

# Smart-City Development Management: Goals and Instruments

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## Summary.

At the present stage of the world economic development, a new economic system is being formed, in which non-economic values, in particular environmental and social parameters, have become widespread. A new vision of economic activity is being formed, which acquires the qualities of Smart-economy. The purpose of this paper is reveal the features of managing the development of smart cities as specific entities of the Smart-economy. New functions of economic entities are formed within the framework of the Smart-economy concept, while their role and weight in the localities' activity or formation have changed. Determining that the key trends in the Smart-economy development are such as digitalization, greening, socialization, institutionalization, and urbanization, this is necessary to note that all these trends are most active in the formation of urban ecosystems. These trends are determined by the general population growth and the urban population growth, which requires considerable attention to planning each city's development itself. Such planning could ensure the comfort of living for all its inhabitants, quality, safe, and modern life. The Smart-city's key elements and the intellectualized approach implementation planes to the decision of these or those tasks are defined. It is determined that a new ecosystem of governance is being formed.

### **Key words:**

*Smart-economy, urban population, smart city, smart city management, smartivist.*

## 1. Introduction.

A characteristic feature of the current stage of world economic development is the intellectual economy development, in which the dynamics and direction of social progress are determined by such factors as knowledge and information. At the stage of the industrial economy, the rates of economic growth were used as important indicators of its development. Gradually, since the 1960s, it has become clear that it is generally important to achieve not only economic growth, but also social and economic development. Real progress in the country is measured not so much by GDP growth as by other parameters. It becomes important to assess not only the dynamics of key macroeconomic indicators, but also to take into account other factors such as environmental and social processes. In the present century there is a growing human attention to environmental and social problems related to the global

economy. The emphasis is placed on the need to ensure the development of ecosystems, in which the economy is considered as a system that balances different areas of activity and their entities.

The manifestation of all the latest processes was the emergence of the SMART-economy concept, which

is the embodiment of consistent and pervasive intellectualization and greening of the economy. An important feature of it is that all these processes are implemented on the basis of the latest technologies, a new role of which is not only to perform certain important functions, but - in the management of processes and relationships between different elements and actors. The spread of smart technologies that provide communication and control processes in various spheres of life marks a new quality of economic life, which, in fact, embodies the Smart-economy concept. To the greatest extent, the Smart-economy concept is implemented at the level of individual localities such as the cities, within which there are present practical opportunities to combine the processes of intellectualization, informatization, greening, socialization, etc within a unified stream.

The emergence of the Smart Cities phenomenon and their rapid spread in the new millennium is an extremely interesting material for research. After all, on the one hand, there are general patterns of development and success for Smart Cities, which are based on the competent use of available opportunities in each case. On the other hand, the success of each city is unique due to a special combination of all factors. This is the basis of the great attention of scientists and practitioners to the smart cities issue, which is a wide field for research, and which is an urgent problem of modern world economics.

## 2. Analysis of recent research and publications.

The study of the concepts of economic environment transformation is an urgent scientific issue, which is the subject of research by a large number of scientists. Given the growing role and quality of intellectualization factors, this issue is especially relevant in the aspect of post-industrial society formation, and the search for options and forms of its manifestation at the present stage of economic

development. The coverage of paradigmatic changes is found in the works of D. Bell (Bell, 1973), V. Inozemtsev (Inozemtsev, 1998), F. Machlup (Machlup, 1966), A. Chuhno (Chukhno, 2005), J. Schumpeter (Schumpeter, 2005), L. Edvinson (Edvinson, 1999), G.Hamel and K.Prahalad (Hamel, 2014), T.Stownjer (Stownjer, 1986), F.Webster (Webster, 2004), E.Toffler (Toffler, 2010) and others.

A new milestone at the beginning of the XXI century is the emergence of the Smart-economy concept. This concept embodies the spread of new smart technologies with the goal to manage efficiently economic, social, and environmental processes. A manifestation of modern development is the growing attention to social and environmental issues. This caused developing a new approach to the perception of economic phenomena and processes, namely their study as ecosystem elements.

This new concept has not yet received sufficient justification and definition, which is now of great scientific interest. Some issues of the growing role of ICT, digitalization processes in the general context of global social development are studied by L. Antoniuk (Antonyuk, 2005), N. Oulton (Oulton, 2002), Vu Khuong, T. Kretschmer, O. Kuklin (Kuklin, 2012), H. Meijers, B. Santo, TD Stanley, J.-P.Hong, L.Tsymbal (Tsymbal, 2014) and others. The role of individual subjects in the development of Smart-economy concept is revealed in the works of V. Maksimova (Maksimova, 2011), Mazurenko (Mazurenko, 2014) and others. The analysis of separate factors in formation of economy of new type is carried out in works of Y.Kanigin (Kanigin, 1993), M.Heylin (Heylin, 2006), D.Kellner (Kellner, 2002), D. Held, A.McGrew (Held, 1999) and others. At the conceptual level, the issues of environmental protection are studied, while the concepts of sustainable development, green growth, and green economy appear in the works of foreign and domestic economists A. Bowen, I. Gaidutskiy, I. Kalenyuk (Kalenyuk, 2018), J. Harris, D. Pearce, N. Stern, M. Jänicke and others. Studies of various aspects of the formation and development of smart cities (smart-city) were carried out in the works of R. Giffinger, B. Coen, V. Kumar (Kumar, 2017), R. Novotny (Novotny, 2014), R. Kuchta, J. Kadlec, M. Eremia, L.Toma, M.Sanduleac (Eremia, 2016), and others.

However, it should be noted that the phenomenon of smart cities (SMART-city) still needs in-depth study. The issue of development and definition of the main components, mechanisms of functioning, and instruments for success still remains insufficiently covered.

### 3. The purpose

The purpose of this paper is to reveal the features of managing the smart cities development as specific entities of the Smart-economy.

### 4. Results

The current stage of world economic development is characterized by a huge increase in the importance of intellectual component in socio-economic processes and resources. They are intellectual resources that directly determine economic growth parameters; create foundations for innovative development and formation of a post-industrial society. Intellectual resources create opportunities for breakthrough in economic, scientific, and technological development, even for those countries that do not have significant natural resource factors for this. Intellectualization in some national economies is realized as a nonlinear, but at the same time incremental and consistent process of intellectual factors accumulation, as well as strengthening the cultural and ethical component. Economic activity is increasingly based on a combination of economic interests, ethical and cultural values.

That is why the emergence of "SMART-economy" concept is evidence of consistent and pervasive intellectualization, which together with the processes of institutionalization, socialization and greening of the economy becomes crucial for the new society formation. New content of intellectualization includes not only in classical growth of the intellectual factors importance (human resources, knowledge and information). The fact is that certain results of intellectual activity acquire independent significance. For instance, the driver of the new economy is the spread of new technologies (ICT, nano-, bio-, etc.), a new role of which is not only to perform certain important functions, but also in the management of processes and relationships between different elements and entities. The emergence of intelligent technologies that control other processes marks a new quality of economic life, which, in fact, embodies the concept of Smart-economy.

Thus, the key trends in Smart-economy formation, in our opinion, are the following: digitalization; greening; socialization; institutionalization; urbanization. The selection of the latter two is caused by the following circumstances: one of the most important problems in the formation of intellectualized economy are institutional barriers that arise in the process of the economic system transformation and modification, transition from resource economy to highly developed and high-tech. The main players of Smart-economy can be: individual; locality, city; region; country; global city. Overcoming the above obstacles becomes possible, first of all, at the level of individual localities - cities. That is why the urbanization and institutionalization processes of all stakeholders'

influence on decisions within cities are becoming important and distinctive trends today.

Cities as economic entities, and in addition, global economic entities, are gaining high importance in the context of urbanization process acceleration. The share of urban population is growing steadily, and from the second half of the twentieth century, very quickly. In the world, the share of urban population has grown from 29.6% in 1950 to 56.2% in 2020, and is projected to reach 68.4% in 2050 - more than doubling in a century. The fastest growing urban population between 1950 and 2020 was in Africa (3.04 arte of growth), Asia (2.92), Latin America and the Caribbean (1.97). In Europe and North America, the growth rate is not so high, but the share of urban population is very high - 74.9% and 82.6% in 2020, respectively, (Table 1):

**Table 1.** Urban population in the world and regions, % (1950 -2050 pp.)

	1950	1980	2000	2015	2020	2050
Africa	14.3	26.8	35.0	41.2	43.5	58.9
Asia	17.5	27.1	37.5	48.0	51.1	66.2
Евpоnna	51.7	67.6	71.1	73.9	74.9	83.7
Latin America and Caribbean	41.3	64.6	75.5	79.9	81.2	87.8
North America	63.9	73.9	79.1	81.6	82.6	89.0
Oceania	62.5	70.9	68.3	68.1	68.2	72.1
World	29.6	39.3	46.7	53.9	56.2	68.4

Source: (World Urbanization Prospects, 2018).

Not just the urban population is growing. There are trends in both the growing number of cities - millionaires, and the total population of cities. According to the UN website "World Population Review", in the beginning of 2020 the populations of world largest cities were:

**Table 2** Top 10 cities in the world by population

№	City	Population	Country	Change
1	Tokyo	37,435,191	Japan	-0,11%
2	Delhi	29,399,141	India	3,03%
3	Shanghai	26,317,104	China	2,82%
4	Sao Paulo	21,846,507	Brazil	0,90%
5	Mexico City	21,671,908	Mexico	0,51%
6	Cairo	20,484,965	Egypt	3,56%
7	Dhaka	20,283,552	China	2,03%
8	Mumbai	20,185,064	India	2,13%
9	Beijing	20,035,455	China	1,12%
10	Osaka	19,222,665	Japan	-0,30%

Source: (World City Populations, 2021)

Most of large cities are located in the largest countries in the world - China and India. Among European countries, the largest cities are Istanbul (14.5 million

inhabitants), Moscow (more than 12 million), and Paris (more than 11 million) (World City Populations, 2021).

Along with the increase in the number of large cities and their population, attention has growth in the recent years to the new role of cities as entities to ensure quality, safe and modern life of citizens. Evidence of this was the emergence of such concepts as "future city", "sustainable city", "connected city", "resilient city", "intelligent city", "digital city", "digital community", "cyber city", "knowledge- based city", "cyberville" and others. Each of them has the right to life, as it emphasizes the most important imperatives of modern cities development. Each of these concepts reflects the important features of new phenomenon: growing role of digital technologies, growing intellectualization of urban life, or its greening. In recent times, the term "smart city" as an embodiment of all these trends is becoming more widely used. However, despite some attention of scientific circles to this issue, there is no single approach to understanding its nature and structure. In our opinion, Smart-city is the most successful term, as it includes the aspect of digitalization, sustainability, knowledge-based and smart technologies-based.

The concept of smart cities has become widespread with the development of ICT since the end of the last century. Moreover, the practical direction of smart cities implementation is developing rapidly and provides much information to consider.

The research group of European smart cities at the Centre for Regional Science of the Vienna University of Technology under the leadership of Professor Dr. R. Giffinger investigates the issue of smart cities. They identify the smart city as the hive, calling it "bee smart city", and promote it on a specified website. According to them, a smart city "uses the opportunities of the city / community to create and make decisions to overcome challenges and increase opportunities that will help transform "the place we call home" into a promising and more liveable for all stakeholders. The ecosystem of implemented solutions is what determines whether a city / community is smart." A smart city means human-cantered approaches to developing and implementing a smart city solution ecosystem, which create added value and become a community good (Redefining the smart..., 2020). This research group identifies six key areas of smart city: Smart Governance, Smart Economy, Smart Environment, Smart Living, Smart Mobility, and Smart People.

Vinod Kumar also considers the Smart-city system that includes Smart People, Smart Economy, Smart Mobility, Smart Environment, Smart Living, and Smart Governance (Redefining the smart, 2017). Krisna Adiyarta et al. define eight components of a smart city: Smart Governance, Smart Environment, Smart Mobility, Smart People, Smart Economy, Smart Living, Smart

Infrastructure / Technology, and Smart Energy (IOP Conf. Series, 2020).

R. Novotny et al. consider the structure of Smart-city in a rather applied way: "general municipal and business services", "intelligent, sustainable buildings and building management (smart building)", "education, health and social care areas (smart education)", "energy production and energy efficiency (smart energy, smart lighting)", "gas, electricity and water smart metering (smart grad)", "smart water and waste management (smart utility)", "public safety, security and crime prevention", "real-time locating services and geographic" (Novotny, 2020).

A similar approach is proclaimed by Romanian scientists M. Eremia, L. Toma, and M. Sanduleac, who consider Smart-city as the set of such components: "smart buildings", "education, medical and social care", "smart energy", "smart grid (smart metering of natural gas, water, electrical energy)", "smart utilities (smart water distribution and smart waste management)", "smart parking", "integrated supply systems", "smart and integrated transport" (Eremia, 2016).

Although each of approaches has its peculiarities, they all have in common selection of such blocks: governance, economics, infrastructure, social sphere. Various authors can consider infrastructure more deeply, emphasizing not only transport, but also energy supply, water supply, waste management, etc. The authors can also emphasize various aspects of social sphere: education system, culture, "smart people", living conditions, etc. But an integral component of smart cities is governance and, although not highlighted in the structure, information and communication technologies, which are a key tools for its implementation.

Smart cities are a modern and dynamic phenomenon that is rapidly developing and improving, creating new forms of communication and implementation of various aspects. There is no standard at all; each city develops based on its capabilities, mental and cultural traditions. At the global level, there are leading cities that managed to implement key aspects of smart living in their community. It is also important that the management of a smart city does not remain unchanged. Boyd Cohen, who has been researching the problem of smart cities since 2011, identifies three stages, three different generations or evolutionary phases of smart city development:

**Smart Cities 1.0: A technology-centric vision of smart cities**, characterized by technology providers encouraging cities to apply their solutions, which have not actually been equipped to properly understand the implications of technological solutions or possible impact on citizens' life quality. Smart Cities 1.0 is also the core philosophy of most smart city projects proposed worldwide, from PlanIT in Portugal to Songdo in South Korea. These

visions of the future city were driven by private sector technology companies, such as Living PlanIT and Cisco.

**Smart Cities 2.0: a government-centric vision** with use of technology solutions as a means to improve life quality. In this generation, the municipality - led by promising mayors and city administrators - takes the lead in determining the city's future, implementing smart technologies and other innovations. At this stage, city administrators are focusing more on technological solutions that help improve life quality. A good example is Barcelona, which has more than 20 smart city programming sites and literally more than 100 active smart city projects.

**Smart cities 3.0: a citizen- and human-centric vision of smart cities, citizen- or person-centred and based on shared creativity.** In this model, smart cities use citizen co-creation strategies to help manage smarter cities to improve the life quality and prosperity of future generations. Vancouver has led one of the most ambitious joint strategy initiatives, involving 30,000 citizens in co-sponsoring the *Vancouver 2020 Greenest City 2020 Action Plan*, while Vienna attracts citizens as investors in local solar power plants as a contribution to the city's 2050 renewable energy goals (The 3 Generations...; Redefining the smart...).

Cohen argues that some cities move from one phase to another, while others stay at one and experiment with smart cities. In general, in his opinion, the combination of Smart Cities 2.0 and Smart Cities 3.0 is the best choice for the future.

Thus, the main trend in the development of a smart city management system is the involvement of all parties, all entities to the management process. This is even called the "fourfold spiral" - the involvement and cooperation of all stakeholders: between the government, the private sector, academia and civil society (especially citizens). The targeting of all stakeholders to achieve important goals of urban development is a key factor in the success of all smart city indicators (Redefining the smart...).

A smart city is not only the involvement of all stakeholders in management, but also the focus of all activities (goals, mechanisms, and tools) on human. The overall goal is to create and implement a smart city solutions ecosystem that produces added value and becomes a collective good. In such ecosystem, all stakeholders take smart actions: smart people formulate smart goals, business joins to their smart implementation; the municipality smartly manages all components of urban life, operating on the basis of smart environmentally and socially oriented development.

The term "smart" in this context has two aspects. First, it is the penetration of all activities and the process of city management with important social and environmental

values. Second, it is strengthening of the intellectual nature for both management process and all decisions made.

This situation has even led to the idea that now, by analogy with the "rise of the creative class" of Richard Florida, there is growth of smartivists. According to the founders of the "Bee intelligent city concept", the most effective factor in the success of the smart city is collective intelligence as the embodiment of the total intelligence of all agents involved in smart management based on modern smart technologies. This allows us to homologate a smart city with a hive, in which each bee plays its intelligent role. This allows creating and making decisions that effectively transform the community into a strong Smart-city solutions ecosystem.

Proponents of the bee approach believe that the differences between various smart cities are in the ability of a city or community to use collective intelligence. This aspect characterizes the ability to connect different agents in a city or community. Collective intelligence provides a 360-degree perspective, covering all aspects of the community, as well as connections with neighbouring communities or regions. The way to becoming a smarter city or community is largely not driven by a top-down master plan or a technology partnership with one big agent. Rather, it is the sum of smart initiatives, projects and solutions that are developed and implemented by a large number of different private and public entities throughout the city and in different strategic areas.

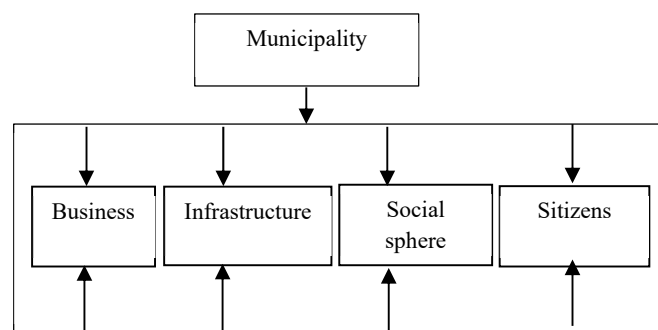
In a smart city of the third wave, which is focused on citizens, not only technological "sensors" are used, but first - people as "smartivists" and living "sensors" of the environment. Therefore, "encouraging the growth of smartivists who can shape this third wave and take the city's challenges into their own hands is a key to stimulating innovation now. This will ensure that human ideas and experiences can influence not only the current strategy of a smart city, but also the "smart" movement into the future" (Redefining the smart...).

Active citizens become part of the city government, while remaining only members of such a cohesive society. The formation of such an ecosystem is facilitated by the development of technologies, where anyone can join the management system, such as Waze and Citymapper, in which each participant can make own changes and convey particular information to all users. Resource sharing becomes the basis for the formation of a conscious society. However, not only technologies help build a smart society, for instance, Incredible Edible project was set up in Britain to build mini-farms, particularly in backyards, roadsides and other places where vegetables, crops and greens can be grown and then used for food. It is worth noting that this initiative is becoming widespread not only in the UK, but also obtains global characteristics, which contributes to the formation of Smart-economy by "bottom-up" in projects

that cannot be implemented by governments or local authorities (If you eat...).

Larger projects are Better Reykjavik, or public hackathons, such as the Barcelona CCCB Data Quality Datathon, in which people are involved in the formation of the urban areas ecosystem, planning, land management through forums, platforms and initiatives. This format allows the population to directly participate in improving the functioning of the residence place, its convenience and environmental friendliness, to find new ways and methods of management, implementation of ideas. In general, initiating some changes from people living in a certain area will contribute to the formation of their community area, which becomes more economically sound and efficient, will promote the formation of a cohesive society, reduce distrust in government, government institution, etc.

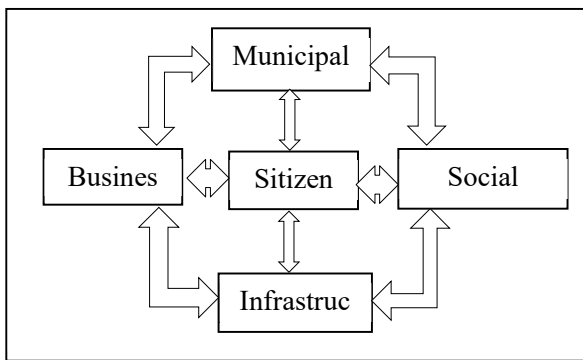
It should be noted that the classical system of city management involves the formation of a bureaucratic system that manages a set of elements as separate units (Fig. 1).



**Fig.1. Classic city management system**

*Source: systematized by the authors*

Attracting a significant number of residents contributes to the formation of a strong public-private partnership, strengthening the inclusiveness of society, its cohesion. In fact, "integration" of the community into the city management is formed through the active participation of citizens, entrepreneurs, initiators of social change, or so-called smartivists. The formation of a smart system also leads to the so-called chain effect, when the involvement of one citizen or entrepreneur contributes to the dissemination of information, actual involvement of other citizens and the formation of collective intelligence, synergy effects. In fact, the smart city ceases to use classic management systems, and a special system of cooperation is formed, which is in uniting all active participants for city management (Fig. 2).



**Fig.2. Smart city management system**

*Source: systematized by the authors*

In a smart city, all stakeholders are involved in management. The initiative of various agents: private business, citizens, public organizations, educational and cultural institutions, infrastructure units, etc. is not just welcomed. In general, effective mechanisms are being created for their participation in the city management process. These include opportunities to discuss various projects, opportunities to initiate and implement their own projects, and control over the projects implementation and management. In addition, information and communication technologies allow the development of software that actually replaces certain government services. Thus, the collective intelligence (which is the embodiment of synergistic interaction of all stakeholders) together with the active penetration of modern technologies forms and becomes the basis of a new city quality.

Collective management involves the interaction of all participants in local formation to improve living comfort and quality of life. One of the most successful examples is the development strategy of Amsterdam Smart-city (the Netherlands), where the combination of interests of all active participants creates a specific ecosystem, which brings together businesses, research institutions and laboratories, government, and city residents to reduce carbon emissions. In total, the program consists of over 30 projects, which include business plans and innovative ideas, and among them, particular areas of implementation are determined, such as: smart life, smart society, economy, databases, mobility, infrastructure and others. All initiatives in these areas should be tested and approved in small areas and then spread to other areas of the city, including awareness-raising activities on the wise use of energy, water and other resources. Among the initiatives, there are introduction of climate management "Climate Street" and "West Orange", which are aimed at the use of smart calculators and the spread of energy-saving technologies (Amsterdam Smart City...).

It is important to note another feature of the smart city implementation. Encouraging "smartness" from citizens, business, academic, and the public sector also allows resolving funding issues to some extent. A rather common problem for social, environmental, and other projects is the lack of financial resources, which cannot always be provided through public funding. Crowdfunding allows local businesses and the community to be involved in funding important projects for the city's development.

The smart city of the third wave uses not only technological "sensors", but also people as "smartivists" and living "sensors" of the environment. Therefore, encouraging the growth of smart people who can get ahead of this third wave and take the city's challenges into their own hands is key to stimulating innovation now". This will ensure that human ideas and experiences can influence not only the current strategy of a smart city, but also the future movement (Redefining the smart city...).

## 5. Conclusions.

The emergence of the Smart-economy phenomenon was caused primarily by the acceleration of the process of the world economy development intellectualization. The emergence of new technologies, products, services increasingly means the spread of completely new principles of economic activity and people's lives. All this is also accompanied by increased attention to social problems and environmental issues. An important feature of it is that all these processes are implemented based on the latest technologies, a new role of which is not only to perform certain important functions, but also in the management of processes and relationships between different components and agents. The spread of smart technologies that provide communication and control processes in various spheres of life marks a new quality of economic life, which, in fact, embodies the concept of Smart-economy.

The emergence and rapid spread of the smart cities phenomenon in the world is a clear example of Smart-economy formation. The growing attention to this issue in world economic science has led to the existence of various theoretical approaches to understanding the nature and structure of smart cities. Despite the differences in definitions, a common feature of all approaches is accentuation of such blocks: management, economics, infrastructure, social sphere. Sometimes, the infrastructure can be considered more deeply, not only transport, but also energy supply, water supply, waste management, etc. are differentiated. Attention can be focused on various aspects of the social sphere: education systems, culture, "smart people", living conditions, etc. Management is also an integral part of smart cities, and although it is not separated in the structure, information and communication technologies are a key tool for its implementation.

The modern and dynamic phenomenon of smart cities is rapidly developing and taking new forms. Moreover, this evolution also in turn confirms the inevitability of a constant intellectualization process, and growing importance of human factor as a carrier of intelligence. There are three waves, three stages of smart cities development: Smart cities 1.0, based on technology-centric vision; Smart Cities 2.0, which are characterized by a government-centric vision; and Smart Cities 3.0, where civic- and human-centric approaches predominate.

World practice provides rich experience of smart cities implementation. With it, each city is unique, because it develops and creates its history based on its capabilities, mental and cultural traditions. Nevertheless, the general trend is strengthening the human role in the management and implementation of the smart city project. This is reflected in the increasing involvement of citizens in the processes of urban governance, and the forms of this participation are becoming more diverse. This situation allows discussing the formation of the city's collective intelligence as an effective force for managing its development on the basis of environmental friendliness and sustainability.

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