

Centre for Smart Cities and Infrastructure

Annual report 19

STRATEGIC PARTNERS:















It is well known that the Construction sector is the engine of a country's economy, where innovation can pay off very quickly. Smart cities, digital construction, and building information modeling are the main areas of interest for the Centre for Smart Cities and Infrastructure (CSCI), and requires interdisciplinary competencies to tackle a wide range of challenges. Celebrating one year after the official opening of CSCI, we look back to what was achieved at the Centre in 2019.

CSCI launched 3 non-formal upskilling programs for engineers, achieved 2 grants for research and innovation projects, established contact with more than 50 public and private sector organizations and increased visibility of the construction sector for future construction professionals.

Nevertheless, year one was very much focused on developing the strategy of the Centre for the upcoming years. We have made the first steps in developing city digital twin and we now see this as the main challenge for the years to come. In partnership with Class of Your Own (UK) and Lithuanian institutions, we have launched the DEC LT project for school students, to enable them to see how architecture and civil engineering can be linked to STEM, and most important – how decisive it is for the sustainable future of our cities and societies.

Under the project BIM-LT, we have also got involved in the development of BIM legislation and classification systems for Lithuania.

We're looking forward to exciting projects and initiatives in 2020.

Dr. Darius Pupeikis Head of CSCI

OUR MISSION

is to build, sustain and develop a community focused on smart cities and infrastructure, advancing the field through lifelong learning, research and innovation.

OUR VISION

is to establish and maintain an interdisciplinary community on smart cities and infrastructure-related topics (teachers-researchers, students, alumni, companies, municipalities, science partners) for joint activities and projects at all levels of study, non-formal education, and $R\otimes D$.

We care about:

- Digitization of the built environment;
- Informational modeling and data analytics;
- Sustainable asset management;
- Social aspects of smart city;
- Smart infrastructure and transportation systems;
- Sensors, data collection and use for automated decision making;
- Mathematical statistics, data processing and machine learning.

We contribute to:

• Digitalization of the entire life cycle of our built assets in order to enhance the public's quality of life, encourage an innovative culture, deliver more value and increase productivity for cities and infrastructure;

• Active acquisition and implementation of the digital engineering concept and BIM methodology in the study programs in the University;

• Development of policies on digital transformation in the built environment;

• Fundamental and applied research related to the challenges of the AECO (Architecture, Engineering, Construction and Operation) industry in order to obtain efficiency and increase automation in the design, construction and operating processes;

• Development and provision of the lifelong learning courses and qualification upgrades for the AECO industry stakeholders;

- Promotion of the application of ICT in order to increase sustainability of the built environment;
- Collaboration with industry, municipalities, policy makers, international knowledge partners, fostering the interdisciplinary community focused on smart cities, buildings and infrastructure;

• Production of the outputs on BIM transition, guidelines, standards, requirements and online resources, in order to facilitate the use of BIM in the entire life cycle of built assets;

• Raising awareness on the benefits of BIM, asset information value and sharing examples of best practice;

• Ensuring visibility, dissemination and representation of the outcomes, activities and initiatives, motivating young individuals to pursue a career in the construction sector and engineering.

BEFORE CSCI OFFICIALLY LAUNCHED



smart cities and infrastructure Kaunas, 22 May 2018

Background and Motivation

The parties involved acknowledges the importance of construction sector in the European economy, as well as in the delivery of the Europe 2020 Strategy on smart, sustainable and incluive growth. European construction sector generates along 10 % of GIP and provides 20 million (Showever, spending on research and innovation remains quite low compared with industry in general. European Commission outlined the main challenges faced by the construction sector and addressing priority actions as follows:

- Energy efficiency and climate change: Buildings account for the largest share of total EU final energy
- consumption (40%) and produce about 35% of all greenhouse emissions.
 Innovation: More active uptake of new technologies.
- Stimulating demand: Efficiency improvements in existing buildings and renovations have the highest
 potential to stimulate demand.
 Improve design, construction, demolition and recycling of construction products, as well as simplify
- data in the use of resources to reduce waste. • Helping the construction sector and its SMEs digitalise and automatize, e.g. by supporting Building Information Modelling (BIM) in the public sector.¹

Significant results in facing these challenges can be achieved through university and industry collaboration. It enables the alignment of studies and life-long learning programs, research and innovation activities carried out in the university with the needs of the construction sector in the region.

Purpose

2018

This Memorandum of Understanding (MoU) provides guidelines for joint activities to increase the uptake of new technologies in the construction sector, with the strong focus on digitalisation and Building Information Modelling (BIM).

The parties involved support the development of the centre of excellence at Kaunas University of Technology— Centre for Smart Cities and Infrastructure (CSCI) as a unit for university and industry collaboration. This includes developing and maintaining the facilities, environment and community (industry – alumni – academic saff – students).

This MoU is considered as non-legally binding statement of intent. Specific arrangements between parties will be signed to address particular issues, e.g. financial support, scientific research, training or other activities. Such arrangements must be documented in a legally binding agreement.

¹ Source – European Commission (<u>https://ec.europa.eu/growth/sectors/construction_en</u>) Challenges faced by the construction industry, 2018.

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CSCI signed a Memorandum of Understanding on collaboration in the field of smart cities and infrastructure with:

Bentley Systems

YIT Lietuva

INHUS Group

Kauno tiltai

Staticus

Digital Construction

This was followed by cooperation agreements.

Centre for Smart Cities and Infrastructure (CSCI) was established within the Faculty of Civil Engineering and Architecture (FCEA) of Kaunas University of Technology and the remodeling of the connected academy room has started.

Brand identity was developed for CSCI, the academy was ready for use. Darius Pupeikis was approved by KTU Senate as the Head of CSCI.



YEAR IN CSCI

The official opening of CSCI.

Nearly a hundred invited guests from industry, government, universities and municipalities participated in the opening of the centre. The context and vision of the centre was presented by the Dean of the Faculty of Civil Engineering and Architecture, Andrius Jurelionis, Bentley Institute's programs director, Zeljko Djuretic, Rector of Kaunas University of Technology, Eugenijus Valatka. Panel discussions were organized for the second part of the opening, where the impact of ICT technologies on the construction industry, as well as university and industry collaboration in the creation of smart cities was discussed.



The event was broadcasted live and received wide media coverage, with over 3.5 thousand views:



https://www.facebook.com/ktu.lt/videos/295068627818342/ https://www.youtube.com/watch?v=8z_WLXjxkGs

2019

Students start using CSCI space for studies, esearch and development of BIM models.



CONSTRUCTION AFFECT SMART CITY? CSCI team answered this question at the Conference on Real Estate Trends and Development at the exhibition "House World 2019"

HOW DOES DIGITAL



CSCI team participated in training "An energy efficient city, transport systems and infrastructures development" in Stuttgart, Germany.



Baltic sea region countries joined forces with Aalto University, in order to develop a more sustainable built environment. KTU CSCI together with MITA represents Lithuania.









Prof. Dr. Irina Matijošaitienė conducted training on the application of artificial

For the first time in the Faculty of Civil Engineering and Architecture history, defense of undergraduate students took place without a paper drawings in CSCI.



CSCI organized event "SHARING KNOW-HOW" - between academia-industry, academia-academia and industry-industry. Participated: YIT Lietuva, INHUS, Staticus and Kauno tiltai and academics of KTU FCEA.







Faculty's students BIM project was awarded 1st prize at Lithuanian BIM awards 2019 (category – BIM in studies).









⊗ Kaunas, LT









⊗Kaunas, LT



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DEC LT team visit to Drummond Community High School in Scotland, Edinburgh. Workshop and hands-on training on OpenBuildings.

⊘London, UK

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CSCI activities and strategy for Kaunas were presented at the international conference "Year in Infrastructure 2019" in Singapore by A.Jurelionis.







Visit to Czech Standardization Agency regarding BIM development and acquiring valuable experience from Czech Republic colleagues.

BuildingSMART Nordic LT, professional certification committee meeting.







BIM • LT

In the spring of 2019, a joint contract between the Ministry of Environment, Kaunas University of Technology and Vilnius Gediminas Technical University was signed to create BIM standards, public procurement methodology, BIM progress benchmarking and a national construction classification system. This project is now known as BIM-LT.

This project is crucial to the digital future of the country's construction sector. It will provide the essential prerequisites for the successful application at state level of a single approach, and collaborative BIM for the design and construction of complex and high value public sector buildings.

The project promoters suggest that complex buildings could include critical energy, state and municipal social infrastructure, road and rail infrastructure, and so on. The requirement to apply them to BIM would also cover cases of reconstruction or overhaul. It is debated that the high value of the structure could be understood as the estimated cost of its construction, amounting to at least 3-5 million EUR depending on the group of buildings (buildings or civil engineering works). It is noteworthy that these values have been suggested for discussion based on the experience of foreign countries.

Until the entry into force of the BIM obligation, only minimum requirements are planned for 1 st July 2020 as part of the substance of that obligation. In the long run, essential documents and requirements to start to apply BIM and develop the competencies of the supply chain (private sector) and main employer (public sector) under the project BIM-LT will be produced. In addition, 200 public sector clients will be trained to use the developed products.

The Centre of Smart Cities and Infrastructure is the leading team of Kaunas University of Technology experts and is responsible for the development of a national construction classification system, creation of BIM educational programs and qualification system.





DESIGN. ENGINEER. CONSTRUCT! • LT

The industry and universities are aware of the digital transition and the disruptive technology adoption in construction. There is a need for talented engineers and architects in the field to make use of this technology in tackling global sustainability issues. There is vast potential for the construction industry in attracting talented people by making this new technology visible. CSCI is focused on changing the outdated image of the construction industry for school students.

Together with our partners from the United Kingdom "Class of your own" we agreed to bring project "Design. Engineer. Contstruct!" to Lithuania. After 6 months of preparations, in September 2019 we finally did it! Three schools have signed up for the pilot project: KTU Engineering Lyceum, Vilnius Žemynos and Panevėžys J. Balčikonis gymnasium.

More than 70 students gathered at Kaunas University of Technology in September, committed to test their skill in built environment design. The challenge – to design an unconventional hotel for the legendary James Bond.

Participants were required to complete various stages of architectural and engineering design in groups throughout the year. From hotel function definition, analysis of territory and environment, to branding and 3D design.

Invited speakers shared their experience during the launch event. Masters student and engineer Airimas Rocius outlined what drives him in civil engineering. Renowned architect Gintaras Prikockis shared his insights on where to draw inspiration for architectural design. Jūratė Rudienė, the director of Kaunas Park Inn by Radisson Blu Hotel, provided inside information on hotel operations and things to keep in mind.

In 2019, students created their hotel vision, brands, made various analyses and sketches. They also visited architects' offices and got the opportunity to get feedback on their draft designs. All participants were provided licenses by Bentley systems to freely use OpenBuildings software, as well as hands-on training. In May 2020 teams will present their projects to a jury.

Project External Partners: Bentley Systems Europe B.V. (UK), Class of Your Own Limited (UK), Heriot-Watt University (UK), KTU Engineering lyceum, Vilnius Žemynos gymnasium, Panevėžys Juozas Balčikonis gymnasium, Kauno tiltai AB, INHUS Group UAB, YIT Lithuania ", UAB" Staticus ", Kaunas Park Inn by Radisson Blu Hotel and others.

https://youtu.be/0ayDxMUPwm8



design...engineer...construct!"

DigitalTwin • KAUNAS

CSCI is seeking visibility and impact on both an international and regional scale. One of the key priorities is the development of the DigitalTwin model of Kaunas city. Only the first steps were made in 2019, by building a reality mesh of Kaunas old town area. Nevertheless, CSCI gathered a team of enthusiasts and partners for building the KTU campus and Kaunas first digital photogrammetry models using drones and Bentley Context Capture technology.

The project aims to gain international visibility, positioning KTU as a leader in Lithuania and the region in terms of DigitalTwin and smart cities. The goal is to have Kaunas DigitalTwin by 2022. The Center for Smart Cities and Infrastructure at KTU would become a center of attraction for doctoral students and postdoctoral trainees. The developed competences will be applied at all levels of study, and a new Master's program in English and non-formal education courses will be developed.

The project is implemented systematically - by providing master's and doctoral topics that will help to develop the city's DigitalTwin concept. The project will lead to a challenge for the ECIU University project in partnership with the University of Twente (Netherlands).

What next?

Action 1: Continue to develop a reality modeling topic by searching for possibilities to collaborate in R®D activities, scientific projects, etc.

Action 2: Integrated digital built environment data to reality mode.

Action 3: Publish and disseminate reality models on the web for open access.

Action 4: Analyze 3D point clouds extracted from reality model by using AI (Artificial Intelligence) methods.



3D photogrammetry model (digital twin) of Kaunas Old Town main area generated with Bentley Context Capture technology.

It's intended for scanning of the objects (buildings, terrains, etc.) and creating digital models with accurate geometry, possibilities to add attributes (e.g. energy performance indicators, asset tagging), analyze texture and views with Artificial Intelligence algorithms. The methodology of photogrammetry could be useful to collect digital data about existing buildings and assets.

https://www.youtube.com/watch?v=oTM2S5wnuTU

TRAINING PROGRAMS FOR DIGITAL EGINEERS:

In 2019, CSCI prepared 3 training courses for digital engineers and the construction market.

• Data Analytics and Applied Machine Learning

The program delivers knowledge and practical skills for solving engineering, financial and other problems, by applying data analytics and machine learning methods and tools - currently the most trending areas. Lectures are intended to improve programming skills, extract knowledge and valuable information from data, make prediction models, analyze text images, big data, etc.

🕔 Duration - 40 academic hour

• Fundamentals of Building Information Modelling

Common understanding about Building Information Modelling (BIM) is crucially important for today's engineers, but it is so much more than choosing the appropriate software for design, construction and operation of buildings. The BIM Fundamentals Course offers a knowledge package about BIM/GIS essentials, team working principles, BIM processes and the role it plays in the construction and related industries. It is suitable for beginners in BIM.

🕔 Duration - 16 academic hours

Building Information Management

Building information management (BIM) learning course introduces digital information management to asset owners, designers, construction professionals and asset managers. Designed to develop an understanding of the principles and potential of BIM, international standards, data exchange processes, common data environment, BIM uses, digital plan of work, and to introduce some of the applications of those principles. The Programme is based on experience of BIM expert Phil Jackson and the construction sector of Great Britain. It is suitable for specialized roles (architects, site managers, project managers, structural and HVAC engineers, asset managers, etc.) in the construction and related sectors.

() Duration - 16 academic hours

BENTLEY SYSTEMS CONNECTED ACADEMIES



The Centre for Smart Cities and Infrastructure not only prepared training programs for engineers, but is also part of the Bentley Systems Academies network and first in university. CSCI members have a great opportunity to gain international experience and valuable knowledge by participating in virtual courses, which are broadcasted from connected academies in London, Houston, Dubai, Pune, Beijing, Singapore, Sydney and Kaunas. CSCI are proud to be a part of Bentley's connected academies network.

PUBLICITY:







WHAT CSCI ARE PLANNING FOR 2020?

Resta 2020

In April, CSCI will participate in the largest Lithuanian construction fair and will organize mini conferences about digitalization in construction field.

DEC LT

CSCI are planning to increase the DEC LT project and get more pupils participating in this life changing project.

BIM-LT

The main tasks for CSCI under the BIM-LT project are to develop a National Construction Information Classification System and run a piloting project to test it.

H2020 Next-generation Dynamic Digital Energy Performance Certificates (EPC) for Enhanced Quality and User Awareness. The main objectives of CSCI in the project context are to cover issuance of EPCs with the use of digital construction tools (referring to BIM). The analysis and definition of how it is possible to use and generate BIM data for NG EPC, which is a general task CSCI.

Participation in buildingSMART Nordic_LT_SKST_PCERT Professional Certification program. Delivering learning courses approved by buildingSMART International.

Delivering already prepared

COUISES: Building Information Management, Data Analytics and Machine Learning are scheduled.

DigitalTwins

Extending research in Kaunas Old Town and KTU Campus terrains. Publishing on OpenCityPlanner, adding different kinds of layers, tags, attribute data, etc.

Apply Artificial Intelligence for recognizing objects.

