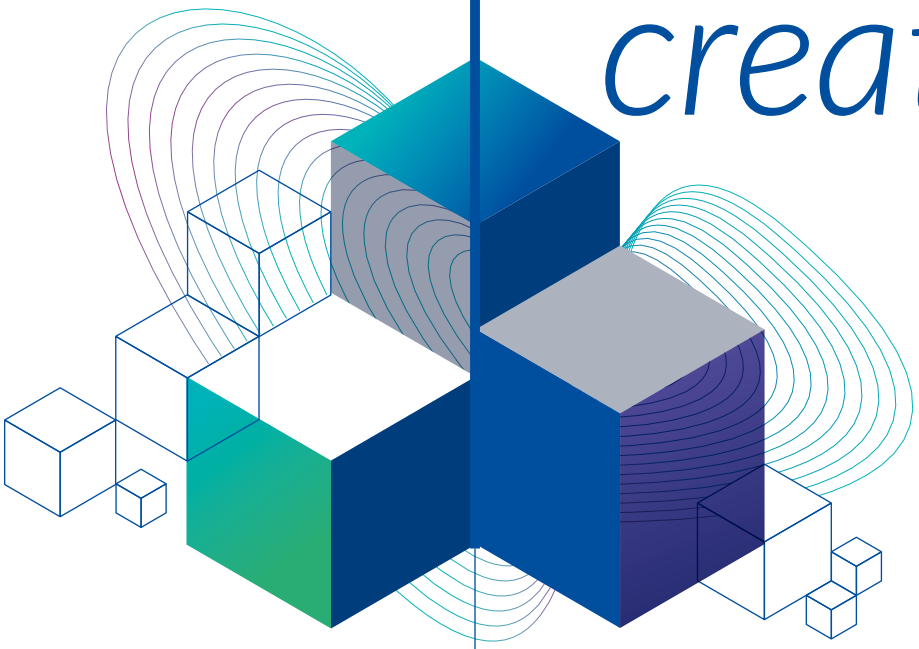
Knowledge *creates* value



Bright minds
Excellent research
Innovative business

Christian Doppler
Forschungsgesellschaft

New knowledge and innovation with the Christian Doppler Research Association

Federal Ministry
Economy, Energy
and Tourism
Republic of Austria

CD Laboratories and JR Centres are funding programmes
of the Austrian Federal Ministry of Economy, Energy and Tourism.

FTE NATIONAL FOUNDATION
RESEARCH | TECHNOLOGY | DEVELOPMENT

Funding from the public purse also comes from the Austrian National
Foundation for Research, Technology and Development

New knowledge and fresh ideas: an important basis for our future

Austria is facing substantial challenges in our rapidly changing world. The Christian Doppler Forschungsgesellschaft is making an important contribution to overcoming them. It is strengthening Austria's ability to compete on the global stage by enabling excellent scientists to work on deep-seated questions from industry. Application-oriented basic research is leading to new solutions, which in turn give rise to innovative products, services and processes for the global market. As one of the state's central research funding agencies, the CDG has a key position in the transfer of knowledge between science and industry and is contributing to the long-term security and competitiveness of Austria as a location for science and business, as well as to the country's wellbeing.

An innovative location for research is the backbone of a competitive and forward-looking economy. The Christian Doppler Forschungsgesellschaft represents a key component, as testified to by more than 100 active CD Laboratories and 15 JR Centres, over 200 regular members and practically all universities and universities of applied sciences in Austria that are active in research.

Dr Wolfgang Hattmannsdorfer
Federal Minister of Economy, Energy and Tourism

The CDG is a jewel in Austria's research and innovation system.

I have often heard this, or similar remarks, from stakeholders in academia and in the private sector. The CDG is a "central institution for research funding" in accordance with the Research Promotion Act and as such has attained a fixed place in Austria's research and innovation system. It is a central element of the strategy of innovative companies to become members of the CDG and not only to be active users of Christian Doppler Laboratories and Josef Ressel Centres but also to continue to develop the model. Challenges posed by mobility and energy transitions, the transformation towards a circular economy and the application and further development of artificial intelligence are underlining the importance of excellent research units and innovative companies.

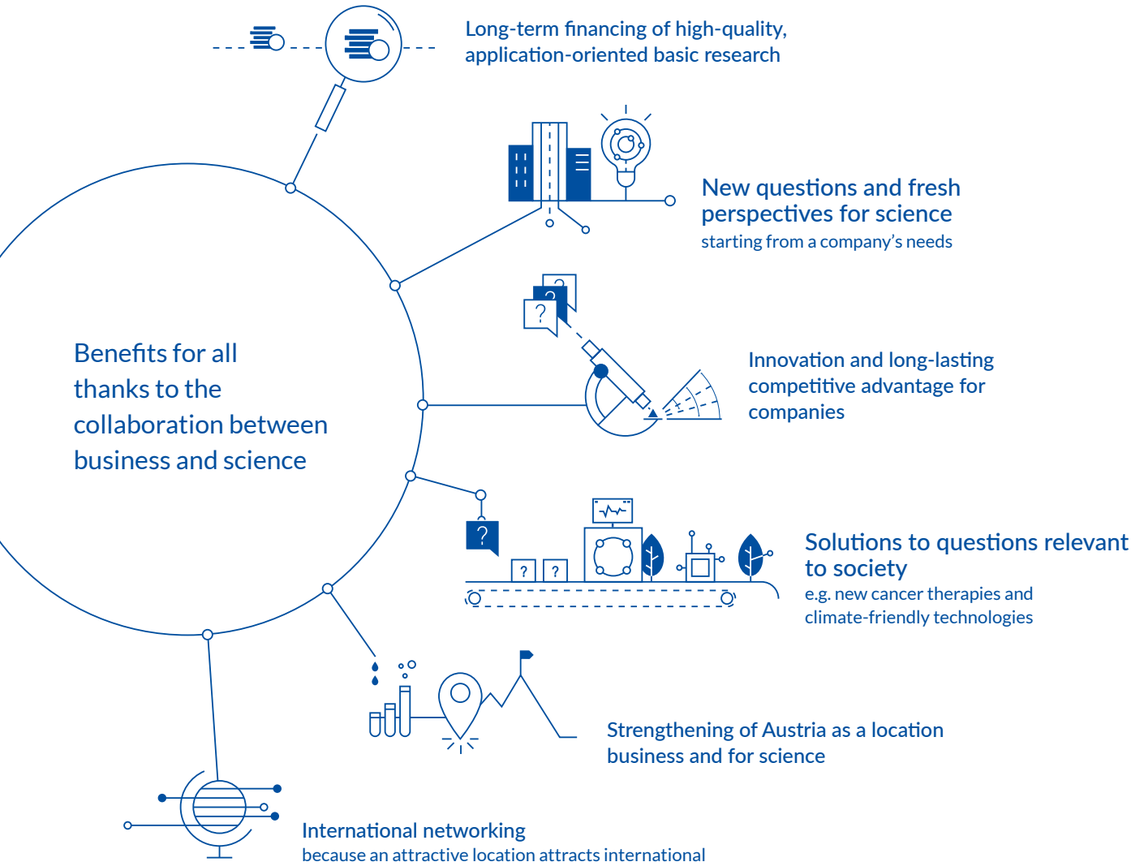
The CDG aims to have a high impact on the technological and thus economic development of Austria as a location for business and by supporting excellent research work to strengthen the country as a location for science. The high number of citations of publications from Christian Doppler Laboratories and Josef Ressel Centres in patents shows the synergy between the two aims.

The CDG and its PPP model are essential for Austria – if they did not exist, we should have to invent them!

Univ.Prof. DI Dr Dr.h.c.mult.
Martin Gerzabek
President of the Christian Doppler Research Association

Why the CDG?

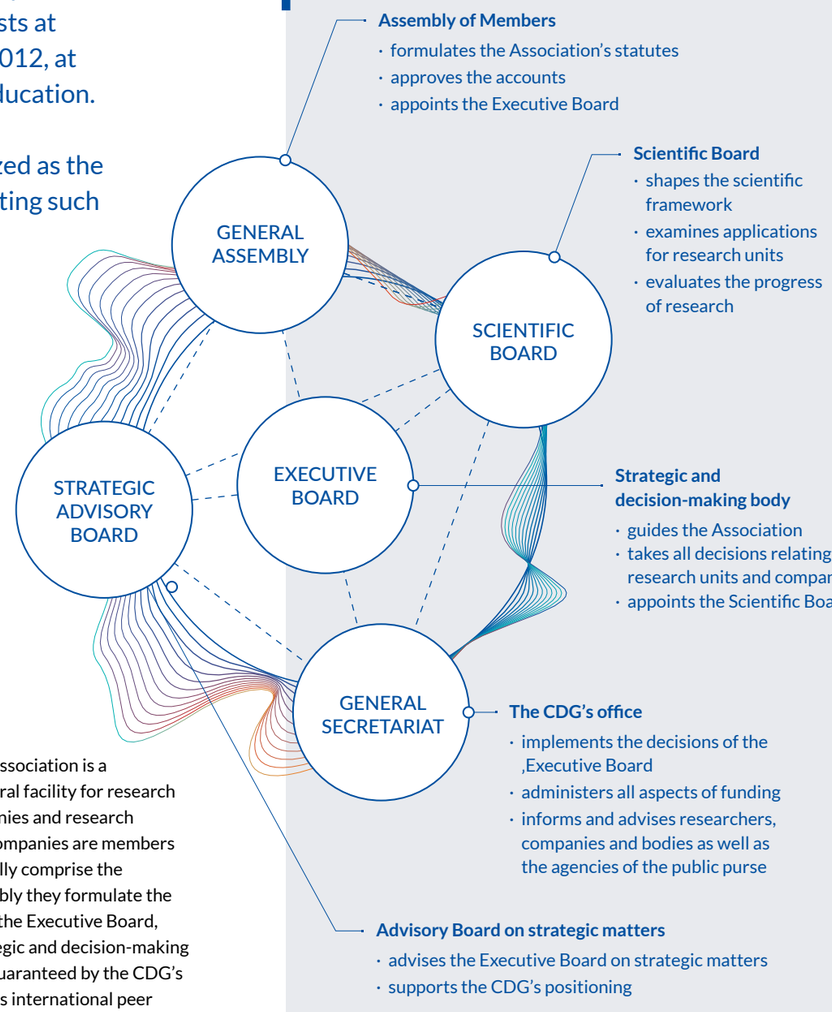
Excellent science
Application-oriented
Innovation
Strong location



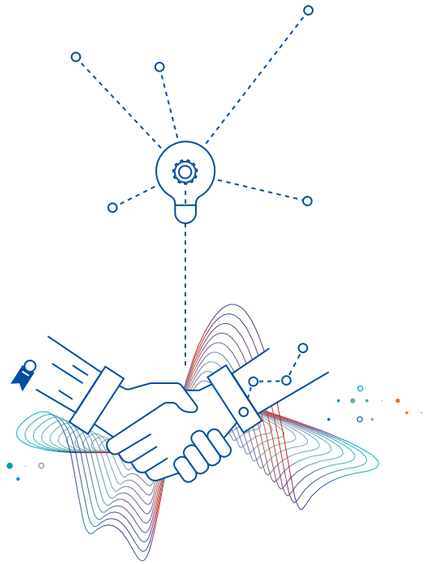
From 1995 the Christian Doppler Research Association has been promoting the collaboration between innovative companies and outstanding scientists at universities and, from 2012, at universities of higher education. Its funding scheme is internationally recognized as the best practice for promoting such collaborations.

Partners and organization
The Christian Doppler Research Association is a non-profit organization and a central facility for research promotion in Austria. Both companies and research institutes have important roles. Companies are members of the CDG and thus they essentially comprise the Association. In the General Assembly they formulate the Association's statues and appoint the Executive Board, which represents the CDG's strategic and decision-making body. The scientific excellence is guaranteed by the CDG's Scientific Board, which coordinates international peer reviews and evaluations.

Organizational structure



Breeding ground for innovation



Long-term collaborations between science and business represent the basis for leadership in innovation. The Christian Doppler Research Association can look back on almost thirty years of experience and creates a stable environment: quality assurance by an internationally recognized evaluation procedure, flexibility in research and security for all those involved thanks to a clear legal framework.

The Christian Doppler Research Association enables long-lasting collaborations between science and business:

Christian Doppler Laboratories (CD Labs) carry out application-oriented basic research at universities and non-university research institutes.

Josef Ressel Centres (JR Centres) conduct application-oriented research at universities of applied sciences.

The CDG's basic principles have applied to all research units since 1995:

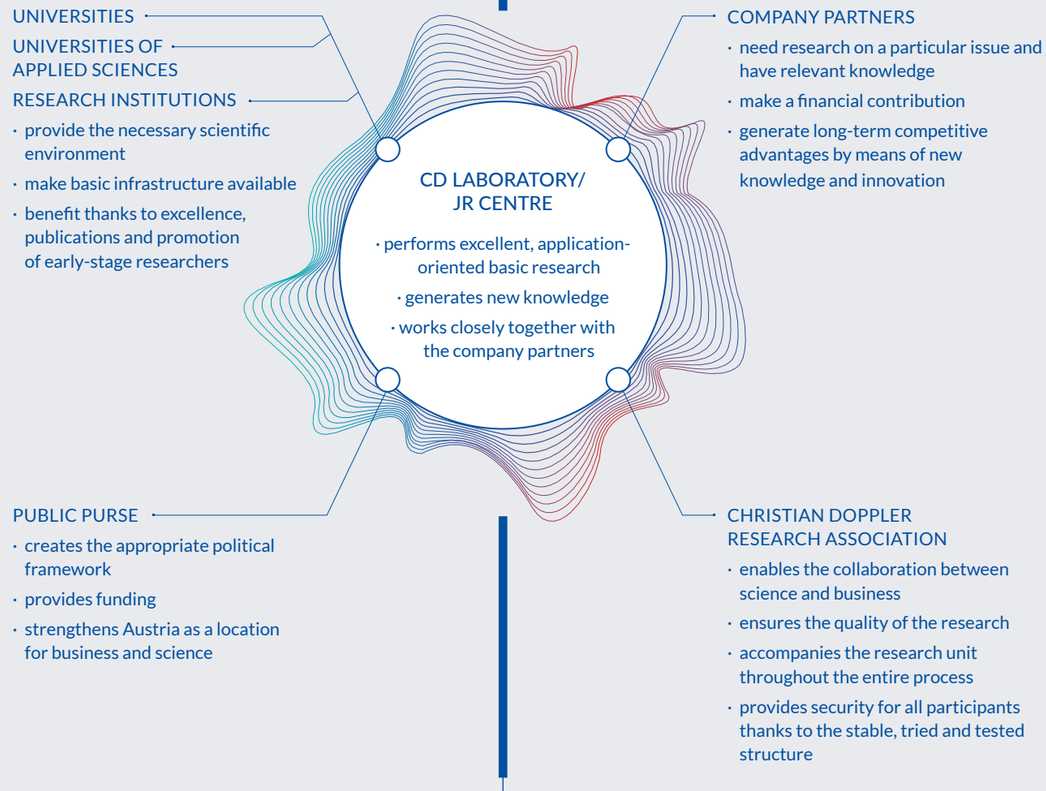
The research programme is based on company problems (bottom-up).

The research groups are embedded in their scientific environment.

The researchers are guaranteed scientific freedom.

The results include high-quality publications, patents and innovations.

The CDG's funding model

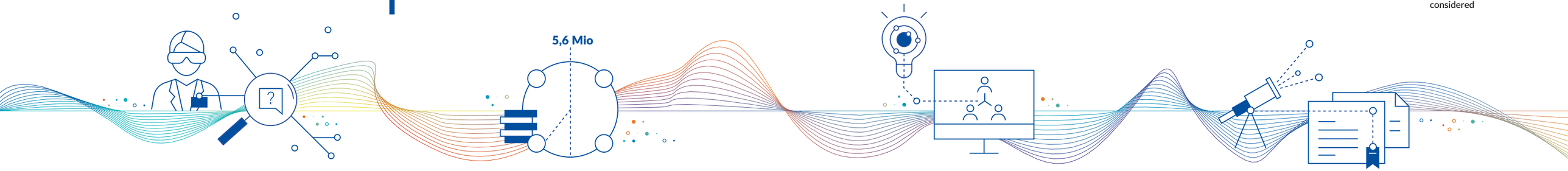


CD Laboratories

JR Centres

Highly qualified scientists at universities or non-university research institutions	2 years introductory phase 3 years first extension phase 2 years second extension phase 7 years	EUR 140,000	EUR 800,000	EUR 5.6 Mio.	Application-oriented basic research	Ca. 30%	None	50% of the eligible costs With participation of SMEs 60% (in proportion to their involvement)	50% of the eligible costs With participation of SMEs 40% (in proportion to their involvement) No in-kind contributions considered

Who can submit an application?	**Duration**	**Min. annual budget**	**Max. annual budget**	**Maximum budget for total duration**	**Nature of research**	**Proportion of scientific freedom**	**Proportion of experimental development**	**Support from public purse**	**Private support (company partners)**
Highly qualified scientists at universities of applied sciences	5 years 2 years introductory phase 3 years extension phase	EUR 90,000	EUR 460,000	EUR 2.3 Mio.	Application-oriented research	Ca. 20%	None	50% of the eligible costs With participation of SMEs 60% (in proportion to their involvement)	50% of the eligible costs With participation of SMEs 40% (in proportion to their involvement) No in-kind contributions considered



Research topic and scientific freedom
A Christian Doppler Laboratory or a Josef Ressel Centre focuses on a topic from a company, which is addressed by outstanding scientists. To enable an in-depth approach to the research questions, the scientists are guaranteed scientific freedom in the use of 30% (20% for JR Centres) of the resources – the ideal conditions for excellent scientific advances and radical innovations that go well beyond pure developmental work in companies.

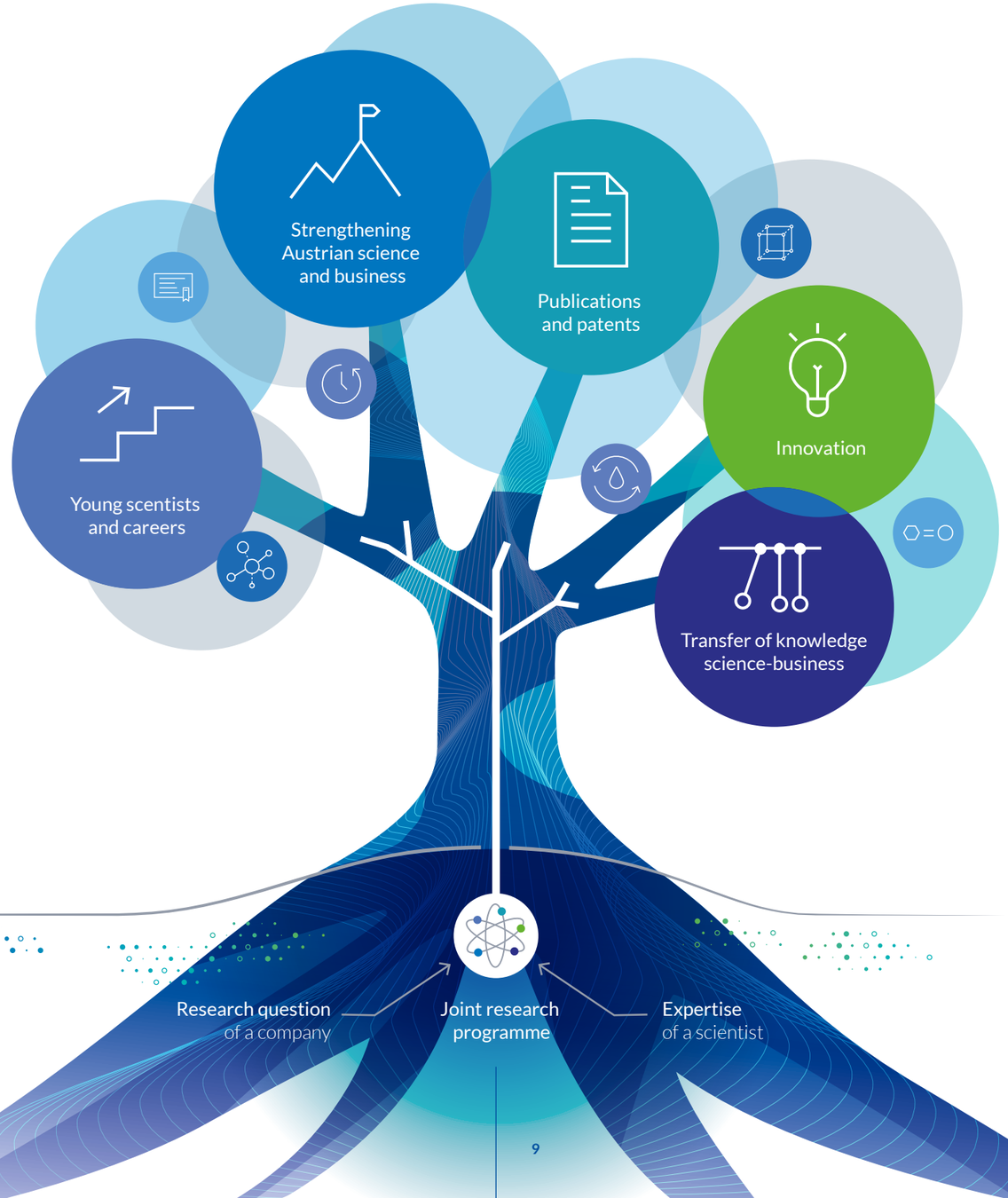
Costs and legal conditions
Each of the CDG's research groups has a total budget of up to 5.6 million Euro, with an annual budget of up to 800,000 Euro. The public purse covers 50% of this amount, increasing to 60% if SMEs are participating. The rest of the budget comes from the membership fees paid to the CDG by the collaborating companies. Contract research is not eligible for support.

Inventions and intellectual property
The exclusive rights to inventions or results that can be protected and that arise from a Christian Doppler Laboratory or a Josef Ressel Centre are transferred from the university or the university of applied sciences to the company if they relate to the specific area of the company's business that has been agreed upon by the company and the host institute.

Scientific excellence
Christian Doppler Laboratories and Josef Ressel Centres are locations of scientific excellence and are reviewed and evaluated by international peer review procedures based on the criteria of scientific excellence. The demanding procedure for approval is followed by a stop/go evaluation after two years and for CD Laboratories after five years. High-ranking scientific publications are required for a positive evaluation and are published with the agreement of the company partners.

The CD model: Strong roots, many fruits

Two essential conditions must be met at the start of a CD Laboratory or a JR Centre. A company must have a concrete requirement to extend its knowledge on a particular topic and a scientist must be interested in undertaking basic research in this application-oriented area. The partners then develop a joint research programme and its fruits include publications, patents and careers. The CDG's funding model gives its research units a high degree of flexibility.

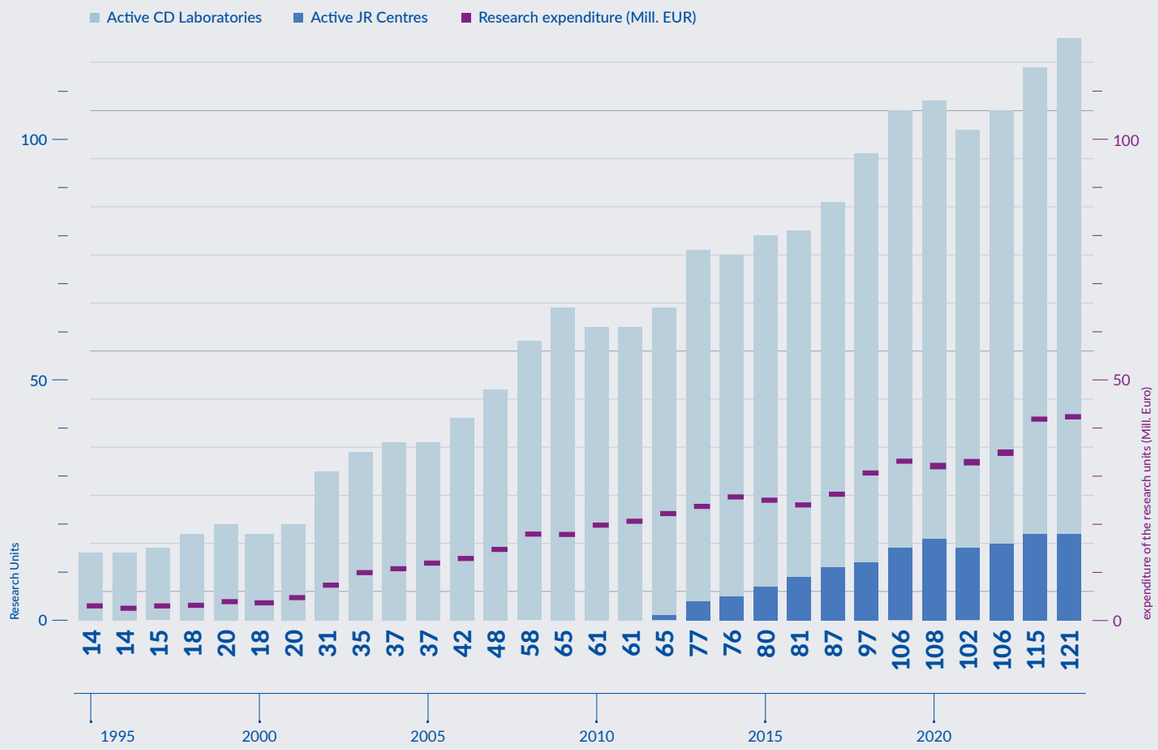


Facts and figures

DEVELOPMENT of the Christian Doppler Research Association

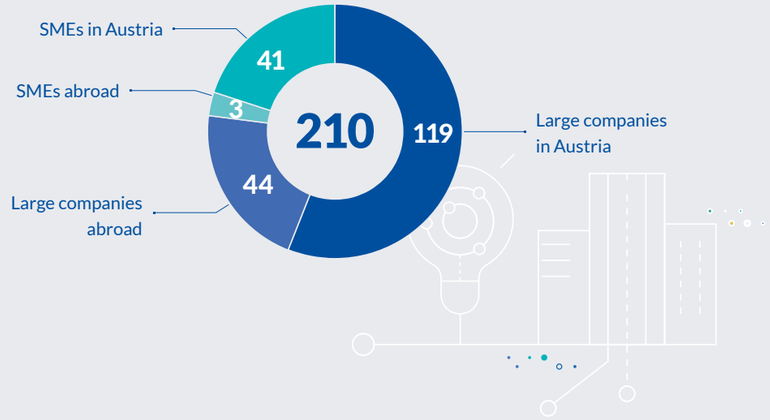
121 Active research units 2024

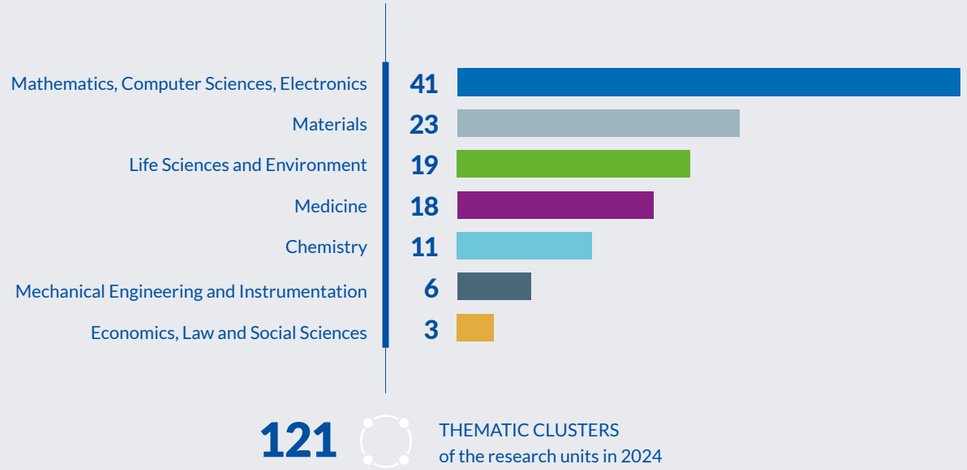
42.3 Mill. Euro research expenditure 2024



210 ACTIVE COMPANY MEMBERS

In 2024, 210 companies participated in the CDG's research units

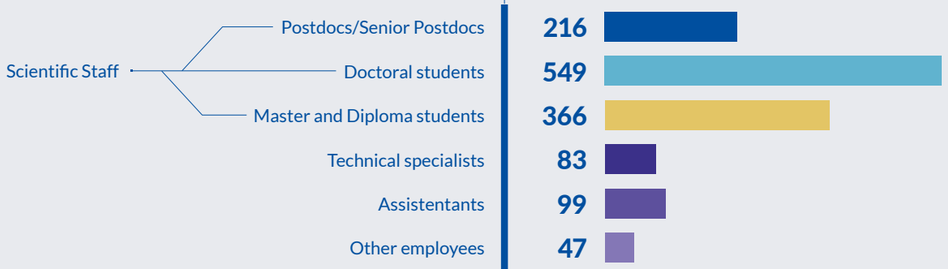




121 THEMATIC CLUSTERS of the research units in 2024

1,360 EMPLOYEES

in Research Units of the CDG 2024, 1,360 thereof are scientific staff



Publications **460**
in periodicals with peer review

1,500 Participations in conferences
thereof **240** with invited presentation

Patents and announcements of inventions **40**

320 Conference publications with peer review

Output

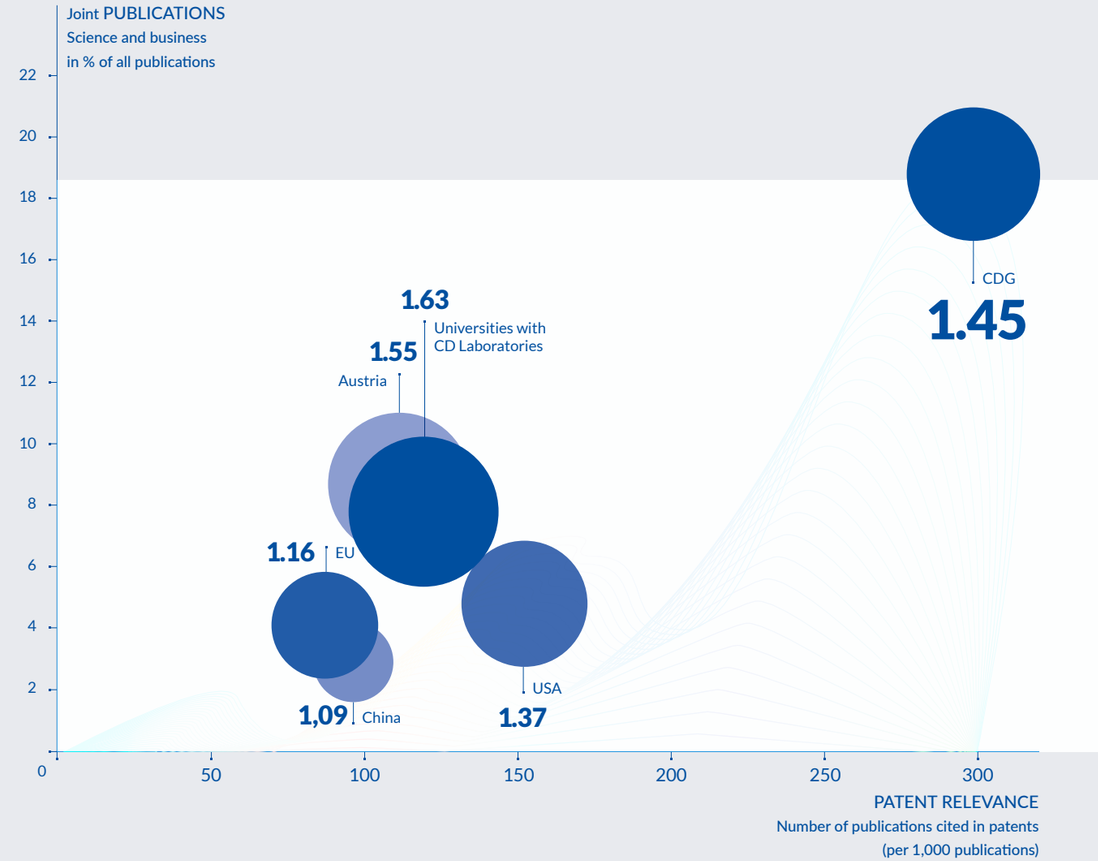
of the CD Laboratories and JR Centres 2024 (rounded)

We hit our targets

— highest numbers of joint publications between science and business

— Patent relevance: About 300 of 1,000 publications are cited in patents, an internationally leading figure.

— The citation frequency of scientific papers is in line with the Austrian average (Field-Weighted Citation Impact = 1.45, corresponding to the circle diameter).



Data: 2015–2024, © 2025 Elsevier B.V.*

Two sides of a (climate protection) coin

CD Laboratory for Innovative Control and Monitoring of Automotive Powertrain Systems

Head
Assoc.Prof. DI Dr Christoph Hametner

Duration
01.02.2017 – 31.01.2024

Commercial partner
AVL List GmbH

Thematic Cluster
Mathematics, computer science, electronics

Sustainable electricity production and the most efficient possible use of the energy are equally important. For this reason, the two winners of the 2024 CDG Award complement each other particularly well.

CDG Award for Research & Innovation 2024

CD Laboratory for Sediment Research and Management

Head
Priv.Doz. DI Dr Christoph Hauer, Universität für Bodenkultur Wien

Duration
01.10.2017 – 30.09.2024

Commercial partner
Andritz Hydro GmbH, Voith Hydro GmbH & Co KG, Verein für Ökologie und Umweltforschung, via donau – Österreichische Wasserstraßen-Gesellschaft mbH

Thematic Cluster
Life Sciences and environment

Scientific challenge

Prof. Hametner considered vehicles and their propulsion systems on various levels, as physical and distributed models, integrating measurement data and component models on a number of system levels. Only after simplifying all of the complicated interrelationships was it possible to implement the resulting control and monitoring systems in vehicles in real time. Doz. Hauer addressed complex questions relating to sediments in river landscapes: where do they come from? Where do they go (and why)? How do they interact with hydroelectric power plants, turbines and ships? And how can all these factors be predicted to manage sediments so as to reduce the costs of river management and support the rivers' natural ecosystem?

Christoph Hametner is looking into the black box
Partly or completely electrically powered cars and other vehicles and machines have the potential to make a substantial reduction to CO2 emissions and so to make an important contribution to limiting climate change. Christoph Hametner at the Vienna University of Technology is studying ways to optimize hybrid and electrified propulsion systems. In particular, he is hoping to optimize the efficiency and lifespan of the battery or fuel systems. For example, if an electric car can use its propulsion resources more efficiently and remains operational for a very long time, there will be benefits both to the user and to the environment.

The challenge is that the insides of a battery or a fuel cell are like a black box and we cannot simply peer inside. With the support of the company partner AVL List GmbH, the CD Laboratory has worked on innovative solutions with "virtual sensors" that can use physically measured signals such as current, potential and temperature to draw conclusions on aging, degradation and residual lifetime. This information can be used to regulate the vehicle's operation, increasing lifetime and efficiency.

Christoph Hauer and river sediments
On the other side, electrical power can only be as "clean" as its production. If emissions occur during power generation instead of in street traffic, the problem is only moved elsewhere. We need research on energy sources with low emissions, such as hydropower. The rivers on or in which hydroelectric power stations are cited are complex and sensitive ecosystems and power plants and rivers must be able to coexist.

This is where the CD Laboratory of Christoph Hauer (BOKU Vienna) comes in, supported by the commercial partners Andritz Hydro GmbH, Voith Hydro GmbH & Co KG and the Verein für Ökologie und Umweltforschung as well as via donau – Österreichische Wasserstraßen-Gesellschaft mbH. Its research on sediment movements in flowing waters has led to predictions on the behaviour of sediments, which enable hydroelectric power plants to be operated and maintained more efficiently, at the same time preventing additional ecological damage. Hauer is also working on overcoming the consequences of climate change, as the sediment balance is affected by the melting of glaciers in the catchment areas and by the increased flooding of agricultural land by heavy precipitation.

Added value for the companies

The methods developed in Prof. Hametner's CD Laboratory and the resulting patents and knowledge are allowing the company partners to prepare for rapid changes in the automobile industry. The focus is on battery and fuel cell systems but much of the information can also be applied to other areas. The CD Laboratory of Doz. Hauer is producing models that can be used for improved prognostic tools for the efficient management of sediments in the hydroelectric power plants, turbines and shipways. They may lead to massive cost reductions while simultaneously preventing ecological damage to river landscapes.

SUCCESS STORY

Wafer-thin but highly effective

CD Laboratory for Advanced Coated Cutting Tools

Head
Priv.Doz. DI Dr Nina Schalk,
Montanuniversität Leoben

Duration
01.10.2017 – 30.09.2024

Commercial partner
CERATIZIT Austria Gesellschaft m.b.H.

Thematic Cluster
Materials

Added value for the company

A concrete example of the value of the CD Laboratory's basic research to CERATIZIT Austria Ltd is the "dragon skin" coating, which was successfully brought to the market at the start of 2022. It is a newly coated type of hard metal for turning steel that not only has a longer service life but also features an indicator layer to show when it is heavily eroded. In this way, users can always see when they need to replace a tool and never have to do so too early or too late, which improves efficiency and sustainability.

When industrial production involves turning, milling and boring components, the process is bound to affect the tools. The microcosm conceals a fascinating possibility to counteract their wear and tear.

Scientific challenge

For the preparation of the coatings, a so-called "pre-material" is evaporated in a deposition chamber and deposited on the tool to be coated. By altering parameters such as the composition of the pre-material, the pressure or the temperature, different coatings can be created that are only about 2–3 micrometres thick, about 16–25 times thinner than a human hair. It is extremely challenging, even with top-of-the-range equipment, to research these miniature landscapes of elements, phases, layers and crystals and to draw conclusions on material properties such as hardness, toughness, temperature resistance and oxidation.

The topic
So-called chipping tools, which gradually remove chips from unfinished parts until they take on the shape of an industrially usable component, are key in a wide range of applications. They play important roles in the automobile industry as well as in the production of turbines and engines. To maintain a chipping tool, and to ensure that it can be used as long and as efficiently as possible, it (or its hard metal core) is surrounded by tough, abrasion-resistant coatings. Working out the optimal type and arrangement of the coatings to protect a particular tool is so complicated that in the past it could only be done by trial and error.

The research question: coats and tales
Nina Schalk, Head of Laboratory and Winner of the 2023 CDG Award, is undertaking fundamental research into the smallest possible objects. How are the various elements arranged in the wafer-thin tool layers? How do they form crystals and how do they react to heat or oxygen? And what does all this mean for the hardness, fracture toughness and service life of the chipping tool? Many of the techniques the CD Laboratory is using to tackle these questions involve bombarding the material with electrons or X-ray beams to draw conclusions about the fine structure. The use of an atomic probe is particularly spectacular. Specially prepared thin tips of a few hundred nanometres are evaporated atom by atom and the atoms land on a position-sensitive detector, enabling the scientists to deduce which atom was located where. The result is a representation of the components of the layer at near-atomic resolution.

Collaboration in the CD Laboratory
Equipment such as the atomic probe does not run on its own for a particular application, so a large part of the CD Laboratory's research is dedicated to developing methods. The Laboratory is supported by the company partner CERATIZIT Austria Ltd, which is benefiting from the basic research undertaken by Prof. Schalk and her team. The Laboratory's results form the starting point for the improvement of current tools and the development of new tools for metal processing.

Results
The methods developed in the CD Laboratory are replacing the need for "trial and error" approaches and enabling an understanding of why particular materials and processes are more suitable than others, leading directly to innovation and advancing the state-of-the-art. The increased understanding is also enabling the use of improved coatings to reduce the necessity for environmentally damaging cooling agents or lubricants and facilitating their recycling by minimizing the number of elements they contain.

Statements

"CD Laboratories combine excellent basic research with applications close to industry, at the same time promoting young scientists. And all of this with minimal overhead costs. The labs are best-practice cases that drive innovation and strengthen Austria as a location for research. If we didn't have CD Laboratories we should have to invent them – they are an essential part of our research system."

Univ.Prof. DI Dr. Horst Bischof
Executive Board of the Austrian Universities Conference and TU Austria, Rector of the TU Graz and member of the CDG's Strategy Board

"With the Josef Ressel Centres, the CDG has provided the universities of applied sciences with a forward-looking format that is substantially helping the universities of applied sciences to develop their profile. The first-class research undertaken in the Centres leads to innovation of high relevance to society and to a sustainable strengthening of Austria as a location for business."

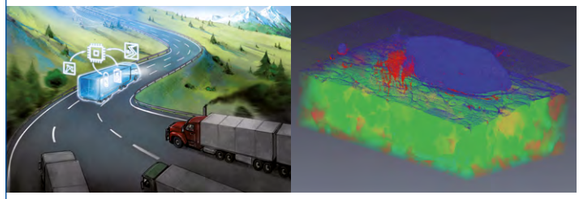
Mag. Ulrike Prommer
President of the Austrian Conference of Universities of Applied Sciences and CEO of the IMC Krems University of Applied Sciences

"International referees and a Scientific Board made up of top-ranking scientists. It is a real honour for scientists to satisfy our review process and be able to head a CD Laboratory or a JR Centre."

em.o.Univ.Prof. DI Dr Dr.h.c. Hans Irschik
Chair of the CDG's Scientific Board

"The ensure the future of Austria as a site of production and for the country's wellbeing, it is essential that we continue to implement the results of excellent research. The Christian Doppler Forschungsgesellschaft is an international best-practice case for the successful collaboration between science and industry and an essential partner for our industry on its journey to the future."

Mag. Isabella Meran-Waldstein
Area Manager for Research, Technology and Innovation of the Federation of Austian Industries and member of the CDG's Strategy Board



"Important industrial innovations often arise by moving even closer to the limits of the physically possible. The CDG's collaboration model is focusing precisely on this region. The results of application-oriented basic research lay the foundations for innovations and new products with substantially improved properties."

Prof.h.c. Dr Peter Prenninger
Corporate Research Coordination AVL List and First Vice-President of the CDG

"The collaboration between science and the private sector brings new knowledge, research and innovation – and leads to competitive advantages for companies and to a strengthening of Austria as a location for business. Austria can be proud to have the Christian Doppler model as an internationally recognized best-practice case for this important kind of collaboration."

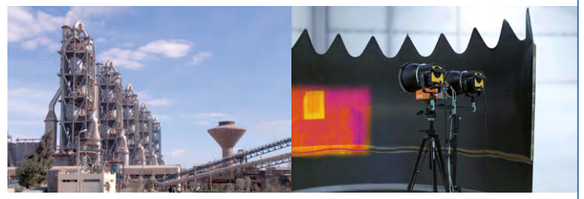
Mag. Dr Maria Theresia Niss, MBA
CEO of the Mitterbauer Beteiligungs GmbH, Chain and Initiator of the MINTality Foundation and member of the CDG's Strategy Board

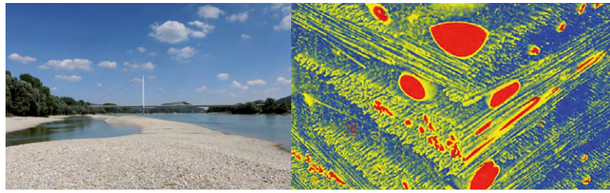
"The Christian Doppler Forschungsgesellschaft is backing excellent research that is relevant to Austria, guided by the demands of its company members. It is firmly established as a motor for innovation and progress and is making a substantial contribution to Austria's competitiveness as a location for business."

Mag. Florian Frauscher, MLS
Head of the Section I Business Location, Innovation and Internationalization in the BMWET

"In 30 years, the Christian Doppler Forschungsgesellschaft has developed into a central pillar of the domestic innovation system and an international best practice example. Excellent, location-relevant research tailored to the needs of the participating companies forms the basis for prosperity and future-proof jobs."

Mag. Thomas Saghi
Department Head of Key Technologies in the BMWET





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