Smart city management and development by applying technology

Ngo Thi Kim Dung[1,2], Nguyen Thi Lan Phuong[1,3],
Nguyen Hoang Minh[1,4], Nguyen Huy Hung[2,4]

Abstract

Along with the development of science and technology and the application of the achievements of the 4th Industrial Revolution, many countries around the world have succeeded in building a smart city model that contributes to improving the quality of life, improving the service quality of the city government, reducing energy consumption, and enhancing the effective management of natural resources. Smart city development is one of the important driving forces to realize the goal of turning Vietnam into a modern, high-income industrialized country by 2045, while promoting national digital transformation, digital economy development on the basis of science - technology and innovation. This article aims to propose technological solutions in smart city management and development associated with digital transformation.

Key words: *Smart city, Management and Development, Technology solutions*

[1]*Dr. Arch., Hanoi Architectural University*
[2]*Email: dungnkhau@gmail.com,*
[3]*Email:phuongntl@hau.edu.vn,*
[4]*Email: nguyenminhsdh@gmail.com*

Date of receipt: 17/10/2023
Editing date: 13/11/2023
Post approval date: 8/12/2023

1.Introduce

Currently, facing global issues such as economical use of resources, energy, response to climate change, towards green growth and sustainable development strategies, smart city development strategy is an inevitable trend being applied by many countries. In the context of the Fourth Industrial Revolution, according to the direction of the Politburo's Resolution No. 52-NQ/TW dated September 27, 2019 on a number of guidelines and policies to actively participate in the 4th industrial revolution [6]; Resolution No. 50/NQ-CP dated April 17, 2020 of the Government promulgating the Action Program to implement Resolution 52/NQ-TW [1], the Ministry of Construction, the Ministry of Public Security, the Ministry of Information and Communications, the Ministry of Science and Technology, the relevant localities are assigned the task of researching, building and completing the legal framework on sustainable smart city development; system of national technical standards and regulations; the data infrastructure system, the system of criteria for evaluating the operational efficiency of smart cities; allow pilot implementation of a number of specific mechanisms in the pilot implementation of smart city development, ensuring efficiency and suitability with actual conditions. In particular, the project "Sustainable smart city development in Vietnam for the period 2018 - 2025 and orientation to 2030" according to Decision No. 950/QD-TTg dated August 1, 2018 approving the scheme, assigning the Ministry of Construction to assume the prime responsibility for, and coordinate with central and local ministries, branches in implementation. The project aims to implement the national socio-economic development strategy and plan through sustainable smart city development in Vietnam. [2]

Smart urban development must be based on the guidelines of the Communist Party of Vietnam, State laws, orientations, strategies, master plans, plans and programs for socio-economic development, etc. At the same time, this is an important content of the 4th Industrial Revolution, using means of supporting information and communication technology (ICT) and other means to improve the efficiency, quality of urban development, increase the living environment, and improve the quality of urban life, economic and social development. On that basis, in order to realize the above content, it must be people-centered, making an important contribution to the implementation of the National Strategy on green growth and sustainable development goals, based on scientific and technological achievements with many platforms, ensuring network information safety, network security, protecting personal information, ensuring the synchronization between technological and non-technological solutions.In the implementation process, it is necessary to ensure the consistency and optimize the existing technical and ICT infrastructure based on the ICT reference framework for smart city development, technical regulations and standards to ensure the interoperability and synchronous operation of smart cities as well as between smart cities; using key performance indicators (KPIs) for smart cities. In addition, in order to organize the implementation of sustainable smart city development, it is necessary to encourage investment participation from socialized sources on the principle of correct calculation, adequate calculation of costs and risks, harmonization of interests of stakeholders, and encouragement of the use of domestic products and services. Organize typical pilot implementation, ensure short-term and long-term investment efficiency, do not develop spontaneously, rampantly, following the movement.

The most important tasks and solutions today are to perfect institutions and policies to facilitate the process of urbanization, planning, construction, management and sustainable urban development; To soon build a legal

framework for smart city development, management of urban technical infrastructure, urban underground space; Improve the quality of urban planning to meet the requirements of construction, management of sustainable urban development, comprehensive innovation in methods, processes and contents... Building a national data system on urban development planning; widely apply geographic information system (GIS) and technology, digital foundation in urban development planning and management; Focus on building and developing a national urban system in a sustainable and synchronous manner through the effective implementation of national projects and programs on urban development in Vietnam in response to climate change, natural disaster and epidemic prevention and control; Urban renovation, embellishment, reconstruction and upgrading; Building and developing smart cities; New rural construction in line with urbanization orientation. Promote housing development, synchronous, modern, connected urban infrastructure system and adapt to climate change [3]. Promote investment in synchronous digital infrastructure development in urban areas equivalent to developed countries in the region and the world; integrate measurement systems, sensors, data systems, effectively exploit digital platforms and apply digital technology to essential infrastructure in urban areas; promoting the smart management model in the operation, management and exploitation of urban technical infrastructure systems. To build and perfect the urban government model in order to improve the effectiveness and efficiency of management, the quality of urban life, to ensure security, social welfare, security, safety and urban order; Building e-government towards digital government in urban areas closely linked with smart city development; Renovate financial mechanisms and policies, urban development investment. Developing service economy, circular economy, sharing economy, night economy, tourism economy, sports... in special urban areas and big cities...

This article will present researches on new technologies in urban planning and development management, technical infrastructure system operation management, thereby proposing new technological solutions in planning management and smart city development.

2. Research methods

2.1. Technology application in urban planning and development management

Geographic information systems (GIS) have been widely applied in urban planning and development management in the world since the 1960s. Currently, many technology companies in Vietnam have built a number of application systems that allow the integration and management of Planning Documents with full layers of data for management (spatial planning, land use, traffic, water drainage and drainage, and ground level, water supply, etc.), With a database built synchronously on the same national coordinate and elevation system, it allows to support spatial analysis to support planning, collect public comments, publish planning, look up, and provide planning information to stakeholders. In addition, the urban development and planning information management system allows linking with state management application systems of the construction industry at the provincial and urban levels in management of investment project licensing, construction permits, housing and real estate market management, management and operation of technical infrastructure systems, and inspection, inspection and supervision of construction investment activities. [4]

Although the effectiveness of the geographic information system (GIS) as well as a number of technology solutions for planning management have been initially applied, currently neither Vietnam nor the Ministry of Construction have issued a standard framework for the planning geodatabase, so the current applications are still single, standardized on the basis of a system of regulations on drawings and symbols of planning schemes according to the method of Circular 12/2016/TTD dated June 29, 2016/TT. In addition, there is a current problem when construction and urban planning projects are made on the basis of topographic survey maps, while the practice of land management of the natural resources and environment sector is managing on the basis of cadastral maps and there is a certain deviation in the locality. With the orientation in Project 950/2018, the development of urban spatial data infrastructure, consolidation of land, construction data and other data on GIS basis, along with the early research and issuance of a standard framework of planning geodatabase are indispensable requirements for synchronous urban planning & development management.

2.2. Technology application in management and operation of technical infrastructure systems

a. Smart Traffic management and operation

The intelligent traffic system is set up to support the management, control, operation, exploitation and maintenance of the external, urban, bridge and tunnel traffic network during the operation and use; allows to collect, process information, control decisions to the management department and control network of traffic signals. A number of solutions have been deployed such as automatic weighing system, automatic toll collection without RFID, traffic monitoring system, traffic information board system, traffic measurement, weather monitoring, inner city traffic signal control system. Advanced technology in the recent research phase has used 2D, 3D laser scanning systems, artificial intelligence (AI) in identification.

On the basis of a synchronous and unified management system, it allows can automatically assist in handling and operating traffic to help reduce traffic congestion and reduce emissions into the environment; capable of real-time management, intelligent analysis, creating diverse traffic scenarios and situations in reality, increasing flexibility, and simplifying traffic management. Some main functional components system: traffic surveillance camera system, vehicle flow metering system, event management system, vehicle load control system, traffic information supply system, traffic control signaling system, weather information system, communication system, emergency telephone system, equipment monitoring system, toll collection control system, traffic control center, toll collection system traffic signal, automatic traffic incident detection system. [4]

These systems are built on the basis of digital map technology (GIS), mobile technology and cloud computing with full information of various types of map data, field data (location, images, information) using mobile devices (tablets, smartphones) capable of correcting location on the basis of field maps, synchronizing and interlinking with road search and navigation tools.

b. Management and operation of the water supply network

Managing the water supply network for water supply enterprises effectively on the basis of building a geodatabase

Fig. 1. Real-time simulation model provided from the network of monitors and sensors[7]

system on the water supply network, modernizing the management of plant assets, equipment assets, asset maintenance, monitoring the operation of the smart water supply network with the Dashboard system, meter life cycle management, and inventory management; incident management system, property maintenance, repair, management and customer care of water use, support for water loss prevention as well as integration of value-added service solutions: VOIP 1900 customer care switchboard, SMS, e-invoice and electronic payment into the customer management system.

A number of operational management solutions for businesses have been implemented such as: customer management software system, Dashboard to monitor production and business activities, VOIP customer care switchboard, electronic portal, customer care to look up: water bill, installation registration; Indexing on mobile devices, issuing and paying bills electronically.

With a WebGIS-based solution, water supply network assets and data are updated from as-built records, capable of accurately updating information and GPS location from the field in the field, can be connected from anywhere via the Internet.

c. Managing the tree system in the city

Currently, the management, inspection and care of trees in urban areas is still quite manual. Advanced technology application solution allows building GIS database of overall tree map to visually control trees: information, location, image; control the total number of trees, increase, decrease over time; track tree history during growth, development, tree movement history; develop a plan for periodic care, special care according to the condition of the tree; assigning and supervising the implementation of tree care work in the field.

Tree database with information on attributes, locations, images, status of trees in the field updated via applications installed on mobile devices; In addition, setting up a system to receive incidents and request treatment of trees between people and management units. [5]

d. Management of lighting systems and electrical networks

The system allows to build and manage a GIS database of the overall status of the lighting network, the power supply network (street lights, power poles, electrical cabinets, power supply networks, substations, transformers, etc.) link with application control systems on property, increase or decrease the number of lights; control safety, leakage of electricity of each asset in the system, record the index by mobile device; synchronize data between mobile devices into the management system; track equipment repair and replacement history; make periodic maintenance and replacement plans; In addition, there is the ability to connect to the system to receive and respond to lighting troubleshooting requests from the people, to integrate the monitoring and remote lighting control system. The database is updated directly in the field through devices and smartphones. [5]

Currently, customer management, issuance and electronic invoice payment services have been integrated into the payment systems of banks through providers such as Viettel, VNPT, BKAV, VNIs...

e. Drainage Management

The system allows building and managing a GIS database of the overall status of the urban drainage system, modernizing the management, inspection and maintenance of the drainage system; improve the use efficiency, asset life from the strict management of the operation and maintenance of the drainage network assets. Database of drainage system from sewer network, location of manholes, discharge gates, pumping stations, drainage connection points, etc. in the field by mobile application. The collected data is synchronized directly from the mobile device to the database system for mapping and management of the drainage network.

The contents of property management and equipment are displayed visually on the map:

- Manage information, images, documents,... associated with visual assets on the map of the drainage network.

- Allows monitoring and recording of content and results of inspection and maintenance associated with each asset and equipment

- Provides the ability to allow users to actively adjust and expand management information for existing assets and equipment, add new assets and equipment to meet future management needs.

- Detailed management of devices in an asset unit

- Provide the ability to query assets, schedule maintenance, assets need maintenance

- Synthesize, inventory and report on the management and use of assets and drainage network equipment according to the report templates, output to formats according to different filter conditions. In addition, the system allows receiving information requested and reflected by people about the status and problems on the drainage system. The results of the field inspection are updated accurately about

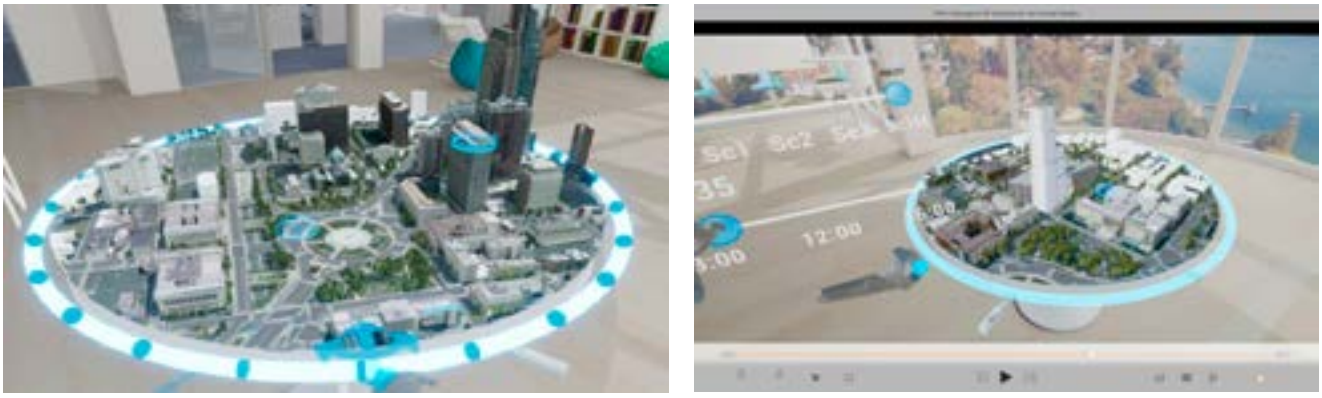

Fig. 3. Building 3D city model on GIS platform[7]

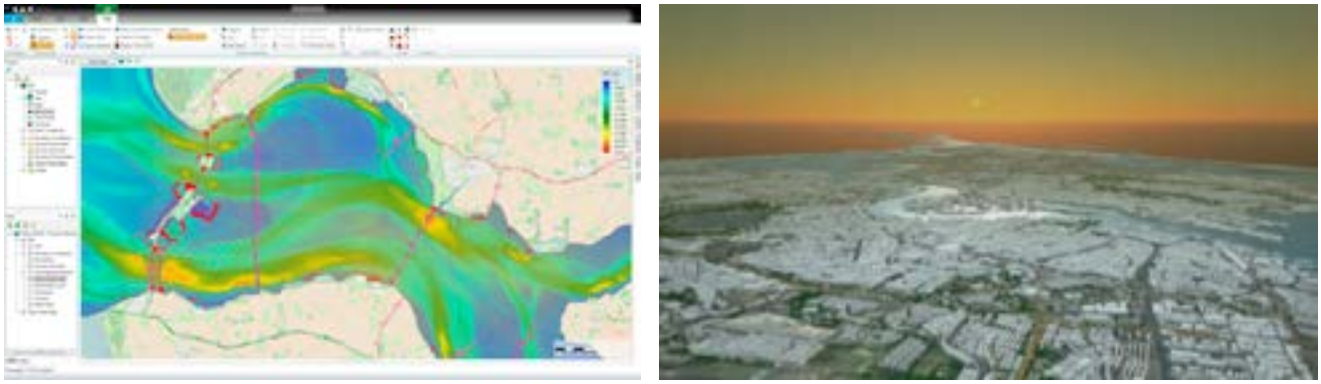

Fig. 2. Analytical model of infrastructure based on spatial development[7]

the location, images, and the situation of troubleshooting.

2.3. Smart technology to support spatial planning

The parallel existence of the digital city, which allows to provide up-to-date status information of the city, allows the construction of master plans and plans to be tested and simulated. Challenging urban problems such as environmental pollution, noise, traffic overload in the city center, the requirements of creating a better and more attractive living environment pose requirements for situational solutions for each area related to many factors and fields. The parallel digital city is a bridge between the digital model and the real city, allowing researchers and policy makers to experiment with adjusting solutions, parameters, and evaluate solution effectiveness through simulation of traffic patterns, noise pollution, gas environment based on interaction with real-time data provided by monitoring and sensor networks.

Many solutions and analytical models of infrastructure related to other spatial development orientations such as hydrological analysis, simulation of flooding and drought due to the impact of climate change, high tide,..., dike system, drainage basin, planning of ground elevation impact on urban space.

In addition to GIS-based technology solutions combined with 3D simulation that have been applied in planning and architecture, recently many virtual modeling and augmented reality applications have been developed to a higher level for urban spatial planning. Users use GIS databases to build 3D city models and have options to design spatial architecture, landscape, and simulation according to their ideas from adding or subtracting buildings or streets. In virtual reality, users can observe urban space from many different perspectives, and have the ability to simulate observations according to the time of day to evaluate the shaded area of the building.

3. Research results

3.1. Proposing smart solutions on technical infrastructure systems

a. Smart Traffic

Types of transport such as electric cars, electric bicycles, mini electric bicycles are a new trend in the development of green, environmentally friendly, people-centered means of transport, safer and more convenient to participate in traffic. Smart technology is researched to integrate multimedia traffic in the direction of approaching public transport to people, to everywhere: connecting from the subway system, sky train, bus, shared electric bicycle network. To form parking lots, bike gathering points at public transport transit points at train stations and bus stations. Information on the operation of vehicles participating in traffic, information on weather, traffic status on each route, information to support traffic participation, status of stops, parking lots, stopping and parking status of the shared e-bike network is updated in real time on the mobile application system.

In addition, the specific information of the traffic sign system is updated to calculate the time, compare the travel routes, and link with the positioning data of the user of the positioning device (smartphone) to calculate the navigation. The integration and continuous updating of maps, sign systems and navigation data of vehicles on the road will optimize traffic management efficiency and navigation.

On the basis of the navigation system of the network of vehicles participating in traffic to provide a large database,

serving to analyze traffic participants' habits, thereby improving the Services and Adjusting the smart traffic network planning of the city. From the mobile application, road users can choose from a variety of public and shared transport connectivity options in real time. With the trend of developing advanced technology, autonomous vehicles are also being researched and developed. These models have been developed in many pioneer cities such as: Barcelona, Amsterdam, London,...

Along with the development of friendly and shared means of public transport, solutions to encourage urban people to walk through urban design solutions and connecting transport networks play an important role. Analytical models ensure that people can access public transport and the nearest service points in an average time of 15 minutes, urban design solutions create attractive landscapes, green space systems, roof systems, building setbacks with shade to ensure convenience for pedestrians, and at the same time increase the health of the community.

b. Smart Water management

- Water supply management: With the rapid urbanization and migration to big cities, the demand for urban water increases and is also affected by climate change, a new requirement is posed towards the method of integrated management of water resources in a smart and efficient way. Issues for a smarter water management approach include:

+ Diversify and effectively manage water supply sources: Take advantage of many water sources from rain water, sea water and reuse treated wastewater; Remove pollutants and algae from the river system; non-pollution management from the very beginning of the water source.

+ Production and supply of clean and safe water: Upgrading the water treatment technology process; Real-time, remote quality monitoring via sensor system; Automating water treatment processes

+ Efficient water supply and monitoring: Remotely monitor and avoid pipe leaks

+ Integrated management: Integrated monitoring of water management in terms of volume and quality; Integrated management of water production, supply and consumption; Water treatment infrastructure asset management

- Water supply network management: More efficient water supply management through the application of information technology that provides real-time data on water use from water consuming units and devices, from households to integrated watershed management, water treatment plants and transmission networks, for example:

+ Reuse of water from collection and treatment sources

+ Leak monitoring system: A system of sensors and leak detection technology connected to real-time automatic monitoring software

+ Smart sensor and meter system: Upgrade and install a water meter system capable of measuring normal flow and monitoring water quality

+ The application automatically connects the clock network to the monitoring system.

- Sidewalk surface water collection system for urban water circulation management:

Low-impact development technologies are a new trend in developed countries. The creation of urban spaces with the function of managing water circulation rather than simply using water as traditionally is a trend of interest. In traditionally developed urban areas, about 70% of the urban surface is impermeable, of which an average of 50% is pedestrian or sidewalk traffic. The management of rainwater collection for most of the traffic surface impervious to water, requiring rapid drainage due to unusually heavy rains or an increase in heat island phenomena during the summer months imposes a requirement for a system of green spaces, temporary water storage areas, and groundwater recharge capacity. The proposed solution, besides increasing the surface of green space along the sidewalk, can form a water tank under the walking pavement surface. Parallel to the traditional water collection system along the road, rainwater is absorbed and replenished from the increased green space system along the sidewalk, naturally filtered through the soil layers and filtration system before overflowing into the collection tank system under the sidewalk. The storage tank system acts as a temporary water storage source, and at the same time, the filtered water can be used to circulate for watering plants on both sides of the road. [5]

- Automatic management and monitoring of river water level warning system:

Sensors are often used to monitor and measure river water levels or at sluice gates and send information to a monitoring center. However, after using the sensor system, it may malfunction and lead to false alarms. With the popularity in the installation and use of surveillance cameras in recent times, it is possible to combine high-resolution traffic and bridge surveillance cameras to read river water levels from painted elevation landmarks of bridges and culverts. Building an automatic monitoring system that integrates information and data from a sensor system or a network of security surveillance cameras (in appropriate locations) will optimize efficiency for water level management, flood warning, as well as assist in regulating river water levels when storms and floods occur.

c. Smart energy management

- Smart urban energy management system:

Towards the goal of green growth, low carbon emissions, in addition to solutions to balance supply and demand for energy use at the national level, urban governments need to have their own energy management system, efficient use and saving of energy at the urban scale and in each region. The system considers the current state of energy demand as well as the future direction of urban expansion, synthesizes energy supply data from different sources (grid electricity, gas, solar power,...), especially considering the supply from renewable energy sources, and at the same time optimizes the energy demand of urban areas from these sources. The analysis of energy demand and consumption is displayed on the basis of a physical GIS database. In addition, the system allows real-time monitoring and forecasting of energy demand; at the same time connected to the weather forecasting system related to the renewable energy supply to coordinate the supply.

- Optimization of power supplies:

Faced with the problem of global warming, implementing the Paris agreement on climate change, countries must develop their own plans to reduce greenhouse gas emissions and reduce fossil energy consumption. Many policies to encourage the use of renewable energy have been issued recently. Some systems that optimize power supplies such as:

+ Self-sufficient energy system for remote areas and islands: General supply from solar power sources, small wind power, mini hydroelectricity can be supplied to remote areas and islands serving a population of about 1,000/person; Optimally collecting rainwater, groundwater, pumping from the storage tank system to generate hydraulics and generate hydroelectricity; Develop solar and wind power farms on the basis of optimal research on weather conditions of each region.

+ System for collecting piezoelectric effect energy from roads: Road technology with the collection of energy from the piezoelectric effect through elastic materials allows the conversion of energy collected from pressure to electricity. PZT ceramic material is applied under the road material allowing to collect energy when there is traffic passing above. With product prices falling in recent years, and at the same time higher energy efficiency (increasing from an average of 0.33 mW/cm2 in the past to 5mW/cm2 now), this will be a promising trend in the near future.

+ Geothermal development: besides solar and wind energy which have been widely applied, access to geothermal energy is a new trend of developed countries.

3.2. Proposing smart solutions in construction and construction management

a. Smart construction management

Construction management is one of the topics of interest in smart development. From the technology aspect, the application of IT in construction management of a project starts from the planning, design and construction steps to the operation, maintenance and maintenance steps. The technologies considered, researched and integrated include: flying equipment, 3D printing, infrastructure BIM, big data, IoT, BIM-GIS integration, sensor systems, virtual reality, augmented reality, unmanned vehicles, etc.

- Integrated BIM/GIS system

The problem of integrating the building information management system (BIM) with the geographic information system (GIS) is necessary for smart city development on the basis of urban modeling. BIM allows to provide full information throughout from progress, construction techniques, activities from planning, design, construction, maintenance, repair, and operation to construction on the basis of 3D spatial model with a high level of detail. Meanwhile, the GIS system has a lower level of spatial detail, based on the large-scale geospatial background, 2D geometric data on the survey map. Currently, there are many studies to close the gap towards integrating 02 BIM & GIS systems. BIM application helps to solve the content related to the building and geographical information inside the building, GIS manages the geographical data outside the building. The BIM/GIS connection platform allows the integration of 3D BIM/GIS information from processing related information from diverse geographical data of the city. The project management information can be managed, operated, linked with the utility service systems of the city, such as energy management system, real-time traffic management, fire prevention, security system, property management in the area... [4]

- Management of construction geotechnical information with an information database (geological survey drill bits, geological information, administrative information) stored and integrated with the Integrated Underground Space Map, including the information system of utilities (water supply, drainage, lighting, heating, ventilation, communications, gas pipelines); underground works system (walkway, underground traffic, subway, underground parking, public space and underground commercial services) and related thematic maps and information.

- Building a 3D model of the construction surface through 3D laser scanning technology with a surface dot matrix with geographic coordinates and linking attributes of soil type, moisture, relative density, groundwater level,... supporting analysis for earthworks.

- Using flying equipment to build 3D models of works, support rescue work, overcome blind areas that are not within the field of view of conventional camera systems.

b. Smart building energy management

Besides the connected building equipment management system (BMS), common smart device management systems in the home, specialized energy management systems are continuously being developed such as:

- Managing energy used in the house, synchronizing equipment such as air conditioners, heating equipment, water heaters, standardizing synchronous equipment in the house from lights, door locks, curtains, gas lock valves, indoor ventilation system, heat sensor, water heater, security system, main circuit breaker, air conditioning system, etc.

- Developing analysis models for each device's energy use, thermal models between indoor and outdoor, automatic control of temperature and indoor equipment to ensure optimal energy efficiency.

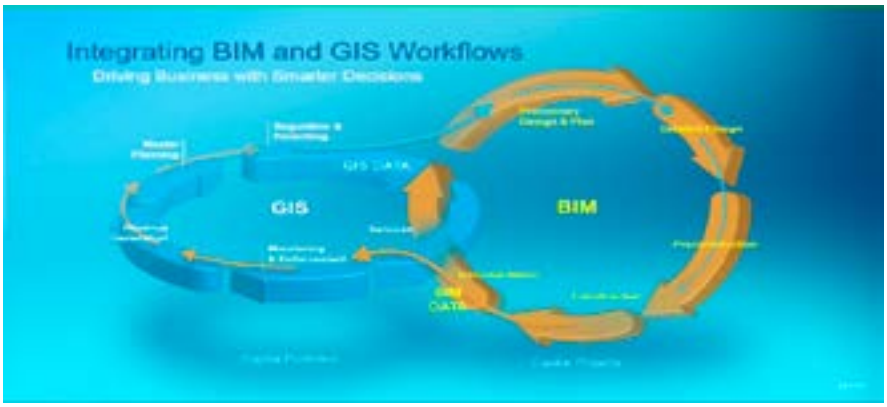

Fig. 4. The combination of BIM and GIS systems in smart city management[4]

3.3. Practical application: GIS application in urban planning in Hanoi, Vietnam

The geographical information system (GIS) has been researched and piloted into a number of planning projects to support the formulation and management of urban planning; The pilot research contents in the Hanoi Capital Construction Master Plan are integrated throughout the planning process, including:

- Investigate, survey and collect data on the current status of the fields: socio-economic, social infrastructure, technical infrastructure & environment.

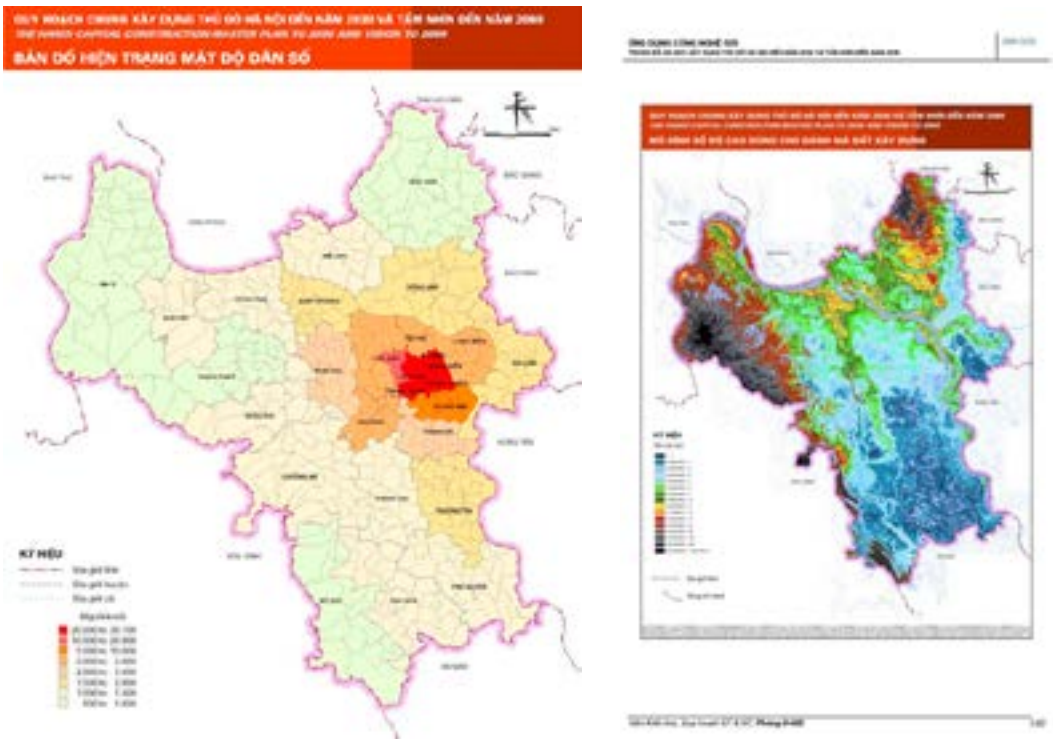

Fig. 5. Some analysis when applying GIS in general urban planning of Hanoi capital[4]

- Building the current status database on the collected data.

- Develop diagrams to analyze and evaluate the current status of the fields based on the current status database of the fields: socio-economic (population distribution, population density, economic development by sectors, network and information on the network of industrial zones, industrial zones, agricultural development, trade and service network), current status of distribution and serviceability of the network of technical infrastructure, health care, and information technology system (prices of the system of urban infrastructure, health, and environment) environment (traffic, water supply, rainwater drainage, ground elevation, power supply, wastewater treatment, solid waste, environment).

- Building a number of analytical models to support the assessment of the current status: digital elevation model for topographic analysis for urban construction land assessment, drainage basin zoning, assessment of service coverage of the social infrastructure network by distance, analysis of distribution status and current status information of each field.

- Statistics of data by field, current status of land use, land use planning based on GIS database.

- Urban 3D simulation according to basic information about density and height.

- Build a database for urban planning management according to approved planning documents.

*Advantages:

- From the GIS application approach, in the process of surveying, collecting current data is collected in a more integrated and systematic view, thereby allowing to perform analysis of current data on the map system quickly, saving time, and highly convincing analysis.

- GIS allows to overlay many different types of maps and data as well as to perform complex spatial analysis that cannot be done by planning support software; especially the analysis of digital elevation model, slope analysis, drainage basin division are simulated clearly.

*Disadvantages:

Planning units still mainly apply traditional design support technologies to build basic map data (mainly Autocad), do not have systematic thinking and thinking about geographic data management, showing drawings without the management method of geographical features, so it is difficult to standardize, convert and build GIS geodatabases; There are no guidelines & standards for geographic data framework planning to build a synchronous and unified database.

4. Conclusion

Facing global issues such as economical use of resources, energy, response to climate change, towards green growth and sustainable development strategies, smart city development strategy is an inevitable trend being applied by many countries. In the period of 2018-2025, the development of smart cities in Vietnam will prioritize the construction of the following contents: Smart urban planning; Building and managing smart cities; Providing smart urban utilities for organizations and individuals in urban areas with the basic infrastructure of technical infrastructure and ICT infrastructure system, which includes a spatial database of smart cities that are interconnected and integrated with the above two systems. [2]

The research of the article includes applications such as: Technology in urban planning and development management, technology in management and operation of technical infrastructure systems, new technologies to support

(*continue reading page 86)*

Province, contributing to improving the quality of water supply services according to Orientation of water supply services in urban and industrial areas until 2025 and vision to 2050.

4. Conclusions

The study proposed solutions to control water supply reserves and quality in order to achieve management objectives including management control solutions according to the water supply reserve planning; solutions for monitoring the quality of water supply for urban areas and industrial zones in Phu Yen Province under climate change conditions. Moreover, proposing the process of early warning, controlling the quality of River used for water supply (Taking the Ba River at the location of the water intake workfor Tuy Hoa Water Company as typical).

The results of the proposed study are practical, which can help Phu Yen provincial managers to objectively see the current situation of water supply and the solutions to control water supply reserves and quality for urban areas and industrial zones in Phu Yen Province. Based on the study results,proposing plans, solutions and decisions for urban water supply activities in general and expanding the scale of urban water supply projects in the province in particular to achieve the set goals./.

References

1. *Circular No.08/2012/TT-BXD dated November 21, 2012 of Ministry of Construction on Guiding the implementation of safe water supply ensuring.*
2. *Vu Binh Son. Doctoral thesis (2021) Managing water supply for urban areas and industrial zones in Phu Yen Province to respond to climate change.*
3. *Decision No. 2502/QD-TTg of the Prime Minister dated December 22, 2016: Approving the Adjustment of the Orientation of water supply services in urban and industrial areas until 2025 and vision to 2050*
4. *People's Committee of Phu Yen province (2020), Decision No. 749/QD-UBND dated May 11, 2020 of the People's Committee of Phu Yen province on plans to prevent and combat drought and salinity causing lack of domestic water in 2020 in the area. Phu Yen province table.*
5. *Vu Binh Son. Factors affecting water supply management for urban areas and Industrial zones in Phu Yen Province in response to climate change. No. 11/2019, ISSN 1859 - 459X,Vietnam Bridge and Road Magazine.*
6. *Public disclosure authorized (2010), Climate Change and Urban Water Utilities: Challenges and Opportunities.*
7. *Phu Yen Water Supply and Sewerage Joint Stock Company (2019) – Report on the implementation of the water supply management plan in Phu Yen province.*
8. *Anna Hurnimann and Elizabeth Wilson (2018): "Sustainable Urban Water Management under a Changing Climate: The Role of Spatial Planning"*

Smart city management and development...

(continued on page 37)

urban spatial planning, thereby proposing smart solutions for operating technical infrastructure systems, construction and construction management, and introducing experience in applying GIS in implementing general urban planning in Hanoi and Vietnam. These are important studies to effectively implement the three main pillars of smart city development associated with digital transformation in Vietnam as stated in Project 950/2018.

Currently, in the localities in Vietnam, each different province/city is gradually building its own "smart city" according to different criteria and fields, depending on the size, nature of the city, economic conditions, culture - society, desired level of investment and the problems the city faces; In addition, the current government policies for smart city construction are lacking specific studies and guidelines. Based on practical experience, by studying the effectiveness of technology in system operation and inheriting the achievements of the 4.0 industry revolution, the research of the article will be the basis for localities to effectively apply and deploy the management and development of smart cities, as well as an important premise to realize the sustainable smart city development project in Vietnam associated with digital transformation.

Acknowledgements

This work is partially supported by Academy of Managers for Construction and Cities,Vietnam Institute for Urban and Rural Planning. Author also gratefully acknowledges the helpful comments and suggestions of the reviewers, which have improved the presentation./.

References

1. *Government of the Socialist Republic of Vietnam, Resolution No. 50/NQ-CP dated April 17, 2020 promulgating the Action Program to implement Resolution 52/NQ-TW*
2. *Government of the Socialist Republic of Vietnam, Decision No. 950/QD-TTg dated August 1, 2018 approving the Project "Sustainable smart city development in Vietnam for the period 2018 - 2025 and orientation to 2030"*
3. *Luu Duc Minh (2022) Smart City – An important motor for Vietnam's comprehensive development, Construction and Urban Magazine, Academy of Managers for Construction and Cities*
4. *Luu Duc Minh (2021) Chapter 4: Some technology solutions in management and Smart City development, Training materials on Smart City development management, Academy of Managers for Construction and Cities*
5. *Notes summary Smart City construction Project vinh phuc province 2022-2025 orientation to 2030 (2023) Department of Construction of Vinh Phuc rovince.*
6. *Politburo of the Communist Party of Vietnam, Resolution No. 52-NQ/TW dated September 27, 2019 on a number of guidelines and policies to actively participate in the 4th industrial revolution*
7. *Rotterdam-Delft3D-Flexible-Mesh-using-3D-interactive-modelling3-1366x768.png (1×1) (deltares.nl)*
8. *Le Hoang Trung, Nguyen Hoang Minh "Urban development approach to-wards smart cities", Jounal of construction 01-2023, 86-92.*