

Advanced nuclear projects as a driver of high-tech development - opportunities and options

Rut Bízková, Central Bohemian Innovation Center

Every country has its own "best" and Czech Republic has it too - the Czech Republic is not only in the "heart" of Europe, but it is one of the countries that for more than 30 years the supporters of the use of nuclear energy is overwhelming dominant over those against it.

Another Czech "best" is the volume of EU funds invested in research and development. The emergence of 48 newly built state-of-the-art research centers give our country an extraordinary opportunity to become the scientific heart of Europe, a place where people not only enjoy good living conditions, but which also offers well-equipped research institutions and excellent education at high-quality universities.

R & D statistics

Some time ago the Czech Republic was referred to as the "country of assembling plants." Investment incentives have attracted a number of large companies, which have built up large-scale production capacity. The automotive industry is still the strongest sector representing more than 10% of the Czech exports. Car production binds a considered number of subcontractors from plastics, glass, rubber and other industries, generating a large share of the national GDP.

Nevertheless, we have ceased to be the country of assembling plants. Large investments on research, both in the public and private sectors, have transformed the Czech Republic into a development location. Let's see some statistics. Investment in research, from foreign companies, increased threefold in ten years and increased 2.5 times the number of employees during the same period. Today, 35 % of the researchers are employed by the largest foreign companies followed by the Czech owned medium sized companies. In a ten-year period, the spending of large foreign companies on research have gone from just over CZK 7 billion to almost CZK 22 billion.

The Czech Republic's annual financial support to research represents about 2 % of GDP, which is comparable with the EU average. Although, over half of the funding is paid by the private sector whose expenditures show the fastest growth. However, government spending and other resources from the EU structural and investment funds play also an important role. The government funding support for basic research is particularly higher than for applied research. Conversely, companies quite dominantly invest in applied research and experimental development.

The number of people involved in research is growing. It is worth noting that today we are at the same level as the European average. Per one thousand people employed, 15 are researchers and more than 20 are additional staff in research. Basic research is mainly concentrated in the Academy of Sciences while applied research is more typical for universities. A total of 2,800 research centres exist in the Czech Republic, of which the vast majority are operated by companies. This total number includes 54 institutes of the Czech Academy of Sciences of the Czech Republic, 26 public and state universities, university

hospitals, 17 public research institutions and other organizations supervised by the ministries. On top of that, it also includes the newly built research infrastructures established with the received support from the European Structural Funds - 48 new research centres specialized in natural and technical sciences, medicine, nuclear research and other fields.

Long-term research is concentrated mainly in the capital city of Prague and the Moravian city of Brno (the second largest city). European funds have helped certain "equalization of opportunities" between these two cities, since Brno was eligible to build research capacity within European money, whereas Prague was not (Prague is one of Europe's richest cities, therefore it exceeds the eligibility criteria for support according to some of the EU funds). Moreover, many centres were established near Prague and a significantly amount of funds were invested to support research in Ostrava (the third largest city), in addition to other university towns like Olomouc, Plzen and České Budějovice. With some level of exaggeration, we can say that with the support of EU funds the Czech Republic has begun to write a new chapter on research and improvement in social conditions for the development of its regions and the country as a whole.

Four representing stories

IT4Innovations – National Supercomputing Center

Moravian-Silesian region is historically a synonym for coal and steel. Its main city Ostrava was called in the past the "steel heart of the Republic". Mining, metallurgy, coal-based energy and heavy chemistry prevailed and up until today still form a very important part of the production of this industrial region. Research, whose base lies in several major private research organizations and the Technical University of Ostrava (VSB) - Czech fifth largest university - was also focused on these fields in the past. With the support from European funds, the VSB has established several infrastructure centers for materials research and energy and one large infrastructure of international importance, IT4I, which it owns and operates, belongs to the Top100 most powerful supercomputers worldwide. This new research infrastructure provides to the region with completely new options. Simply saying, school now generates more IT crowd and less miners.

STAR – Science and Technology Advance Region

Similar to other capital cities in the world, Prague surroundings suffer from a sort of vacuum effect: Prague – home of many big companies, of at least one third of all research potential of the Czech Republic, and of eight of the 26 Czech universities - attracts the attention of those who are interested in cutting-edge education and research. Nevertheless, the Star region - something that is somewhat similar to the Weizmann Institute in Israel - has emerged just outside of Prague in recent years. Three large research infrastructures, responding to the "challenges of the future" - projects ELI, HiLASE and BIOCEV - have grown on the territory of several municipalities. First of these projects, ELI, is part of the pan-European structure for examining physical background of lasers. Its other parts are located

in Hungary and Romania. With a certain (small) exaggeration, we talk about ELI, which will soon become part of a new entity - an international scientific organization - as the workplace of future novelists.

HiLASE studies the practical applications of lasers (e.g. in 3D printing). BIOCEV is a large research center for cellular biology and virology, functional genomics, protein and tissue engineering, biotechnology and for the development of therapeutic and diagnostic procedures.

The triangle formed among these infrastructures gives enough space for those who would like to establish research-based startups. The Central Bohemian Innovation Centre (SIC) located in the vicinity provides support to such activities. The whole area bears the common name - Star region - a region where people not only do research and develop but also live, and educate themselves. As such, this place that is so close to Prague has a centripetal force. All due to new scientific work and smart management of local municipalities.

JIC - South Moravian Innovation Centre

South Moravian Region was the first one to develop and adopt the Regional Innovation Strategy in 2001. Based on it and for its implementation JIC was established afterwards. During more than 15 years the local government, the City of Brno, research organizations and universities in the region found their “common language” and started to work together on the development of the innovative potential of the region. The result is a growing number of new successful companies, of which more than 200 technology startups and companies have gone through the JIC program. Today, JIC is an innovative center of European significance with three buildings, two subsidiaries and nearly 50 employees.

SUSEN

In the municipality of Řež, located near Prague, was built a new research infrastructure for energy technologies called SUSEN (Sustainable Energy) belonging to ÚJV Řež, the biggest research institute in the nuclear field. The project, approved by the European Commission in 2011, today marks a new challenge for nuclear research in Central Europe. It strengthens the basis for material and technical research for nuclear energy, the research into the new generation of nuclear reactors and the development of advanced technologies. With four major research directions - technological experimental circuits (TEO), structural and system diagnostics (SSD), nuclear fuel cycle (NFC) and material research (MAT) – it gives an extraordinary opportunity for international cooperation. There is extensive R&D in the countries that are potential supplier of new nuclear resources for the Czech Republic. In all the countries from which the potential suppliers of new nuclear resources in the Czech Republic come from, there is very extensive research and development. The Czech research base is competitive and gives the opportunity to involve foreign experts into it or let other specialist do "research" about research problems from multinational companies or other large foreign companies. R&D is a very good opportunity for something like an “offset program” that accompanies the construction of new energy sources.

The country where the word "robot" has its origin

Czech Republic has a very long and rich industrial history. At present, it belongs to the European countries with the highest share of industry in national wealth (gross value added). It is therefore an opportunity for us, as well as, the risk that - due to the "digitization of everything", using the Internet, the rapid transmission of large volumes of data and processing independently of the point of origin - the way of industrial production will change completely, which it may mean fundamental change of the way of life of people. Robotic production, decentralized energy production, autonomous transportation are challenges that can only be overcome when we are able to innovate fundamentally to change products, services, processes, implement new ideas and people needs. The Czech Republic's research institutions are well prepared for this change. There are three centers with centripetal force, named: Prague - Smart City, Brno - Silicon Valley and Ostrava - Smart Energy. We are ready to solve everything related to the new conditions of people's lives in the 21st century, and whatever is associated with digitization and new energy. Research of new materials, technologies, new fields of medicine, biotechnology and nanotechnology are a natural part of this solution. In the long term the Czech Republic is exceptionally strong in chemical sciences, mathematics and physics. For all of this we have our own research potential - both in equipment and in human resources.

Overall, Czech Republic is a country extremely well prepared for international cooperation in research and development – and also in new nuclear technologies.