IdeaSquare

Licence to dream

Progress Report 2017-2018

CERN

Ideas

“

To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.

Albert Einstein

IdeaSquare

Connecting curious minds to accelerate ideas

Progress Report 2017-2018

Welcome to IdeaSquare, a place where scientists and society meet to push the boundaries of knowledge and to share and explore new ways to reach societal impact through research and technology. A space designed for collaboration through curiosity, creativity and science. A place where people have a licence to dream.

Welcome to IdeaSquare by CERN Management

As the Chair of the IdeaSquare Advisory Board, it is my pleasure to present this 2017-2018 Progress Report to you.
From the day IdeaSquare opened its doors in December 2014, it has made a significant contribution to CERN's mission of fostering research, technology, education and international collaboration. It does this by bringing together two very different communities; researchers of early-stage detector technologies on the one hand, and students involved in projects addressing societal challenges on the other. These challenges range from providing access to clean water and air, reducing food and plastic waste, bringing education to rural areas, and bringing electricity to make-shift refugee camps – to name just a few.
What happens when these two worlds connect? To date, over 350 events and 100 student projects have taken place at IdeaSquare, supported and mentored by CERN personnel. CERN teams offer their technical knowledge and experience to help the students structure their thinking and raise awareness of new inventive solutions. This sharing of expertise resonates with CERN's overall Knowledge Transfer goals of accelerating innovation and spillover of CERN's technology and know-how for the benefit of society. In this respect, IdeaSquare has played a leading role in preparing the ground for the pan-European initiative ATTRACT that is building an innovation ecosystem around detection and imaging. I am very pleased to report that ATTRACT has successfully launched its first phase, and I expect IdeaSquare to continue playing a leading role in the project.
The dramatic increase in the volume of activities at IdeaSquare over the last two years is a testament to its success. Looking forward, 2019 will bring more big changes as IdeaSquare prepares for the next phase of ATTRACT and the evolution of CBI-like student programmes. On the recommendation of the Advisory Board, we will promote closer links between Knowledge Transfer, education and public outreach. Finally, we will tap into new exciting opportunities that emerge as the Science Gateway is established just next door. I would like to thank all the people that have made IdeaSquare such a visible success both inside and outside CERN. I would also like to thank my Board member colleagues who have been generous both with their time and advice. I look forward to seeing the new achievements of IdeaSquare in 2020 and beyond.

Thierry Lagrange
Chair of IdeaSquare International Scientific Advisory Board (ISAB)
Head of the Industry, Procurement and Knowledge Transfer Department at CERN

“At CERN, we experiment with new ideas all the time and IdeaSquare is a key part of that drive towards innovation. Here, we bring together people from the worlds of scientific instrument-building and societal action to find practical solutions to challenges on the ground, for the Sustainable Development Goals agenda, in humanitarian work and in many other areas. It is an innovative process with innovative outcomes.

Charlotte Warakaulle
Director for International Relations at CERN

Current members of ISAB:
Prof. Julian Birkinshaw (LBS)
Prof. Matteo Cavalli-Sforza (IFAE)
Prof. Kalevi Ekman (Aalto University)
Prof. Sijbrand De Jong (Nijmegen)
Mr. Thierry Lagrange (CERN, Chair)
Prof. Ezri Tarazi (Technion).

What is IdeaSquare?

IdeaSquare is a place, a facility, an experiment. It's a place between physics and society to connect Research & Development (R&D) to societal needs, to explore novel solutions for the future of humankind. It's a facility designed to generate new ideas in an open and collaborative environment, to promote experimental innovation and rapid prototyping for innovation-related projects. It's an experiment exploring how we can enhance connections from inside CERN to outside and vice-versa; it is about making breakthroughs in scientific research with parallel societal challenges.

CERN, in its commitment to fundamental research in particle physics to solve the mysteries of the early universe, has pushed the boundaries of human knowledge and created many new technologies to do so better. Inspired by that, IdeaSquare is an experiment in itself, designed to explore how to translate a substantial part of fundamental research findings into societal value by systematically applying technological insights and inspiration in the context of human needs.

Since IdeaSquare was launched in December 2014, our purpose has been to bring people together to generate new ideas and work on prototypes related to detection and imaging technologies in an open environment; to host special innovation-related events; to offer ad-hoc meeting space and rapid prototyping facilities for innovation-related projects; and to be a valuable interface between new technologies for fundamental research and society to address pressing societal challenges from a human-centric perspective.

The human-centric perspective is a core aspect of the IdeaSquare conception and it works in many directions; it's one of the IdeaSquare goals but it's also a way of working, encompassing a multidisciplinary perspective and collaboration of people from diverse backgrounds, disciplines and cultures to ideate widely open innovation. This working culture links IdeaSquare to the Design Factory Global Network (DFGN), a network of innovation platforms that drive change in their own institutions to improve the world of learning and research through a challenge-based culture.

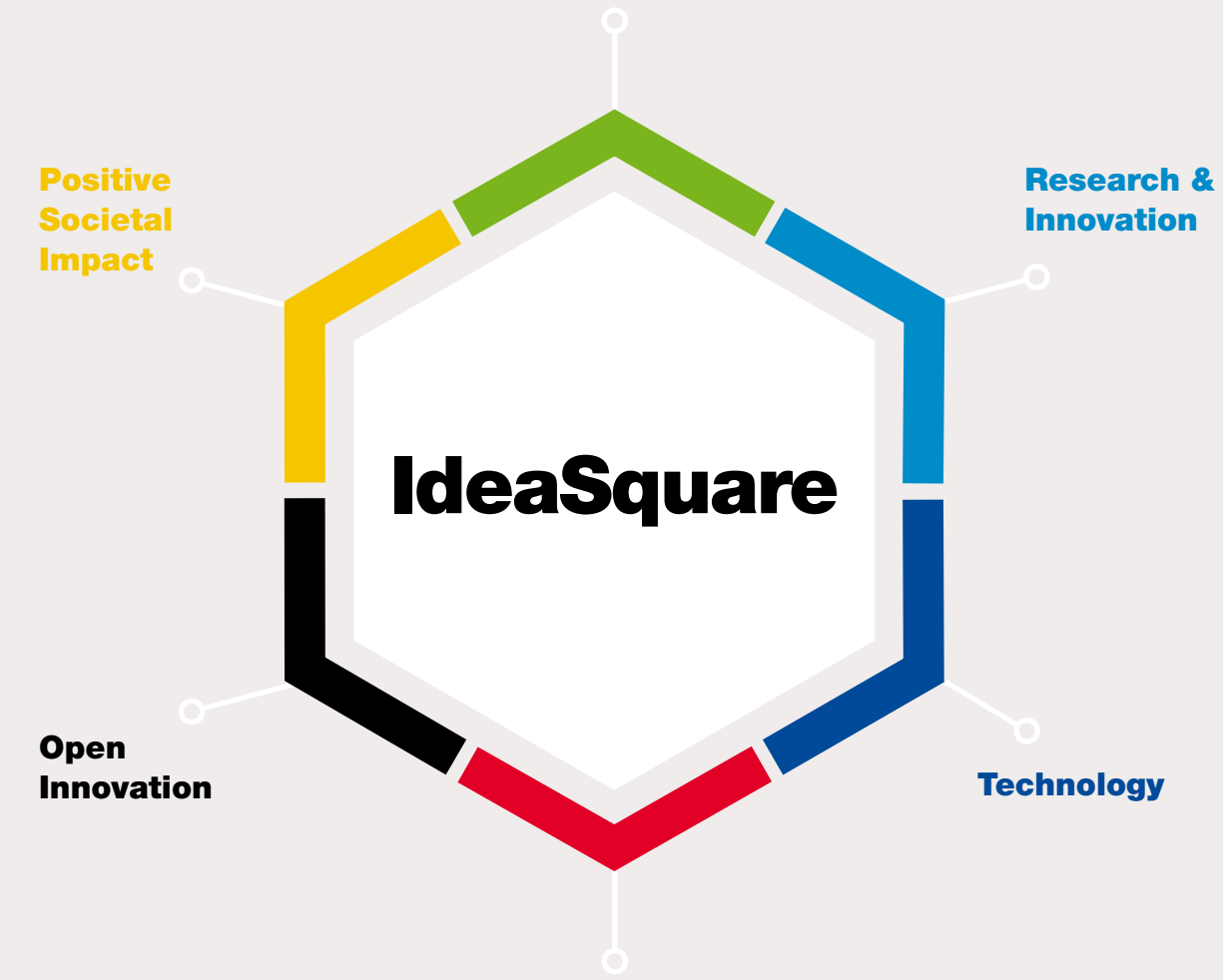
The IdeaSquare explorative spirit is already building bridges between physics and societal challenges, between the CERN community and the wider world. Through education, collaboration and technology, IdeaSquare is a space for new ideas, undiscovered and unexpected paths and novel solutions to benefit humankind through innovative frontier research and the interaction of science and society.

> **"It's a difficult time for particular physics and the organisations involved in it. CERN has had to do different things, to diversify its activity, motivate young people and also raise awareness in wider society of the importance of fundamental research. For me, IdeaSquare fulfils this mission through different experiments which are also closer to the timeline expectations of the general public.**
>
> **Matteo Cavalli-Sforza**
> IFAE Institute for High Energy Physics, Barcelona (IFAE), Member of ISAB

IdeaSquare

a bridge between SOCIETY & CERN

SOCIETY ..... **CERN**



Creating change in the world of learning & research:

- Driven by a passion-based culture.
- Stems from inspired and empowered individuals such as students, teachers, researchers and business experts, amongst others.
- Born from the freedom of imagination and the seeds of intuition & inspiration.
- Benefits from the creative interaction between collaboration and competition.
- Rooted in technology and scientific research.
- Creates an impact on the education of the scientists and citizens of the future.
- Capable of boosting breakthroughs in societal evolution.

What is IdeaSquare?

Education

Increasing the awareness of interest in science is one of CERN's educational goals, recognised as early as the founding convention of the laboratory in 1954. CERN offers a unique environment for inspiring the scientists, engineers and innovators of tomorrow, who will play a key role in contributing to scientific progress, technological innovation, solving complex societal challenges and as an outcome, the global economy.
IdeaSquare is contributing to CERN's educational mission by exposing next-generation scientists, engineers, designers, business professionals, entrepreneurs and the critical and curious thinkers to the frontier R&D environment at CERN. It provides them with skills and tools to tackle societal challenges, including industrial innovation, new product development and human-centric problem solving.
At IdeaSquare we aim to offer a space for the scientific community and people from other walks of life to collaborate and collectively imagine a future for humankind and come up with revolutionary solutions to human challenges. With the IdeaSquare project we also seek to understand and systematise the way multidisciplinary groups reach truly innovative responses to challenges. Research into how to better connect and strengthen the relationship between physics and society is at the heart of IdeaSquare's work.

Research & Innovation

Curiosity is as old as humankind, and it is CERN's *raison d'être*. Connecting curious and multidisciplinary minds to accelerate ideas is the main purpose of IdeaSquare.
Fundamental research is CERN's primary mission. When CERN was founded, the structure of matter was a mystery. Today, we know that all visible matter in the universe is composed of a remarkably few elementary particles, whose behaviour is governed by four distinct forces. CERN has played a vital role in reaching this understanding through discoveries such as the W and Z forces and the Higgs boson. But we also know there is so much more to find out to really push the frontiers of knowledge.
At IdeaSquare we are not just carrying out physics R&D; we are also conducting research on how to connect high-energy physics and society through innovative projects and processes. The aspiration, the ultimate aim, would be to systematise our approach. This would contribute to the discovery of massive-impact solutions for society's big challenges, originating in fundamental research. That goal is almost as ambitious as solving the paradox of systematising serendipity.

> **So, we need to be aware of what our scientists are doing in the accelerators, detectors, in computing. What technology are they designing and building? What are our scientists good at and how can we increase the opportunities of finding applications for what they are doing in society? So, we need to speak to people outside: companies, industries. However, there are very different ways of doing that, and that's why IdeaSquare is essential. Through activities like CBI we don't talk about technology first, we talk about societal problems or industrial challenges and then we search in our technology. Another powerful force behind IdeaSquare is that when students emerge, they are different people, and that is a fundamental part of CERN's mission.**
>
> **Giovanni Anelli**
> Group Leader, Knowledge Transfer Group (KT) at CERN

Innovation workshop during the IdeaSquare Activity Day.

Technology

CERN is a unique place for contributions to the development of breakthrough technologies. In the quest for answers about the nature of the universe, the CERN research community expertise builds broadly on three main technological fields: accelerators, detectors and computing. These technologies, and the human expertise associated with them, translate into a positive impact on society across many different fields: Medical and Biomedical Technologies, Aerospace Applications, Safety, the Environment, Industry 4.0, Cultural Heritage and Emergency Technologies. Without the know-how obtained in particle physics, progress in many fields would have been much slower.

The CERN Knowledge Transfer (KT) group's mission is to maximise CERN's impact on society, and works actively to disseminate knowledge from the Organization to fields outside high-energy physics. In close collaboration with the CERN KT group, we want to explore new ways and perspectives from which to access technology to achieve positive societal impact. Technology is a powerful tool in the quest for responses to societal challenges. That's why IdeaSquare itself is an experimental space which connects society, technology and scientific knowledge in CERN's high-tech environment, and where ideas and new approaches can be explored through iterative prototyping.

5 years
since the opening of IdeaSquare

IdeaSquare's performance 2017-2018

251
total events

+750
EXTERNAL PARTICIPANTS PER YEAR

77%
OCCUPANCY RATE

187
DAYS DURING 2018
in activities and events related to experimental innovation, collaboration and education

24
collaborating institutions from outside CERN during 2018

+60
papers / research published

What is IdeaSquare?

> **I think IdeaSquare is the first design factory to get close to deep-tech.**
>
> **Marzio Nessi**

Collaboration

Since its foundation in 1954, CERN has become a prime example of international collaboration. CERN's mission has been to unite people from all over the world to push the frontiers of science and technology, for the benefit of all humankind.
Designers, entrepreneurs, scholars and other professionals with different profiles are invited to collaborate with scientists and engineers to come up with new ideas and concepts, inspired by the work carried out at CERN. As a result, IdeaSquare is often quipped to be the Small Human Collider at CERN, bringing people together from diverse backgrounds, disciplines, nations, genders, cultures and languages, for fruitful discussions and collisions which generate not only ideas, but better listening, shared imagination and collaboration along unexplored pathways.

Open Innovation

Fundamental physics, such as the research carried out at CERN, is deeply rooted in the history of Open Science. CERN's philosophy of openness and transparency is expressed in the Convention, and the Organization has continuously been a pioneer in this field.
IdeaSquare was founded as a facility where people and ideas meet in a highly open-minded environment. Through the basic principles of Open Science and Open Innovation, at IdeaSquare we are experimenting in new ways of research through a shift towards working more openly, collaboratively and interdisciplinarily. This in turn is expected to lead to positive impacts and outcomes and helps to bridge the gap between what is discovered in basic research and what society needs.

Positive Societal Impact

The transfer of CERN technologies and expertise to society is an important part of CERN's activity. In a global context, it is acknowledged widely that to succeed in building a sustainable future, we need to invest in fundamental research. However, we also need to build better bridges between science and society to utilise the discoveries, technology and knowledge developed in research as efficiently as possible. At IdeaSquare, the projects we help to facilitate, and the related socio-economic research, aims to understand how to build those better bridges in order to maximise positive societal impact. IdeaSquare educational programmes and research activities involving students and participants from around the world also have a direct positive impact. They challenge participants to think, approach problems and search for solutions from multiple perspectives, fuelled and inspired by scientific method. This is an important part of the IdeaSquare mission: to share the full potential of science with the world.

IdeaSquare's performance
2017-2018

+370
Students involved at all levels

53
University faculty during 2018

31
University faculty during 2017

+60
CBI Projects / prototypes developed

People at IdeaSquare meet **5** new people every day

+20
CERN Staff involved in education activities

+60
SOCIETAL CHALLENGES ADDRESSED


Kensington
Charing Cross
Bank
EMERGENCY EXIT
ALDWYCH

Why a place between physics & society?

Central to the CERN mission is a particular interest in developing technologies in an open way to improve scientific practice for the benefit of the collective good.
At IdeaSquare we are interested in harnessing the dialogue exploring differences and similarities between scientists, engineers, designers and entrepreneurs and how these multidisciplinary groups can work together to generate new knowledge and innovation.

Coffee interview with Marzio Nessi & Markus Nordberg, founders of IdeaSquare

IdeaSquare is an experiment that explores new ways to access technology

Marzio- I spent 12 years working with Markus in the management of the ATLAS Experiment. After many years working hard on it, we felt the time had come to take a different road. Markus began to be involved in the Aalto Design Factory (ADF) and the Design Factory Global Network (DFGN) student projects and soon he had dreams of how to establish something similar (to ATLAS) in the CERN R&D and innovation context. From my side, I was feeling from my experience in ATLAS that technology was moving too slowly and from my personal point of view I'm still a total technology guy... and I started to have some dreams of my own too.

Markus- IdeaSquare was born sharing the philosophy of the DFGN international network, with the goal of making an impact on the world in a positive way, based on the passion-driven culture we have here at CERN. However, we are unique within this context, because unlike all the other members of DFGN, we are not a university but instead a research centre, a laboratory.

Marzio- Something that I was concerned about while in ATLAS, was that we had so much knowledge that could be projected 25-30 years into the future, but it wasn't happening fast enough in real life. There was too much of a gap between knowledge and technology. So, I began to think that maybe we should try to encourage the idea of open innovation. Why couldn't scientists organise themselves, access the funding and redistribute it? I went to Brussels to see if the European Union could provide that funding and we could redistribute it and find ideas. That's how the idea of ATTRACT came about. It was an initiative to create an entirely new European model of open innovation that could become, in the longer run, an engine for jobs and prosperity.

Markus- So on one hand it was the idea of launching ATTRACT and on the other, it was the concept of harnessing all this student-energy… Somehow both were pushing in the same direction towards finding new ways to improve basic research by incorporating also a human-centric perspective.

Marzio- Then, we asked ourselves, 'why not develop a prototype for ATTRACT at CERN?'. The concept of ATTRACT allows anybody with a smart idea to benefit from the knowledge created in research laboratories in Europe, to access funding to launch that idea by presenting a proposal to make it real. We began to make some plans and in a few months we constructed the IdeaSquare building and started the Challenge Based Innovation (CBI) activities as a prototype for ATTRACT.

Markus- The CBI was designed as a pilot course where multidisciplinary student teams and their instructors collaborate with researchers at CERN to discover novel solutions for the future of

Marzio Nessi is general coordinator of the CERN Neutrino Platform (CENF). He served ATLAS (one of the large physics experiments at the Large Hadron Collider (LHC)) as project manager from 2001 to 2013 and currently he's involved as a science consultant at the ATTRACT project.

Markus Nordberg (Cosmic Janitor) was the Resources Coordinator of the ATLAS Experiment from 2001 to 2013. Since 2013 he has been acting as the Head of Resources Development in a new unit in the IPT Departament, created for launching new initiatives such as the ATTRACT project and IdeaSquare.

humankind. To think, collaborate and test the ideas that came up we needed a space that could be reconfigurable, that could change, easy to understand, informal. This lead us to use containers and workshops for doing prototypes quickly, to the concept of a kitchen for the students, which is now probably the most important part of the entire building... and the red bus, to give some atmosphere and practical meeting rooms, which originally was just a crazy idea…

Marzio- We saw IdeaSquare itself and the CBI as a way to carry out research about open innovation, about how new ideas coming from outside CERN could interact with CERN's technology and knowledge to reach societal impact. I think it's the first design factory to get close to high-tech.

Markus- Yes, it is an experiment that explores new ways to access new technologies.

Marzio- Our scientific community is very strong in finding and using technology in different ways, so why not allow students and other curious people to have the same possibility? Only a few researchers have an idea how to use certain specific technology or knowledge and as a result, new technologies often die in the labs, while industry has no idea how to make the most of the knowledge as they want more mature, applicable technologies to begin with. Why not think about projects along a 3-4 year timeline to develop something, to come up with completely new ideas that go beyond their mere exploitation by industry?

Markus- We are not talking here about constructing a startup accelerator or an incubator. We are trying to make a link between technology developed for physics research with possible new applications having societal significance. Our primary goal is not to set up companies, the goal is to see whether our scientific knowledge can inspire new ideas that can create value for society in a wide variety of ways.

Marzio- For me CBI is interesting because it brings people together who may be completely ignorant of this knowledge, of this technology, yet they see the world in a very different way. I think there are people of around 25 years old now who have a totally different vision of the future.

Markus- After CBI, students understand things differently. There is a sense of a before and an after. They are transformed. Bringing design people to CERN, students from electrical and mechanical engineering, economics and business, architecture and robotics, gives a completely different view of the world, also for the researchers.

Marzio- Moreover, if we assume that basic research must be protected in order to work in a visionary way in the long term, one of the best ways to protect it, is to spread it around as much as possible and to give it the chance to be shown to society. The students who come here will share that idea and they will go on to disseminate it.

Markus- That's right, our mission at CERN is to generate new fundamental knowledge, and if along the way we are helping society to deal with complex challenges, we are delighted to be able to contribute to that process. But the real question is, what is the process? Right now, there is no description of such a thing, which is where IdeaSquare comes in. We want to experiment and look at the way fundamental research is carried out and how to connect that to society and explore new ways that benefit all. That is what IdeaSquare is all about.

Marzio- Yes, there is a lot of knowledge sitting quietly in labs, there are lot of people, a lot of expertise, and we have to get them out of the cave and encourage them to go out and explore!

Our goal is not to set up companies, the goal is to see whether our scientific knowledge can inspire new ideas that can create value for society in a wide variety of ways.

Markus Nordberg

Basic research must be protected in order to work in a visionary way in the long term. One of the best ways to protect it, is to spread it around as much as possible.

Marzio Nessi

30,000+ cups of hot beverages are consumed at IdeaSquare annually

47% black coffee (including espresso)

14% coffee with milk (including cappuccino)

21% hot milk (hot chocolate)

17% hot water (tea)

138,493 total cups since IdeaSquare opening

IdeaSquare in their words

IdeaSquare is the place to go when you need the support of a community that is driven by a thirst for innovation and a belief in the power of diversity and it's the place where you can escape from your routine and explore creativity out of your comfort zone, which is extremely refreshing. IdeaSquare is an excellent place, so approachable, so open and appealing, inviting people to grapple with those disruptive challenges.

Martin Gastal
Manager of the CMS Engineering and Technology Interface at CERN

A lab like IdeaSquare is unique because of the environment in which it's placed; CERN, a laboratory where thinking and doing is carried out as a constant mental quantum jump. Building the Large Hadron Collider (LHC), the world's largest and most powerful particle accelerator, means having the capability to think of and build the technology of the future, and this disruptive mindset, this potential to anticipate 25-30 years into the future is something unique that very few research centres in the world possess. **Exposing students from different disciplines from around the world to thinking beyond the present, breaking assumptions, is what makes IdeaSquare necessary as a place to imagine the future.** The licence to dream linked to the research and technology developed at CERN is essential for envisioning disruptive ideas that can have a future impact on society while contributing to fundamental research at the same time.

Pablo García Tello (Kumamon)
Section Leader - Development of EU Projects & Initiatives

> **IdeaSquare is an extremely important translation tool between fundamental research and societal challenges, trying to help all the stakeholders to understand a fraction of the other areas and create an inspiring atmosphere for everyone to work together.**

Joona Kurikka
Researcher and Project Coordinator at University of Turku
IdeaSquare alumni

We have an aspiration: a holistic approach to innovation by bringing people from different backgrounds, disciplines, countries and cultures together to exchange ideas. **This is a safe place to produce and exchange mad ideas, a place which allows the imagination to come through**, and a space of encouragement to explore and empower enthusiasm.

John Wood
Chair, Project Advisory Committee of ATTRACT. Consultant to universities and on international science

From the KT perspective, IdeaSquare is much more open to society and this is good for KT, which is more focused towards CERN itself and industry. KT is a tool for IdeaSquare and IdeaSquare is a tool for KT. In this way, we are both services for CERN and take different approaches to the transfer of knowledge to society. **At IdeaSquare, creativity can be maximised, and it's not only intuition-based, it's also about the capability to abstract and discover something there wasn't before**. That creativity needs to feed itself on rigorous knowledge and performance in a scenario prepared for experimentation, an environment where mistakes can be learned from.

Marcelo Losasso
Industrial Relations at CERN's Knowledge Transfer Group (KT)

CERN is where the huge ring is situated, the place where particles accelerate and collide. When enough energy is given to the particles, they collide and the result is not only new particles, but the unexpected. For me, as a metaphor, **IdeaSquare is also a collider, a Small Human Collider**. You need the collision point (that is IdeaSquare), and then you need the energy (given by the facilitators that run IdeaSquare or participate in their activities or programmes) and of course you need the collision materials (ideas, and people). The challenge is to produce results which are valuable for society after these collisions have happened. So, IdeaSquare **is following the same rules as CERN do with particle collisions, and sometimes you get meaningful results.**

Matteo Vignoli
Assistant Professor in Management Science and Engineering at the Reggio Emilia Engineering School, Member of the Design Thinking SUGAR network, founding member of the Challenge Based Innovation initiative (CBI)

As a CBI alumnus with a background in business development, I can say that IdeaSquare is a revolutionary space when it comes to colliding minds from different disciplines. **I think IdeaSquare is where open innovation springs into action.**

Santeri Palomäki
IdeaSquare Activities Coordinator
Challenge Based Innovation (CBI) Coordinator

How do we want to do it?

Connecting curious minds to speed up the flow of ideas through collaboration, prototyping and experimental innovation.
We aim for scientists and society to ideate, build and test in a collaborative environment and a unique space.

Think-Do-Collaborate

When we talk about how we want to do things at IdeaSquare, first we talk about the great challenge of having ideas and sharing them. Secondly, we talk about how we can do that and produce positive and innovative results for society. On the way to finding out how, we know that the people, place and the tools we use, are significant. People from different cultures, backgrounds, disciplines, languages and nations meet in this environment: CERN, a unique place and IdeaSquare a singular space for innovation. We offer a physical interface between CERN and society where scientists are free to collaborate with professionals from different fields, and with students from many disciplines, companies, NGOs and other organisations in an experimental, innovative way.

Think

The core idea of IdeaSquare is to give everyone the chance to meet and generate ideas. It is a place for thinking outside the box, to reach-out for mind-blowing conversations. It is a place where CERN's scientific infrastructure and knowledge can offer opportunities to work on prototypes related to:

- Developing next-generation detection, imaging and related computing technologies.
- Solving global challenges facing our planet.
- Implementing innovation methodologies that support multi-faceted research, exploration, problem reframing, and iterative testing.

Do

Individuals and teams need facilities and tools to develop and test ideas to see how they could perform in the real world. IdeaSquare provides them with flexible access to instrumentation for **rapid prototyping: 3D printing equipment** that allows easy and rapid construction of 3D prototypes, an **Electro Shop** to design, build, program and test electronic gadgets, a **Machine Shop** for cutting, drilling, assembling and gluing mechanical components and a **Light Lab** to provide a semi-cleanroom environment for detector assembly and testing, equipped with a variety of instruments and tools.

Collaborate

Collaborative processes are central to the way of working at IdeaSquare. These are based on principles and methods of open science and open innovation which offer new ways to:

- Rethink and redesign scientific research through a shift towards working more openly, collaboratively and interdisciplinary work.
- Develop and test new methods for integrating open science and open innovation principles.
- Establish new forms of stakeholder interactions and collaborations beyond the boundaries of scientific research organisations and disciplines.

With teams offering different expertise, we invite people to take part in or host **collaborative activities**, like targeted detector R&D projects, Challenge Based Innovation (CBI) student programmes, hackathons, workshops, innovation and entrepreneurship-driven events to nurture and grow the collaborative innovation community at CERN*.

The outcome we are looking for is also for the scientists to benefit from the new interactions, different forms of collaboration, innovative methods for generating and communicating scientific knowledge, contributing in a meaningful way to societal challenges.

Collaboration means multidisciplinary teams, diversity, inspiration, creativity and breaking through boundaries to achieve novel results.

* Find an overview of these activities in the section *What have we achieved so far?* on page 20.

From the initial projects at IdeaLab (the predecessor of Ideasquare) we learned the basics: how to facilitate dialogue, to help both students and researchers understand each other and work together as an interdisciplinary community under the same roof. Realisation of ideas as rapid prototypes and boundary objects for prompting dialogue played an essential role in helping to test assumptions in real life and to accelerate the development of things that work. As an impact, I feel that we have been able to make a teeny tiny dent on making CERN more humanistic and open to new ideas and ways of working, by offering people opportunities to take part and develop themselves in the process and cheering on many more to learn new skills and make positive change in the world happen!

Harri Toivonen
(Idea Shepherd)
Cooperation Associate at CERN Ideasquare

Machine Shop

The Machine Shop has everything you need for cutting, drilling, assembling, and gluing.
As always, remember to ask for help before you need it.

Use the prototyping labs to build your ideas

ElectroShop

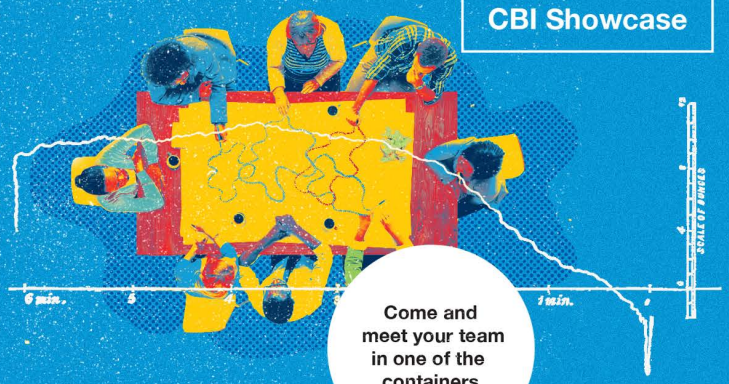
The ElectroShop is set up to let you create, program and test your electronic creations. It contains equipment for printing circuit boards, soldering, programming and testing.

For a detailed description of the equipment found in each of the workshops, visit our website.

Come and prototype your ideas with your team in one of our workshops

Share your ideas with the people you have not met before

CBI Showcase



Come and meet your team in one of the containers

Do!

Make possible the impossible

Give shape to your ideas

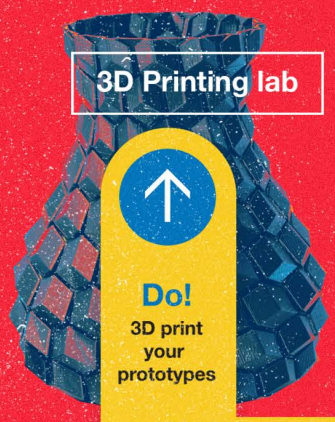
Get out of your comfort zone

Have an inspiring discussion in our Red Bus meeting rooms

Collaborate

Meet our multidisciplinary community

3D Printing lab



Do!
3D print your prototypes

Think
Develop new projects as a team

Stand at the Hugging Point and get a hug

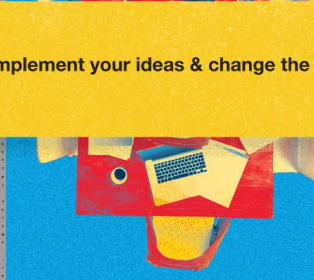
Hugging point

Discover Open Innovation

Be curious and dream

Spread the methodology

Apply your new learnings



Go out, implement your ideas & change the world

IDEASQUARE LICENCE TO DREAM

THE BOARD GAME

Think
Do
Collaborate

Welcome to IdeaSquare

Light Lab

Light Room is set up to provide a semi-cleanroom environment for detector testing. It is equipped with and optical table, PC controlled stereo-microscope, and activation sources. A small set up is provided to perform tests at Kelvin level.

Kitchen

Ask for help

Collaborate!

Provoke serendipity sharing coffee or lunch with other people in the kitchen

Meet people from other disciplines and apply scientific knowledge to societal challenges

Collaborate!

Participate in hackathons and workshops

Think!

Join seminars and conferences

(re) Define the problem
Design never ends

Needfinding + Benchmarking
Understand the users. Design space

Bodystorm
Ideate

Prototype
Build

Test with users
Learn

Ideasquare

Feeding Loop

Game Instructions: How to play IdeaSquare?

1. Be curious, be ambitious. Dream. **2.** Contribute. Collaborate. **3.** Talk to the ones you have not met before. **4.** Share your surprise of discovering the unexpected. Share your story. **5.** Cut the red tape by using scissors, cardboard, duct tape … and produce a prototype. **6.** Ask for help before you need it. **7.** Take full advantage of the Hugging Point. **8.** Don't worry about making a mess here. The only way you create a mess is by leaving it behind unattended. **9.** Be prepared to explain what on Earth you are doing. **10.** It's always better to check the electrical wiring before you...

What have we achieved so far?

2017-18 has been a record year of activities, projects and advances in R&D at IdeaSquare. Scientists, researchers, engineers from CERN and from research centres and universities around the world, PhD and MSc students, NGOs, people from innovation networks, companies and EU institutions have all been involved in IdeaSquare projects, generating new ideas, developing, testing and collaborating in this open innovation ecosystem.

Statistics 2017-2018

Hosted or supported R&D Projects

4 ongoing projects

2 PAST PROJECTS

+20 researchers involved

IdeaSquare Journal of Experimental Innovation (CIJ)

88 authors

from **17** countries

61 INSTITUTES

KT Group activities at IdeaSquare

19 MEET-UPS AT IDEASQUARE (during 2018)

1st CERN Entrepreneurship Student Programme

2 CERN - NTNU SCREENING WEEKS

1 CERN Medical Technology Hackathon

Experimental innovation

Student projects

23

CBI & MSC-LEVEL STUDENT PROJECTS

29

WEEKS HOSTING STUDENT PROJECTS

Internal CERN events

26

Hackathons

24

Courses

18

Events, Seminars & Workshops

+50

Map of IdeaSquare's exploration of the unknown

Through education and collaboration between students, curious minds and the scientific community, at Ideasquare we have worked on building a bridge between society and the world of CERN. Based on physics research and technology, we aim to develop projects capable of producing a positive impact on society as a whole. With that goal in mind, here's a map of IdeaSquare's main activities.

SOCIETY

Connect CERN with SDGs

Events, seminars and workshops

- OpenCare Meetings
- BioFabbing Convergence
- Curious Mornings
- IdeaSquare Activity Day
- Finland at CERN
- The Port Open House
- Groupe Innovation Entreprise Publiques Autonomes
- Data Science Meetup - Société Genévoise des Données
- LHCreate
- EIROforum Instrumentation Working Group
- Food Cultures
- OpenCare Workshop
- Devoxx4Kids
- Django Girls
- UN Data Innovation Lab
- Foresight Co-creation
- Humanitarian Foresight Workshop
- We Start! Entrepreneurial Program for Migrants
- UNIGE Project Workshop
- UNIGE Open Science Day
- FuSuMaTech Workshop
- Researchers Night Robotics Workshop
- Volunteer Computing for SDG
- Physics Meets Blockchain Workshop
- Corporate Venturing Leadership Forum
- Ecolint Mini-Workshop in Societal Innovations
- Workshop on Systematizing Serendipity
- CineGlobe Workshops on Robotics & AI
- ENOLL OpenLivingLab Workshop
- TCSI IdeaSquare Seminar

Develop solutions for humanity at large

Positive Social Impact

Environment for innovation

Courses

- Playing with Protons
- Media Course with Webster
- Stream ITN Winter School
- GCSP Course at CERN
- Italian High School Students in Residence
- Raspberry Pi Tutorial for CERN Summer Students
- ESADE Executive Education Program
- Hands on Workshop Basics on Design Thinking
- Hands-on Workshop Basics of 3D Printing

Open Innovation

Hackathons

Sharing knowledge

- Science Hackathon
- Cambridge Hack
- ACAPS Hack
- The Port Hackathon
- Gosh roadmap Hackathon
- Mobility Hacks
- E3E Hackathon
- AI for Culture Hackathon
- Cineglobe Hackathon

Human centric

Multidisciplinary

IdeaSquare Journal of Experimental Innovation

New methods and processes

The map lists the main activities developed in each of IdeaSquare's areas of action.

IdeaSquare
a bridge between SOCIETY & CERN

CERN

Inspiration

Innovators in Residence Programme

- öBot
- CBI Barcelona
- CBI A^3
- CBI ER
- CBI Tampere
- RCA Grand Challenge
- Innovation for Change
- IED Design Management Master Student's Project
- NTUA Students in Residence
- CreaGENEVE
- Design the Future
- C4SI
- Laurea Bootcamp
- ATTRACT Young
- Master Innovation, Human Development and Sustainability - University of Geneva

Experimentation

Passion

Student programmes

CBI & MSC-Level student projects

Dream

Education

Serendipity

Knowledge

Research & Innovation

Internal collaboration

Curiosity

Technology

Medtech:Hack •
Entrepreneurship Meetups •
CERN Entrepreneurship Student Programme (CESP) •
CERN - NTNU Technology Screening Week •

KT Group

- Konstantinos' Cooking Workshop
- LHC Machine Learning Working Group
- CERN Women in Technology Strategy Meeting
- LHCb Hackathon
- Programming Meetup CERN IT
- Cues CERN Hack
- Superconductor Hackathon
- CMS Reconstruction Software
- IT Hack
- Unicos - CPC Hack
- CERN2 Market Hackathon
- CERN Exhibition Team Hackathon
- Data Science Hackathon
- ATS Student Course
- HiLumi - FCC Innovation Course
- LabView Workshop 2018
- Diversity Office Workshop
- Science Hackathon - The Port
- Malt Project Workshop CERN IT

Collaboration

Experimental physics

Prototyping

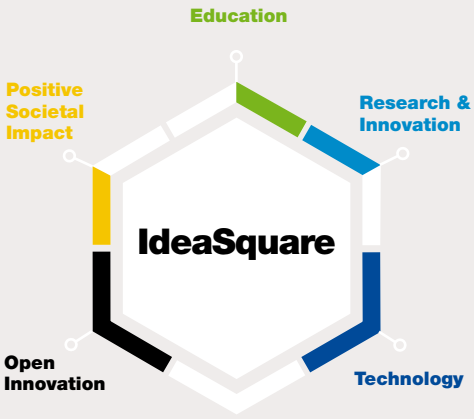
Host R&D projects EU projects

- CERN Neutrino Platform
- STREAM
- TT-PET Collaboration
- HEALTH
- SIMPLE
- TALENT
- ATTRACT

Embracing human power

Hosted or supported R&D Projects

The R&D projects hosted or supported at IdeaSquare aim to contribute to future CERN programmes, developing next-generation leading detector, imaging and related computing technologies. They offer a shared technical platform which, in parallel, has a strong connection to society, as well as inspiring next-generation scientists, engineers and entrepreneurs by exposing them to the frontier R&D environment at CERN.



CERN Neutrino Platform (CENF)

The CERN Neutrino Platform is an initiative to foster fundamental research in neutrino physics at particle accelerators worldwide, as recommended by the 2013 European Strategy for Particle Physics.
Marzio Nessi is the project leader of the Neutrino Programme at CERN.
"*The neutrino platform pulls together a community that is scattered across the world and CERN has committed significant resources to supporting R&D in all aspects of neutrino research. We are using the organisational model of the LHC to help to develop an international project on US soil and to contribute to neutrino programmes in Japan and elsewhere*". Understanding the neutrinos is a worldwide priority, in which exciting results for physics beyond the Standard Model are expected. Neutrino research at particle accelerators is complementary to studies made in cosmology and provides crucial input to knowledge of the universe. Future measurements could cast light on outstanding questions concerning, for example, the nature of dark matter and the matter/antimatter imbalance in the universe. The experiments at accelerators will also have the ability to observe neutrinos from supernovae.

STREAM

Smart Sensor Technologies and Training for Radiation Enhanced Applications and Measurements, is a four-year Innovative Training Network (ITN) project under the Marie Skłodowska-Curie Actions within the Horizon 2020 framework programme involving partners from Austria, CERN, France, Germany, Switzerland and the UK. Stream ITN will finish in 2019.
STREAM is a career development network built on the scientific design, construction and manufacturing of advanced radiation instrumentation. It targets the development of innovative radiation-hard, smart CMOS sensor technologies for scientific and industrial applications.
The platform technology developed within the project will be tested in the demanding conditions posed by the CERN LHC detector environment as well as by European industry leaders in the field of CMOS imaging, electron microscopy and radiation sensors. This leveraging factor will allow fine-tuning of the technology to meet the requirements of industrial application cases on demand such as electron microscopy and medical X-ray imaging, as well as forging a pathway towards novel application fields such as satellite environments, industrial X-ray systems and near-infrared imaging.

The TT-PET Collaboration

The TT-PET Collaboration is a 3-year project finishing in 2019 and is financed by SNSF to produce a pre-clinical PET Scanner based on silicon detector technology, insertable in an MRI machine and with 30ps RMS time resolution. The TT-PET collaboration is a project co-lead by the University of Geneva, CERN, INFN of Roma Tor Vergata, University of Bern, Hôpitale Cantonale de Genève and Stanford University.
The development of a silicon time of flight detector for Positron Emission Tomography is a challenging project in

> **The world is lacking in scientific culture and IdeaSquare works to inject more scientific culture into the world. IdeaSquare has the potential to do frontier research in order to link society and science, putting together three pillar concepts: education, knowledge and development capability.**
>
> **Giulio Aielli**
> Physics Researcher at CERN.
> Detector Expert for the ATLAS experiment

CERN NEUTRINO PLATFORM

- **119** teams
- **5** experiments
- **757** participants
- **IdeaSquare is the central design office**
- **4** designers + **3** engineers

STREAM

- **7** countries involved
- **17** early stage researchers
- **11** research papers published
- **19** participations in international conferences

TT-PET COLLABORATION

- **3-year** project
- **6** collaborating institutions
- **6** research papers
- **13** researchers

the medical physics field that will require great R&D efforts in sensors and electronics. In addition to TT-PET, IdeaSquare has also been hosting other initiatives under the GRADE platform: HEALTH (an integrated system for quality assurance in hadron therapy consisting of a 3D motorised water phantom with a GEMPix detector and reference PTW ion chamber, built and tested at IdeaSquare) and SIMPLE (SiPMs for generic detector R&D). All the projects have acted as an intermediate step while waiting for ATTRACT-type opportunities to arise. They are set to finish in 2019 unless continued e.g. within ATTRACT.

TALENT

The outcome of TALENT (an EU-funded ITN project) was to create the means to produce affordable high-performance detector modules in European industry and thus answer the forthcoming needs of research infrastructures and industry application demand. The project strengthened the cooperation between research and multidisciplinary industry in the fields of advanced radiation sensors, fast and low power consumption read-out and data acquisition electronics, new cooling technologies and ultra-light mechanical support structures. It set out the foundations for the STREAM project described before.

ATTRACT

The idea behind ATTRACT is to create a co-innovation ecosystem between fundamental research and industrial communities to develop breakthrough detection and imaging technologies for scientific and commercial uses. Its goal is clear: a bigger return on Europe's scientific investment that will benefit both the economy and society at large. The project aims to help revamp Europe's economy and improve people's lives by creating products, services, companies and jobs. IdeaSquare will be acting as a prototype for ATTRACT in the next few years, creating a self-sustained ecosystem by successfully bringing together the different actors in the process.
Funded by the European Union's Horizon 2020 programme, the ATTRACT initiative is co-lead by CERN and leading European research institutions as Aalto University; the European Industrial Research Management Association (EIRMA), European Molecular Biology Laboratory (EMBL), ESADE Business School, the European X-Ray Free Electron Laser Facility (European XFEL), the European Southern Observatory (ESO), Institut Laue-Langevin (ILL) and the European Synchrotron Radiation Facility (ESRF).
Can new networks of sensors be installed in big farms to make agriculture more productive and less energy and water intensive? Can smarter use of monitoring and Big Data analysis make factories work better, cheaper and greener? Can we use sensors to help the visually impaired navigate the world more easily? Can we develop better forms of online learning? Can we pioneer ways to monitor our changing climate more accurately and cost-effectively and develop strategies to anticipate and mitigate the damage?
Answering these questions requires an open innovation mindset so that breakthrough innovation concepts can be rapidly identified, assessed and industrially scaled by multiple experts throughout the innovation value chain.
To achieve this, ATTRACT will couple national and European Research Infrastructures, universities and research organisations with actors who can extract societally relevant and commercially interesting innovations from them.

From Open Science to Open Innovation

Incremental innovations may bring about positive impacts on societal challenges, but getting ideas and hunches realised is a lengthy process. The ATTRACT methodology aims to springboard science towards actors with vision for innovation potential. In contrast to incremental innovation, which generates reactive or adaptive responses to a problem, breakthrough innovation is driven by a desire to anticipate emerging or future needs.
To bridge the gap between basic research and real market needs, ATTRACT has called for researchers, entrepreneurs and companies to put forward breakthrough projects in pioneering imaging and sensor technologies.

TALENT

3-year project
3 research facilities
7 universities
8 industrial partners
4.5 million euros through EC Marie Curie Action

ATTRACT

17 million euros to fund **170** disruptive ideas
100,000 euros each
1,211 total proposals received from over **40** countries worldwide
58% related to sensors
20% to data acquisition systems and computing
17% to software and integration
5% to front and back-end electronics
12 months to develop and implement research ideas

Next Steps

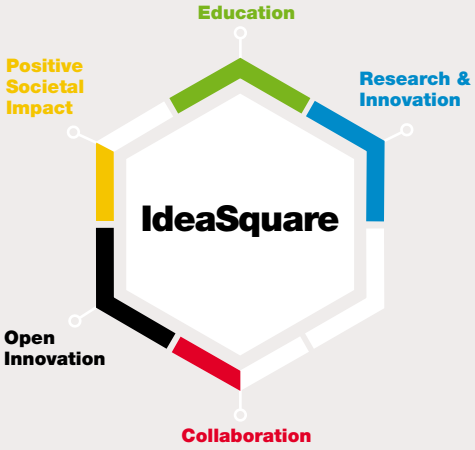
As the funded **170** ATTRACT projects start in Spring of 2019, the GRADE platform at IdeaSquare will support the projects, linking them also to CBI-activities, whenever feasible.

Detection & imaging technologies affect all major technology areas:

- **Advanced Manufacturing**
- **Medical Devices & Imaging**
- **Life Sciences & Biotechnology**
- **Clean & Green Technology**
- **Sensors & Automation**
- **Materials & Coatings**
- **Intelligent Transport and Cities**
- **Information & Communication**
- **Microelectronics**

CERN IdeaSquare Journal of Experimental Innovation (CIJ)

IdeaSquare's new online journal (CIJ) publishes empirical and theoretical research on the practice of strategic technology and innovation management, to better understand innovation processes. It is a multi-disciplinary, open online journal that focuses on in-situ innovation experimentation, strategic innovation management, knowledge transfer and management and innovation policy issues.



IdeaSquare and CIJ offer a new and unique platform to carry out and investigate student experimentation-driven innovation, inspired by the way CERN does frontier physics research. Saku Mäkinen, Editor in Chief of the New Journal explains: "*Without experimentation, no real innovation is possible. The process of innovation is just as important as the product of this creative process. This is why it's so significant to report results of contemporary research on the innovation experimentations in places like IdeaSquare through this publication*."
The CIJ aims to increase our understanding of how the innovation process happens, and what the optimum conditions are to efficiently accelerate innovation. It also aims to investigate how innovation permeates into society and how new innovations are adopted, modified and even eventually discarded. In that sense, the CIJ is interested in the social dimensions of experimentation in innovation, as well as the innovation management aspect.

Examples of research topics addressed in CIJ

- **Medical technology**
- **Online distributed learning platforms**
- **Theories of innovation experimentation**
- **Open Source Hardware**
- **R&D processes, tools and design activities**
- **Collaboration and work design**
- **Leadership**
- **Organisational change**
- **Project management**
- **IT system development**
- **Collaborative spaces**
- **Science parks**
- **Re-organisation of research and innovation activities**
- **Electrical design and engineering**

> **Areas of study have ranged from electronic design and Open Source Hardware, to leadership and collaborative work design.**
>
> **Saku Mäkinen**
> Editor in Chief

CIJ DATA

4 volumes published
22 original articles
4 Coffee papers
14 areas of research

The journal's homepage has had **8,548 views in its first 2 years of publications** from June 2017, when the first issue was published, until the end of 2018.

Vol.1

Issue 1 (summer 2017)
1,899 views
Issue 2 (winter 2017)
2,041 views

Vol. 2

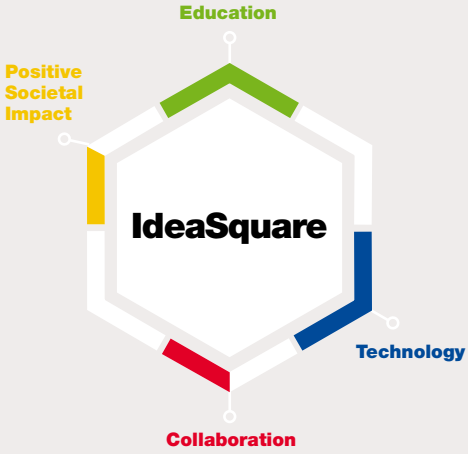
Issue 1 (summer 2018)
941 views
Issue 2 (winter 2018)
254 views

A connection we would never ever have made by ourselves is how augmented reality can help autistic children

Knowledge Transfer Group entrepreneurship activities

Activities developed in collaboration with the KT Group

IdeaSquare is a close and natural partner of the CERN Knowledge Transfer Group (KT) in the CERN innovation ecosystem. Many different KT activities are hosted at IdeaSquare: Student Projects, Hackathons and the Entrepreneurship Meet-Ups (EM-Us).



Entrepreneurship Meet-Ups

The EM-Us are a regular activity at CERN. They were set up to create an entrepreneurship community, bringing people and companies together at CERN to learn about and debate topics related to entrepreneurship and innovation. The EM-Us facilitate new interactions among the CERN community and generate relevant connections between people, projects or innovations from outside. EM-Us have been taking place at IdeaSquare since 2018. Every other week, experts are invited to share their knowledge on a subject, followed by discussions and networking related to the topic. Previous EM-U topics have included: Blockchain, Intrapreneurship, Intellectual Property, How to support the creation of spin-offs at CERN, How to thrive through failure, How the creation of bridges between disciplines boosts innovation, What value prototyping can create in start-ups; as well as successful case-studies of companies working with innovative technologies.

CERN Entrepreneurship Student Programme (CESP)

CESP is an Education & Outreach project within the CERN & Society Foundation, established to enhance CERN's beneficial footprint on society. It is part of CERN's effort to cultivate a culture of entrepreneurship and nurture the next generation of high-tech entrepreneurs, indispensable for future economic growth. The programme is aimed at entrepreneurship students enrolled in master's-level courses and taps into CERN's scientific expertise to provide a technological dimension to the students' training. During the programme, they put their own ideas into practice by leveraging CERN technologies.

CERN-NTNU Technology Screening week

Students from the Norwegian University of Science and Technology (NTNU) School of Entrepreneurship have one week at CERN to identify the commercial potential of CERN technologies. Students must understand a given CERN technology, identify new applications and assess if this can lead to a sustainable business. From this intense activity, various spin-offs and start-ups have been set up in recent years such as the CERN Spin-Off TIND.

Medtech:Hack 2018

Students and young professionals were selected and invited to CERN to find solutions to challenges in the medical field. The challenges were set by healthcare organisations and industry partners (from humanitarian to business organisations) and the teams were given access to relevant CERN technologies in order to solve them. They had the support of The Port, which has extensive expertise in hackathons and also shared their methodology.

ENTREPRENEURSHIP MEET-UPS

19 meet-ups at IdeaSquare (during 2018)

Average of **24** participants per meet-up

Average of **12** people choosing to stay to continue discussions afterwards

The network counts **281** members, **241** from CERN and **40** who are external to CERN

In 2018, **75%** of the speakers were not associated with CERN, while **25%** were from within CERN

Gender representation of speakers in 2018: **6** Female, **10** Male, **3** Mixed

Most popular:
Intrapreneurship with Gib Bulloch (**65** participants) and *A fireside chat* with serial entrepreneur Whurley (**50** participants)

CERN ENTREPRENEURSHIP STUDENT PROGRAMME (CESP)

1st CESP in 2018

5 week residency at IdeaSquare

10 students

CERN - NTNU TECHNOLOGY SCREENING WEEK

2 CERN- NTNU screening weeks

30 students in 2018 (+ **2** professors, **2** student assistants and **4** observants)

36 students in 2017 (+ **3** professors and **3** student assistants)

MEDTECH: CERN MEDICAL TECHNOLOGY HACKATHON

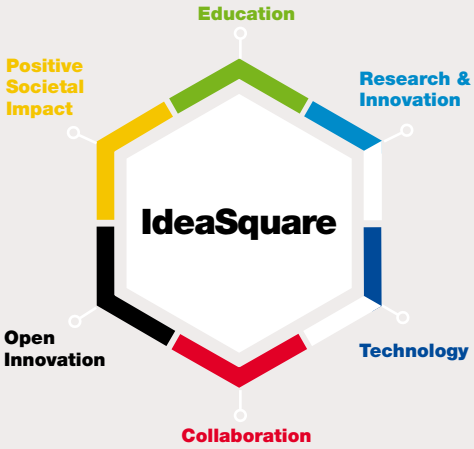
25 applications from **14** different countries

5 teams of students and young professionals selected

Experimental innovation

IdeaSquare hosts and facilitates innovation and entrepreneurship-driven events that combine different aspects of technology and society. It has the very specific purpose of generating innovative solutions to global challenges. Most of the events are organised and funded by external organisations while IdeaSquare provides the facilities and offers experimental innovation-related education & coaching.

→ Student programmes



Challenge Based Innovation (CBI)

CBI is a challenge-driven, student programme where multidisciplinary student teams and their instructors from universities all around the world collaborate with CERN researchers to discover novel solutions for the future of humankind. The projects are an elaborate mixture of technologies inspired by research at CERN and elsewhere, addressing societal, human-driven needs. Students come from a diverse background of disciplines. So far there have been students from industrial design, electrical and mechanical engineering, robotics, economics, business, architecture and social sciences. The power of multidisciplinary teams lies in the ability to act as catalysts in creating novel solutions to pressing problems and bridge the gap between science and society. Each CBI programme has its own characteristics depending on the culture each participating university has developed in their home countries. In the same way CERN has been fostering scientific collaboration, IdeaSquare is fostering innovation initiatives with its partners around the world. After four years of conducting collaborative projects, the CBI programme is being replicated and adapted to serve several local contexts within partnering institutions.

Country-Specific CBI

The country-specific programmes are the backbone of CBI. Directly connected to CERN, for four to six months, students are exposed to the CERN environment and can establish direct contacts with the scientists to learn more about their specific areas of knowledge. Students explore, identify real user needs and learn about various related problems before deciding on specific challenges that they want to work on. Then, after setting the basis of their approach to a given societal challenge, they will start the stage of prototyping and testing ideas to solve the problems they have found. One of the most exciting moments is when the students present their findings at the CBI "Gala" event in front of a live CERN audience. Encouraged by the feedback received, some of the teams rapidly pursued further avenues through incubator programmes offered by their home universities. Several hubs in the CERN KT Business Incubator Network (BIC) have been following CBI activities since 2014.

CBI Barcelona

Each year, some 40 eager students forming five to six student teams come from ESADE, IED (Barcelona Design School) and ETSETB (Barcelona School of Telecommunications Engineering from UPC) to tackle challenges revolving around the 17 Sustainable Development Goals (SDGs), established by the United Nations to set out the 2030 Agenda for Sustainable Development in the areas of education, health, pollution and emergency assistance.

IdeaSquare hosted over **600** students since 2015

+5 start-ups created resulting from our Students Programmes

2017
146 students

2018
225 students

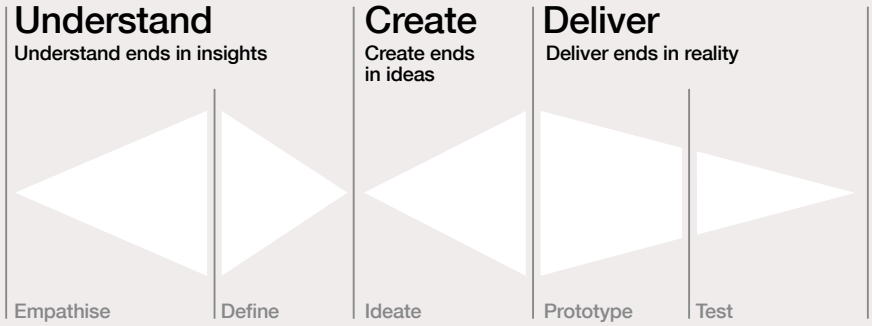
34% engineering
20% design
38% business
8% other

52% female students

33 oBot (Porto)
50 Innovation for Change (Torino)
33 C4SI (Geneva)
21 Laurea BootCamp (Helsinki)
16 CreaGeneve (Geneva)
10 CESP (CERN)
6 ATTRACT Young (Trieste)

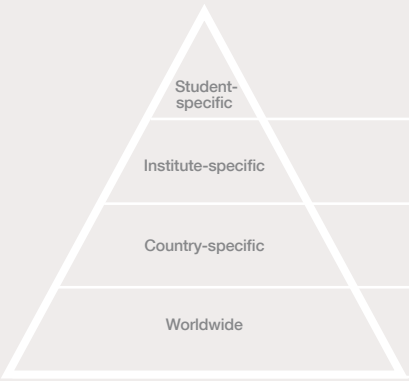
Beyond the Design Thinking process

CBI teams have been experimenting with the Design Thinking process. This has been the basis for IdeaSquare to move forward, research new methods and to take the next step beyond.



The CBI Programme

Different types of programmes for different types of reach. The CBI programme at IdeaSquare connects with students at different levels: worldwide networks (e.g. DFGN) where physical presence at IdeaSquare is optional; country-specific networks (e.g. the Spanish and Italian collaborations); institute-specific (e.g. CBI at Tampere University) and student-specific initiatives (under development).



Student-specific	Under development
Institute-specific	The CBI programme is adapted to the special features and goals of an Institution (e.g.Tampere University)
Country-specific	Cross-country hubs have an immersive experience at CERN, such as CBI Barcelona or CBI ER
Worldwide	Virtual (online) and global CBIs such as the DFGN collaboration with IdeaSquare where physical presence at IdeaSquare is optional

In 2018, participants focused on developing innovative solutions related to five major challenges: empowering women and young people in developing countries through education and entrepreneurial activities in the STEM fields (science, technology, engineering and mathematics); developing operational methods for radiation safety inspections; designing immersive technologies for training activities in emergency health missions; redesigning solutions for sharing knowledge; and assessing the impact of the environment on public health.

From challenge to proposal

Each team starts with a global challenge to formulate a more specific proposal for iterative prototyping. For example, in the 2018 edition, CBI Barcelona came up with a system based on blockchain technology for collecting secured data on academic certificates, a project inspired by refugees who have had to flee their countries, unable to certify their educational qualifications; a device for detecting radon gas, the second most common cause of lung-cancer-related deaths; and a project based on haptic technology that allows virtual interaction based on the sense of touch; an alternative to the current scientific publishing system, measured only in terms of the number of citations received by a particular scientific article (the “h-index”) that focuses more on the dissemination of the results and their impact on society; and a device to improve air quality in indoor spaces and on urban mobility systems.

CBI A³

CBI A³ is a Design Factory Melbourne initiative which builds on earlier Challenge Based Innovation (CBI) pilots at IdeaSquare. CBI A³ focuses on future solutions to contribute to achieving the UN Sustainable Development Goals by 2030. Some of the projects that arose, addressed solutions to problems like electronic waste, food wastage in hospitals, energy efficiency and deforestation. Currently, CBI A³ includes partners from the Politécnico do Porto

The connection between CERN and our students enables this immense source of knowledge to become accessible to our students, so they feel that as designers they can play an important role in shaping both the present and the future.

Savina Torrisi
Royal College of Art (RCA),
Innovation Design Engineering
Senior Tutor of RCA-CERN
Grand Challenge

CBI 2018

4 CBI Courses
12 universities

38% engineering
28% design
16% business
18% other

52% female students

29 CBI Barcelona
17 Design the Future 2018
14 CBI A³
29 CBI ER

DT(t) for Physicists

Design Thinking

(t) =

starting with improved human experience **(X)**
+ converging on societal context **(Y)**
+ reaching solution using technology **(Z)**

Experimental innovation

in Portugal, inno.space in Hochschule Mannheim, Germany and Pace University in New York, USA.

CBI ER

In the Italian CBI programme, student teams from the University of Ferrara, the University of Bologna and the University of Modena and Reggio Emilia prototyped and tested ideas connecting UN Sustainable Development Goals and CERN Knowledge and Technology in the fields of medical applications and personalised mobile communication. Some of the projects presented have included a device that helps nurses to check and count the number of instruments used throughout all surgical phases. Another offers a digital platform that brings customised information to users, guaranteeing their anonymity and giving them full control over their data on the Web.

Institute-Specific CBI

Inspired by CBI country-specific programmes and to extend their impact locally, Tampere University in Finland is the first institution to incorporate a local version of CBI within its Masters programmes, involving all of its seven faculties.
For universities, CBI represents a significant change from a traditional university course setting in which the lecturer stands in front of a group of students in a typical classroom layout. Instead, CBI offers a hands-on exploration in a collaborative space, where teachers and students exchange ideas and work together to create innovative solutions to current and emerging global issues.
The CBI at Tampere was launched in 2018 with a multidisciplinary team of students from physics, chemistry, bioengineering and IT backgrounds. Seven weeks of intense work culminated in the development of a real-world application project. Under the mentorship of five teachers, the team created a memory-foam filter prototype, worn in the nose to provide protection from air pollution.
As professor Saku Mäkinen from Tampere and editor in chief of CIJ specifies, CBI implementations need to have a local flavour to suit the curriculum of the students, faculties' priorities and other needs, in order to have a real impact.

Implementing the CBI@Tampere pilot came with several challenges such as curricular timetable and content decisions, but communicating openly with the students helped overcome them. The connection with CERN and the possibility to take advantage of its resources allowed for hands-on experimentation and prototyping, which are essential in a CBI course model.
This successful piloting of the CBI course model will be taken further in the coming semesters and hopefully inspire also other universities to adopt it. For this, professor Mäkinen and his team are developing a guidebook for future local CBI implementations that aims to help foresee any complications and encourage both educators and students to engage.

Worldwide CBI Network

IdeaSquare is a member of the DFGN (Design Factory Global Network). From the outset, the CBI programme, as an educational experiment, has been shared and developed with the innovation network partners with the aim of enriching the learning experience.
Realising the saturation of available space at IdeaSquare, we launched an initiative in the form of a massive open online innovation pilot-project (MOOP). Developed by IdeaSquare, the project's purpose is to reach out to students who wish to contribute remotely and whose

> **IdeaSquare is an inspirational space for curious minds that brings together people from interdisciplinary backgrounds to look at the past, understand the future and envision it. IdeaSquare is more than a place, it is an open space for open and enthusiastic people, giving an opportunity to everyone to fly with their imagination and explore futuristic approaches to thinking about innovation, to have critical thinking and to be skilled in problem solving for our society.**
>
> **Oday Darwich (Serial Learner)**
> Manager of the Future Innovator Program and Coordinator for the Open Innovation Framework.

Through bold initiatives we aim to make the serendipitous flow of innovation to society more structured.

presence at IdeaSquare would thus be optional. The global online “virtual CBI” programme aims to offer DFGN members and other partners a new way to contribute to CBI, and to boost different types of engineering-driven student assignments as part of the teaching curriculum of their home universities, all around the world.
Offering an opportunity like this to students requires effective dialogue and shared development of the teaching curriculum in participating universities. For IdeaSquare this means planning and setting up a MOOC/MOOP platform structure that enables universities to use, monitor and evaluate the contributions of the students. Once the initial pilots have been completed, the university staff involved will be invited to integrate the collected student input and converge on the final deliverables.
The first two MOOP challenges launched are: a commercially viable supersonic passenger aircraft; and the design, testing and development of next-generation nanosatellites, with a focus not only on testing new technologies but integrating also society-driven (educational) features, such as new Earth observation capabilities and new business models.

Other Students Programmes at IdeaSquare

öBOT (Porto)

öBot is an intensive and immersive introduction to prototyping with embedded systems, sensors, integrated circuits and actuators. It is designed to function parallel to a larger product development project in Mechanical Engineering 310 / SUGAR program (ME310), Product Development Project (PdP) and Challenge Based Innovation (CBI), in order to give the students essential skills for using advanced electronics in their prototypes. öBot is a five-day exercise in mixed teams of 5-6 students with the help of an expert team tutoring and assisting the students. The purpose is to design and build a robot capable of expressing at least four different human emotions in one week. The prototype building process is supported by inspirational visits to CERN workshops, laboratories and experimental spaces.

RCA Grand Challenge (London)

Working in 74 interdisciplinary teams, supported by 16 tutors from CERN and 16 tutors from the Royal College of Art (RCA), 374 students from across the School of Design were given four weeks to devise workable solutions to global problems.

(Opposite page)
Students at IdeaSquare during the presentation of one of their prototypes.

Challenge Based Innovation students working on their projects at IdeaSquare during the immersion period at CERN.

“The IdeaSquare environment is super-inspiring. You can find really in-depth knowledge, have amazing weird conversations and you feel yourself being pushed to the limit, and your mind being opened to new ideas. At a certain point, you start thinking differently in a non-incremental way and your mind changes how you view things. It took me three years to understand Design Thinking and innovation processes. It was tough, but I finally realised that IdeaSquare makes sense because it came about to break the definition of boundaries. I think it’s a place where serendipity happens and ideas blossom.

Jani Kalasniemi
(Prototype Viking)
Project Associate at CERN

Experimental innovation

The mixed-disciplinary student teams addressed four themes: Health and Wellbeing; Digital Disruption; Energy, Infrastructure and the Environment; and Social and Economic Disparity. Each team identified the underlying causes of these grand challenges, determining the needs of the communities most affected and the key stakeholders that could help resolve issues. They then explored technologies from CERN or beyond, to create compelling new solutions. The results demonstrated how design can create an integrated solution that is as much about human behaviour and social innovation as technological innovation: from an interlocking brick-cum-tile made from a versatile mould using plastic reprocessed from the established recycling industry in Dharavi, a Mumbai slum which deals with waste, to a low-cost menstrual cup sanitisation device for women in rural India to use safely and subtly, on-the-go. Using nanotech filtration, the menstrual cup sanitisation helps reduce the rate of infection from cleaning with contaminated water.

Innovation For Change (Turin)

As a close cousin of CBI, the Innovation for Change project annually invites approximately 50 students from scientific or engineering backgrounds to work together for five months in Turin and at CERN. The students are split into 8 groups, all with a common goal: to apply the most advanced technologies to global social challenges.
New projects are expected from the five-month intensive work period. Each of these must be capable of competing on the global market with innovative products or services that also respond to global societal challenges and that match the needs of industrial groups or global organisations. Large industrial companies and global organisations also collaborate with the teams by selecting relevant social challenges, guiding them through this joint effort to find viable innovative solutions. The programme collaborated in previous editions with the Italian Ministry of Economic Development, the United Nations Industrial Development Organisation, the Associazione Italiana Ulcere Cutanee, the Casillo Group, ENEL and Humanitas. The teams were supported by the Collège des Ingénieurs Italia (CDI), along with CERN scientists and researchers from the Politecnico di Torino.

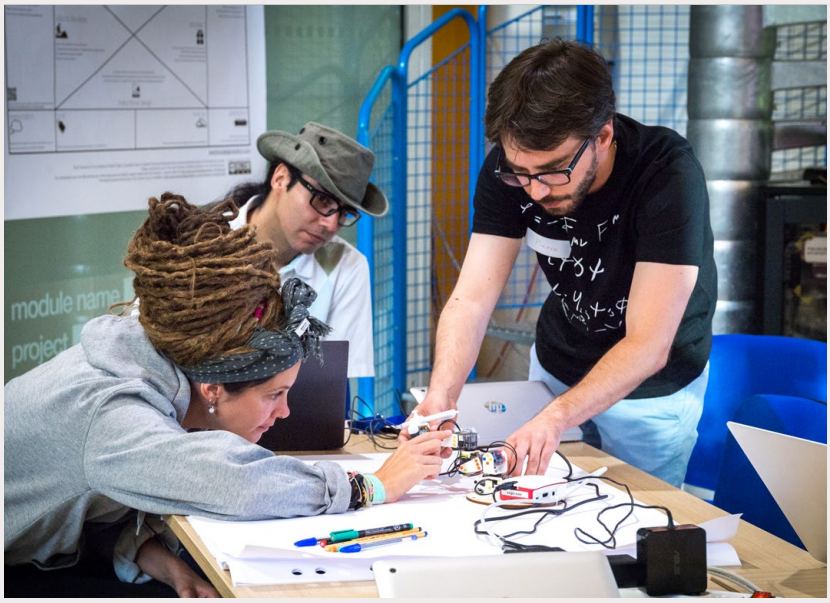
C4SI (Geneva)

Collaborate for Social Impact (C4SI) is an experimental education programme based in Geneva which challenges students and young professionals to engage innovatively with pressing social issues. Participants are students and young professionals based in Switzerland from any discipline, ranging from business and technology, to international affairs and development. C4SI is promoted by **Just Innovate** as a non-profit educational organisation devoted to fostering creativity and inspiring social innovation within student communities and beyond. Challenge Setters are international affairs and development organisations, private companies and NGOs. They provide concrete challenges based on issues they have identified in their respective fields.

CreaGENEVE (Geneva)

CREA is a leading school in Geneva for Marketing, Communication, Digital Marketing and Art Direction. Students on the International Masters in Digital Marketing & Communication course were invited to IdeaSquare for a workshop focused on delivering a digital strategy and activation plan to promote IdeaSquare as an Innovation Hub at CERN.
Since its launch in 2014, IdeaSquare has been promoted gradually to an external audience, focusing on aspects linked to challenges in society. IdeaSquare has also enjoyed reasonably good exposure with different partners around the world through

> **IdeaSquare is about creating space for thinking beyond disciplines and present possibilities. Its where unknown steps into reality, where the magic lies.**
>
> **Tuuli Utriainen**
> Researcher at CERN



Multidisciplinary teams develop and test prototypes at IdeaSquare

We aim to create future changemakers by offering international students and researchers a unique, real-life experience in prototyping.

our society-driven impact on humanitarian, health and industrial innovation, startups, student programmes, workshops and exploring the innovation process itself. However, within the CERN community, a group of some 15,000 people, IdeaSquare exposure posed more of a challenge. The opportunity to collaborate with CREA came at the right time to develop an IdeaSquare social media strategy project. The collaboration has been very successful, the student efforts having increased the social media presence of IdeaSquare ten-fold.

Design the Future 2018

Students from the Tampere University of Technology, BIC Araba and UPV/EHU, along with CBI ER students from the University of Bologna, the University of Modena and Reggio Emilia and the University of Ferrara participated in the Design the Future or DTF workshop. The general objective of this workshop is that MSc level interdisciplinary student teams discover:

1. what CERN is by interacting directly with CERN researchers
2. what is happening at CERN by interacting directly with CERN researchers
3. how to think disruptively
4. how to build future world scenarios in which social aspects and technology interlink and propose transformative technology concepts.

Point three, in particular, constitutes the essence of how CERN professionals approach challenges in fundamental physics and will serve the students to become original thinkers and innovators. Exercises are introduced by tailored explanatory talks. Their goal is to provide the students with a disruptive thinking toolbox that will be fully put into practice in the final challenge of the workshop consisting of a challenging future scenario building project.
The final projects of the first edition of the DTF workshop gave answers to questions like how to make a world where people can have enough food and energy and nothing goes to waste, where there are no longer limiting borders between countries, where people can access cutting-edge technology without it ruling the society?
The DTF, among other student programmes at IdeaSquare, will generate data that helps to define new innovation practices beyond the current reach of tools like Design Thinking. These will be recorded and published in the spirit of Open Innovation.

Innovator in Residence Programme

This programme offers the opportunity for external people from divergent backgrounds to work with IdeaSquare personnel in the dedicated innovation space at the heart of CERN. The programme aims to contribute to current in-house projects, offering perspective through mentorship to help develop "surprising, sustainable and delightful" solutions for the future. Here, one can experiment with different ways of connecting humankind with technology in an array of collaborations with academic, business and other partners who can help to expand the scope of socially relevant innovations and explorative research.
The IdeaSquare residential programme is targeted, in particular, at postdocs or researchers who wish to stay at IdeaSquare to carry out experimental innovation-related research for a longer time period, from six months up to two years.
While carrying out research at CERN, the researcher is expected to contribute to the ongoing programmes at IdeaSquare (e.g. CBI) and/or to the referred CERN IdeaSquare Journal of Experimental Innovation. Currently, there are two Innovators in Residence.

"Suddenly we weren't just a classroom of students, we were a team working on a society-oriented project and exchanging not only ideas, but also teaching methods. The multidisciplinary approach also taught me how to think outside of the engineering thought box.

Laura Valtonen
Industrial engineering and management student at CBI@ Tampere

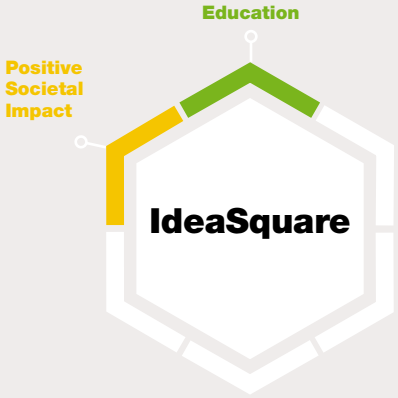
Photobooth

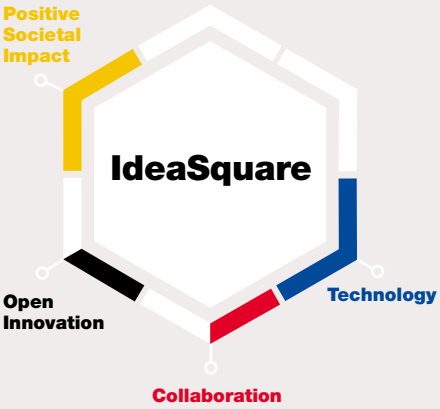
4,995 pictures in 2017
4,645 pictures in 2018

Students, scientists, visitors and people participating at IdeaSquare activities enjoy taking pictures at the PhotoBoot located at the entrance of the building.

→ Special Innovation Events

During short periods when the building is not fully occupied, IdeaSquare can host or facilitate innovation or entrepreneurship-driven events and courses. Such events combine different areas of technology and society with a very specific purpose, organised and funded by external organisations. These events are typically short in duration, lasting up to two or three days. IdeaSquare provides the facilities and can contribute by offering innovation-related education and coaching.





Events, seminars & workshops

The type of events, seminars and workshops taking place at IdeaSquare is diverse. Most of them are driven by innovation and technology, and seek to connect science and technology with social and global challenges. These activities give professionals, scientists and students the chance to experience open collaboration and multidisciplinary work.

Hackathons

Throughout 2017 and 2018 IdeaSquare hosted 26 open hackathons where diverse organisations and universities were invited to drive forward projects dealing with positive societal impact, whilst internal CERN hackathons focused on technology and research related development at CERN. Hackathons take place in a short window of time, usually over one or two-days, during which hand-picked teams work on constructing a prototype and respect a tight deadline through challenge-driven assignments. The largest Hackathon hosted by IdeaSquare is the humanitarian-challenge driven PORT, organised by the PORT Association, which combines creative minds from CERN and non-profit organisations in interdisciplinary teams to work on humanitarian technology-related benefits to society.

CURIOUS MORNINGS

15 participants on average every Tuesday

1640 croissants for breakfast during 2017-2018

Curious Mornings

IdeaSquare has been open for breakfast on most Tuesdays to allow CERN community members and special guests to hear about ongoing projects, share their own projects and ideas and to gather for some nourishment from tea, coffee, croissants and morsels of curiosity. Curious Mornings was an ideal introduction to IdeaSquare in a casual setting. Since it was set up, several projects emerged from these multidisciplinary conversations: a 3D printing project conducted by Marcello Losasso, to an artistic installation by Agnes Chavez who unexpectedly found the inspiration for the Fluidic Data installation which found its place at the CERN Data Centre. This work of art, through the interplay of water and light, assists visitors in visualising both real time and archived data from the Large Hadron Collider while experiencing the magnitude and flow of information coming from the four major LHC experiments: ALICE, ATLAS, CMS, and LHCb.
From prototyping to inspiring artistic responses to expressing the power and essence of technology, the Curious Mornings have aspired to boost serendipitous encounters.

Courses

The courses run at IdeaSquare offer innovation-related education and coaching for experimental innovation purposes. The range of activities is very broad and seeks to reach diverse sectors, both inside and outside the CERN community. For example, the courses offer training to teachers of elementary schools as well as senior company executives, and expand the use of methodologies such as Design Thinking for scientists and technicians at CERN.

(Photo above)
Playing with Protons Course for Greek Primary School Teachers.

Multidisciplinary teams in a Robotics workshop during the IdeaSquare Activity Day.

What's next?

The ATTRACTing Way. As 170 ATTRACT projects start in early 2019, IdeaSquare and the KT Group are expected to help several of them in connecting with innovation-related activities, such as the CBI, and to prepare them for the next phase of ATTRACT by late 2020. IdeaSquare will become a hotspot for the ATTRACT projects applying the principles of IdeaSquare to a new breed of projects, laying new foundations for addressing societal challenges through the use of deep technology.

Further efforts to systematise serendipity

We have a saying at IdeaSquare: "Think big, do good." Don't let your imagination stop you, it's OK to push beyond your dreams. From this point of view we are not so different from philosophers or poets. The students are socially more adaptable, they smell the future. So let us try to help them make their future happen.

Markus Nordberg

IdeaSquare inspires people to think differently, to detach from the reality they know in order to design the future we want to live in. That means building strong critical thinking capabilities, strengthening the ability to question what is established and to ask oneself the obvious. It is about the breaking of assumptions.

IdeaSquare welcomes people to dream big, wide and long-term from a human-centric perspective. We ask people to imagine the future of society, to bombard current challenges with questions to reach unexpected solutions, some of which may be truly revolutionary. This is what we hope the fostered projects will achieve, like in ATTRACT.

The diversity and creativity of the CBI programme teams has lead to creation of possible solutions to address societal challenges with the help of CERN technology, knowledge, and design thinking methods. Exploring this has helped us in shedding light on the innovation processes and strategies for boosting the depth and disruption potential of presented projects. The connections between ATTRACT and CBI need to be systematically explored and further strengthened.

One potential path to explore in this respect is connecting with innovation-driven executive management offered by ESADE, a key partner in ATTRACT. This could help to strengthen the connection between research, business and entrepreneurship.

To continue the leaps forward, a new student programme, with new processes and goals, is being evolved to reach real breakthrough solutions: "Design the Future 2018" is a new experiment to further smash through the frontiers of knowledge and innovation. In Pablo Garcia Tello's (Section Leader - Development of EU Projects & Initiatives) own words: **"*Design the Future" tries to reach beyond the Design Thinking. We want to push students further to break through the borders of their imagination. To imagine an unknown reality, you have to push beyond your assumptions. Even management students have to break their traditional business models and think of new ways to do business*."**

In the words of Saku Mäkinen, editor in chief of the CERN IdeaSquare Journal of Experimental Innovation (CIJ), "*IdeaSquare is and continues to be a vibrant centre for experimentation in creatively solving wicked societal problems, largely described in the UN's SDGs. On top of this, IdeaSquare is also extending the human knowledge-base on how these problems can be solved in various ways by pushing rigorous practice agendas for experiments and reporting the results of these experiments in a scientific manner, facilitating knowledge accumulation and reproducibility*". CIJ is crucial to the mission of CERN and IdeaSquare, because through reporting the outcomes of innovation experiments at IdeaSquare, we can pursue our dream of systematising serendipity and contribute to a better world through new knowledge and technology.

Contact

Would you like to know more about us? We would love to hear from you!
Contact us with any questions or for more information:
ideasquare@cern.ch
http://ideasquare.web.cern.ch/

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Credits
IdeaSquare
Licence to dream
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Location
Building 3179
Entry through LHC Point 1 gate -ATLAS-
Route de Meyrin 385, 1217 Meyrin,
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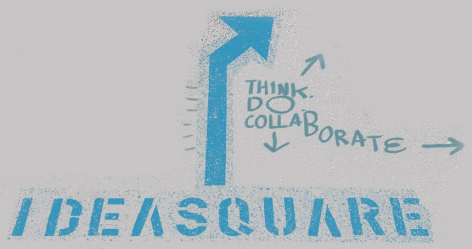
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