

Workshop on “Universities as motors of innovation in Central and Eastern Europe”

Organised by EUA *within the framework of the EUA Expert Group on Research and Innovation Strategies for Smart Specialisation (RIS3)*

Hosted by University of Warsaw

Thursday, 13 October 2016



TECHNICAL UNIVERSITY OF KOŠICE



Strategic roles of the Technical University of Kosice in the implementation of regional innovation ecosystem

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What is an Innovation Ecosystem?

(the analogy with biological ecosystems)

Biological ecosystem

- is a complex set of relationships among
- the **living resources**, **habitats**, and **residents** of an area,
- whose functional goal is to maintain an equilibrium sustaining state.

The *equilibrium* state is described by modeling the energy dynamics of the ecosystem operations

Innovation ecosystem

models the economic dynamics
of the complex relationships
that are formed between:

actors

- *material resources* (funds, equipment, facilities, etc.)
- *human capital* (students, faculty, staff, industry researchers, industry representatives, etc.)

or

entities

(e.g. the universities, business firms, venture capitalists, industry-university research institutes, Centers of Excellence, funding agencies, policy makers, etc.)

whose functional goal is to enable

- **technology development**
- **and innovation.**

The innovation ecosystem comprises two distinct, but largely separated economies,

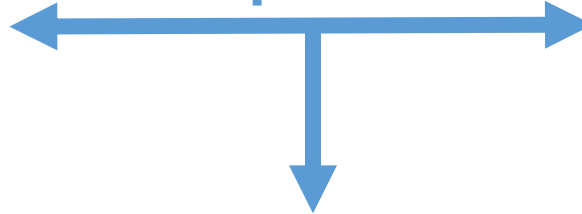
1. **knowledge economy**, (driven by fundamental research),
2. **commercial economy**, (driven by the marketplace).



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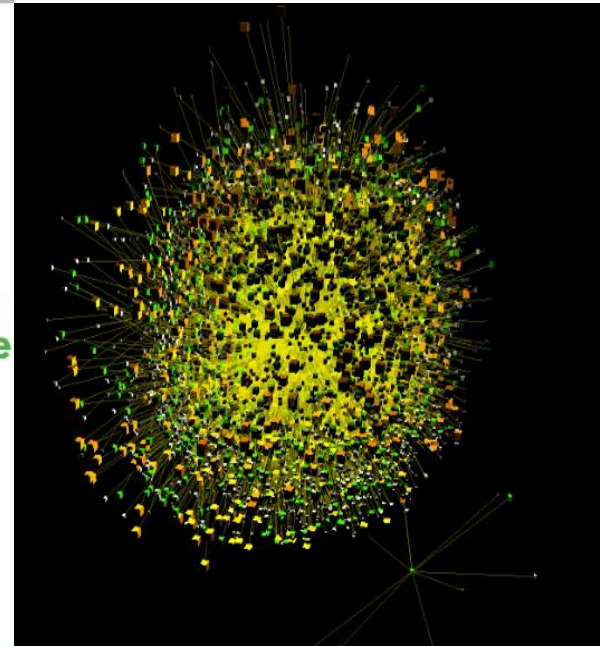
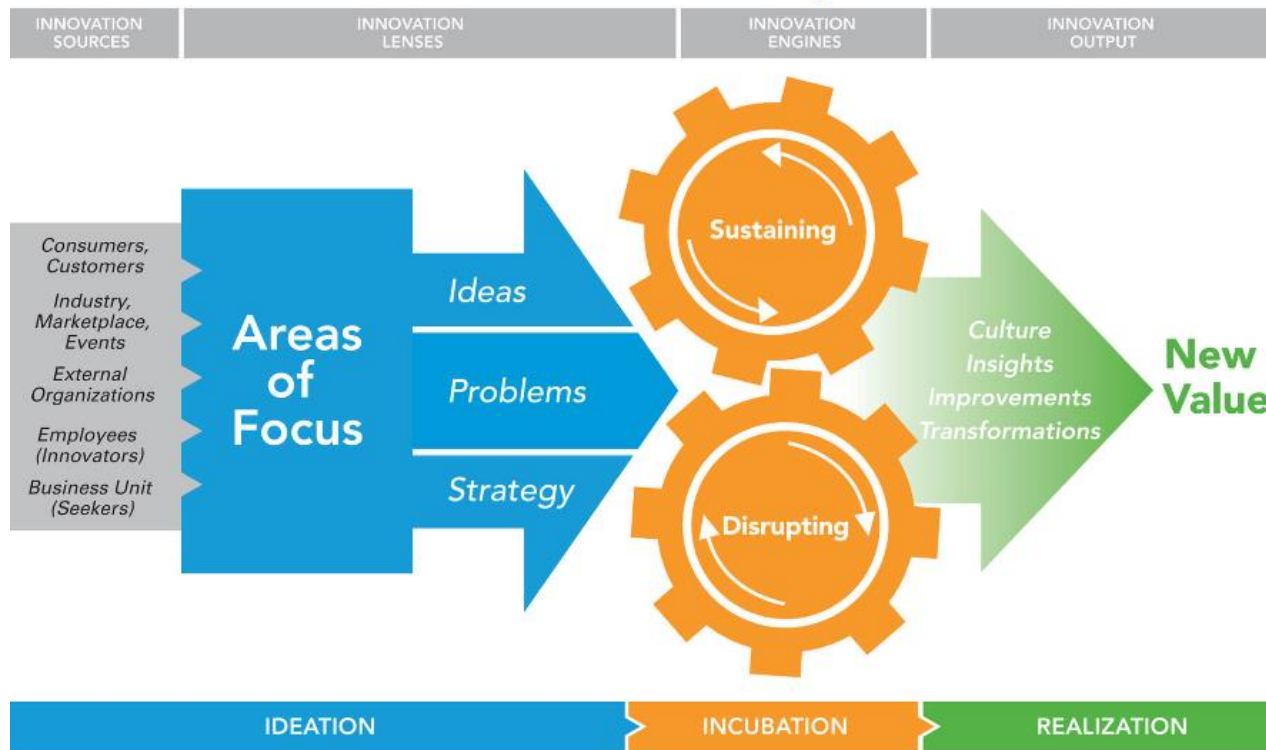
Cooperation



RIS of Košice Region 2016 +

Regional Innovation Strategy *in accordance with*
National and Regional Research and Innovation Strategy for Smart Specialisation

Innovation Ecosystem



Vision of RIS 2016+: Košice region economically grows and has a developed innovation platform and open collaboration in research, development and innovations

Measurable indicators: economic performance of the region, investments in research and development, the number of innovative companies, number of start-ups, the number of scientific and engineering personnel, the number of excellent research workplaces, university science parks, technology and competence centers, number of patents, the share of goods and services with higher added value, the share of goods and services with greater added value for export

Mission: By means of the mutual cooperation of all stakeholders using internal innovation potential and available financial resources to achieve prosperity of the Košice region

Pillars of RIS 2016+

**Excellence in
research and
development**

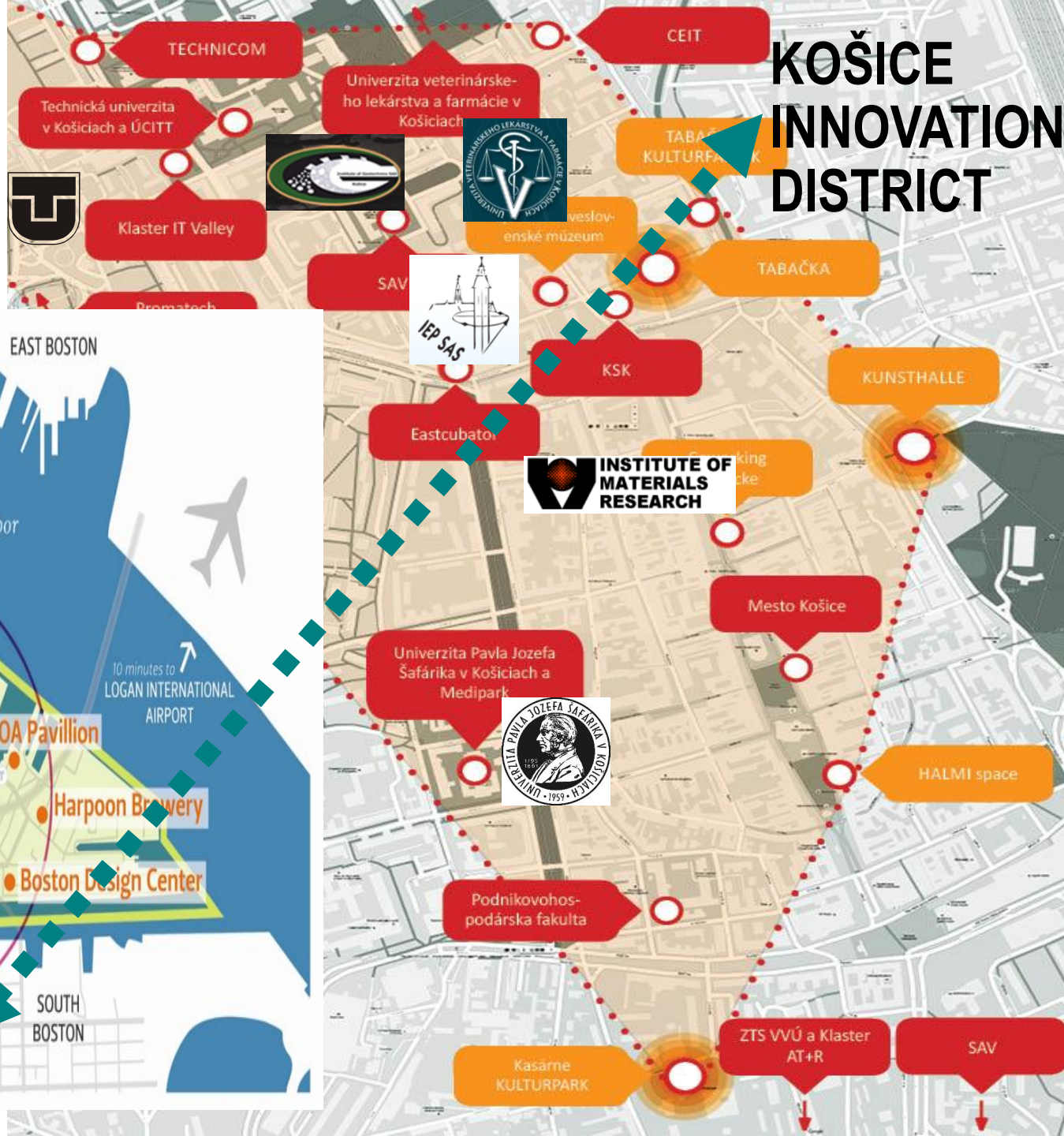
**Commercialization
of research and
Innovation**

**Support of
innovative
business and
promising
sectors**

**Quality human
resources for
increased
innovation
performance of
the region**

Regional innovation ecosystems at the European level

KOŠICE INNOVATION DISTRICT





TUKE – is a strong player



Cities	2
Campuses	3
Buildings	80
Area	50 ha

TUKE faculties:

1. Mining, Ecology, Process Control and Geotechnology (1952)
2. Metallurgy (1952)
3. Mechanical Engineering (1952)
4. Electrical Engineering and Informatics (1969)
5. Civil Engineering (1977)
6. Economics (1992)
7. Manufacturing Technologies (1992)
8. Arts (1998)
9. Aeronautics (2005)



TUKE – is really a strong player !

1

interesting composition of faculties

1. Mining, Ecology, Process Control and Geotechnology (1952)
2. Metallurgy (1952)
3. Mechanical Engineering (1952)
4. Electrical Engineering and Informatics (1969)
5. Civil Engineering (1977)
6. Economics (1992)
7. Manufacturing Technologies (campus in Presov) (1992)
8. Arts (1998)
9. Aeronautics (former University of military) (2005)

**more than
77.000 alumni**

2

teacher/student

3

robustness

9 050 students,

808 pedagogical staff

750 others (administration, technicians)

→ **125 mil. EUR total current assets !!!**

→ **73 mil. EUR total revenue per year 2015:**

→ **42 mil EUR government support**

→ **31 mil EUR from other sources!**



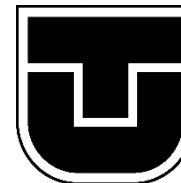


ACCREDITATION

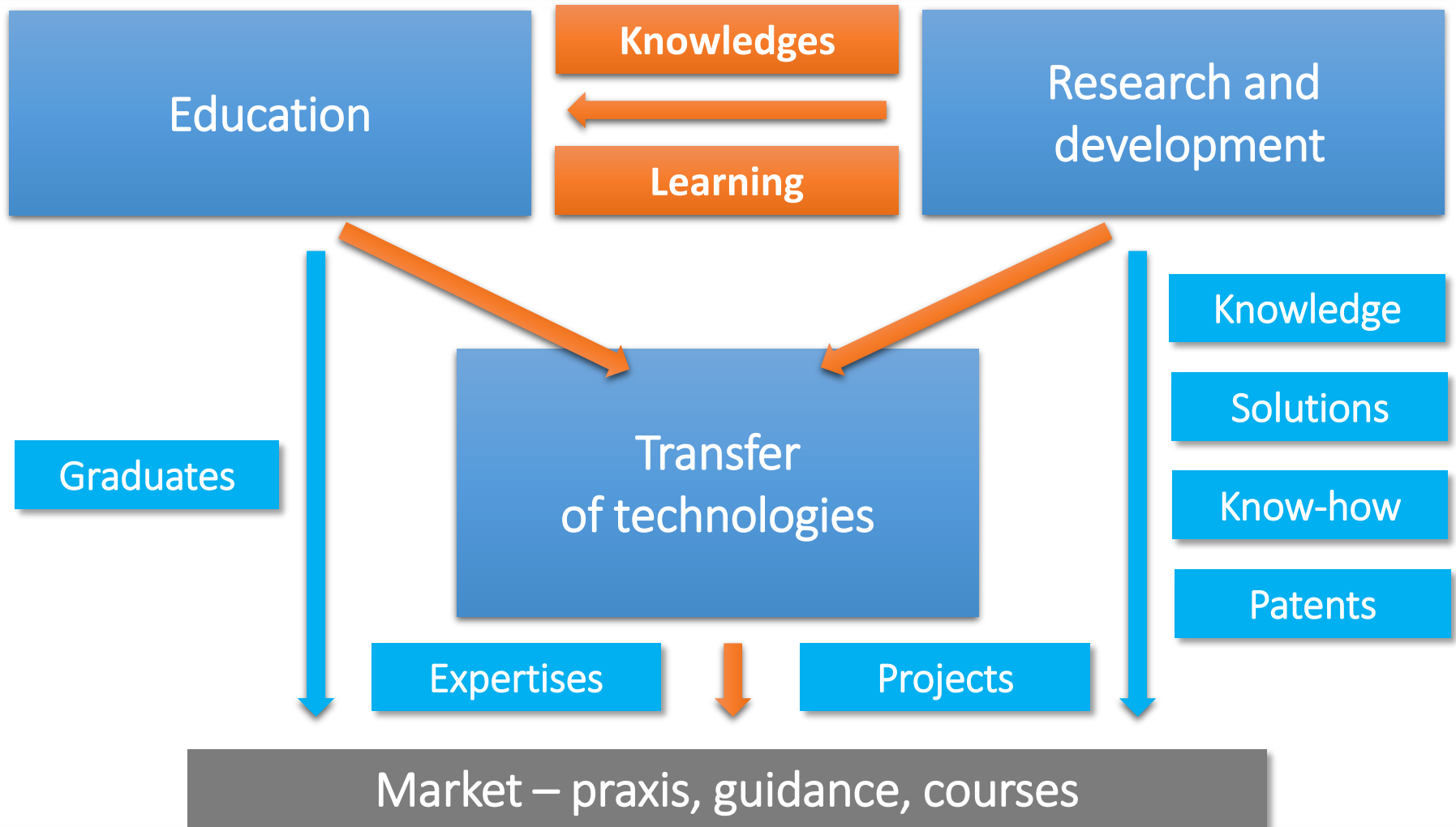
Conclusion: **TUKE – Research University**



One of the 4 best universities in Slovakia



BASIC ROLES OF THE UNIVERSITY



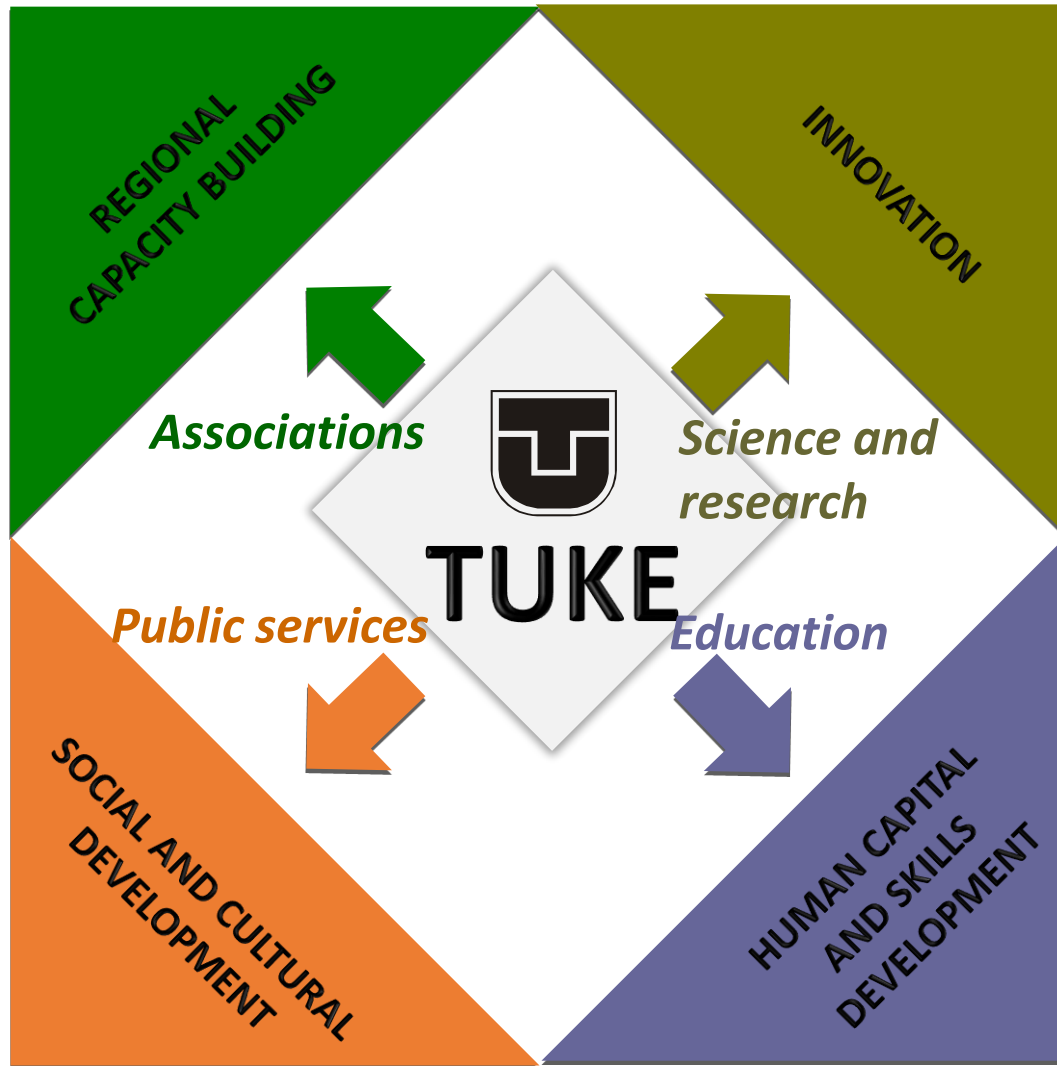
External pressures:

- ▶ **Insufficient resources for education and research**
- ▶ **European and global world competition in the knowledge ecosystem**
- ▶ **The need for solutions of major difficult challenges of mankind**

Internal pressures:

- ▶ **The needs of multi-disciplinarity and inter-disciplinarity**
- ▶ **The need for concentration of research (not atomization)**
- ▶ **The challenges raised by the international assessment and competition in the academic and university sector**
- ▶ **The need for commercialization of innovative ideas and inventions (transfer knowledge)**
- ▶ **The need for rationalization of the process: ideas - innovation - research (University + Experience = Products)**
- ▶ **Sometimes insufficient and limited infrastructure and others**

POSITION
of the Technical University of Kosice
in innovation ecosystem



The role of universities in regional development (I)

Regional
innovation

Research function
of the university

vedecký a technologický park
TECHNICOM



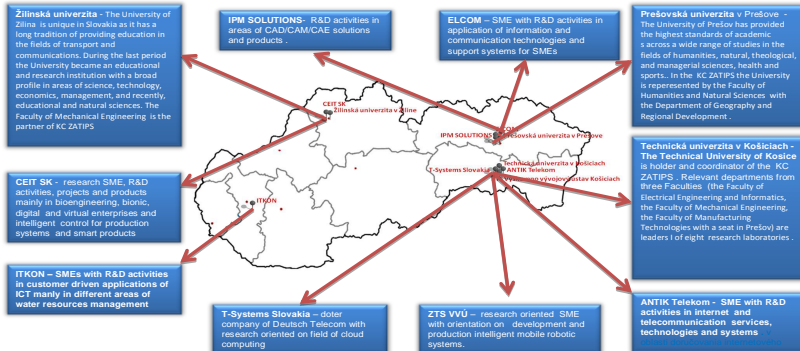
5

Centres of excellent research

COMPETENCY CENTRE

KC ZATIPS

COMPETENCY CENTRE FOR KNOWLEDGE TECHNOLOGIES APPLIED AT
INNOVATION OF PRODUCTION SYSTEMS FOR INDUSTRY AND SERVICES



CENTER VUKONZE



Research center for efficient integration of the renewable
energy sources (Center VUKONZE)

in R&D activities are oriented on:

*Technologies of the biomass utilisation in energy sector;
Collection and utilization of solar energy and technologies for hydrogen utilisation and storage;
Efficient exploitation of the geothermal resources obtaining from the short and long depths;
Efficient integrations of different renewable energy (multi – valence) sources according to customer need and conditions (model of the customer as smart low energy building is applied);*

Areas

• ICT- information and communication technologies • Knowledge-based technologies • The use of domestic raw materials and resources • Waste recycling and processing of waste • Renewable energy • Automotive industry - Robotics, automation - Plastic technologies - Automotive components and electronics • The use of wood, timber structures • Ceramic materials • Logistics

Innovation = science and research



Centre of information and communication technologies for knowledge-based systems



Centre of gaining and processing of earth resources



Centre for integrated research of progressive building structures, materials and technologies

Centres of excellent research



Center of research and control of technical, environmental and human risks of sustainable development of production and products in mechanical engineering



Centre of integrated research and use of progressive materials and technologies in automobile electronic



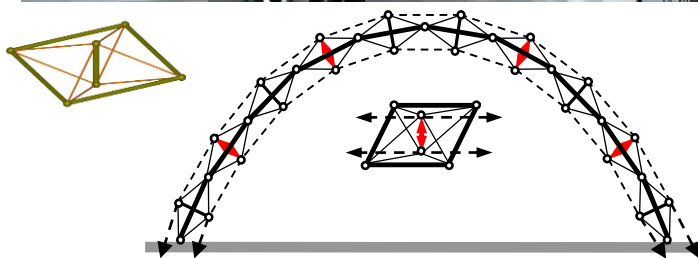
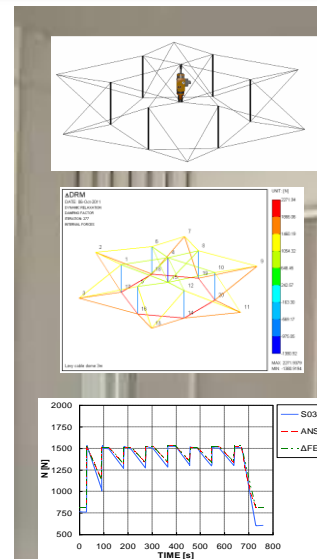
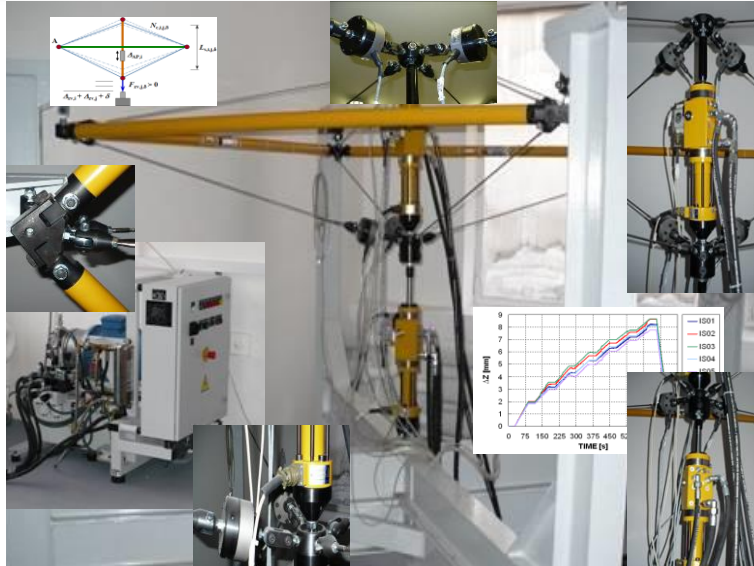
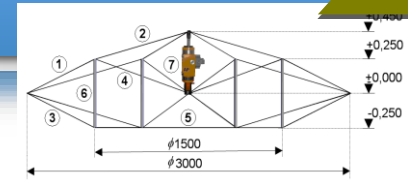
Európska únia
Európsky fond regionálneho rozvoja



Operačný program
VÝSKUM a VÝVOJ

Centre of excellence for integrated research of progressive building structures, materials and technologies

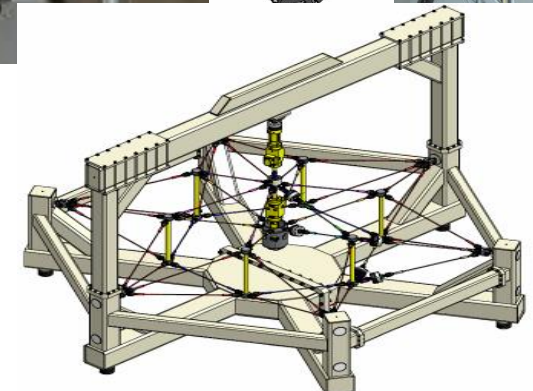
● Development of adaptive tensegrity structures



● Publications in CC journals: *Journal of Non-linear Mechanics*, *Strain*, *Advances in Engineering Software*, *Structural Engineering and Mechanics*



TECHNICAL UNIVERSITY
OF KOŠICE



Why adaptive structures: able to resist to the accidental loads

An active structure (also known as a smart or adaptive structure) is a mechanical structure with the ability to alter its configuration, form or properties in response to changes of various physical fields in the environment.

- Sensors are one key component of any adaptive systems.
- Actuators are the elements, which cause changes in the controlled system, in order to achieve the desired specified condition.
In the case of civil engineering bearing structures

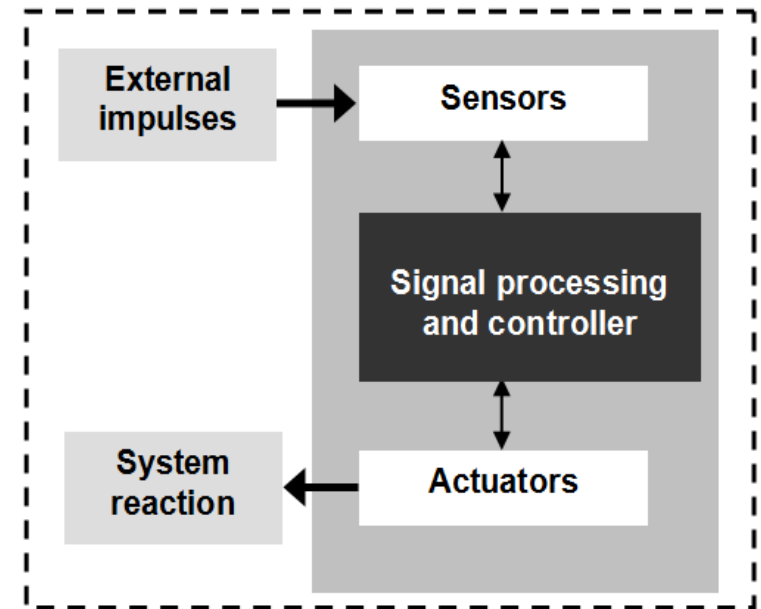
- reliability conditions

- ▶ Ultimate limit states

- ▶ Serviceability limit states

Hydraulic, pneumatic and electrical actuators

- Control unit and signal processing play an substantial role in an adaptive system.



Adaptive system – basic principle

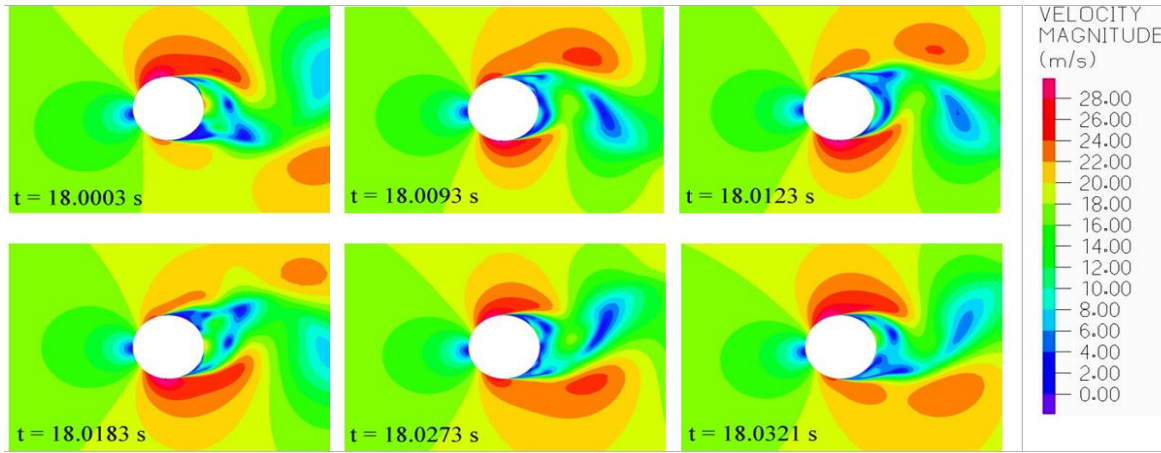
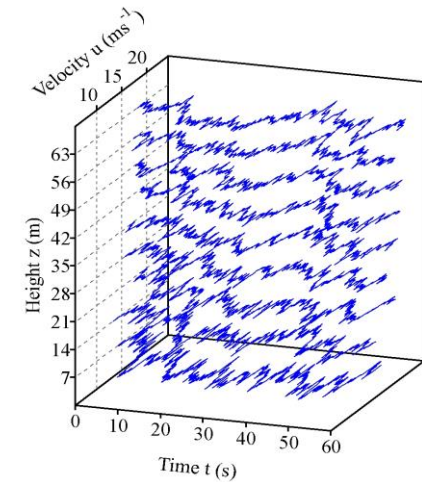


Chameleon:
a natural
adaptive
system

Accidental loads = short duration but significant quantity

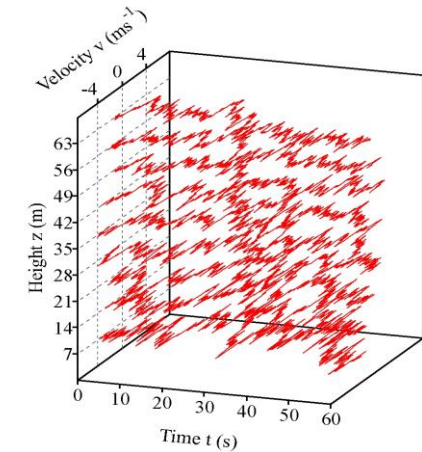
- Seismic load (earthquake)
- Impact (vehicle crash)
- Snow
- Wind (turbulent wind)

Wind velocity records: View of the anemometer located on the mast



Wind velocity fields and **vortex shedding phenomena** at the mid-plane of the cable in the selected times

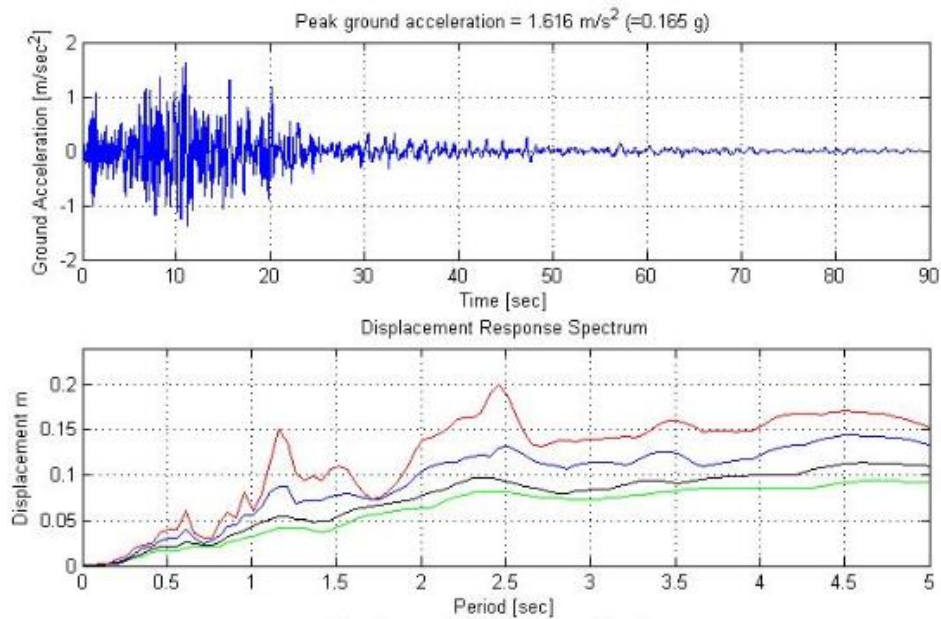
(planes



Generated wind velocity fields:
(a) in the longitudinal and
(b) lateral direction

Earthquake effects

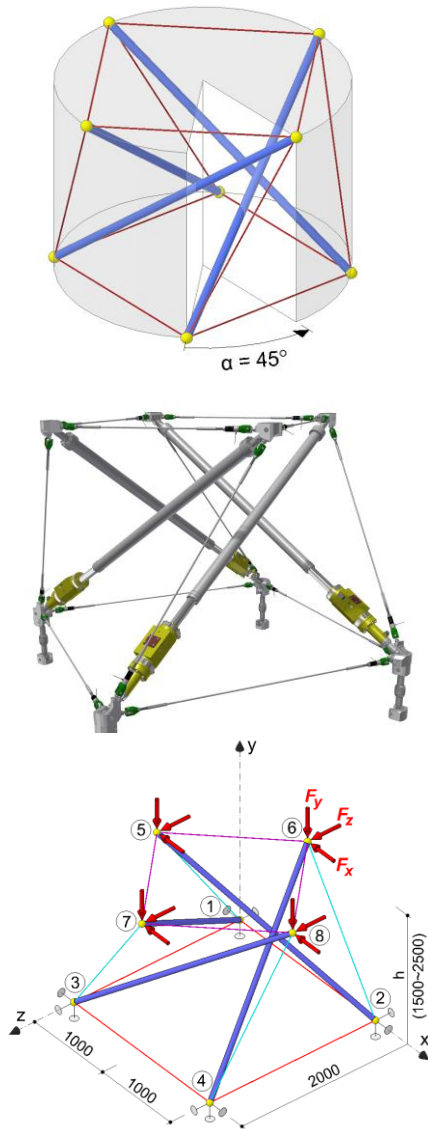
Accelerograms - earthquake database



Solutions how to resist to the accidental loads: adaptive structures



Adaptive tensegrity system S4 AS4 C12



General view of the structure

Industry – University Research centers&Labs & Lecture halls



CISCO IPv6 Lab



CISCO Telepresence



VW robotic cell



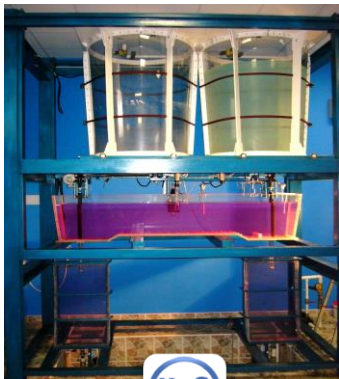
Laboratory IBM



METROTOM Carl Zeiss



Laboratory ABB



U. S. Steel Košice
United States Steel LLC



Volkswagen Slovakia



T · Systems ·

COMPETENCY CENTRE

KC ZATIPS

COMPETENCY CENTRE FOR KNOWLEDGE TECHNOLOGIES APPLIED AT INNOVATION OF PRODUCTION SYSTEMS FOR INDUSTRY AND SERVICES

Žilinská univerzita - Faculty of Mechanical Engineering

IPM SOLUTIONS- R&D activities in areas of CAD/CAM/CAE solutions and products .

ELCOM – SME with R&D activities in application of information and communication technologies and support systems for SMEs

Prešovská univerzita v Prešove - Faculty of Humanities and Natural Sciences with the Department of Geography and Regional Development .

CEIT SK - research SME, R&D activities, projects and products mainly in bioengineering, bionic, digital and virtual enterprises and intelligent control for production systems and smart products

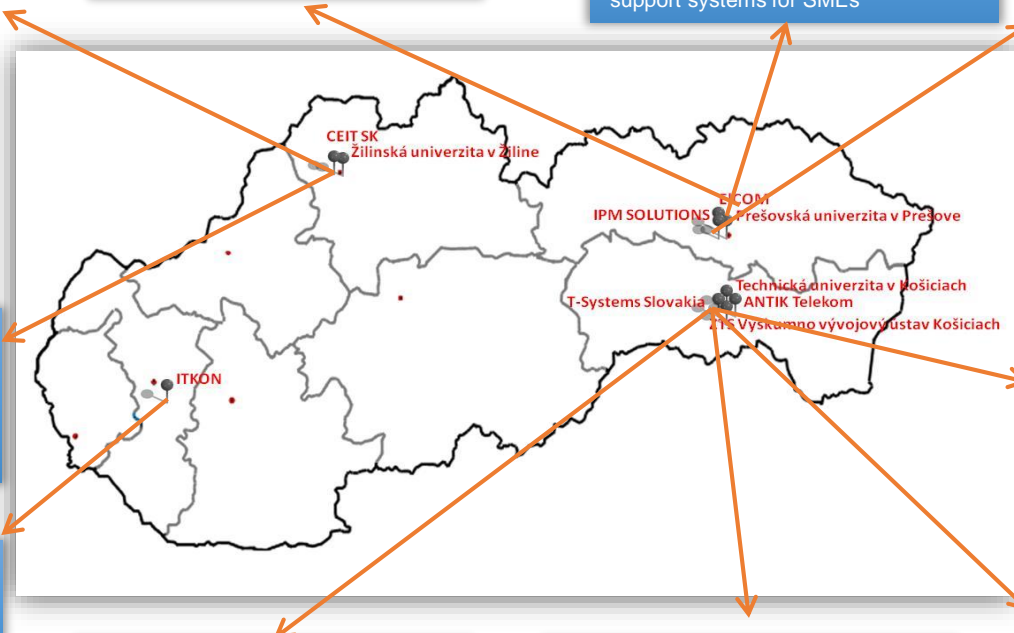
ITKON – SMEs with R&D activities in customer driven applications of ICT mainly in different areas of water resources management

T-Systems Slovakia – daughter company of Deutsch Telecom with research oriented on field of cloud computing

ZTS VVÚ – research oriented SME with orientation on development and production intelligent mobile robotic systems.

ANTIK Telekom - SME with R&D activities in internet and telecommunication services, technologies and systems

The Technical University of Kosice is holder and coordinator of the KC ZATIPS

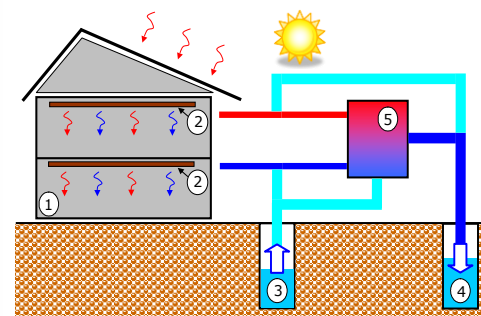
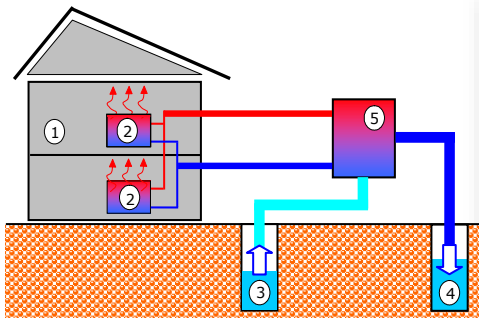


Research centre for efficient integration of the renewable energy sources

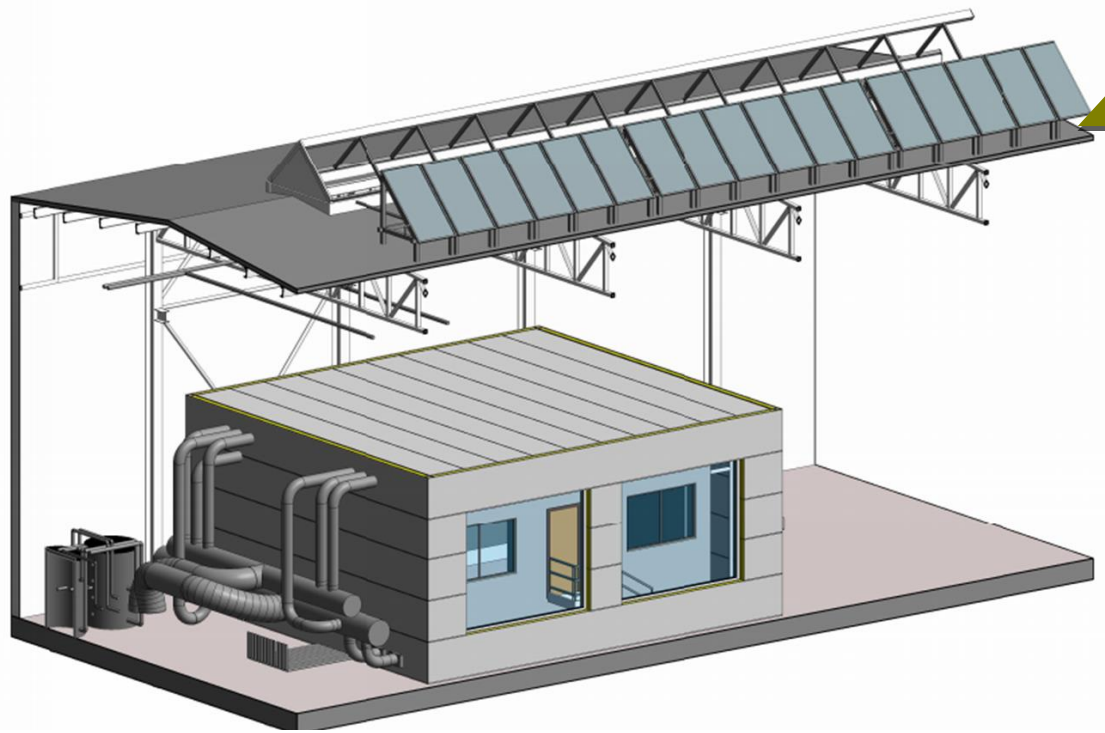


Main R&D activities are oriented to:

- Technologies of the **biomass** utilisation in energy sector;
- **Solar** energy and technologies for **hydrogen** utilisation and storage;
- Efficient exploitation of the **geothermal** resources;
- Efficient integrations of different renewable energy (**smart low energy building**);
- **Intelligent control systems** ;
- The integrated support for the risk's life-cycle management.



Smart low energy building in practice





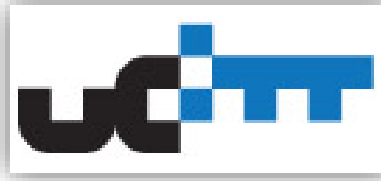
UCITT performs the following tasks:

- Connects science with practice
- **Protects and highlights your ideas**
- Seeks partners for your success at home and abroad
 - **Supports research and innovation projects**
 - Identifies sources for your projects

ucitt.tuke.sk

University Centre For Innovation, Technology Transfer and
Intellectual Property Protection

UCITT - University Center for Innovation, Technology Transfer and protection of intellectual property rights



The services fully support:

- Preparation, development and performance of national and international R&D activities.
- Efficient collaboration and technology transfer with social and commercial practice.
- Development and establishment of relevant „Spin – off“ and „Start – up“ firms.
- Human resource development for management and administration of research and TT.
- Marketing in the fields of R&D and Technology Transfer.

For more information, visit the website <http://ucitt.tuke.sk>



University Science Park Technicom

for Innovation Applications Supported by Knowledge Technology



Visualisation



Reality = Smart Building before finishing



MISSION

- “Win to Win” collaboration between academic and public research organisations
- Producing expected and required outcomes for technology transfer
- **Incubator for „Hi-Tech“ companies and Spin-off, Start-up initiatives**
- Management, development and operation issues are provided by the UCITT
- Consultancy, expertises, technical and technological support for the transfer of research and development knowledge and products
- Relevant support for education and training activities



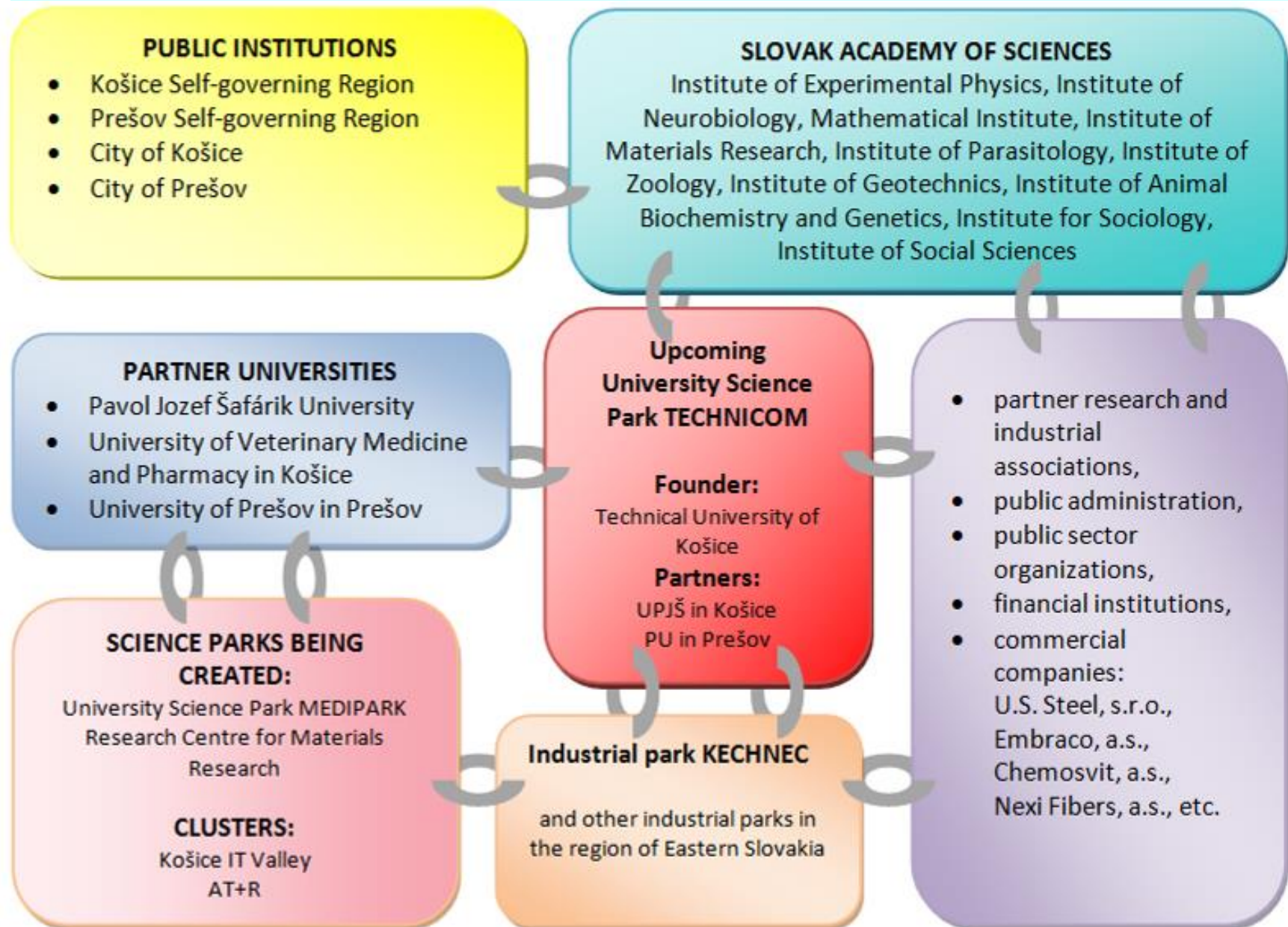
SCIENTIFIC AREAS

- Information and Communication Technologies,
 - Electrical Engineering, Automation and Control Systems,
 - Mechanical Engineering,
 - Civil Engineering (construction, transport, geodesy)
 - Environmental Engineering (mining, metallurgy, water management sciences),
- including its socio-economic dimension.



University Science Park Technicom for Innovation Applications
Supported by Knowledge Technology

Košice – Science City – concept of innovation partnership in Eastern Slovakia





STARTUP CENTRE

VISIT OF THE PRESIDENT OF THE SLOVAK REPUBLIC

STARTUP
centrum
TECHNICKÁ UNIVERZITA V KOŠICIACH

EXAMPLES
OF CURRENT
STARTUPS

STARTUP centrum
Technická univerzita v Košiciach
Univerzitný vedecký park TECHNICOM

Startup centrum TUKE predstavuje

CHARGEBRELLA

Chargebrella je unikátne zariadenie v podobe dáždnika, ktorého poháňaná technológia premieňa teplo na elektrickú energiu. Technológia využíva tepelnú energiu slnka alebo iného teplejšího zdroja vzduchu, ktorého dokáže nabiť batérie mobilných zariadení. Parabola dáždnika slúži ako ochrana pred dažďom, na po jej obrátení k Slnku, slúži ako koncentrátor tepelnej časti slnečného žiarenia priamo do ruky a tým zabezpečí nabitie.

Facebook | Instagram | Twitter | LinkedIn | YouTube | Website: www.chargebrella.com | Tel: +421 905 100 100

STARTUP centrum
Technická univerzita v Košiciach
Univerzitný vedecký park TECHNICOM

Startup centrum TUKE predstavuje

VARIM

Varim sa zameriava na automatickú prípravu halových jedál. Systém Varim sa postará o prípravu nápojov, polievok, príloh a pod. Je vhodný pre domácnosti, firmy, nemocnice, internáty, sociálne zariadenia. Varim systém komunikuje s užívateľom cez dotykový display alebo cez sms, aplikáciu či internet. Stačí do systému vložiť vybrané potraviny, zvoliť recept, nastaviť čas a Varim sa postará o prípravu čerstvých a chutných jedál.

Facebook | Instagram | Twitter | LinkedIn | YouTube | Website: www.varim.sk | Tel: +421 905 100 100

STARTUP centrum
Technická univerzita v Košiciach
Univerzitný vedecký park TECHNICOM

Startup centrum TUKE predstavuje

HONEYLOG

HoneyLOG (honeylog logs) je systém založený na pasciach pre útočníkov (honeypotoch), ktorých cieľom je priťahovať útočníka a získať o ňom rôzne typy informácií, najmä však cieľe útočníka, postup pri útoku a použité nástroje. Systém zbiera rôzne záznamy z honeypotov a pomocou korelácie týchto údajov, poskytuje rôzne štatistiky a deklaratívne analýzy. HoneyLOG sa zameriava na malé a stredné podniky, ktoré si nemôžu dovoliť hardvér pre väčší stupeň bezpečnosti.

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STARTUP centrum
Technická univerzita v Košiciach
Univerzitný vedecký park TECHNICOM

Startup centrum TUKE predstavuje

EMOMIME

Emomime je inteligentná digitálna postava vo výkladoch obchodov, ktorá analyzuje okoloidúcich ľudí. Na základe tejto analýzy (pohlavie, vek, typ oblečenia a emócie) Emomime vyberá svoje správanie, aby získal pozornosť ľudí a priťahoval ich dnu do obchodu používajúc stálo sa zlepšujúcu umelú inteligenciu. Cloudové a "plug and play" riešenie obchodníka jednoduchého zapojiť. Emomime transformuje výklad na emocioný zázitok a nahrádza staromódne statické figuríny.

Facebook | Instagram | Twitter | LinkedIn | YouTube | Website: www.emomime.com | Tel: +421 905 100 100



More than
4.000
high school
students.



OPEN DOORS DAY at the university

RAW MATERIALS UNIVERSITY DAY



General
Partner



European
Commission

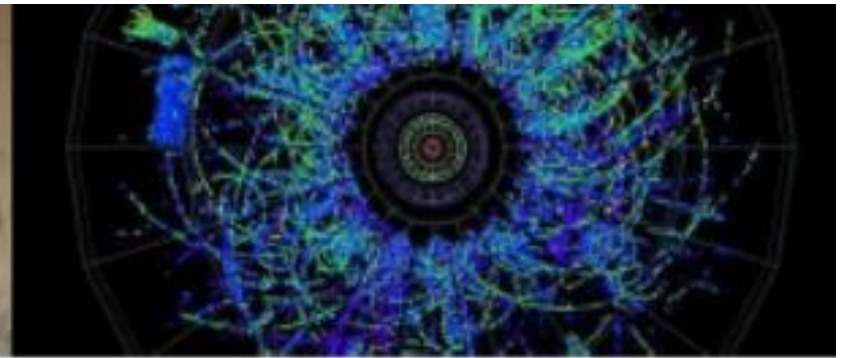




SCIENTIFIC ROADSHOW

Several activities for a popularisation of science and technics

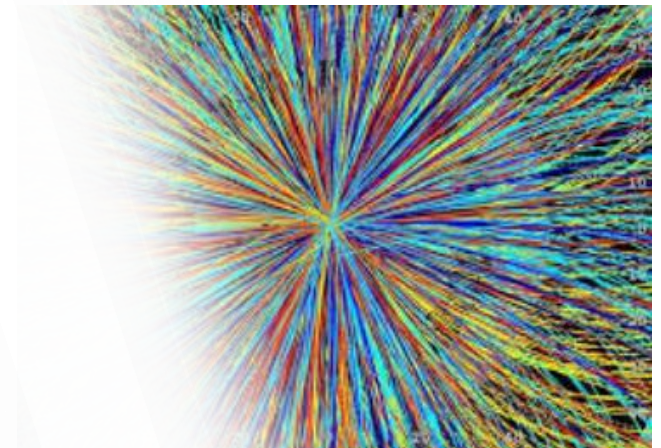




European Organization for Nuclear Research CERN



Faculty of Electrical Engineering and Informatics
[Department of Cybernetics and Artificial Intelligence](#)





FACULTY OF AERONAUTICS
TECHNICAL UNIVERSITY OF KOŠICE



Space satellite

Ten years anniversary





Košice TEAM

HORIZON 2020 Work Programme
2016-17:

Spreading Excellence and Widening
Participation

Call: WIDESPREAD 1-2016: **Teaming**

Smart Information and Communication Technologies
enhanced by Smart Materials (SITMAT)

Project Goal

To establish **Centre of excellence** (CoE) focused on **two priority areas of** National and Regional Research and Innovation Strategy for Smart Specialisation according to available R&D capacities:

- **Material research and Nanotechnology**
- **Information and Communication Technology**

Participating institutions

Coordinator

- Technical University in Košice, Slovakia

Partners

- Pavol Jozef Šafárik University in Košice, Slovakia
- Institute of experimental physics of Slovak Academy of Sciences in Košice, Slovakia
- Fraunhofer Institute for Applied Information Technology FIT, Sankt Augustin, Germany
- Istituto Superiore Mario Boella (ISMB), Center for Applied Research on ICT, Turin, Italy
- Košice self-governing region, Slovakia



Project Base

Policy, Regulations & Standards

Public Procurement

Fiscal Environment

Government

Taxes

INNOVATIONS

WEALTH
AND JOBS

Sales & service improvements

Finance

R&I Funding Agencies

R&I ECOSYSTEM

Finance

Universities and Public
Sector Research
institutions

Licenses

Finance

Trained People

Knowledge

Large firms

Trained People

Finance

Intellectual property

SMEs including start-ups

Sales

Knowledge

Investment

Finance

Knowledge

Venture capital, Banks &
Public Markets

Finance

Equity

Finance

Knowledge

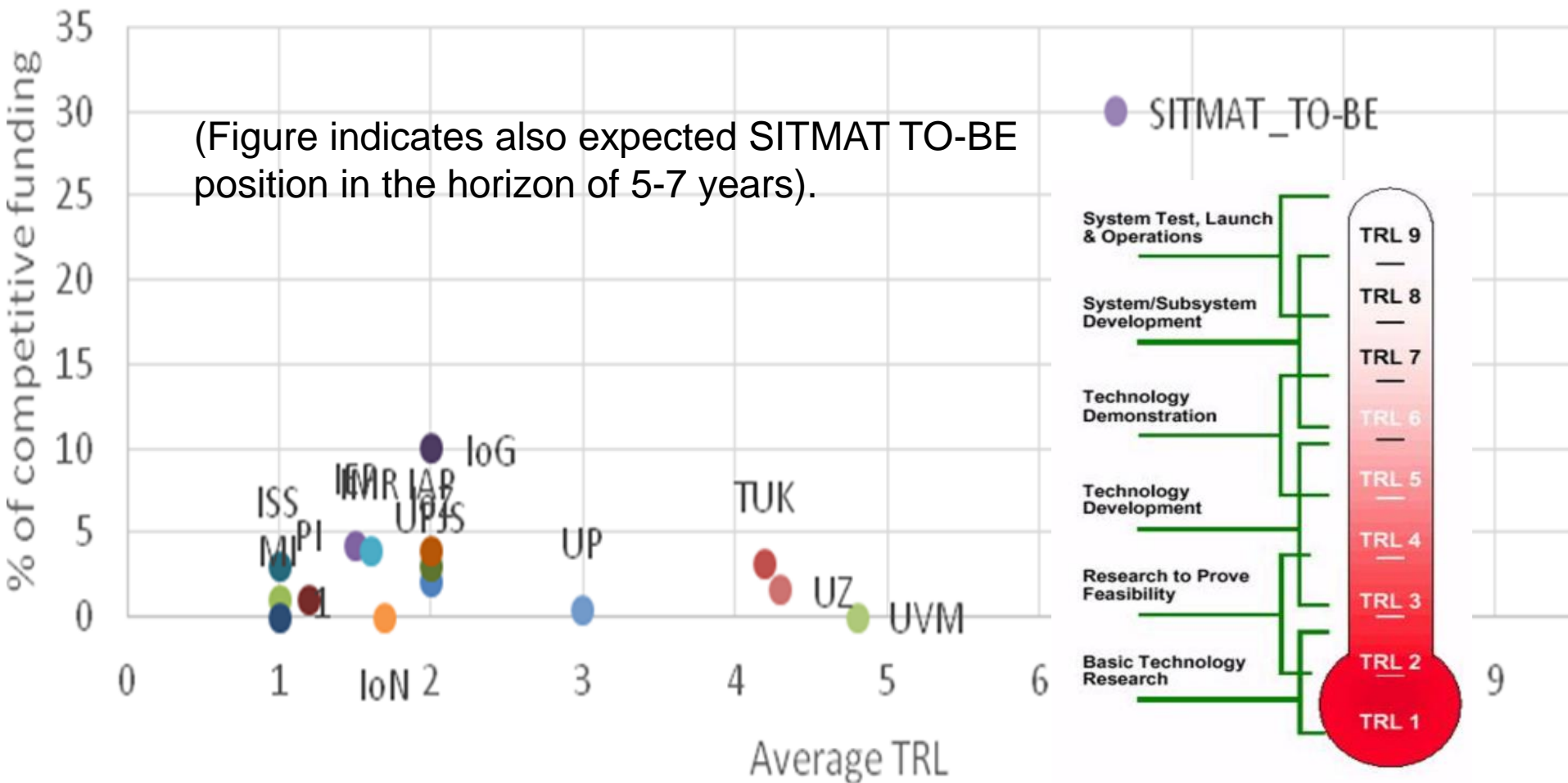
Research and
Technology
Organisations

Tax breaks

Finance

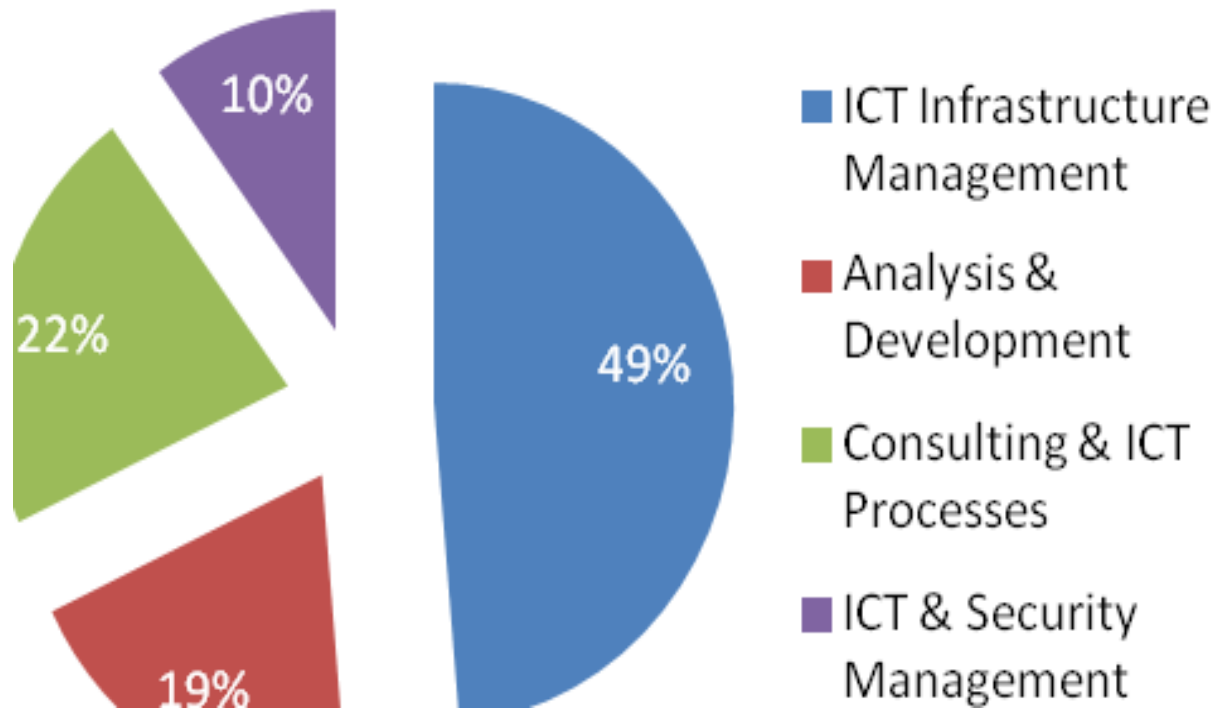
This figure illustrates positioning of the existing universities and research institutes located in the Kosice region in terms of: **TRL (Technology Readiness Levels) of research results** produced by the institution, and b) **percentage of international competitive funding**

Portfolio of R&D institutions in Kosice region



Project Base

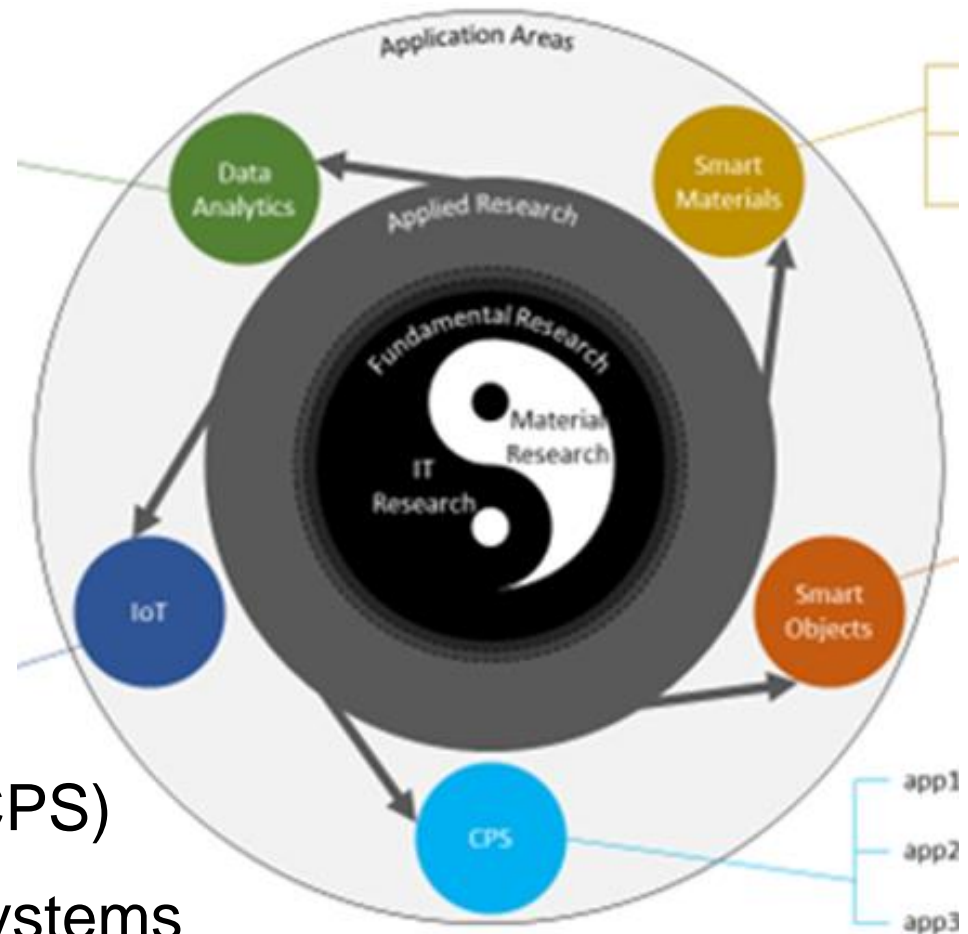
ICT Market Segmentation



Regional ICT market shape in terms of focusing on different aspect of ICT

Project Base

The Concept of the SITMAT CoE

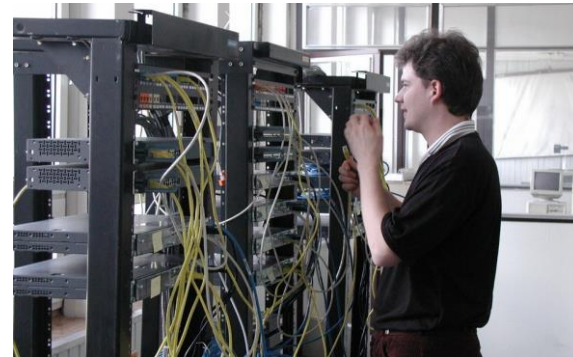


1. Smart Materials
2. Cyber-Physical Systems (CPS)
3. Smart objects and Smart systems
4. Cloud and Data Analytics
5. Internet of Everything (ioE)

The role of universities in regional development (II)

Human capital and
skills development

Teaching function



Cisco Systems Slovakia Academy

Human capital and skill development = education +



U. S. Steel Košice, s.r.o.
A Subsidiary of United States Steel



embraco POWER IN.
CHANGE ON.



SLOVALCO



at&t



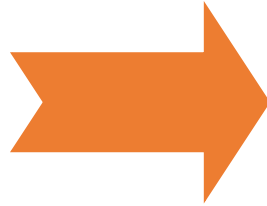
**ŽELEZIARNE®
PODBREZOVÁ**

- **T-Systems Slovakia – about 20 tailored courses,**
- **VW Slovakia: „IngA“, Internship, labs, etc.,**
- **US Steel Kosice Internships,**
- **RWE – TUKE agreement about PhD support,**
- **CISCO Academy programme,**
- **Embraco - about 40 courses,**
- **etc.**



The role of universities in regional development (III)

Social and
cultural
development



Public service role
of universities



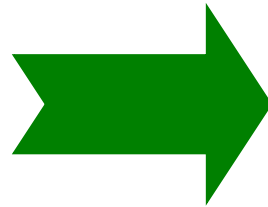
KOŠICE2013
EUROPEAN CAPITAL OF CULTURE

Social and cultural development = **public services**



The role of universities in regional development (IV)

Regional
capacity
building



Associations



- more students
- more new jobs (**8 000 new jobs for IT**)
- more IT and high-tech companies

The legend of Svatopluk's three wands

Well known is the legend about Svatopluk (Sphendoplokos) the prince of Moravia, who had three sons, and when he was dying he divided his country into three parts and left a share apiece to his three sons. He exhorted them not to fall out with one another, giving them this example by way of illustration: *he brought three wands and bound them together and gave them to the first son to break them, and when he was not strong enough, handed them on to the second, and in like manner to the third, and then separated the three wands and gave one each to the three of them; they broke them through at once.* By means of this illustration he exhorted them and said: *"If you remain undivided in concord and love, you shall be strong etc.*

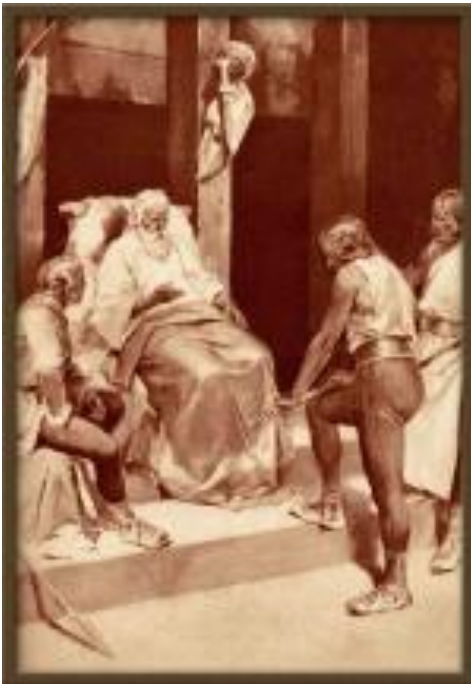


Statue of Svatopluk I in
[Loštice](#), [Czech Republic](#)

How to make the innovation ecosystem sustainable and robust

Svatopluk vision

Three wands of Svatopluk

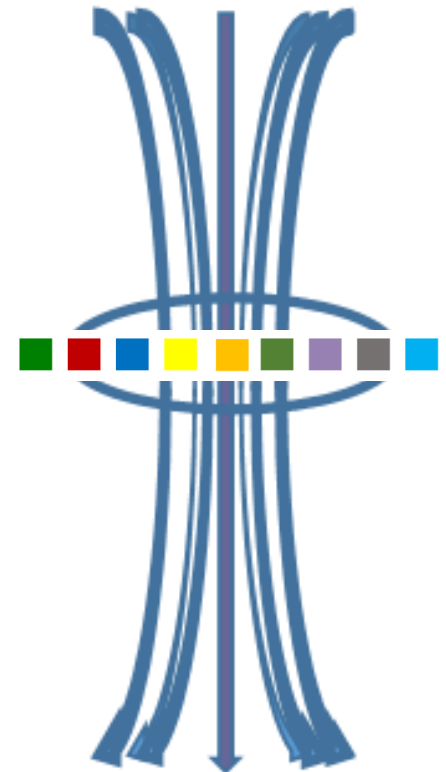


EU vision



TUKE vision

The Multi Helix – Many wands





Thank you for your kind attention