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РОЗДІЛ 5. РОЗВИТОК ПРОДУКТИВНИХ СИЛ І РЕГІОНАЛЬНА ЕКОНОМІКА

INNOVATION AS A FOUNDATION OF SMART CITY ECONOMY IN TERMS OF WASTE MANAGEMENT IHHOBAЦІЇ ЯК ОСНОВА СТВОРЕННЯ РОЗУМНОГО МІСТА

ТА ІНТЕГРАЦІЇ УПРАВЛІННЯ ВІДХОДАМИ

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Postgraduate Student at the Department of Economic Theory, Management and Administration Yuriy Fedkovych Chernivtsi National University In this article, we reveal the main stages of urban development, the content of the concepts of Smart City and the importance of innovation for their development. Climate change problems, lack of resources and too much waste lead to climate problems. In turn, the development of Smart Cities leads to increased comfort, which is why it creates a dilemma between balanced comfort for citizens and the preservation of the natural planet. Thus, countries such as Cambodia and Uganda receive external waste from other more developed countries. Also, you need proper city waste management. The development of smart cities in solving environmental problems is a necessary issue to be solved; among the main problems the most unified sorting system, selection and displacement boxes can be mentioned. Installation of smart containers is already launching in cities such as Amsterdam, Atlanta, London, Melbourne; this is due to a good source of dissemination and promotion of transfers. The development of such a system supported by local authorities has a high perspective in the development of smart cities. Key words: smart city, waste management, waste management indicators, innovative development, urban development.

В этой статье мы раскрываем основные этапы развития города, раскрываем содер-

жание концепций Умного Города и значение инноваций для их развития. Проблемы с изменением климата, отсутствие ресурсов и слишком большое количество отходов приводят к проблеме с климатом. В свою очередь, развитие Умного Города приводит к повышению комфортности, а поэтому создает дилемму между сбалансированной комфортностью для граждан и сохранением природы планеты. Следовательно, такие страны, как Камбоджа и Уганда загрязняют свою территорию внешними отходами, которые получают от других более развитых стран. Также, нужно правильное управление отходами, большая часть которых создается именно в городе. Развитие разумных городов в решении экологических проблем, необходимо вопросом для решения, с решением одного из главных является сама унифицированная система сортировки, выбор и коробки смещения. Описанная концепция развития инфраструктуры для соответствующего сбора содержания на всех уровнях и жизненных циклах создания и переработки изменений.

Ключевые слова: умный город, управление отходами, индикаторы управления отходами, инновационный рынок, развиие городов.

У цій статті ми розкриваємо основні етапи розвитку міст, розкриваємо зміст концепції Розумного Міста та значення інновацій для їх розвитку. Проблеми зі зміною клімату, недостатньо ресурсів і занадто багато відходів призводять до проблем з кліматом. В свою чергу, розвиток Розумних Міст призводить до збільшення комфортності, і саме тому постає дилема між балансом комфортності для громадян та збереження природи планети. Отже, такі країни, як Камбоджа та Уганда, повні відходів, які вони отримують від інших більш розвинених країн. Саме тому, потрібне правильне управління відходами, більша частина яких утворюються саме в містах. Зростаюча кількість міст у всьому світі призводить до нагальної потреби імплементації розумних рішень управління відходами, щоб збільшити ефективність затрат та збільшити підтримання переробки сміття та збереження природи. Розвиток розумних міст у вирішенні екологічних проблем, є важливим питанням для вирішення, з рештою одним з головних є саме уніфікована система сортування, збору та переробки сміття. Встановлення розумних контейнерів уже спостерігається в таких містах як Амстердам, Атланта, Лондон, Мельбурн - це становить хорошим джерелом поширення та популяризації переробки сміття. Розвиток саме такої системи, яка підтримується місцевими органами влади має високу перспективу та потенціал у розвитку розумних міст. Описана концепція розвитку інфраструктури для належного збору сміття на всіх рівнях та життєвих циклах утворення та переробки сміття. Обговорення екологічних проблем змінило свій напрямок з меж зростання через відсутність природних ресурсів, до меж зростання через перевантаження природних реципієнтів – не тільки на місцевому та регіональному рівнях, а й у глобальному масштабі. На місцевому рівні, одним із аспектів створення стратегії сталого розвитку в Норвегії є написання її на базі "екологічного відбитку" (ecological footprint). Першим таким проектом, була стратегія сталого розвитку міста Осло. Таким чином, в даній статті розглянуто головні засади інновацій Розумного Міста на базі інтегрування систем переробки сміття в довгостроковій переробці. Розглянуто історичні передумови створення Розумних Міст з доісторичних часів до нашого часу.

Ключові слова: розумне місто, управління відходами, індикатори управління відходами, інноваційний розвиток, розвиток міст.

«Smart City is the tool to control future in for better life of future generation» Unknown

Formulation of the problem. In the course of history, we can see that one of the main characteristics of human life has been and is to be gathered together, and after some time, such gatherings have been named as cites. Cities take one of the main parts of our life whether we notice it or not. Each city is unique in its culture, communications and architecture. These very functions influence the quality of life of the city's inhabitants and give their special style and comfort of life. City development has reached a radically high level through innovation, which provides greater comfort of the city. On the other hand, we should remember to save balance between the nature of the planet and human comfort. One of the main factors that can influence and regulate this, is an agricultural waste management. After all, there is the operational waste, so it is an integral part of the impact on the environment.

Analysis of recent research and publications. Recently, the following domestic and foreign scientists have focused their researches on the prospects for the development of the agricultural sector: V. Andriychuk, E. Kakutych, O. Ulyanchenko, O. Pavlov, M. Khvesyk, I. Vinichenko, O. Datsiya, L. Melnyk.

Setting objectives. Today, smart cities are a trend of new well-being around the world. But they raise the question: are they good or bad for the planet? Do they resolve the problem with waste? We see that most of the smart cities are located in developed countries, such as the United Arab Emirates, the Republic of Singapore, Spain, etc. [4]. On the other hand, we can say that the more smart cities are in the country, the more this country is developed because evolvement and new technologies make a good foundation for innovation and rapid progress. To sum up, these results show that such world order has created a huge gap between developed and underdeveloped cities, such as Tokyo in Japan and Harare in Zimbabwe [3].

Presentation of the main research material. In the ciurse of history, we see a lot of types of city building. Firstly, it comes from the groups that start to live together because it has been much more comfortable to live in a community. Because of the people living together, it has reduced the cost of the facilities and has led to quiker human development. The city's history can be divided into seven periods: Origins, Ancient Times, Middle Ages, Early Modern, Industrial Revolution, the 20th century, the 21st century. Nowadays, the scholars do not have sole opinion on where the first city appeared. But we can say that the oldest city is dated near 7000 BC and named Çatalhöyük. What we know about the fist city founding is largely based upon guessing with just a small amount of scientific discoveries and facts.

Some scientists think that the point that pushes the developing and spreading cities in the world is a Neolithic Revolution. Its main foundation was the invention of new processing land in agriculture. In that period of time, it was possible to raise the cities just on the place with a big amount of raw materials and good trading connections. In this connection, the best place for the first cities was the land that connected Europe and Asia, Europe and Africa, Asia and Africa [1].

In the book "City Economics", Brendan O'Flaherty argues that cities can go through thousands of years only when their pros forward are deficiencies. On the economic side, this is reflected in the price of raw materials, labor and delivery costs. If we look through the history, we see, that it makes sense, especially in such example as the Maya [2].

Innovations that were implemented in the Ori-gins time have increased the speed of urban development. In this period, we see that the people's quality of life as preparing food and spreading wider territories lead to better civilizations and more urban life, creating the first foundations of empires. The first cities in that period, as Byblos in Lebanon, Luxor in Egypt and Rey in Iran, were established in 3000 BC. Also, the development of cities led to the growth of the whole population, likewise this development of the cities have great influence on medicine and hygiene development. Besides, the raising of cities contributed to the development of politics, trade and production [5]. There has been found a big quantity of the documents and archives from the ancient times that showed the main concepts of development of the cities. In addition, political aspects have strongly influenced the development of cities, and, as a result of it, we can divide the development of cities by territory in this period. Here we mention: Mediterranean, Asia, Sub-Saharan Africa and Americas territories. In the history of Mediterranean, we can see that this period is noted by the growth of culture, political and social life and also such area of science as mathematics, philosophy and astrology. It can be seen in such counties as Greece, Ancient Mesopotamia and the Roman Empire. Additionally, we want to note that in this period. Greece was the first country where the beginning of a democratic policy appeared [6]. Traditionally, Asia consisted of two main countries of the Indus Valley Civilization and ancient China in that period. The interesting case is that those countries have been created by celestial microcosms, where the pole stars play the main role [7].

On the other hand, an interesting fact is that the Djenné-Djenno, oldest city which is known to mankind, is located in sub-Saharan Africa, where there are not many cities. However, it was developed more like a factory and industrial center with a small quantity of cultural buildings and the agrarian regions were far from the cities. The development of Mediterranean is completely different [8]. America's territories as the youngest and uncharted for the scientists, are like "terra incognita". Nowadays, it is known that the oldest of the urban centers developed in America is the Norte Chico civilization. The growth of the Norte Chico cities is the major cause of development of others civilizations as the Aztecs and Teotihuacan [9].

The main difference from the previous centuries is that in the Middle Ages the development of cities has begun to be strongly influenced by political aspects. And after all this, it has been close to the political atmosphere in the empire or country where that city belongs. The main points in Europe have been Roman, German and Britain governments where we can see a colossal difference between Ancient and Middle Age cities.

The change in the architecture of the Middle Ages showed a new call for socio-economic activity and such goal as freedom, which gave the main impetus for social, governmental and economic change. This point of view is seen even in the slogan of that time: "Stadtluft macht frei", which translates into English as "Urban air makes you free". This expression also shows the main principles of law in this period. The cities developed into large groups [10].

Secondly, cities that have a good transport location turn into great commercial and delivery hubs, that sell and deliver luxury goods such as spices and silk, as well as iron, timber. This period is shown that the Middle Ages period can be presented as a main scenario for the future cities buildings. In the history of Early Modern city building, the focus has always been on trading development. This result leads to progress that Western Europe cities become international trading hubs. It was a driving force for making London the greatest city in that period with more than million citizens in it.

The other primary point for urban development in this period was the time of Spanish colonization of the Americas in 1519. The search of Spaniards (as well as Portuguese, Dutch, French, etc.) for a new way to India was dictated by the accelerated pace of development of the European society, the growth of industry and trade, the need to find large stocks of gold (subsequently reflected in the legends of Eldorado and Paititi), demand for which grew sharply. The fact that in Spain itself, the Reconquista had just ended, the south of which was liberated from the Moors, was important. During 8 centuries, in Spain, the Reconquista formed a large class of servicemen, including military adventurers, accustomed to living by looting, plundering, plundering and exploiting the Morricos, while defending the desire to spread the faith of Christ and liberate Iberia from infidel Muslims. Most of the cities were small, so in 1500, only a dozen places in the world contained more than 100,000 inhabitants. As early as 1700, they were less than forty; in 1900, the amount increased to 300 [10].

Basically, this period is significant by the great amount of migrants from the farming places to the new urban cities. One of the most important industries of the late stage of the industrial revolution was gas lighting. Similar innovations were introduced in different places, but the largest was the work of William Murdoch, employee of Bolton and Watt in Birmingham. Murdoch developed a process that consisted of the pyrolysis of coal in large furnaces, gas purification (removal of sulfur, ammonia and heavy hydrocarbons), as well as its storage and distribution. The first gas lamps were installed in London in the period between 1812–1820. Soon, gas lighting became one of the main coal consumers in the UK. Gas illumination affected the social and industrial organization of society, allowing longer work of factories and shops in comparison to the use of oily candles. Due to the introduction of gas lighting in cities and towns, nightlife began to flourish, as interiors and streets could be much better than before.

The transformation of the leading European countries into giant factories caused significant changes in the population distribution, in its composition. There were large cities, new classes and social groups appeared, serious changes in the political system, and then in the spiritual life of society.

The criterion that helps determine the beginning of an industrial revolution in one or another country is considered to be the beginning of the formation of the factory system, which is associated with the emergence of a significant number of genuine factories. In England, which stepped on this path earlier than others, factories began to emerge everywhere in the 80s of the 18th century. At the end of the century France joined it, but already in the 19th century, their example was followed by other European countries. Despite the peculiarities of the industrial revolution in each country, it is possible to trace its certain logical sequence. Initially, the machine industry is being developed by the textile industry. Then the developed methods are transferred to other branches and in new areas. The manufacture of machines, prior to handicrafts, is allocated to a separate branch of production. The similar actions led to development of public transport in the cities. At the end of the 19th century, electric urban rail transport (including trams and rapid transit) began to replace them, later completed with buses and other motor vehicles [11].

Essentially in this period, as a huge increase of numbers of the cities, especially in the Third World in countries as India, China, and Africa, was showed. The main factors of this move were industrialization, urbanization and other factors.

Industrialization is the historical process of technical and economic transition from agrarian to industrial production of public production, which is offered through the machine stage of economic activity and services. The concept of industrialization was proposed for better understanding of the historical epoch of the European industrial revolution, which began in the second half of the 18th century in Great Britain. More specifically, it extended to other countries in Europe and North America. In Asia and Latin America this movement started from the middle of the 20th century [12].

It can be observed in the 20th century that the "garden city" model became the icon of being selfcontained. Garden city is a city intended for a healthy life and work, the size of which is no more than to provide a complete social life, surrounded by a rural landscape. Ebenezer Howard was the ideologist of the concept. The idea of a garden city is to combine the positive boundaries of the city and the countryside: all of its land is in the public domain or secured by the community.

In accordance with the project described in the book, the population of the new city should have been 32 thousand inhabitants. Cities should have formed larger groups with a single center. The total population of such "constellation" of cities should have been about 250 thousand inhabitants [13].

The Howard's ideal city was a structure of concentric circular zones. In the very center of such a city was a park, surrounded by a residential area, consisting of low-rise buildings with private plots. The radius of the zone with residential development should be about one kilometer. The periphery was carried out by industry and farmland [14].

Most cities in the 21st century are developing a knowledge-based approach, driven by the new urban paradigm to smart cities that use technology and communication to create more efficient agglomerations in terms of competitiveness, innovation, environment, energy, utilities, governance and delivering services to the citizen [15]. Knowledge economy is the highest stage in the development of a post-industrial economy and an innovative economy characterized by an information society or a knowledge society; also, it is the next stage of a large development of the economy and society of the advanced countries of the world. So far, the economy of knowledge has been created by the US and partly by the EU. The term knowledge economiy is often used as a synonym for an innovative economy. However, the knowledge economy is the highest stage in the development of an innovative economy and is the basis, the foundation of the knowledge society or the information society.

Knowledge economy is an economy where knowledge and human capital are the main drivers of development. The process of developing such an economy is aimed at improving the guality of human capital, in raising the quality of life, in producing knowledge of high technologies, innovations and high-quality services. In sociology, it is the economy of the daily technological revolution. The knowledge economy is the highest stage in the development of the postindustrial economy and the innovative economy, and is, therefore, most characteristic of the most developed countries such as the USA, Germany, Great Britain, the Republic of Korea and Japan. There are other definitions of developed and future societies and economies in the literature. Today, the production of knowledge and high technology is the main source of economic growth in developed countries [16].

The main factor in the formation and development of the knowledge economy is human capital. At the same time, it is required a sufficiently high level of social capital development. Countries differ by the following types of economy and level of development:

1) with a pre-industrial economy (typically, a country with a commodity economy or its main share);

- 2) with the industrial economy;
- with postindustrial economy;
- 4) countries with mixed economic structures;

5) countries with an innovative economy or knowledge economy (also used terms: intellectual economy, new economy, information economy, innovation and information economy, etc.).

Human capital (accumulated knowledge, inte-lligence, innovations, professionals) has been and remains the main factor in changing the types of economies and societies. The developed countries of the world have a major share of world human capital. The most developed countries are investing mostly in human capital. This gives them a decisive advantage in technological and intellectual development, as well as in advance of the growth of the quality of life of the population.

Human capital in the developed countries has become the main productive factor in the creation of the latest technologies, the development of production, and increasing their efficiency, ahead of the development of science, culture, health, safety and social sphere. It follows from the UN Human Development Report that the share of human capital in such highly developed countries as the United States, Finland, Germany, Japan, Switzerland, and others make up 80% of their national wealth.

The world's leading countries have created close to optimal conditions for the rapid and effective implementation of scientists' ideas into specific products and services. It is fundamental research, increased investment in human capital, and the new breakthrough technologies that it generates, provide leadership to the world's leading countries [17].

"Smart City" is the concept of the integration of several information and communication technologies (ICT) and the Internet of things (IoT solutions) for the management of city property; city assets include, in particular, local information systems departments, schools, libraries, transport, hospitals, power plants, water supply and waste management systems, law enforcement agencies and other public services. The goal of creating a "smart city" is to improve the quality of life with the help of urban information technology to improve the efficiency of services and meet the needs of residents. ICTs allow the city authorities to interact directly with communities and urban infrastructure and to monitor what is happening in the city, how the city is developing, and what ways can improve the quality of life. Through the use of sensors integrated in real time, the accumulated data from urban residents and devices are processed and analyzed. The information gathered is the key to solving inefficiency problems [18].

The purpose of creating a "smart city" is to improve and simplify city management, improve the

urban environment, provide security and increase the quality of life of the city's residents. Modern information technologies perform three important tasks in the "smart city":

1) provision of the fast communication channels for information transmission;

2) collecting and transfer of the necessary data to the municipal services;

3) acting as a means of feedback between the city administration and its inhabitants.

An important task of the "smart city" is to ensure public safety. The use of CCTV cameras and video cameras, video data analysis tools, communication facilities and computer information technologies enables security to the urban environment, comfortable for living. The "smart city" system operates through the continuous processing and updating of data coming from information channels. "Smart city" is able to track the proper movement of vehicles and pedestrians, the situation in public places, hospitals and schools independently. From a safety standpoint, "smart city" should learn to monitor not only this, but also electricity networks, gas and water supply, safety in transport, the state of heating networks and drains, etc.

One of the first Smart City was the resort Santander (Spain) with a population of 180 thousand people. At the beginning of the SmartSantander project, in 2011, there were data processed from 16 thousand sensors installed only in the city center. Sensors reported air pollution, traffic intensity, free parking spaces, filling garbage containers, etc. Total of a dozen hightech projects with a budget of 60 million EUR. The information received by the City Hall was used to save street lighting, improve waste collection and road unloading [19].

Thus, we see the main preconditions for waste management to be an integral part of smart city development. One of the first conditions of the smart city is waste collection and recycling. Each of the cities is trying to take sorting and processing to a new level by reducing the time, labor and human resources for processing.

There is also no secret that smart cities such as Singapore, Barcelona and San Francisco have long used IoT models for waste management, which significantly optimizes all factors of collection and recycling [20]. Therefore, such factors include: transportation, storage and recycling of garbage.

Governments around the world are trying to implement general waste management. In general, such implementation consists of such steps as: implementation of waste management policy; introduction of processing plants; provision of waste collection systems; waste management institutions; stimulating waste sorting.

Implementation of waste management policy is one of the priority needs for the development of

this industry. However, it also has a danger from the state, as too strict rules in the field of processing scare away investors from cities, which in turn will reduce the pace of development of this sector of the economy. Therefore, the government should develop appropriate policies that provide for the proper disposal of waste and the use of tools for its recycling. Also, the government has the power to stimulate the market for the use of secondary materials. There are cases when the government or certain cities ban the full use of plastic, which in turn dramatically reduces the amount of garbage. Also, the state can implement programs to motivate businesses and citizens to stimulate the development of the recycling market. Thus, in the Czech Republic, recycling plants receive subsidies from the budget for recycling of household waste. In its policy, the government must combine three main factors: the community, business and government.

The implementation of processing plants requires significant investment. It can be both foreign and domestic investors or the state. The creation of plants for the capital of foreign and domestic investors is most strongly influenced by government policy, as it depends on the sustainability of such business and future income of the investor. Also, the amount of garbage produced and its quality in a certain area is significant. Nowadays, we witness the situation of Sweden, which is forced to buy garbage from neighboring countries due to the high capacity of recycling plants. In general, processing plants are divided into: sorting and processing of solid waste, incineration plants and biogas.

Ensuring the efficiency of waste collection depends on the development of waste collection infrastructure in cities. To ensure this, businesses and the government must create and provide all the tools, transportation and special places for sorting garbage to ensure the recycling of garbage generated in the city. The best efficiency in waste recycling in the city can help track and optimize statistics and analysis. The main indicators of waste management in smart cities are:

- the amount of waste generated per day;

- the amount of waste generated by a district;

- type and ratio of materials of waste generated;

- the number of enterprises in the district and

their share in the total waste of the district;

- seasonal change of types of waste;

the ratio of types of waste processing depending on the types of waste;

- the average price of waste collection and storage.

These factors can help cities and businesses to optimize the waste collection and recycling effectively. Also, it will help in the distribution of collection and transport facilities for the city and business in different districts of the city [21].

Conclusions. Development and innovation are an integral part of human life, they go hand in hand. However, when developing strategies and integrating recycling systems, nature conservation should not be forgotten. This article shows the great need for development and transition of cities from the system of sustainable development and the typology of the smart city. Also, we realize that one of the main and key parts of sustainable city development is waste management because the more developed the city, the more waste it produces. One of the most important deterrents to the development of waste recycling is that it is cheaper to dispose of waste than to recycle it. That is why we see a great development of waste recycling in highly developed countries, where GDP per capita is high, which is not experienced by almost all the developing countries. Also, it can be linked to the Maslow's hierarchy of needs and it is understood that until the priority needs of people in cities are met, waste management will not be as efficient, as recycling is not a high priority in developing countries.

The government is most responsible for the development of urban waste management. Because it is the government policy, it combines three main parts of the sorting and recycling system, including citizens, businesses and the state. Also, it is the government that can motivate business and investors to develop waste management.

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