Journal of System Management (JSM)
Online ISSN: 2538-1571, Print ISSN: 2322-2301
Doi: 10.30495/jsm.2023.1978331.1754
9(3), 2023, pp. 263-283

Received: 22/01/2023
Accepted: 18/04/2023

RESEARCH ARTICLE **Open Access**

Identifying and Analyzing the Effective Factors of the Establishment of Knowledge-based Cities in Less Developed Areas (Case Study: Sistan and Baluchestan Province)

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Abstract

The main purpose of this research is to identify and analyze the effective factors of establishing a knowledge-based city in less developed areas. The research method is mixed (qualitative-quantitative). In addition to studying documents, the ground theory method with MAXQDA12 software was used to identify the effective factors. The statistical population in this research was all experts in the field of public management, urban management, economics, managers of knowledge-based companies, and managers of Sistan and Baluchestan governorate and Zahedan municipality, which was conducted after conducting 17 theoretical saturation interviews. Finally, open, central, and selective codes were extracted and in the quantitative part, Dematal technique was used to determine the effectiveness of the effective dimensions on the establishment of a knowledge-based city. According to the semi-structured interviews, 6 dimensions (cause, main phenomenon, contextual, interveners, strategies, consequences) and 15 components (core codes), and 69 indicators (open code) were extracted for the establishment of the knowledge-based city. The Finding showed that dimensions of development, skill and expertise, education and technology, infrastructure, internationalization, institutional factor, urban knowledge development, knowledge management, foreign policies, laws and regulations, cultural-native, knowledge-based city development, policies, domestic, cultural conflict, and urban geography, in order from high impact to low impact, as well as dimensions of urban geography, cultural conflict, internal policies, knowledge-based city development, cultural-native, laws and regulations, foreign policies, knowledge management, knowledge development urban, institutional factor, internationalization, infrastructural, education and technology, skill and expertise and development are respectively from high effectiveness to low effectiveness.

Keywords: *Knowledge-based Urban Development, Knowledge city, less developed areas, Sistan and Baluchestan province*

Introduction

Today's world is the dawn of a new millennium in the direction of the transformation of regions and cities from industrial and electronic societies to knowledge-based societies. In fact, the societies of the 21st century are post-industrial societies, and the knowledge city is the foundation of its horizon. The 21st century is known as the century of cities. While the mass migration of rural populations to cities began with the Industrial Revolution, this process, even if historically short-lived, is still an ongoing process. A few centuries ago, the urban population constituted only 0.5% of the human population on earth (Stenvall et al., 2022: 143). In the 1980s, the total urban population worldwide was less than 30%. Currently, the world's population

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in cities exceeds 50% and is expected to reach 75% by 2025 (a percentage that most developed countries have already reached). Hence, urbanization, human experience as a dominant phenomenon, is a reality in the new millennium. (Hu et al., 2021: 138).

The basic changes throughout human history, which are referred to as waves, can be divided into four periods. The first change in human society - the agricultural era - began before the birth of Christ, the purpose of which was to solve the problems of human livelihood and food. After that, with the industrial revolution and the invention of the steam engine, mankind entered the second wave, which was the production of materials and work tools (Taheri et al., 2023: 72). In this era, traditional cities gave way to industrial cities. After that, the invention of the computer and the speed of development of telecommunications and human communication created a new need in humanity, and that was access to information and knowledge, which caused the beginning of the information age (Moftian et al., 2022: 74). During this period, electronic cities emerged. Since the beginning of this century, mankind has entered the fourth fundamental phase of its history, namely the age of knowledge. The fourth wave is actually the developed form of the information age. In this period, the main problem of mankind in the field of livelihood provision, provision of tools and free and transparent access to information has been solved and the need for greater change and transformation in society has arisen. With the beginning of the fourth wave, humanity will start a new society and a new era, and in fact will experience the maturity of electronic cities, that is, knowledge-based cities, where most of the affairs in those cities will be virtual (Shieh et al., 2021, : 241). In this era, citizenship will take another form and the concepts of time and place will change and everything will change even human identity. In a general summary, these four waves in urbanization can be expressed as follows:

Table 1.
Development of cities (Source: Shieh et al., 2021)

	Traditional cities	**Industrial cities**	**Digital and electronic cities**	**Knowledge-oriented and intelligent cities**
History	Ancient civilizations (Roman, Greek, etc.)	17th Century	1994	2000 onwards
Features	Traditional structure	Entrepreneurship and industry	Information and Communications Technology	General knowledge and learning
Purpose	Agriculture development	Industrial development and mass production	Developing communication and eliminating space and time distances	Development and application of knowledge
Surce of Power	Farm land	Machines and factories	Monopoly of knowledge and information	Creativity, sharing and creation of knowledge

The 21st century is also known as the century of knowledge or the century of learning. According to Sakaya, we are opening a new era: "It is my contention that we are entering a new stage of civilization in which value depends on knowledge is the driving force." We have entered the age of knowledge (Repette et al., 2021: 27). Global urbanization and the emergence of the knowledge society each constitute an unprecedented and complex reality. Each of them has respectively exposed the limits of conventional disciplinary approaches for urban development and creating social value. Both together, integrated in the city of knowledge, is one of the most complex

phenomena that mankind has ever faced and is probably one of the most important crises for its future evolution (Zare et al., 2022: 446).

Conceptual and experimental studies on knowledge-based cities constitute an emerging, pre-paradigmatic and multi-disciplinary and in fact interdisciplinary field that is emerging and maturing with rapid and continuous growth (Malik et al., 2022: 475). The emerging field of knowledge city can be described as pre-paradigmatic. In a general classification, we can divide the world's knowledge-based cities into two categories: developed knowledge-based cities such as Barcelona, Singapore, Ottawa, Helsinki, Boston and emerging and developing knowledge-based cities such as Istanbul, Manchester, and Sydney. The creation of a knowledge-based city cannot be implemented quickly and easily and requires infrastructure and characteristics in cultural, economic, technological and social fields (Abedini et al., 2020: 155). At the global level, knowledge and information are considered as the key to economic growth. The economy of a knowledge-based city creates valuable products and services using technology and knowledge. In fact, knowledge will play a role in generating wealth in such cities. The United Nations, the European Union and the World Bank have all emphasized the vital importance of the knowledge-based economy as a global reality (Asadi & Rezghi Shirsavar, 2019: 604). Considering this emphasis, it is necessary to take steps in the centers of Iran's provinces to achieve a knowledge-based city.

Common methods of urban policymaking cannot deal with the complexities of urban changes of the present century that arise from knowledge-based development. The understanding of this deficiency and the determination to face it leads to the focus of research and urban planning on the basis of knowledge-based urban development (Dehghani et al., 2021: 328). Considering the change in the direction of urban and regional development policies in Iran in the past years, the country's urban development policy and planning system has also tried to move towards knowledge-based planning in response to the new needs of the society (Behzadpour et al., 2021: 79). With regard to this goal, membership in important international institutions of information technology, emphasis on the development of knowledge-based economy and the expansion of information and communication technology in the macro development documents of the country such as the vision document and the five-year development plan are proof of these efforts (Dermina et al., 2021: 93). In addition to the stated programs, the rapid growth of the requirements and needs of the information society and the knowledge-based economy at the country level are among the necessary operational measures in this direction. The results of the report on the status of Iran's provinces from the perspective of the development index of communication and information technology are proof of the accelerated movement of Iran's provinces towards the information society (Aliakbari, 2020: 7-8).

One of the basic requirements of urban growth and development is to earn sustainable incomes at the urban level through the improvement of urban development indicators, and in this regard, the benefits of knowledge-based urban development have been emphasized (Baghersad et al., 2021: 71). One of the most important advantages is that cities and surrounding areas move towards knowledge-based development. With regard to the role of knowledge-based cities, which accelerates the process of knowledge-based economic growth and development by creating a suitable environment for the production of knowledge and creating a connection between academic centers and the industry sector and knowledge-based businesses and urban and regional governance, and from there that the knowledge-based society and consequently the knowledge-based city is considered as a place for cultivating knowledge; These cities attract the elites of various sciences and prevent the migration of the elites and provide a space for nurturing

talent and creating knowledge. On the other hand, the knowledge-based city provides a space for innovation and creativity, which can be said that innovation and knowledge-based businesses are considered as the main factor in urban economic growth and creating sustainable prosperity (Tabibi et al., 2020: 24-25).

Zahedan city is the capital of Pahnavar province of Sistan and Baluchestan. This province has a common land border with the two countries of Pakistan and Afghanistan, and also has a waterway with the Arab countries of the Persian Gulf and the Oman Sea through access to open waters. This itself causes a high potential for goods transit. Also, Zahedan city is located on the international transit route and the Silk Road. Therefore, we should not forget the view of two powerful and economically developing countries, China and India, in order to invest and have an active presence in this province due to its strategic geographical location. Among the potential potentials of this province centered on Zahedan city, we can briefly mention the following:

✓ In the field of agriculture, especially global quality products such as dates and tropical fruits;

✓ Wide tourism and desert tourism attractions;

✓ The presence of seasonal and sunny winds in four seasons for the use and exploitation as well as the export of clean energy;

✓ The existence of parent universities and international academic units, including the University of Sistan and Baluchestan, Islamic Azad University, Payam Noor University, scientific-applied centers, non-profit institutions and the University of Quranic Sciences; This will increase the number of students per capita in Zahedan;

✓ High ethnic and cultural diversity;

✓ Local and traditional handicrafts with high potential and added value for sustainable income generation and export to improve the livelihood and well-being of local citizens;

✓ Presence of rich minerals;

✓ Road, rail and air transportation platform;

✓ Technological infrastructure such as optical fiber lines, high-speed wireless internet, and existence of science and Technology Park and growth centers as well as industrial town equipped with technological infrastructure.

The above-mentioned cases have potential for growth and economic dynamism and sustainable income. All these things can be the basic requirements of knowledge-based urban growth and development. It is worth mentioning that the mentioned cases will have the possibility of communication, growth and cooperation and becoming a sustainable economic, cultural and value-added growth only in the context of a knowledge-based city (Tabibi et al., 2020: 28), which valuable infrastructures and strengths They will be in the direction of transition from an electronic and industrial city to a knowledge-based city. Future cities will be knowledge-based cities, with knowledge-based economy, knowledge-based human resources, sustainable cities that bring prosperity and comfort to citizens. Cities will be based on new technologies and with a fluid and free flow of knowledge and information and a high level of education and culture. Cities that are places of erosion and creation of science. Many prominent cities in the world either introduce themselves as a knowledge-based city or are trying to achieve and become a knowledge-based city. In order to achieve a knowledge-based city, we will need a fundamental transformation and a period of transition from the current situation to the desired situation, which is the knowledge-based city. The purpose of this research is to analyze and identify the dimensions, components and indicators that are effective on the establishment of knowledge-based city in Zahedan city as a less developed region and to determine the effectiveness of these components and to present it to the governorate of Sistan and Baluchestan province. The title is the reference of macro policies of urban governance in order to formulate strategic

plans. In this regard, in this research, according to the mentioned reasons and the importance of the establishment and implementation of the knowledge-based city in Zahedan, the researcher faced some questions and in order to answer these questions, what are the factors influencing the establishment of the knowledge-based city in Zahedan. ? And which of these dimensions is effective and which is influenced?

Literature Review

In general, attention to the idea of a knowledge-based city is not only related to information and economic knowledge, but also to dynamic social and cultural activities with the protection of the rich natural environment, the quality of the built environment, multicultural acceptance, democratic and transparent governance, and the key role of human capital in This area is related; However, it can be concluded that a knowledge-based city cannot be developed simply through the formulation of a strategy, but requires a strong culture to create a strong economic foundation and human capital to help grow a knowledge city (Vakil Alroaia & Nazari Ghazvini, 2022: 296).

Based on the available findings, it seems that in order to analyze the experience of knowledge-based urban development, a detailed review and redefinition of the planning system and clarification of cultural, scientific, technological, innovation and political projects in the city and economic, social and cultural development should be done (Dickey et al., 2022: 153). According to the existing experiences, successful regions in the field of creating knowledge and innovation, and according to the ideas and views of thinkers in this field, it was determined that the creation of knowledge and innovative cities has a significant effect in promoting urban and regional development due to the creation of stable income and financial resources; of course, apart from generating wealth, as it is known at the level of urban design, these areas will play a positive role in improving the environmental quality of cities and surrounding areas (Abbasinejad & Zahedi Khoozani, 2021: 569).

The appropriate design of urban spaces and its containing components can provide the basis for creating a knowledge city; As a conclusion from global experiences, it can be said that building a knowledge-based city is a long and complex process on the way to achieving sustainable urban development. However, each city and region has its own unique geographical, cultural, social, economic and political characteristics; Therefore, knowledge-based development strategies should be appropriate to the city's unique conditions, competence, opportunities and challenges. By examining global experiences, it was determined that after the establishment of knowledge areas and corridors, the economic growth of these areas compared to before and other places. There is a noticeable difference in those countries. Therefore, it can be concluded that the effect of the science and technology corridor and knowledge zones on the economic indicators of the regions includes economic growth, the structure of the economic activities of the region, employment generation and labor productivity, attraction of domestic and foreign capital and venture capital, improvement of human capital and technological advancement based on experiences (Zhang & Sridharan, 2022: 253-255).

-The findings of Hajebi & Bahrampur (2022) article showed that provision of knowledge-based mechanisms in a large and extensive education organization requires efficient and effective management in order to achieve the goals of knowledge-based knowledge by making maximum use of existing facilities and resources and establishing active and effective interaction with other participating and effective organizations in the economic process. provided ڎn the other hand, the fundamental transformation document is an intellectual software for creating transformation in entrepreneurship and creativity of students, which by organizing and implementing a comprehensive entrepreneurship and skill training program

for all academic courses, especially secondary school students, will lay the foundation for their entrepreneurship formation in schools.

-The findings of Rottleb & Kleibert (2022) research showed that in many ways, transnational education zones are a continuation of the established strategies for exceptional economic development pursued by the Gulf states, which aim for global connectivity and rely heavily on the control of temporary and conditional migrant labor.

-The findings of Stenvall (2022) article showed that regional economies are increasingly heterogeneous, as are local capacities to cope with these new conditions. At the macro level, this capacity can be developed through a collective process where individuals and organizations work together to provide better public services. At the micro level, the knowledge society may understandably require that an unimpeded flow of information and knowledge occur. It refers to social capital knowledge and information sharing in the myriad processes of everyday life. This chapter examines how a city's "smartness" lies not only in its infrastructure, but also in the social capital that a region can build to promote social innovation and regional development. Empowering residents means that they not only have a voice, but are also seen as key stakeholders that help shape the smart city as a knowledge-based society.

-The results of Bakhsham et al., (2022) article showed the two factors of more attention of the government and universities to the technology transfer offices of universities and providing advice in the field of feasibility, future research and marketing for people wanting to start a knowledge-based company are at the key level of research factors.

-The results of Vakil Alroaia & Nazari Ghazvini (2022) research showed that the indicators of components of creation, and development of knowledge-based cooperative companies in Semnan province and the model proposed for this purpose. The most important of these components: education and research, technology, management strategies and policy-making, new platforms and infrastructures, expansion of knowledge application, knowledge-based innovation and creativity.

-The results of Dickey et al., (2022) article showed that there are several differing models globally that are adopted to respond to the challenge of knowledge fragmentation. The identified key features include: inclusive knowledge co-production, openness of interaction around a boundary object, ongoing monitoring and evaluation and the sustained investment of time in the institution.

-The findings of Abbasinejad & Zahedi Khoozani (2021) research showed that the weight of different productivity factors was estimated using the Bayesian Panel method. Results of the ranking of the selected countries indicate that the United States, Japan, and Germany are leading countries in a knowledge-based economy.

-The findings of Rafieian & Hagh Rosta (2020) research showed that just as rational planning and holistic planning were influenced by capitalist economics, there is a trace of knowledge-based economics in participatory planning; thus, the role of the planner has changed from the omniscient to the facilitator, and the economic foundations of planning have shifted from the capitalist economy to the knowledge-based economy. Therefore, future planning theories seem to be moving towards a knowledge-based planning approach.

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The innovations of this article are:

-Identifying the components of the knowledge-based city;

-The effect of the knowledge-based city in the realization of urban development;

-Identifying and analyzing the effective factors of establishing a knowledge-based city in less developed areas;

-Identifying the most important obstacles and challenges of establishing a knowledge-based city in less developed areas such as Zahedan;

-Explaining the most important strategies for establishing a knowledge-based city in less developed areas;
-Explaining the most important consequences of establishing a knowledge-based city in less developed areas.

Research Methodology

This study is a mixed method study (qualitative and quantitative). In the qualitative phase, the primary components of the grounded theory method were identified using a semi-structured interview. The participants in the research are experts in the fields of public administration, urban management, economics, managers of knowledge-based companies, managers of Sistan and Baluchestan Governorate and Zahedan municipality who have relevant academic degrees or have articles, books, authorship and also teaching in this have formed the ground. The inclusion criteria were experts with at least three years of university experience in the field of public administration, urban management, economics, managers of knowledge-based companies, managers of Sistan and Baluchestan governorate and Zahedan municipality, specialists with at least a doctoral degree. The sampling method was purposeful (snowball). From the point of view of Tashakkori and Johnson, in this sampling method, the cases are selected non-randomly and completely purposefully (Tashakkori & Johnson, 2020: 93).

Data Collection Method

for collecting qualitative data was a semi-structured interview to identify the dimensions, components and indicators of the establishment of knowledge-based cities in less developed areas of the statistical community of experts, which reached scientific conclusions with 17 interviews. Data collection method to collect quantitative data, a matrix questionnaire was used to examine the influential and influential variables using the paired comparison decision-making method (Dematel) from the statistical community of experts, which consisted of 21 experts. The sampling method in this method was in the form of snowball. The interviews were conducted in the summer and fall of 2022. The average time of the interviews was 73 minutes. After the implementation of the interviews, in order to analyze the data, the method of thematic analysis was used simultaneously with the data collection. Thus, after conducting the interviews, the text of the recorded interviews was played first. After that, a copy of the extracted codes was sent to the interviewee and confirmed. In order to familiarize with the data and sink, the data was read several times. In this way, the primary themes of identification and similar primary themes were placed together in one class and the primary classes were formed. These classes were merged and formed the contents of the subjects. Also, to ensure the accuracy of the collected data, there was a long-term and deep engagement of the data. In addition, two other researchers participated in data analysis in addition to the main researchers. Researchers read manuscripts to confirm coding and classification. To increase the verifiability, the participants are referred again. Having maximum diversity in sampling and long visits were other ways to increase the validity of the data. From the initial interview, open codes and central and selective codes were formed, and then data reduction continued in all analysis units (codes) until themes emerged. The interviews continued until the theoretical data saturation stage. Qualitative content analysis was done with MAXQDA12 software. Pairwise comparison decision making (Dematel) is a method that is used to investigate the effect of each variable on other variables and to distinguish the effective from the ineffective components in the variable of establishment of knowledge base city in order to make the overall goals of the research possible. The paired decision model is able to determine the relationship between indicators that are individually or collectively dependent on each other. Dematal analyzes the relationship between the indicators by breaking down the criteria into two parts, the influential and the

influential. (Aslia, 2019: 51-52). In this research, obtaining informed consent, maintaining identity information and maintaining confidentiality in implementing the content of the interviews were considered as ethical considerations.

Research Findings

First question: What are the dimensions, components and indicators of establishing a knowledge-based city in less developed areas?

To answer this question, interviews with semi-structured questions were designed and conducted with academic experts in the fields of public administration, urban management, economics, managers of knowledge-based companies, managers of Sistan and Baluchestan governorate and Zahedan municipality. Of the 17 experts participating in this research, 1 is the president of the university and 5 are university experts in the field of public administration, urban management, economics, 4 are managers of knowledge-based companies, and 7 people are the manager and deputy of the municipality of Zahedan and the governors of Sistan and Baluchistan. The process of qualitative content analysis was used to identify the dimensions, components and indicators of the establishment of Danesh-Banyan city. In this process, 230 primary codes were extracted. With multiple revisions and integration of codes based on similarities and through several stages, finally 69 indicators, 15 components and 6 dimensions were extracted for the establishment of the knowledge-based city (according to Table 2).

Table 2.
Dimensions, components, and indicators of establishing a knowledge-based city in less developed areas

Main variable		Component	Index component	Interviewee code
Establishing a knowledge-based city in less developed areas	**Causal factors**	Internationalization	Competing with the advanced cities of the world	I 1I10, I6, I5,
			Attracting special talents from neighboring countries	I1, I5
			Cultural and economic relations with advanced countries	I4, I1, I15
			Familiarity with international marketing and the importance of research and development	I3, I4, I11,
		Development	Good quality life	I6, I 18
			New governance	I5, I2, I18, I3
			Mental and physical comfort and security	I16
			Environment	I3, I4, I11, I5
			Job security	I13, I14, I17
	The Main Phenomenon	Knowledge management	Creating knowledge	I3.I11 I10
			Knowledge storage	I3, I4, I11, I15
			Knowledge sharing	I1, I8, I3
			Knowledge assessment	I11, I15, I16
			Knowledge application	I3, I4, I11, I15
			Social interaction	I13, I14, I16, I15

Main variable	Component	Index component	Interviewee code
	Institutional factors	Networking	I1, I8, I3
		Attention to capital, culture and art	I11, I15, I16
		Social cohesion and equality	I3, I4, I11, I15
Strategic factors	Infrastructure	Development of information technologies	I4, I12, I11
		Computer skills	I3, I4, I11, I5
		Broadband Internet	I1, I5, I4, I2, I11
		High-speed Internet	I13, I14, I12, I5
		Reasonable price for internet services	I2, I3, I1, I7
		Use of new technologies in the city	I9, I8, I10, I15
		Skilled human resources	I3, I4, I8, I13
		Hiring experienced managers	I3, I4, I11, I5
	Native culture	Freedom of people to preserve and use their native language	I1, I15, I3
		Getting to know different inner-city cultures	I3, I4, I11, I5
	Skills and Expertise	The suitability of expertise, skills and capabilities of people with their jobs	I1, I15, I4, I2, I11
		Experimental and traditional skills specific to the city	I3, I4, I11, I5
Contextual factors	Education and Technology	Educating people in the field of using new technologies	I3, I5, I4, I2, I11
		Cultural training suitable for the city of Zahedan	I13, I4, I11 I10
		Teaching modern world knowledge to students	I10, I15, I14, I2, I11
		Teaching current knowledge to university teachers and professors	I5, I11, I4
		Teaching practical knowledge to professors and students	I1, I2, I11, I5
		Establishing prestigious	I1, I12, I16, I15

Main variable		Component	Index component	Interviewee code
			universities to attract domestic and foreign students	
		Rules and Regulations	Legal requirement for public cooperation	I10, I15, I1, I7
			The possibility of developing or modifying regulations at the local level	I3, I4
			Awareness of the role, position and mission of oneself and others	I16, I5, I1, I17
			Enact fair and just laws	I8, I17, I11, I13
			Approving laws and regulations related to employment (merit selection and merit cultivation)	I5, I1, I11, I14
	Intervening factors	**Internal policies**	Compilation of internal policies inconsistent with the urban culture of Zahedan	I7, I13, I9, I2, I6
			Employing senior managers of key organizations (governorship and municipality) who are unfamiliar with the culture of Zahedan	I10, I16, I5, I1, I7
			Compilation of tax laws disproportionate to the income level and urban problems of Zahedan	I13, I14, I5
			Approving budgets that are not proportionate to the geographical location of Zahedan	I1, I9, I3
			Making decisions regardless of sectarian differences (Sunni and Shia)	I12, I16, I10, I4
			Not supporting knowledge-based businesses	I15, I12, I17, I13
			Short-term strategic planning view	I5, I2, I12, I3
			Preventing foreign companies from	I16, I9, I10, I14, I15

Main variable	Component	Index component	Interviewee code
		entering less developed cities	
	Foreign policies	Preventing foreign investment in small and medium businesses in less developed cities	I6, I1, I13
		Preventing the presence of foreign engineers in less developed cities	I2, I6, I10, I14
		Confining the level of university education to inner cities and provinces	I12, I8, I3
	Urban geography	The weather of Zahedan city (dry and hot)	I11, I19, I10, I4, I5
		Dust due to the existence of the desert	I17, I3, I14, I1
		Neighboring Afghanistan and Pakistan	I 1I10, I6, I5,
	Cultural conflict (indigenous and tribal)	The existence of two Balouch and Persian cultures in one geography	I1, I5
		The existence of two Sunni and Shia sects in the same geography	I4, I1, I15
		cultural difference with two neighboring countries (Afghanistan and Pakistan)	I3, I4, I11
Consequences	**Development of urban knowledge**	Increasing the level of literacy and information of people in the city	I7, I3, I10, I9
		Increasing public knowledge of the city and modern urbanization issues	I1
		Developing the culture and atmosphere of sharing knowledge and experience in the city	I5, I2, I12, I3
		Encouraging the generation, sharing and use of knowledge	I16

Main variable	Component	Index component	Interviewee code
	Development of knowledge-based city	Improving the quality of applied research	I3, I4, I11, I5
		The quality of the city's physical space for people to talk and share experiences	I4, I12, I11
		Development of business relations in the city	I3, I4, I11, I5
		Participation of actors together in decision making	I1, I5, I4, I2, I11
		The amount of urban spaces suitable for the presence and conversation of people and transfer of experiences	I3.I11 I10
		The readiness of the private sector to invest in new and special activities	I3, I4, I11, I15
		Increasing the economic power and financial ability of activists	I1, I8, I3

According to the results obtained from table (1), 6 dimensions, 15 components and 69 indicators were extracted for establishing a knowledge-based city.

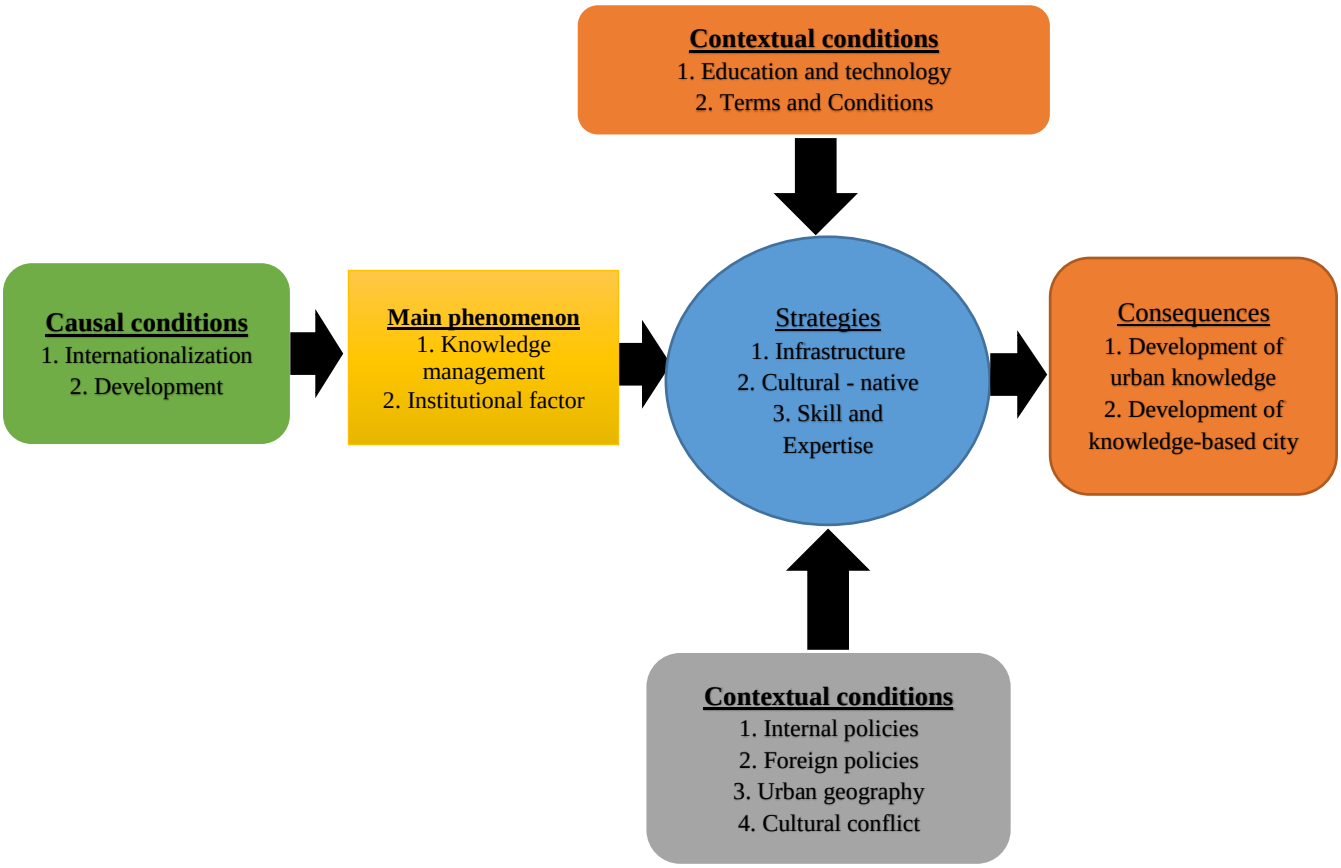

Figure 1.*The dimensions and components of the establishment of the knowledge-based city in Zahedan*

Second question: What are the effective and efficient factors in establishing a knowledge-based city in less developed areas?

DEMATEL technique process

Step 1: calculation of direct correlation matrix (D) In this step, the average opinions of research experts can be seen in Table 2.

This table combines the opinions of 21 experts based on arithmetic average. For example, in cell C_{12}, it is calculated as follows.

$$c_{12} = \frac{1 + 2 + 2 + 3 + 2 + \cdots}{21} = 2.15$$

Table 3.

Direct correlation matrix (D) (average opinion of 21 experts)

No effect=0 Very little impact=1 Little impact=2 **High impact**=3 Very high impact=4	**Internationalization**	**Development**	**Knowledge management**	**Institutional factor**	**Infrastructure**	**Cultural - native**	**Skill and Expertise**	**Education and technology**	**Terms and Conditions**	**Development of urban knowledge**	**Development of knowledge-based city**	**Internal policies**	**Foreign policies**	**Urban geography**	**Cultural conflict**
Internationalization	0.000	2.150	2.714	2.286	1.714	2.714	2.143	2.000	2.714	2.714	2.571	3.143	2.143	2.857	2.321
Development	2.000	0.000	3.29	1.857	2.286	2.857	2.143	2.000	3.143	3.429	3.000	3.429	3.143	3.857	3.102
Knowledge management	1.857	2.286	0.000	2.143	1.571	2.571	1.714	2.429	2.857	2.571	3.000	3.286	2.571	3.143	3.232
Institutional factor	1.857	2.571	2.571	0.000	2.000	2.857	2.143	2.143	2.714	3.000	3.143	2.714	3.143	3.714	2.891

Infrastructure	2.429	2.000	3.000	2.429	0.000	3.143	1.857	2.286	3.000	2.714	2.857	3.143	2.571	2.429	1.892
Cultural - native	2.286	1.857	2.714	2.143	2.143	0.000	2.000	1.857	2.286	1.714	2.857	3.000	2.421	2.571	2.324
Skill and Expertise	2.000	1.571	2.714	2.571	2.143	2.857	0.000	2.143	2.857	2.571	3.429	2.429	2.571	2.857	1.786
Education and technology	1.857	2.143	2.714	2.714	2.000	2.571	1.571	0.000	2.571	2.714	3.429	2.714	2.714	3.000	2.765
Terms and Conditions	2.000	1.571	2.429	2.286	2.143	2.571	1.857	2.000	0.000	2.286	2.857	3.000	2.857	3.000	2.548
Development of urban knowledge	2.143	2.571	3.000	2.000	1.875	3.000	2.571	1.857	2.571	0.000	2.571	2.857	3.143	3.429	2.987
Development of knowledge-based city	2.286	2.000	2.857	2.143	1.875	3.143	2.286	1.857	2.143	2.000	0.000	2.714	2.286	3.429	2.848
Internal policies	1.857	1.857	2.571	1.857	2.000	2.571	1.714	2.286	3.143	2.000	2.286	0.429	2.714	2.857	3.875
Foreign policies	1.857	1.857	2.571	1.571	2.143	2.429	1.714	1.857	2.857	2.143	2.571	2.571	0.000	2.833	2.764
Urban geography	2.000	1.575	2.000	2.286	2.286	1.714	1.571	1.571	21.43	2.000	1.857	2.286	1.286	0.000	2.675
Cultural conflict	1.844	1.098	2.866	2.894	2.986	1.754	1.013	2.65	2.547	2.000	3.425	2.877	1.767	2.536	0.000

Step 2: Normalize the direct correlation matrix To normalize the obtained matrix, mathematical relationships have been used with the help of formulas in Excel software. That is, first, the sum of the rows and columns of the matrix of direct communication should be obtained, then the highest value should be calculated from among the total numbers, which is given in Table 3.

Table 4

Total row and column of direct communication matrix

Total Ccolumn	**Total Row**	
28.273	34.186	C1
27.106	39.673	C2
38.152	35.232	C3
31.179	37.463	C4
29.129	35.749	C5
36.754	32.181	C6
26.298	34.500	C7
28.931	35.480	C8
37.547	33.405	C9
33.857	36.559	C10
39.854	33.848	C11
40.591	34.017	C12
35.339	31.740	C13
42.513	27.246	C14
38.009	32.253	C15
Max	42.513	

Then, in order to normalize all the components of the direct correlation matrix (Table 2), we divide by the number 42.513. The normalized matrix is given in Table 4.

Table 5
Normalized matrix of Dematal method

No effect=0 Very little impact=1 Little impact=2 High impact=3 Very high impact=4	Internationalization	Development	Knowledge management	Institutional factor	Infrastructure	Cultural - native	Skill and Expertise	Education and technology	Terms and Conditions	Development of urban knowledge	Development of knowledge-based city	Internal policies	Foreign policies	Urban geography	Cultural conflict
Internationalization	0.00	0.05	0.06	0.05	0.04	0.06	0.05	0.05	0.06	0.06	0.06	0.07	0.05	0.07	0.05
Development	0.05	0.00	0.08	0.04	0.05	0.07	0.05	0.05	0.07	0.08	0.07	0.08	0.07	0.09	0.07
Knowledge management	0.04	0.05	0.00	0.05	0.04	0.06	0.04	0.06	0.07	0.06	0.07	0.08	0.06	0.07	0.08
Institutional factor	0.04	0.06	0.06	0.00	0.05	0.07	0.05	0.05	0.06	0.07	0.07	0.06	0.07	0.09	0.07
Infrastructure	0.06	0.05	0.07	0.06	0.00	0.07	0.04	0.05	0.07	0.06	0.07	0.07	0.06	0.06	0.04
Cultural - native	0.05	0.04	0.06	0.05	0.05	0.00	0.05	0.04	0.05	0.04	0.07	0.07	0.06	0.06	0.05
Skill and Expertise	0.05	0.04	0.06	0.06	0.05	0.07	0.00	0.05	0.07	0.06	0.08	0.06	0.06	0.07	0.04
Education and technology	0.04	0.05	0.06	0.06	0.05	0.06	0.04	0.00	0.06	0.06	0.08	0.06	0.06	0.07	0.07
Terms and Conditions	0.05	0.04	0.06	0.05	0.05	0.06	0.04	0.05	0.00	0.05	0.07	0.07	0.07	0.07	0.06
Development of urban knowledge	0.05	0.06	0.07	0.05	0.04	0.07	0.06	0.04	0.06	0.00	0.06	0.07	0.07	0.08	0.07
Development of knowledge-based city	0.05	0.05	0.07	0.05	0.04	0.07	0.05	0.04	0.05	0.05	0.00	0.06	0.05	0.08	0.07
Internal policies	0.04	0.04	0.06	0.04	0.05	0.06	0.04	0.05	0.07	0.05	0.05	0.01	0.06	0.07	0.09
Foreign policies	0.04	0.04	0.06	0.04	0.05	0.06	0.04	0.04	0.07	0.05	0.06	0.06	0.00	0.07	0.07
Urban geography	0.05	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.04	0.05	0.03	0.00	0.06
Cultural conflict	0.04	0.03	0.07	0.07	0.07	0.04	0.02	0.06	0.06	0.05	0.08	0.07	0.04	0.06	0.00

Step 3: Calculation of the total relationship matrix (T) To calculate the complete correlation matrix based on formula writing in excel software, first the same matrix (I_{15*15})is formed. Then we subtract the same matrix from the normal matrix and invert the resulting matrix. Finally, we multiply the normal matrix by the inverse matrix. The total relationship matrix is given in Table 5.

Table 6
The matrix of the total Dematal relationship of the criteria

No effect=0 Very little impact=1 Little impact=2 High impact=3 Very high impact=4	Internationalization	Development	Knowledge management	Institutional factor	Infrastructure	Cultural - native	Skill and Expertise	Education and technology	Terms and Conditions	Development of urban knowledge	Development of knowledge-based city	Internal policies	Foreign policies	Urban geography	Cultural conflict
Internationalization	0.181	0.221	0.299	0.249	0.226	0.290	0.216	0.230	0.295	0.271	0.305	0.321	0.269	0.329	0.295
Development	0.253	0.198	0.349	0.269	0.266	0.326	0.240	0.257	0.339	0.317	0.350	0.364	0.322	0.388	0.347
Knowledge management	0.227	0.228	0.245	0.251	0.228	0.292	0.211	0.244	0.304	0.273	0.320	0.330	0.284	0.342	0.320
Institutional factor	0.239	0.245	0.317	0.215	0.249	0.313	0.230	0.249	0.316	0.295	0.339	0.333	0.309	0.370	0.328
Infrastructure	0.243	0.226	0.316	0.261	0.195	0.310	0.218	0.244	0.312	0.280	0.322	0.332	0.289	0.332	0.297
Cultural - native	0.222	0.205	0.285	0.235	0.224	0.217	0.203	0.216	0.273	0.238	0.297	0.303	0.262	0.307	0.281
Skill and Expertise	0.228	0.210	0.300	0.257	0.236	0.295	0.169	0.234	0.300	0.269	0.325	0.307	0.280	0.331	0.285

Education and technology	0.229	0.227	0.307	0.265	0.239	0.295	0.210	0.191	0.300	0.278	0.332	0.321	0.289	0.341	0.313
Terms and Conditions	0.221	0.204	0.286	0.244	0.230	0.281	0.205	0.225	0.229	0.256	0.304	0.311	0.278	0.325	0.293
Development of urban knowledge	0.240	0.240	0.319	0.255	0.241	0.310	0.235	0.238	0.307	0.224	0.320	0.330	0.303	0.357	0.323
Development of knowledge-based city	0.229	0.215	0.298	0.244	0.226	0.295	0.216	0.224	0.280	0.253	0.244	0.308	0.268	0.336	0.302
Internal policies	0.221	0.212	0.293	0.239	0.231	0.284	0.204	0.235	0.302	0.253	0.297	0.259	0.278	0.326	0.325
Foreign policies	0.210	0.202	0.279	0.220	0.222	0.267	0.194	0.214	0.282	0.243	0.287	0.291	0.205	0.309	0.286
Urban geography	0.191	0.175	0.238	0.212	0.202	0.225	0.171	0.186	0.239	0.216	0.243	0.255	0.209	0.215	0.255
Cultural conflict	0.213	0.190	0.289	0.252	0.243	0.258	0.183	0.234	0.279	0.245	0.310	0.302	0.250	0.308	0.230

Step 4: *Creating a causal diagram*

In order to form the causal diagram, we obtain the sum of rows (D) and the sum of columns (R) of the matrix of total relations. And then we calculate D+R and D-R.

Table 7

Importance and effectiveness of criteria

		D	**R**	**D-R**	**D+R**
Internationalization	C1	3.99567	3.348256	0.647415	7.343926
Development	C2	4.584121	3.196382	1.387738	7.780503
Knowledge management	C3	4.099505	4.420433	-0.32093	8.519938
Institutional factor	C4	4.345231	3.668593	0.676638	8.013825
Infrastructure	C5	4.176249	3.456347	0.719902	7.632596
Cultural - native	C6	3.768952	4.256837	-0.48788	8.025789
Skill and Expertise	C7	4.025873	3.105193	0.92068	7.131065
Education and technology	C8	4.137533	3.421119	0.716414	7.558651
Terms and Conditions	C9	3.893084	4.357595	-0.46451	8.250679
Development of urban knowledge	C10	4.24252	3.911308	0.331212	8.153827
Development of knowledge-based city	C11	3.938711	4.597126	-0.65842	8.535837
Internal policies	C12	3.959787	4.666721	-0.70693	8.626509
Foreign policies	C13	3.710646	4.095415	-0.38477	7.806061
Urban geography	C14	3.231632	4.914942	-1.68331	8.146574
Cultural conflict	C15	3.786633	4.479881	-0.69325	8.266514

According to Table 6, the higher the D value of a criterion is, that criterion is highly effective. Based on this, the criteria can be arranged based on the effectiveness rating as shown in Table 7.

Table 8

The ranking of effectiveness under the criteria

Ranking	**D**		
5	3.99567	C1	Internationalization
1	4.584121	C2	Development
8	4.099505	C3	Knowledge management
6	4.345231	C4	Institutional factor
4	4.176249	C5	Infrastructure
11	3.768952	C6	Cultural - native
2	4.025873	C7	Skill and Expertise
3	4.137533	C8	Education and technology
10	3.893084	C9	Terms and Conditions
7	4.24252	C10	Development of urban knowledge
12	3.938711	C11	Development of knowledge-based city

Ranking	D		
13	3.959787	C12	Internal policies
9	3.710646	C13	Foreign policies
15	3.231632	C14	Urban geography
14	3.786633	C15	Cultural conflict

According to Table 7, the higher the R value of a criterion, that criterion has high effectiveness. Based on this, the criteria can be arranged based on the ranking of effectiveness as shown in Table 8.

Table 9
The effectiveness rating of the sub-criteria

Ranking	R		
11	3.348256	C1	Internationalization
15	3.196382	C2	Development
8	4.420433	C3	Knowledge management
10	3.668593	C4	Institutional factor
12	3.456347	C5	Infrastructure
5	4.256837	C6	Cultural - native
14	3.105193	C7	Skill and Expertise
13	3.421119	C8	Education and technology
6	4.357595	C9	Terms and Conditions
9	3.911308	C10	Development of urban knowledge
4	4.597126	C11	Development of knowledge-based city
3	4.666721	C12	Internal policies
7	4.095415	C13	Foreign policies
1	4.914942	C14	Urban geography
2	4.479881	C15	Cultural conflict

According to the table above, the variables in column D indicate influence and the variables with a higher number in column R indicate effectiveness. Finally, the addition and subtraction of each of them shows the final effectiveness of each component is shown in diagram 1.

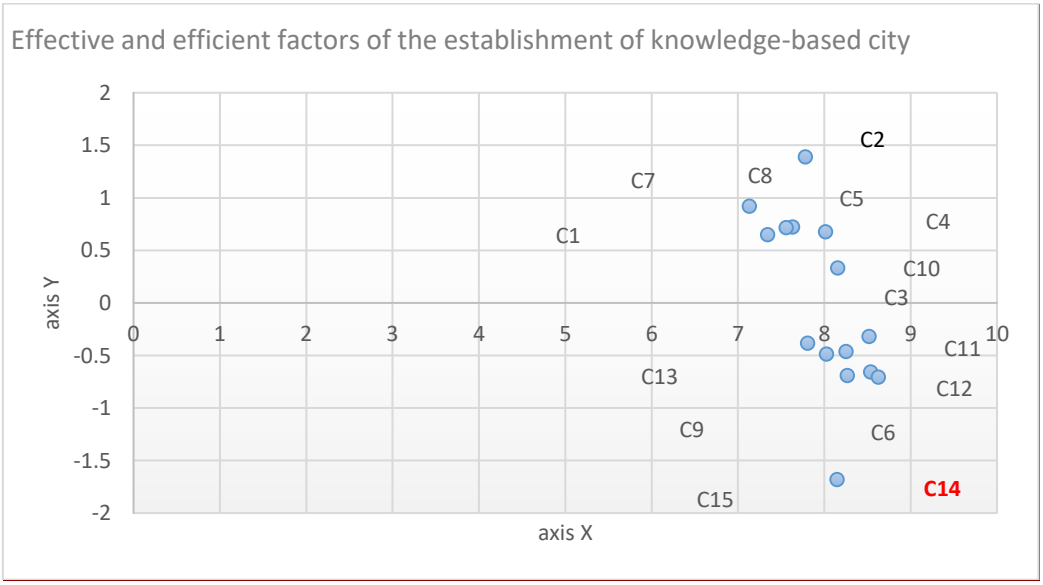

Diagram 1. *The position of criteria based on D+R and D-R*

The measures above the x-axis have positive R-D. These criteria have a causal aspect and their effectiveness is greater than their effectiveness, which respectively include the dimensions of development, skill and expertise, education and technology, infrastructure, internationalization, institutional factor, urban knowledge development. Dimensions of development, skill and expertise, education and technology, infrastructure, internationalization, institutional factor, urban knowledge development, knowledge management, foreign policies, laws and regulations, cultural-native, knowledge-based city development, internal policies, conflict Cultural and urban geography are respectively from high impact to low impact.

The criteria that are located at the bottom of the x-axis have negative R-D. These criteria have a disabled aspect in the research, that is, they have a higher effectiveness, which respectively include the criteria of urban geography, cultural conflict, internal policies, knowledge-based city development, cultural-native, laws and Regulations, foreign policies, knowledge management. urban geography criteria, cultural conflict, internal policies, knowledge-based city development, cultural-native, laws and regulations, foreign policies, knowledge management, urban knowledge development, institutional factor, internationalization, infrastructure, education and technology, skill and Specialization and development are respectively from high effectiveness to low effectiveness.

Conclusion

Today, the growing process of globalization, the emergence and expansion of innovative tools of information and communication technology, the compression of time and space, carrying out activities (especially economic) in real time, the synergistic process of expanding knowledge and technology and the capitalist economy, lead to the formation of capitalism. It is based on knowledge. Also, in the transition to the period of post-Fordism and the period of neurotechnology, the role of knowledge management in adjusting and adapting the value of knowledge base or intelligent capital has become increasingly important. And knowledge is considered as one of the main production inputs and one of the most valuable business assets that must be managed effectively and efficiently to achieve a competitive advantage in the field of knowledge economy, knowledge city and knowledge citizens. In this way, with the huge transformation of the concept of development, the value connected to knowledge, the driving force of urban development and changing the spatial structure of cities by creating opportunities for the production and exchange of knowledge and innovation among citizens, has been raised. On the other hand, the policies adopted by the rulers of the developed countries have made most of the countries to double their efforts to achieve and use the world's technologies optimally to acquire and apply knowledge and finally reach a knowledge-based city. Iran has not been exempted from this and is trying to facilitate this by forming knowledge-based companies and institutions, but this has not been achieved in less developed cities such as Zahedan. Based on this, in this research, the effective factors of establishing a knowledge-based city in less developed cities were investigated. By accepting this premise that various factors have an effect on the establishment of knowledge-based cities in less developed areas and the establishment of knowledge-based cities in less developed areas is also affected by different factors that should be discovered and investigated with the knowledge of the mentioned differences. Therefore, so far, many models and theories have been presented by researchers to explain and identify the factors affecting the establishment of a knowledge-based city and how to evaluate it and how to present and measure it. But most of these patterns and models do not have the necessary comprehensiveness.

Accordingly, in order to achieve the pattern of establishing a knowledge-based city in less developed areas, we must know the

dimensions and components of the establishment of a knowledge-based city that is in accordance with the needs of less developed cities and also in line with the goals of the society. One of the reasons for not addressing this issue in recent researches is the quantitative nature of many researches. In most researches, positivist paradigms are more visible and it is the most widely used scientific view of recent researches. In this research, we believe that if the research is done in a qualitative way and first-rate scholars in the human sciences are used in the field of public administration, urban management, economics and managers of knowledge-based companies and managers of Sistan and Baluchestan Governorate and Zahedan Municipality. It will change into a measurable and tangible word and will lead to the explanation of the theory in this regard. Among the innovative aspects of this research, we can mention the methods of extracting meaning and concepts related to the establishment of knowledge-based cities in less developed areas. Because in most researches, quantitative aspects have been used to derive concepts. While this research is based on semi-structured interviews with experts. Also, the use of MAXQDA and Excel software can be considered as the use of modern technology in the construction of the theories of this research. On the other hand, the extraction of functional dimensions and components is operational in order to establish a knowledge-based city in less developed areas. This section was in line with the findings of Bakhsham et al., (2022), Dickey et al. (2022), Abedini et al. (2020), and Rafieian & Hagh Rosta (2020).

Finally, for the establishment of a knowledge-based city in a less developed region, with the knowledge gained from the components and the effectiveness of each dimension, it can be suggested that:

- Recruiting, identifying and promoting transformational managers (adhering to ethical principles in the field of urban knowledge);
- Development and training of managers who support the use of the dimensions of establishing a knowledge-based city;
- Empowering managers in management and strategic decision-making and familiarizing them with upcoming dimensions and components by conducting in-service training courses.
- Preparation of public administration infrastructures and human resources at macro and micro levels

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