



Introduction to the Hungarian R&D Sector

● WHY INVEST IN THE R&D SECTOR IN HUNGARY?

- Rich portfolio of R&D grants
- High level of scientific research, significant results in the areas of physics, mathematics, biology, chemistry, clinical medicine and engineering
- Established knowledge centres and increasing economic role of networking
- Long-standing tradition of innovation, open economy and proliferation of incubator services
- Smart specialisation supported by funding system
- Supportive legal and taxation environment
- Market compatible education: successful cooperation of companies and educational institutes
- Institutions and framework conditions are rapidly developing and partaking in world-class projects
- Closer cooperation between academia and the business sector
- Increasing economic role of networking, cooperation, and innovation clusters
- Hungary ranks 1st among 190 countries¹ according to the “trading across borders” indicator and has the prominent 13th position for “enforcing contracts”
- Human Resources: the annual growth rate of international scientific co-publications and the increase in new doctorate graduates in Hungary is above the EU-average²

1 RIO Country Report 2017: Hungary, European Commission, 2018

2 European Innovation Scoreboard (2017)



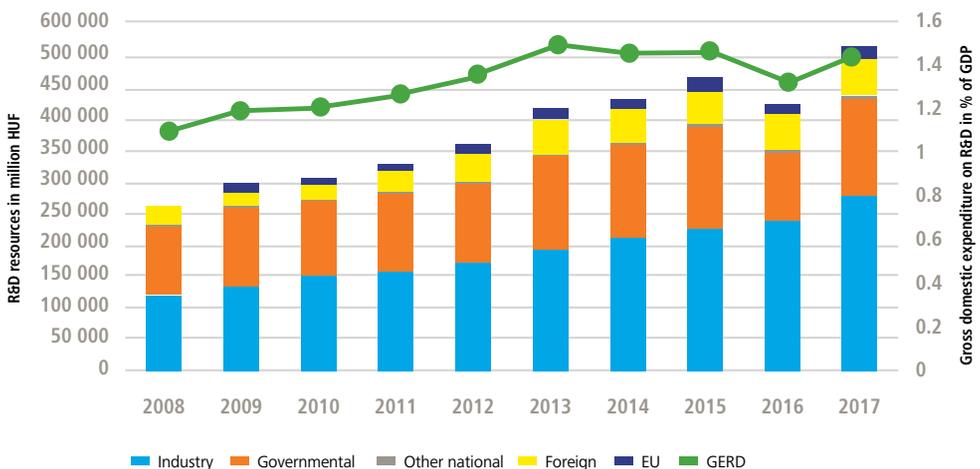
● GENERAL OVERVIEW

The most important factor for a country's high-level R&D&I performance is a balanced innovation system which effectively blends public and private investments, encourages cooperation between companies and scientific institutions, and as a pre-condition enables an excellent and accessible educational and scientific system.

Hungary is an open European economy with a strong industry sector in which foreign investment and technology play a significant role. It has a longstanding tradition in scientific research. Research and development is one of the main priorities of the Hungarian National Economic Strategy; its importance is emphasized in every sector of the Hungarian economy. R&D investment is increasing year by year as a result of the development activity of Hungarian companies, the participation of the Hungarian Government and grants from the European Union.

The importance of innovation in a country can be measured by the Total Gross Domestic Expenditure for R&D (GERD), which shows an upward trend in Hungary:

STRUCTURE OF R&D BUDGET AND GERD



Source: <https://www.statista.com/statistics/420965/gross-domestic-expenditure-on-research-and-development-gdp-hungary/>

http://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_qpt001.html

The statistics show that the peak was in 2013 when GERD represented at 1.39% of gross domestic product in Hungary. However, it fell slightly due to the significant rise of nominal GDP, although this still means an increasing amount of GERD.

Based on the Bloomberg 2018 Innovation Index³, Hungary is the 27th among the top innovative economies in the world. Closer analysis of this index demonstrates that the Hungarian economy is strong in manufacturing value-added⁴ (23.2%⁵) and high-tech density⁶. The Hungarian government invests heavily in business R&D and seeks to promote R&D investment in the economy by granting a preferential tax treatment for eligible R&D expenditures. Hungary ranks 5th among OECD and other major economies in terms of total volume of government support for business R&D, equivalent to 0.31% of GDP⁷. Tax incentives account for 48% of total public (governmental) support for business R&D in Hungary.

● FUNDING OF THE R&I SYSTEM:

The main funding sources of the R&I system are:

- National sources: the National Research, Development and Innovation Fund (NKFIA) integrates two funds: The Research and Technological Innovation Fund (KTIA) and the Hungarian Scientific Research Fund (OTKA). The total budget of the NKFIA for 2018: HUF 82.1 billion (approx. EUR 260 million⁸).
- EU sources: there are six operational programmes of the EU Structural Funds, co-funded by the central EU budget that are available to the Hungarian regions. Their total budget from 2014 to 2020 are the following⁹:
 - Economic Development and Innovation OP (GINOP) Priority 2 (Reinforcement of research, technological development and innovation): EUR 1,687.9 million
 - Economic Development and Innovation OP (GINOP) Priority 7 (Financial instruments to top up R&I support): EUR 2,553.2 million
 - Competitive Central Hungary OP (VEKOP) Priority 1 (Improvement of companies' competitiveness and development of the knowledge economy): EUR 202.2 million
 - Competitive Central Hungary OP (VEKOP) Priority 2 (Financial instruments and development of services): EUR 44.1 million
 - Human Resources Development OP (EFOP) : EUR 898.3 million
 - Rural Development Programme (VP) : EUR 25.3 million

³ Source: <https://www.bloomberg.com/news/articles/2018-01-22/south-korea-tops-global-innovation-ranking-again-as-u-s-falls>

⁴ MVA as % of GDP per capita

⁵ Source: http://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_qpt002d.html

⁶ Number of domestically domiciled high-tech public companies as % of domestic publicly listed companies and as a share of the world's total public high-tech companies.

⁷ Source: <https://www.oecd.org/sti/rdTax%20Country%20Profiles%20-%20HUN.pdf>

⁸ National Research, Development and Innovation Office Budget Proposal 2018

⁹ Pre- Peer Review of the Hungarian Research and Innovation system, Horizon 2020 Policy Support Facility, 2016, p.26



● INNOVATION POLICY

Hungary's innovation policy is the cornerstone of the country's overall development strategy, defined in line with the European Union's cohesion and innovation policies for the 2014-2020 programming period. Foreign-owned players are also eligible for support measures available to all companies operating in Hungary.

○ National Research and Development, and Innovation Strategy

"Investment in the Future - National Research and Development and Innovation Strategy 2020" (RDI strategy) was approved by the Hungarian Government in June 2013. The strategy aims to raise RDI investments, and as a result, to mobilise the Hungarian economy and to strengthen its competitiveness. The strategy was reviewed and assessed in 2017 and submitted for public consultations in 2018. The revised RDI strategy aims to carry out structural changes by 2030 that will significantly increase the Hungarian economy's competitiveness. The revised strategy responds to the EC's recommendations published in 2016 and points out the importance of the increasing number of innovation companies by supporting public-private cooperation in R&I. The strategy has identified priority industries – ICT, biotechnology, cognitive research and nanotechnology –, and distinguishes high quality scientific research as an area of special interest for Hungary. Target value of GERD will be maintained at 1.8% of GDP until 2020 and raised to 3% by 2030¹⁰.



○ National Smart Specialisation Strategy

The Smart Specialisation Strategy (S3) is developed in every member state within the framework predefined by the EU. Hungary's smart specialisation strategy – which is actually a supplementary document of the National RDI Strategy - was approved in November 2014. It sets the directions for the entire country, along with which research, development and innovation are planned to be supported in the most sustainable way, with the greatest social profit and the promise of the best financial utilisation rate.

The Strategy sets up six sectoral and two horizontal research and innovation priorities. These priorities encompass domains, areas and economic activities where Hungary has a competitive advantage or has the potential to generate knowledge-driven growth, and are embedded in the calls of the NKFIH (National Research, Development and Innovation Office) that were published for the new programming period 2014-2020.

Sectoral priorities:

- Healthy society and well-being
- Advanced technologies in the vehicle and other machine industries
- Clean and renewable energies
- Sustainable environment
- Healthy local foods
- Agricultural innovation

Horizontal priorities:

- ICT (info-communication technologies) & Services
- Inclusive and sustainable society, viable environment

Partly from these antecedents the government started to elaborate a new strategy of Industry 4.0 in 2016 (Irinyl Plan). The aim of the Irinyi Plan is to further increase the share of manufacturing in Hungarian GDP with the support of key industries: motor vehicle manufacturing (public transport), the defence industry, the construction industry, the textile industry and medical devices. One of the goals of the strategy is to increase the share of these industries in GDP to 30% by 2020.



● A HISTORY OF GREAT INNOVATION

Historically, Hungary has performed rather well in terms of inventions and patents. There are many inventions that are known and recognised worldwide, although, in most cases, Hungarian scientific inventiveness and innovation are not recognised. Today, the relative strengths of Hungary are in the Knowledge and technology outputs, in particular its high share of high and medium-high-tech manufacturing (3rd globally), creative goods exports as a percentage of total trade (8th globally)¹¹. The most popular inventions include (just a few of the most well-known Hungarian inventions and discoveries from a long list):

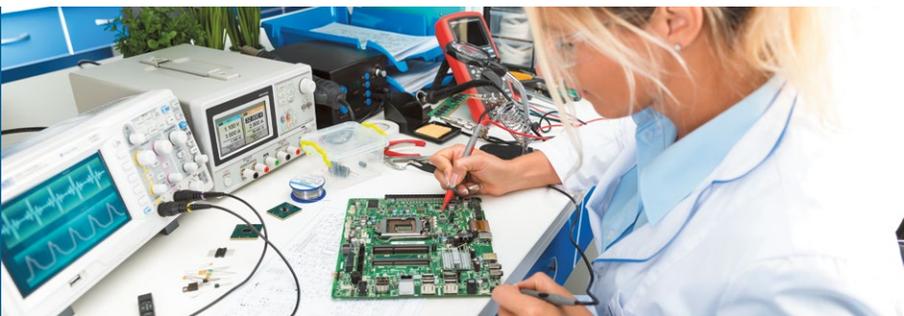
- Segner wheel, water turbine – János András Segner (1750)
- Transformer – Ottó Bláthy, Miksa Déri, Károly Zipernowsky (1884)
- Dynamo – Ányos Jedlik (1861)
- Telephone exchange – Tivadar Puskás (1877)
- Carburettor – Donát Bánki, János Csonka (1893)
- Vitamin C – Albert Szentgyörgyi (1931)
- Nuclear chain reaction – Leó Szilárd (1933)
- Ball point pen – László József Bíró (1938)
- Colour Television – Péter Károly Goldmark (1940)
- Digital computer – János Neumann (1945)
- Holography – Gábor Dénes (1947)
- Basic Programming language – János Kemény (1964)
- Rubik's Cube – Ernő Rubik (1974)

● INNOVATION PERFORMANCE BY SECTORS

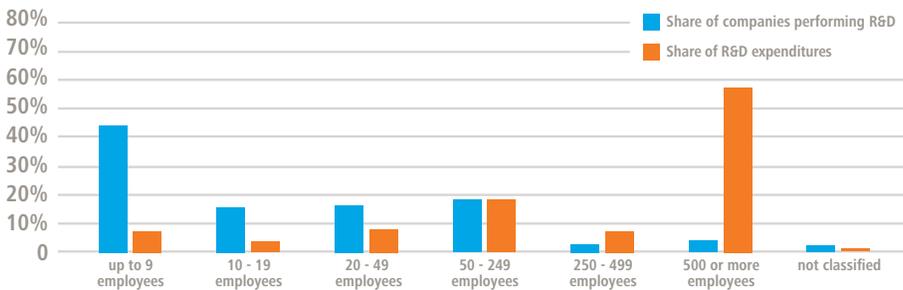
○ Business enterprise sector

The Hungarian private sector has registered notable increases in R&D activities since the country's accession to the EU. The share of the business sector reached in the total of R&D expenditures was 56% or EUR 777 million (HUF 241 billion) in 2016. Large companies accounted for 55.26% of BERD, while SMEs depend on external sources of R&D funding, mostly government and the EU Structural Funds. Central Hungary (along with Budapest) accounts for the majority of corporate R&D, R&D-performing companies and patents. Pharmaceutical, ICT, machinery and automotive companies have the highest contributors to the BERD.

¹¹ RIO Country Report 2017: Hungary, European Commission, 2018



SHARE OF COMPANIES PERFORMING R&D AND THEIR R&D EXPENDITURES BY COMPANY SIZE



Source¹²

The government encouraged the development of the Hungarian start-up ecosystem in the document entitled “Budapest Runway 2.0.2.0. – A Start-up Credo” published in November 2013, which envisions the Hungarian capital as the start-up centre of Central and Eastern Europe within a decade. Four types of measures for building a competitive start-up and innovation ecosystem are proposed: i) education and training, ii) access to funds, iii) taxation and regulation, and iv) an enabling environment.

○ The public R&I sector: higher Education sector and the Hungarian Academy of Sciences

The most important areas of higher education research are health sciences, natural sciences and technical sciences. Industry is intensely engaged with development, the higher education sector collaborated with companies in 37.4% of the more than 2,400 research projects (2014), which is considered high¹³.

The Hungarian Academy of Sciences (MTA), together with its research institutes and its several university research groups, is the largest public research organisation. The HUF 67.6 billion (EUR 211.4 million) budget for R&D expenditure (2017) is particularly significant, while fifteen faculties share this research portfolio¹⁴.

The Academy is involved in several programmes whose aim is to increase the attractiveness of research careers and the efficiency of scientific research.

In the Higher Education Strategy (2014), the government has set a goal of increasing the number of R&D personnel employed by higher education institutions to 56,000 in 2020 (FTE) from the level of 23,647 in 2012 (KSH, 2015b). In addition, there is a target of having 12 R&D employees per one thousand employees by 2020 from the level of 8 registered in 2011 (Ministry for Human Capacities, 2014, p. 35).



¹² Peer Review of the Hungarian Research and Innovation system, EUROPEAN COMMISSION, 2017

¹³ National Smart Specialisation Strategy, Nemzeti Innovációs Hivatal, 2014, p. 17

¹⁴ Source: https://mta.hu/data/dokumentumok/kozerdeku_adatok/2018/MTA%20Titkarsaga%20beszamolo%202017.pdf



○ Collaboration between academia and industry

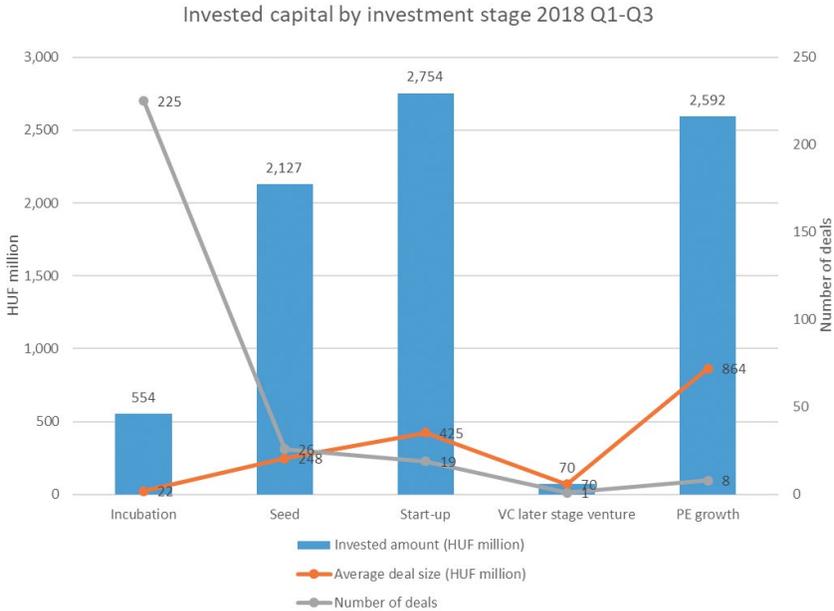
In Hungary, there are R&D-intensive companies that have established close, long-lasting cooperation with universities and play an active role in undergraduate and PhD training. Several multinational companies and large domestic firms triggered a remarkable growth both in expenditure and in the number of R&D personnel.

To support university-industry collaboration Centres for Higher Education and Industrial Cooperation (FIEK) were established in 2017, which will be able to adapt university research programmes in applied science and innovation to industrial needs in the years to come.

KEY PROGRAMMES:

- Ericsson Telecommunications Hungary has developed close cooperation with two major universities: Budapest University of Technology and Economics and Eötvös Loránd University. The collaboration extends to the fields of software, hardware and microwave networks.
- Dunaújváros University and Hankook Tire Hungary launched a joint Rubber Technology Engineer programme in 2009: while the theoretical education takes place at the college, the practical training is conducted in Hankook's state-of-the-art facilities.
- Kecskemét University has established dual vocational training with Mercedes-Benz Manufacturing Hungary and Knorr-Bremse. The aim of the collaboration is to ensure a highly qualified workforce in the field of mechanical engineering.
- The University of Miskolc and the Hungarian Bosch companies founded the Robert Bosch Department of Mechatronics in 2005, supporting practical and research activities in the engineering sciences.
- The more than ten-year-old collaboration between Audi Hungaria and Széchenyi István University of Győr (SZE) reached a new milestone in 2015 with the establishment of the Audi Hungaria Faculty of Vehicle Engineering at SZE.
- Knorr-Bremse and the Budapest University of Technology have had a joint research programme running since 2011 to develop a method for the qualification of cured rubber products.
- IBM and the Budapest University of Technology have been jointly operating a software technology lab since 2009.
- The Hungarian Oil Corporation (MOL) and University of Pannonia have had a department of hydrocarbon and Coal processing since 2009, which together with the Chemical Engineering Institute has achieved numerous industrial results.

VENTURE CAPITAL INVESTMENT IN HUNGARY IN PHASES¹⁵



There are numerous opportunities for both private and state financed accelerators. One of the key players is Hiventures, a state-owned venture capital fund. It has a EUR 160 million budget to invest in incubation, seed, and start-up phase companies.

Hungary is one of the most active countries in VC investments in Europe due to the EU's VC development programme JEREMIE ("Joint European Resources for Micro to Medium Enterprises"). JEREMIE provides several means of enterprise development, with financial support from the European Investment Bank (EIB) and its venture capital arm, the European Investment Fund (EIF). The new JEREMIE Programme launched in 2018 provides HUF 75 billion (EUR 234 million) venture capital for promising Hungarian innovations. These funds, with complementary sources of investment, will boost resources and provide support to a larger number of enterprises with disruptive and innovative technological development. Eight venture capital funds will be responsible for allocating the funds: X-Ventures Alpha Kockázati Tőkealapkezelő Zrt., X-Ventures Béta Kockázati Tőkealapkezelő Zrt., CV Alapkezelő Zrt., Primus Capital Kockázati Tőkealapkezelő Zrt., DBH Investment Kockázati Tőkealapkezelő Zrt., Finatech Capital Kockázati Tőkealapkezelő Zrt., Bonitas Befektetési Alapkezelő Zrt. and Gran Private Equity Zrt.



● EUROPEAN R&D COOPERATION

○ European Framework Programmes for Research and Technological Development

European cooperation in R&D and Innovation is increasing both in scope and importance. Most cooperative R&D projects in Europe are carried out within the European Framework Programmes for Research and Technological Development, such as FP7 (2007-2013), Horizon2020 (2014-2020) and Horizon Europe from 2021. Hungary's performance in FP7 ranked high among newly accessed member states (EU13):

- 1,582 participants receiving EUR 280 million¹⁶
- Rank in grant awarded: sixteenth (EU28); second (EU13)
- Rank in number of participants: sixteenth (EU28); second (EU13)
- Top collaborative links: Germany; United Kingdom; Italy; France; Spain.

○ Horizon 2020 (AS OF NOVEMBER 2018):

- 804 participants receiving EUR 214.1 million¹⁷
- 2,043 SMEs (Small and Medium Enterprises) receiving EUR 64.19 million
- Ranking in grant awarded: 20th (EU28); 3rd (EU13)
- Rank in budget share: 20th (EU28); 3rd (EU13)
- Top collaborative links: Germany, United Kingdom, France, Spain, Italy.

TOP BENEFICIARIES OF THE HORIZON2020 (AS OF NOVEMBER 2018):

Name	EC financial contribution in € M
INSTITUTE OF EXPERIMENTAL MEDICINE - HUNGARIAN ACADEMY OF SCIENCES (IEM HAS)	16.07
KÖZÉP-EURÓPAI EGYETEM (CEU)	15.06
NEMZETI KUTATÁSI FEJLESZTÉSI ES INNOVÁCIÓS HIVATAL (NKFIH)	14.18
MAGYAR TUDOMÁNYOS AKADÉMIA SZÁMÍTÁSTECHNIKAI ÉS AUTOMATIZÁLÁSI KUTATÓINTÉZET (MTA SZTAKI)	11.2
BUDAPESTI MŰSZAKI ÉS GAZDASÁGTUDOMÁNYI EGYETEM (BME)	8

16 Source: https://ec.europa.eu/research/fp7/index_en.cfm?pg=country-profile

17 Source: <https://webgate.ec.europa.eu/dashboard/sense/app/93297a69-09fd-4ef5-889f-b83c4e21d33e/sheet/PbZJnb/state/analysis>

○ European Institute of Innovation and Technology / Knowledge and Innovation Communities

The European Institute of Innovation and Technology (EIT), established in 2008 with its headquarters in Budapest, is the first Europe-wide institution based in Hungary. The EIT is the EU's flagship institute designed to connect European business and research, and to integrate innovation, research and economic growth in Europe. The mission of EIT is carried out through the so-called Knowledge and Innovation Communities (KICs), integrating European innovation platforms of leading European stakeholders from industry, academia and policy. Hungarian participation in established KICs:

- Climate-KIC: Central Hungary hosts a regional implementation and innovation centre
- EIT Digital has an Associate Partner Group consisting of two universities (BME and ELTE) and their industrial partners (consortia partners: Ericsson Hungary, Magyar Telekom, OTP, MTA Sztaki, E-Group, Evopro, Nokia, e-Biz, ELTE Soft, external partners: ABC Accelerator and University of Ljubljana).
- KIC InnoEnergy has an Accelerator HUB in Budapest providing access to proven business coaches and mentors across Europe. It helps entrepreneurs to transform their ideas into successful businesses.
- KIC Health has its headquarters in Budapest and there are five Hungarian Innostar partners: GE Healthcare, Semmelweis University, Budapest University of Technology and Economics, E-Group and CRU Hungary Ltd.

● ATTRACTIVE INCENTIVES IN THE R&D SECTOR

The Law on scientific research, development and innovation in 2014 established the National Research, Development and Innovation Office ("NRDI"). The NRDI integrates the activities of previous ministry departments. It is responsible for preparing, updating and evaluating national R&D policies and strategies, creating and maintaining an attractive incentive system for innovation in Hungary and coordinating intergovernmental science and technology cooperation.

Hungary provides one of the most favourable tax environments for developments, including R&D&I. There are both front-end incentives (at the time when costs arise) and back-end allowances in corporate income tax for the post-investment period. Additional allowances are provided on the labour side as well, e.g. for social security contributions.

With the aim of transforming the Hungarian economy into a remarkable advanced manufacturing and innovation centre of Europe, new forms of cash incentive measures were introduced from 01 January 2017 to enhance corporate R&D activities and the realization of technology-intensive investments. The incentives are based on individual government decisions and managed by the Hungarian Investment Promotion Agency¹⁸.

18 Source: http://www.investhipa.hu/index.php?option=com_content&view=article&id=141&Itemid=953



● KEY DEVELOPMENTS IN RESEARCH AND INNOVATION

Low barriers to entrepreneurship resulted in a strong increase in the share of international patents from 2000 to 2012¹⁹. Business enterprises can benefit from indirect support measures: tax incentives for R&D, and through institutional funding in collaboration with public research organisations. Hungary has proven excellence in its science base and the presence of highly innovative international enterprises, and the government aims to better exploit its intellectual capital, hence the increased willingness to develop and implement demand-side innovation policy measures, such as public procurement of innovation (PPI) and pre-commercial procurement (PCP).

○ Main R&I developments in 2018²⁰

- Updating the National RDI Strategy 2013-2020 is in progress. It is forecast that the renewed RDI strategy will be adopted in the course of 2019²¹.
- The National Research Infrastructure Roadmap was published. It aims to identify the major research infrastructures in Hungary, provides an insight into their operation, presents the nature and diversity of domestic capacities, draws the attention of the national and international research community to Hungarian research capacities and opportunities, provides background information for setting further development directions, and outlines connection points to European infrastructures and cooperation relationships²².
- Mid-term Policy Strategy of Gear Shift in Higher Education, Action Plan 2016-2020, is under implementation supervised by the Ministry of Human Capacities²³.



19 Science, Research, and Innovation performance of the EU, by the European Commission, 2016, p. 56

20 RIO Country Report 2017: Hungary, European Commission, 2018

21 <http://nkfih.gov.hu/policy-and-strategy/rdi-scenario-analysis>

22 Source: <http://nkfih.gov.hu/english-2017/strategy-making-by-the/hungarian-research>

23 Source: <https://net.jogtar.hu/jogszabaly?docid=A16H1785.KOR×hift=ffffff4&treferefer=00000001.TXT>

● SUCCESS STORIES FROM THE R&D SECTOR

Prezi.com

The Company provides cloud-based presentation software and a presentation database. It started in 2009 and has expanded its user base rapidly year by year. By the end of 2015, the number of registered users exceeded seventy five million, and the number of presentations created is already beyond two hundred and sixty million. With these figures, Prezi.com is the world's biggest open presentation database. It received an investment of USD 57 million in November 2014, which indicates the huge potential of the development.

Ustream

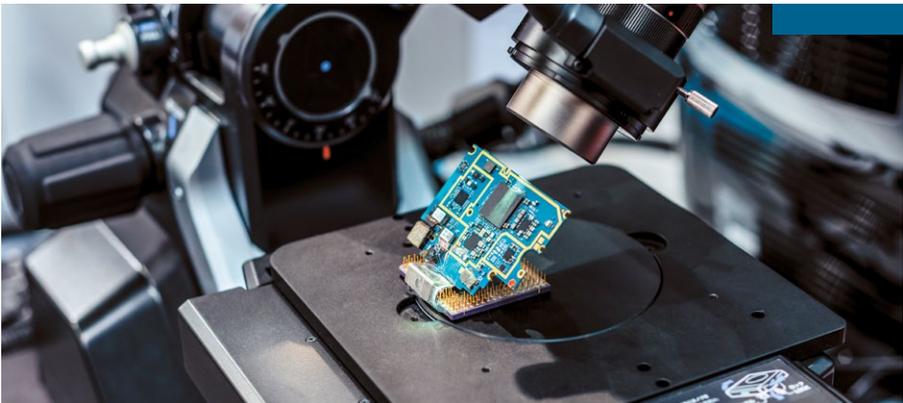
Founded in 2007. Provider of an open live video streaming platform that can simultaneously handle one and a half million viewers. In the last two years, it has increased profits and turnover by 400%. At the end of 2014 it achieved a monthly average of 50 million users. In 2008, Doll Capital invested USD 11 million in Ustream, and in 2010, Softbank injected USD 20 million of capital into the company. Ustream was acquired by IBM in 2016, in a deal valued at USD 130 million (price not confirmed by IBM).

3DHISTECH

3DHISTECH develops and manufactures high speed digital slide scanners that create high quality brightfield and fluorescent digital slides, digital histology software and tissue microarray machinery. The company is one of the market leaders in the field of digital pathology with more than eight hundred systems sold worldwide to large pharmaceutical companies like Roche and Sanofi-Aventis as well as to leading research institutes such as Harvard Medical School or Vanderbilt University. Founded in 1996 by European Inventor Award finalist Dr Béla Molnár, 3DHISTECH employs 120 people and realises a turnover of EUR 8 million.

LogMeIn

LogMeIn Inc., founded in 2003 in Budapest, is a provider of software as service and cloud-based remote connectivity services for collaboration, IT management and customer engagement.[3] The company's products give users and administrators access to remote computers. There are over 300 million devices connected through LogMeIn servers, and they are ranked as the most reliable remote access tool. The company employs more than 800 people around the world. LogMeIn completed an IPO in 2009 and has a market capitalisation of USD 2 billion.





NEXT generation production systems

NEXT is the biggest initiative ever undertaken in Europe in the production systems area. This project integrates the complete value-chain for the European manufacturing industry with the aim of determining the machines of the future, providing substantial reduction of environmental impact and enhanced machine performance via automation and new materials usage. The consortium developed a new business paradigm for the customer-producer relationship, transforming it into a long-term partnership based on sharing risks and increasing mutual benefits, providing a major competitive edge to Europe in a huge global market.

Blockchain Competence Centre (BCC)

BCC is a Budapest based Center which gathers and provides Blockchain competence to players from all industries. Among others things, BCC focuses on advisory, requirement assessment, training, support and the leading of Blockchain related projects with Blockchain development resources. BCC provides management consulting, which services are specialized for the Blockchain industry.

Bitrise

Bitrise, a former Y Combinator start-up, is a mobile continuous integration and delivery platform for app developers, including firms such as Foursquare, Fox, InVision and Grindr. Bitrise was founded in 2014 by Barnabas Birmacher, Daniel Balla and Viktor Benei and has raised USD 3.5 million from investors that include Fiedler Capital, OpenOcean and Y Combinator.

Synetiq

Synetiq uses biometric sensors to measure the way audiences respond to media and marketing content. Clients include the BBC, Vodafone, IKEA, HBO, Tesco and Heineken, to name but a few. Synetiq was founded in 2014 by Adam Divak and David Ottlik, and has raised USD 1.1 million to date from investors that include Google Launchpad, Day One Capital, Startup Sauna, Andgo Partners and PortfoLion.