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Pallaska, Fuat and Hoxha, Visar, "Smart Self - learning adaptive modeling buildings and their impact on creation of the smart cities in Kosovo, challenges and opportunities" (2023). *UBT International Conference*. 12.
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Smart Self - learning adaptive modeling buildings and their impact on creation of the smart cities in Kosovo, challenges and opportunities

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Abstract. The scope of this study is to research or to find the tools for the modeling buildings and simulation on creating the models of smart houses and sustainability and their impact on the whole buildings systems and technologies for better and smarter living conditions for community. Increasing the Energy efficiency and improving the new capacity technologies for Building modeling systems and facilities should create the conditions for the Smart Cities tools and technology and this application in the practice, using the smart modeling systems such as (BIM - modeling) for the adaptive and self-learning buildings. Deepest analyzing Models used for Smart self-learning and Adaptive models of this buildings, can be sample for deep analyses and hypotheses methodology used for further research and developing the new models for the Smart Cities which can be implemented in the construction sector in Kosovo. We find a lot of challenges and more of the opportunities using during the estimation on this research study. Therefore, this paper will try to address the challenges and benefits from integration technologies for creating the Sustainable Buildings and to estimate the study outcomes in the field of Smart cities and technologies used.

Keywords: Smart house, Self-learning, Adaptive houses, Smart Cities, Construction sector Kosovo, Smart living, Smart technologies.

1. Introduction

The Smart City concept is used to define a country that efficiently uses the resources it has available, through the use of innovations and technologies, ensuring the participation of citizens through online participation and e-government to address issues and to improve the quality of life citizen and to develop the energy resources for creating the optimal harmonization the energy generation, distribution, consumption and storage.
Smart city research in this field is used for the further determination and assessment for production from the Smart City or building models which includes together in one area or Smart Habitats or Neighborhood facilities Human residents in these areas called the example for this research ASCR (Aspern Smart City Research) near the VIENA municipality Austria.

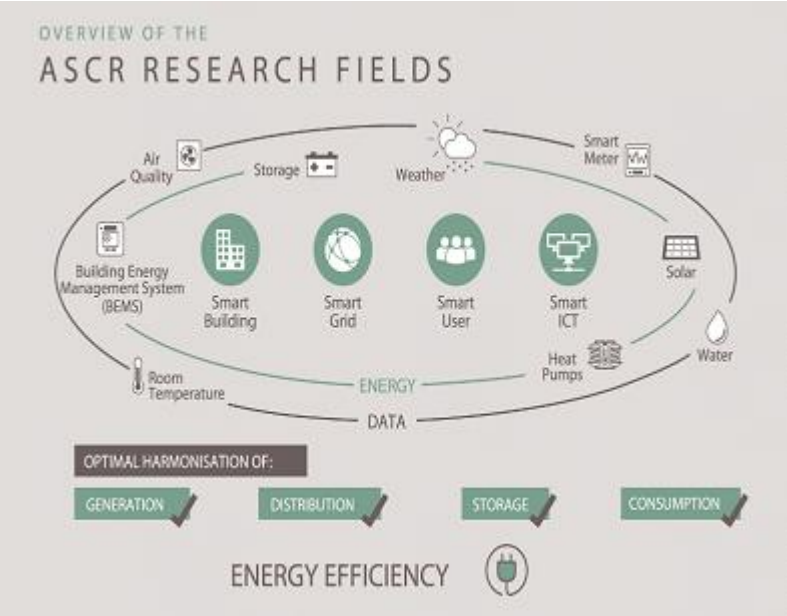


Fig1. ASRC -research circle for SMART CITIES 2018
(https://smartcity.wien.gv.at/en/aspern-smart-city-research/)

Aspern Smart City Research (ASCR), Europe's biggest energy research project, has been conducting applied research at the aspern Seestadt urban development area since 2013. The research association – a joint venture by Siemens Österreich, Wien Energie, Wiener Netze and the City of Vienna (Vienna Business Agency and Wien 3420) – pursues an integrated approach, with over 100 researchers from a range of different fields using vast quantities of real-time data from Aspern Seassted to analyse interactions and correlations between user behaviour and building technology in energy-efficient buildings. The buildings analyzed simultaneously produce and consume energy and are integrated into a smart power grid.

Joint research project extended until 2023

The ASCR research venture was founded by Siemens AG Austria (44.1%), the City of Vienna – municipal infrastructure and utilities operators Wien Energie GmbH (29.95%) and Wiener Netze GmbH (20%), Vienna Business Agency (4.66%) – and Wien 3420 Holding GmbH (1.29%). The core focus of the project is on pre-emptive building automation and leveraging the energy flexibility of buildings in the energy market. ASCR is also developing new methods for the assessment of grid status and grid planning.

In 2016, ASCR won the international World Smart City Award for “Best Smart Project”. In 2018 the project partners agreed to extend the project by a further five years, until 2023. In this current phase, ASCR’s research activities are focused on a total of 17 use cases, ranging from further smart networking of buildings, grids and markets, through new approaches to heating and cooling systems, to the potential future use of electric cars as energy storage units and how they might be incorporated into renewable energy pools.

2. Literature review

Smart cities model and researches- Global Scientifics Community.
Globally we can find a lot of the researches in the field Smart Sustainable cities and building concepts based on smart technologies. Building the capacity for modeling systems and facilities should create the conditions for the Smart Cities tools and technology and this application in the practice, using the smart modeling systems such as (BIM - modeling) or others adaptive and self-learning buildings.
Processes (construction, building management and building maintenance) According to scientists (Alwaer and Clements-Croome, 2010).They conclude that:
The application of the "S.M.A.R.T" system at home has affects the reduction of expenditure costs, the reduction of prices, the growth of the economy as it directly affects the saving of energy.
Eliminating or reducing the expenditure of unnecessary energy at home contributes to the economy, especially if we have higher expenses.
Wong and Jan (2003) propose measures to improve performance in spatial comfort, indoor air quality, visual comfort, technical comfort and acoustic comfort as other attributes of smart buildings.
Because all subsystems work together in a building, the exchange of information through the subsystems is critical (Jiang et al., 2009).
In a smart building, the sensors must be connected in a common communication network (Schor et al., 2009) which carries the sensitive information to the consumer devices in the building (Familiar et al., 2012).
Also Chwieduk (2003) states that the performance of solar systems, heat pumps, waste sorting, waste reuse, water treatment, water saving devices, rainwater utilization and toilet water reuse are attributes of smart buildings.
Wong et al. (2008) propose eight control systems for a typical smart building:
- Integrated building management system for general monitoring of the building;
- HVAC control system for comfort and indoor air quality control;
-Digital fire detection and fire prevention system based on IP addresses;
-Network system of telecommunication communication and data transfer;
-Security monitoring and digital surveillance system;
-Smart/efficient elevator system;
-Digital lighting control with IP address;
-Computerized maintenance system
Cole and Brown (2009) propose some key attributes for smart buildings:
• Intelligent space management: The ability to respond to rapid changes in the size and structure of organizations and the work practices of organizations occupying commercial or administrative buildings;
• Passive intelligence: Building design strategies that positively impact environmental performance by reducing or replacing unnecessary systems.
• Organizational intelligence: Strategic plans that integrate organizational needs with building capacity and capability.
While there is a need for adequate space, residents also require that the building perform well in terms of cost and comfort using as little energy as possible and on the other hand be economically favorable to build, operate and maintain (Kolokotsa et al., 2011).
In a smart building, various information such as temperature, humidity, air flow, lighting and sound can be collected through sensors and transferred as data to building control systems to track conditions and human behavior and in

order to achieving energy savings with an increase in comfort level (Kwon et al., 2014)

2.1 Sustainability for Smart Cities -case study investigation In Kosovo

Smart Cities in Kosovo Opportunity and Challenges
More than half of the world's population today lives in urban areas. This trend is expected to increase to 66% by the year 2050.
At the time when urban areas are expanding to exponentially, one of the most serious challenges-is the creation of the capacities of local governments to manage the growing need for public services.
Creating creative solutions and approaches for a single use more effective of limited resources in an environment that it is constantly changing, it is becoming a thing essential. Therefore, in addition to the challenges, the increase in the trend of urbanization, has also offered an opportunity for the transformation of cities into sustainable places and comprehensive, where citizens' information and reactions through e-government and e-participation are used to improve urban life. These places where innovation and technology are used for efficient use and sustainable resources, those are called smart cities. Smart tools and innovation are making it possible the transformation of our communities towards places of wise, connected, clean, safe, to comfortable and with a high energy efficiency for lived.
Kosovo has joined the initiative of the Cities of Wisdom to integrate efficient solutions and inventive, that will serve the needs arising from the growth of the urban population in the long term. Creating one digital society of the future, i.e. community of wise and safe, is one of its objectives the government of Kosovo. Also, this objective is supported in the national rules that seek to ensure one systematic improvement of the inventive capacities of cities and municipalities. Activities undertaken by Kosovo's institutions cover a wide range
From 2022, By involving 5 universities from 5 different countries (University for Business and Technology - Kosova, TU Wien-Austria, ET University Zurich-Switzerland, Hafen City Universitat-Germany and Mimar Sinan Fine Arts University-Turkey) with more than 20 experts/professionals from academia and other experts/professionals from partner institutions and industry, "Kosova Smart City" project aims to prepare a **National Strategy for Smart and Sustainable Urban Development**, as well as to prepare and communicate **Overall Smart City Strategies** for 7 Kosovo cities, providing them with innovative approaches towards local problems and helping them to promote and generate a sustainable urban development.
Prishtina, Prizren, Ferizaj, Peja, Gjilan, Vushtrria and Lipjan Municipalicies, which all together constitute more than 30 % of Kosovo's territory and 45 % of Kosovo's population, will be targeted by this project. All of these 7 cities will be treated in parallel.

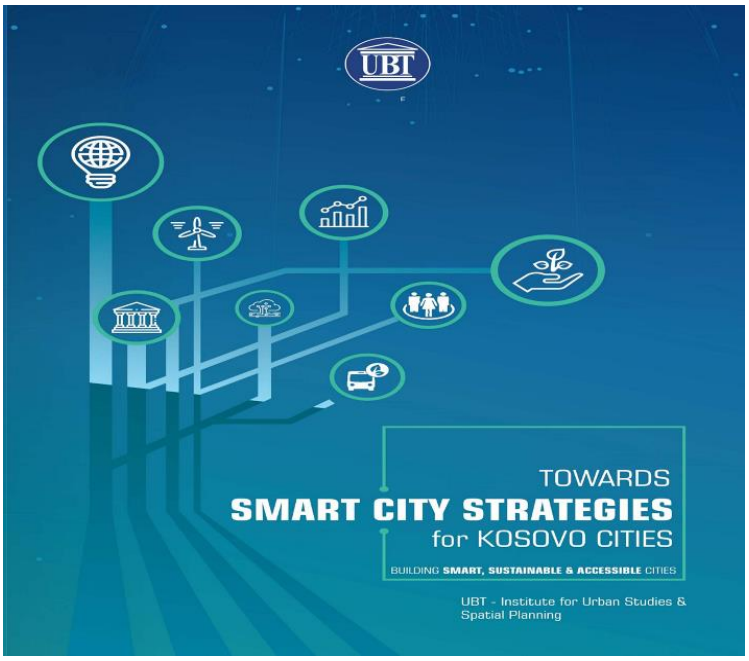


Fig 3- Areas Smart city Strategies for Kosovo Smart Accessible cities (UBT -Institute for Urban Studies& Spatial Planning),Prishtina 2022

Since 2013, the: Friedrich Nauman Foundation has increased the commitment to the thematic area "Smart City", especially at the local level in Kosovo Municipalities.

2.2 Smart Home concepts and Models

Concepts and inventive solutions have been in focus IT that can significantly improve the quality of citizens' lives, not only in urban areas but especially those in rural areas.
The concept "Smart City" should be understood as a process not Objectives.


Fig 4-Smart Home concept - Smart Intelligent Building www.smart.Buildings
What is a Smart Home?

A smart Intelligent home is a connected home with wired and wireless communication between devices, the Internet and the I cloud.
With a connection to a local area network (LAN) or 5G, devices are able to exchange information, media files and databases that are connected to the network, creating a fully connected home and Smart homes connect high-tech devices in a residential building. They are designed to improve security and increase resource conservation in residential buildings.

3. Discusions Problematics for Modeling Smart self-learning Buildings In EU -countries and Kosovo

Comparative methodology used for this paper Where is main work is based on comparative data with EU -countries and Kosovo.
Models for building management end facilities will used as different type for sustainable and Smart Self -learning house based on the smart technology.
The rapid development of information technology has opened the way for its use in the construction sector.
Methods related to the principles of digital construction and building information modeling known as: Building Information Modeling (BIM).

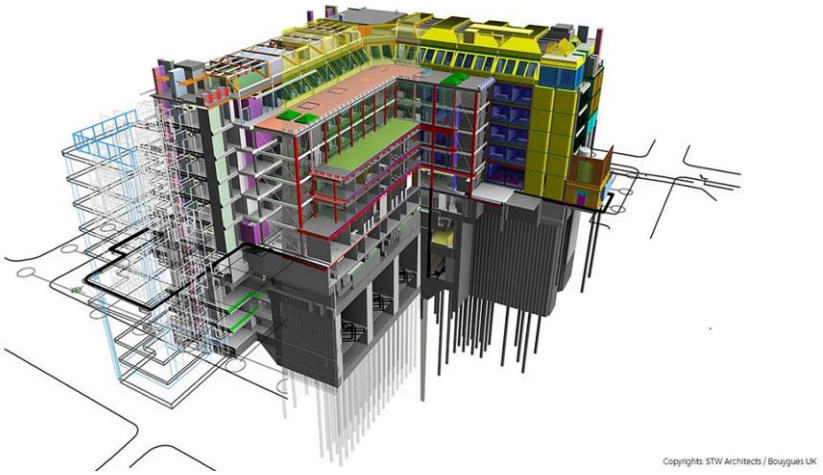
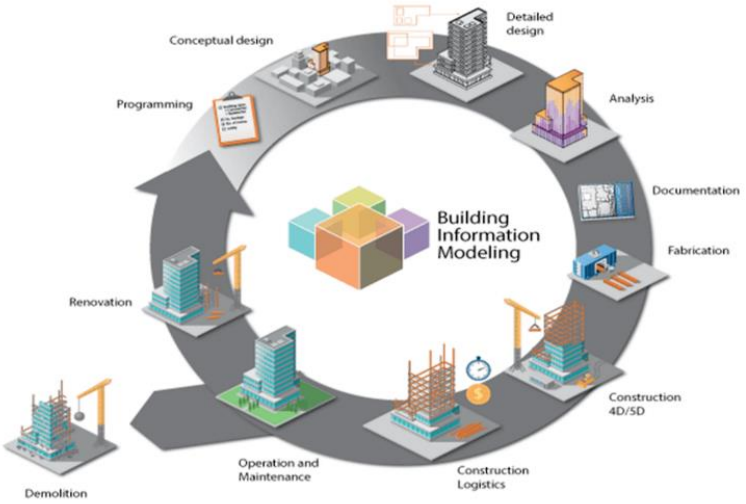


Fig 4- UCLH PROTON BEAM THERAPY CENTRE, LONDON- BIM-model. (2020)

Example ; Smart building design – As the project design and construction plans take shape, the project team can analyze alternatives, identify problems and solve potential problems before they occur in real life.
- This significantly reduces the risk, saving time and money, tools for this Building facility.
Smart Building Modeling Cycle…. Life cycle stages BIM MODEL-can be explained by the figure below: building cycle format for BIM.



The model can contain all the physical and functional characteristics of a project, including structure, geometry, aesthetics, materials, systems and dynamic performance. A 3D model becomes 4D if a time component is added and 5D when construction cost information is included.
Adding value at every stage of the project. BIM is used at various stages of the project life cycle, from design through construction and operation, to sustainable demolition.
High-level BIM implementation provides improved risk management, significant productivity gains, shortened construction time scales and significant cost savings over the project life Cycle.
- Providing the WSP's BIM and VDC services and products include: Parametric Modeling Building Information Modeling is providing integrated project 2D/3D Modeling for Design Support Design Evaluation/Review. 4D Modeling.
Analysis and review of building constructability.
Multidisciplinary collaborative work processes. Simulation and performance analysis.
Power-VDC Modeling and Analysis and Risk Analysis Integration.
Automation of building construction, building!
BIM can also be used to detect clashes and eliminate spatial conflicts, such as areas where electrical and HVAC designs require equipment to occupy them same space.
Other applications include execution scenarios, such as the operation of an emergency ventilation system and energy analysis and modeling.
BIM- can model the movement of the sun to help perform daylighting studies and optimize solar panels.
Sensors that detect if the concrete and other infrastructure of the building is carrying more load than it should which increases safety and reduces the likelihood that a building or object would collapse or be damaged.
This system models protection against explosion and explosive devices.

4. Discussion the results from Analyzing restrictions and challenges for Smart Cities in Kosovo

The Smart City concept is used to define country that efficiently uses the resources it has available, through the use of innovations and technologies, ensuring the participation of citizens through online participation and e-government to address and to improve the quality-of-life for citizens of Kosovo. For the purposes of this study, Friedrich Nauman Foundation has increased the commitment to the thematic area "Smart City", especially at the local level in Kosovo Municipalities.

4.1Methodology for research questionaries

The UBO Consulting agency In Kosovo has used both methods, quantitative and qualitative research, to identify tools and innovations Smart City that have already been implemented, in parallel with Smart City projects, which are either already implemented, initiated, or simply planned in units of local Municipality government in Kosovo.
In the first phase of this study, UBO Consulting has used the quantitative method of research, to evaluate the perception of the LG units about the initiative's Smart city, identifying tools or innovations already planned or implemented and the assessment of challenges that municipalities face during implementation.
The questionnaire consisted of 24 questions, 5 of which they were about demographics. The questionnaire had questions designed to assess the knowledge of to the representatives of the LG units for the topics, activities and undertaken by their municipalities, limitations and challenges as financing of these initiatives. As additional parts, they are provided descriptions for the concepts that the respondents, potentially do not have familiar with them. This is done to make their meaning clearer to them concepts.

4.2 Sample design

One of the most important steps of the study is sample design, as this ensures the accuracy of study information. In this regard, the sample should reflect the main purpose of the study, within the framework for the scientific principles and the possibilities they offer.
Considering the purpose of this study, samples for online survey consisted of representatives of each municipality governments.

The invitation to be part of this study has been send the offices of the mayors of 34 municipalities, of both communities, the Albanian and the Serbian.
Invitation to complete the survey was sent to you via email, had by a phone call with people. The emails contained the text for the purpose of the study, attached to the paragraph for online questionnaire, email address and details for contacting the researcher by phone.
In the middle of representatives of the 38 municipalities that were contacted, 14 of them answered the online survey. Questionnaire for online survey and for discussions in focus groups, was divided into the following topics:
- Knowledge/familiarity with the concept the Smart city?
-Knowledge/familiarity with the concept smart city.
-Tools and innovations the city of wise, planned and those already implemented.
- Sources of financing initiatives smart city?
- The limitations and challenges with which municipalities/directorates face each other in the implementation of city solutions wise.
-Making city initiatives a priority wise on the agenda of the municipality.
- Cooperation between municipalities, central level institutions and the private sector in planning the implementation of smart city solutions.

4.3 Results discussions

To begin with, initial questions from the online survey aimed to assess the respondent's opinion on the Smart City concept. Therefore, the questions from these sections aimed to discover how they assess their level of knowledge on smart cities and how they define Smart Cities.
The following graph shows the evaluation on the knowledge regarding the Smart City concept according to the respondents. Asked to rate their level of knowledge from 1 (no knowledge) to 5 (complete knowledge) on Smart City concept, the majority of respondents have declared to have knowledge to a moderate extent (28.57%) or knowledge to some extent (28.57%). There was only one municipality who confidently affirmed that they had complete knowledge on the Smart City Concept. On the other hand, two municipalities

(14.29%) declared that they have no knowledge on this concept.
7.14%--- They have fully knowledge of respondents but 21.43% they had little knowledge.

5. Conclusions

5.1Advantages

During this study research the conclusions from results discussions providing the Smart Cities concept in a some of municipality in Kosovo must be compared with the Smart Cities in EU.
The key benefits for Smart building and Smart technology are: Smart Cities in Kosovo for providing Sustainable country development.
Sustainable Living, Working, Mobility and Public and reducing the emissions.
Energy efficiency use for physical building infrastructure through the new opportunities and Sustainability managements.
Efficient public utilities and Cost Savings using the renewably resource.
Environmental Impact: Reduced environmental footprint.
Enhanced citizen and government engagement. Public service digitalization
Comparing the results from the analyses we conclude that:
Self-learning and adaptive buildings are the another's model of the sustainable
Models and Smart cities engagements using the Modeling subsystems that
alternatives for the preservation and protection of human life, the protection of health and safety the protection of the environment, the preservation and recovery of critical activities.
- Smart, self-learning and computer help in the form of psychological and emotional help.
This system supports residents' morale and instantly selects the best movie, building music, lighting and other aspects that residents like Smart Buildings
The various models are components of smart, self-learning and adaptive buildings which offer the following
Unbreakable systems to improve disaster management!
Building automation works on the same principle, but on a larger scale.
ACSUS- automation systems and building dispatch. Integration of engineering systems. Work program "Technical use of buildings and structures Software for the operation of buildings.
Building automation (ACSUS) is a comprehensive system of hardware and software. It is intended for remote centralized monitoring and automated management of building engineering systems from a single point of dispatch and decision-making support for building operations.
The use of building automation and distribution systems (ACSUS) provides significant advantages when operating buildings throughout their life cycle. This is achieved at the expense of effective centralized building management.
Automation allows you to create a unified building infrastructure for the effective operation of engineering systems. (ACSUS)
More efficient consumption of energy resources (water, electricity, gas, etc.)
Safe and reliable operation of engineering systems, preventing abnormal regimes and operational response to emergency situations;
High level of comfort for people in the building;
Reduced operating costs of the building. The different models are components of smart, self-learning and adaptive buildings that offer the following:
Advantages of building automation:
WIFI load monitoring system; (4G and 5G systems) applications and monitoring. Advanced systems with smart applications and Software

5.2 Challenges

Low economic development.
Cost benefits and low financial Opportunities for investments in the Smart buildings.
Lack of building code and legislation in force in the field of construction and

infrastructure.
Missing Integration technologies for creating the Sustainable Buildings in the country. Lack of national and country Strategy's in the field of the Smart Cities. Missing and integration of the Mobility Action Plan and Strategy not implemented the Smart city Strategies for Kosovo Smart Accessible cities (UBT -Institute for Urban Studies& Spatial Planning),2022 Prishtina.

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