

THE ROLE OF CRISES IN THE CITY'S FUNCTIONING AND DEVELOPMENT PROCESSES

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Abstract. The article presents the systematization of crises events arising in the process of functioning and development of the city as a complex system with a large number of different components interacting in a dynamic manner. The city is analyzed as an object that consists of a multitude of systems and subsystems, whose life interests on one hand foster development and on the other, limit each other's growth. As they change under the pressure of external and internal factors, these elements encounter limitations imposed by adjacent systems, leading to conflicts in the life interests of the city's subsystems. In this case, the contradictions are necessary and inevitable conditions for the development of any system, providing its mutability under changing external conditions of existence. Practically, they act as the driving force of development, prompting the system to alter its properties. City risks losing its ability to adapt and becoming vulnerable to external influences and internal disturbances.

The study uses ideas taken from systems theory and synergetics, which allow for conclusions that the city as a system demonstrates a classic case of the "Law of Unity and Conflict of Opposites", where there is a constant balancing between the need to maximize self-preservation and survive in a changing world. On the other hand – the aspiration for changes, sometimes leading to crisis. These systemic contradictions can be resolved by sophisticated regulation or can be exacerbated by wrong decisions. This approach offers new horizons for urban planning, where every step should be deliberate and aimed at providing sustainable development, consolidation of the social structure and a higher quality of life for citizens. With this perspective, city governments can transform potential crises into opportunities for the development and modernization of urban environments.

Keywords: architecture, city, crisis, bifurcations, system.

Introduction. The study of crises as factors determining future scenarios and formats of the city's existence provides an opportunity to create a new map of scientific notions and research directions to guarantee its maximum "survivability". Consequently, when forecasting future development, it is necessary to consider possible scenarios and those crises that it can overcome.

In addressing the issues of crises in relation to urban functioning and development, it is noted that a crisis, in this aspect of its examination, signifies a change in the operational conditions of the city system, resulting in a loss of stability.

The origins of crises are recognized as an indicator of the city system transitioning to a new state through equilibrium disruption. Knowledge of the developmental trends of a crisis and the conditions where they evolve allows for the anticipation of the final result – either the city attaining a new state of equilibrium or moving towards a potential catastrophe.

A crisis as a "loss of stability" provides examples of how unpredictability sometimes triggers a cascade of large-scale events. For instance, the immediate cause of the Sepoy Mutiny of 1857-1859 "was the use of new rifles with cartridges in "cartouches", which soldiers had to bite off while

loading. These cartridges were greased with beef or pork fat, offending both Hindus, who revere cows as sacred, and Muslims, who are prohibited from consuming pork. This rebellion led to a prolonged bloody war, resulting in the dissolution of the East India Company's rule and the establishment of the British Indian Empire" [1].

A crisis is a period when something in the system changes. As internal disequilibrium intensifies, the system approaches a bifurcation point, where its evolutionary path diverges. At this juncture, the system becomes highly sensitive to external and internal forces. The choice of one or another path at the bifurcation point depends on the factor of chance. The development of such systems is fundamentally unpredictable.

Arnold Toynbee, for example, identified two bifurcation points in the development of the Hellenic world and analyzed in detail two possible scenarios for the development of events in the era of Alexander the Great. The first scenario envisages Alexander living in old age and creating a world empire from Rome to China. The second involves the unsuccessful assassination attempt on Philip II, Alexander's father, in 336 BC, leading to Alexander's death. Concurrently, an attempt to poison the Persian king Artaxerxes fails, resulting in the rivalry and collaboration between the Hellenic and Persian states becoming the main drivers of the 4th century BC [2].

Analysis of research and publications. In terms of analyzing publications on the research topic, the following points can be noted:

Authors V. Rao and D. Dogruer examines methods and strategies of design and planning that enhance cities more resilient to extreme events and crises [3].

The work "Crises Spaces. Structures, Struggles and Solidarity in Southern Europe" directed by Costis Hadjimichalis is of interest for presenting scientific insights on how urban architecture and space respond to various crises, including social and economic ones [4].

"Urban Disaster Management and Resilience" by S. Nazif [5], "Urban Resilience: A Transformative Approach" directed by Yoshiki Yamagata and Hiroshi Maruyama [6], "How can a municipal government continue operations during megadisasters? An analysis of preparedness using complex adaptive systems" by M. Haraguchi [7] presents theoretical frameworks for the recovery of cities post-crises and disasters with an emphasis on architecture and urban planning.

The work "New Urbanism: Past, Present and Future" by Ajay Garde examines how urban planning and architecture can adapt and respond to various types of crises, including pandemics and climate change [8].

The work "Urban Policy in Times of Crisis: The Policy Capacity of European Cities and the Role of Multi-Level Governance" edited by R. Cucca and C. Ranci explores the role of urban and regional planning in crisis management, such as natural disasters and economic crises [9].

It is important to highlight in this context the book "Architecture and Resilience: From Theory to Practice" by Michelle Laboy and David Fannon, which investigates how architectural design can contribute to the resilience of cities in the face of crises and disasters [10].

Purpose of the study: Identification and systematization of crises inherent to the operational and developmental processes of the city as a dynamic system.

Research Methods. The systematic approach in the study of crises in the functioning and development of urban architecture entails considering the city as a complex dynamic system composed of diverse components and the interconnections between them. This approach facilitates the creation of models and scenarios to predict the outcomes of various decisions and changes within this system [11].

Interdisciplinary approach. The study of crises affecting urban architectural development necessitates interdisciplinary collaboration among architects, engineers, environmentalists, economists, sociologists, and other specialists to fully comprehend the system and its challenges. This collaboration, in turn, will enable the development of strategies for managing changes within the system, taking into account the consequences of crises and potential risks of the city system losing its stable state.

The study also uses methods of synergetic, as a science studying complex systems and their evolution. This method is used in analyzing the development of the city and the bifurcation points

in its evolution in the context of crises. Synergetic helps in understanding how urban systems self-organize, adapt to changing conditions and how the city responds to various challenges. It allows us to identify the moments when the city system is on the brink of a state change, which may lead to new developmental trajectories [12].

Results of the study. Based on content analysis of publications available in the most widespread scientometric databases, a described and systematized hierarchical sequence of global crises has been compiled, which includes:

Demographic crisis. The population size does not correspond to the capacity of the occupied territory to provide the residents with the necessary resources for life. A prominent instance of demographic crisis is the Great Migration, which resulted in the capture and plundering of Rome by the Visigoths under King Alaric in 410 AD and the emergence of new states on the European continent during the medieval period.

Among modern architectural and urban planning examples, we can cite the works of P. Soleri, who sees the way out in the creation of buildings, collectively termed "arcology". The principle consists of the most efficient use of the earth's surface and compact settlement of people inside the building. In other words, if it is a problem for settlements to grow horizontally, the alternative is to grow vertically. The literal embodiment of this principle is the projects of skyscrapers whose height exceeds several kilometres. Such structures have been termed hyper-structures [13].

Agrarian crisis – relates to the inability to feed the population of a territory through existing agricultural resources. The main causes of this crisis can be excessively rapid population growth, crop failures, cold weather, or unsuccessful government policy. Throughout human history, hunger has been a threat to the existence and well-being not only of cities but also of entire countries.

It is known that in the 4th century BC, the Greek architect Deinocrates proposed to Alexander to make a statue of the king out of Mount Athos. On one hand, it would hold a city, and on the other – a cup, which was to collect water from mountain springs and pour it into the sea. Alexander liked the architect's proposal, but he declined to implement it, asking how Deinocrates intended to feed the ten thousand people who were supposed to live in this city.

A potential solution at the current stage of architectural development is the vertical farm. This concept promises the renewal of cities, sustainable production of safe and varied food (year-round production of agricultural crops), and ultimately the restoration of ecosystems that have been sacrificed for terrestrial agriculture.

Ecological crisis. Human economic activity has so altered the environment that these changes become a threat to the existence of humanity itself. An ecological crisis can also occur as a result of climate change and a series of natural disasters.

By the present time, several priority ecological directions have been identified and actively developed by scientists around the world: waste-free, non-destructive production technologies; complete utilization of all life-sustaining waste; use of renewable sources of raw materials and energy; transition from extensive to intensive development. In architecture, these directions have formed into the following concepts: bioclimatic architecture, intelligent or smart building, smart home system, high-tech building, healthy building, ecological, life-supporting building, and so on [14].

Energy and raw material crisis – solving the issue of cheap clean energy and raw materials is key to resolving most other crises. Currently, there are dozens of ghost towns on the planet, created near sources of raw materials and abandoned when these reservoirs were developed [15, 16].

The most famous is Hashima Island in Japan, located in the Sea of Japan, which became famous due to a crisis associated with its history and use during Japan's industrial development. The island was known for its underwater coal mines and residential apartment buildings. From 1887 to 1974, coal mines operated on the island. With the advent of cheaper and more efficient energy sources, and as the coal industry became obsolete, the mines on the island were closed. This led to a crisis, as workers were left unemployed and the island became deserted. Now it has become a popular subject of study and a tourist destination and its history has begun to be researched and documented. In 2015, Hashima Island was included in the UNESCO World Heritage List as part of

"Japan's Industrial Revolution's Golden Age".

A modern example of solving the energy crisis could be alternative energy in architecture. The energy of the sun, wind, water, earth, and biomass is already a real and affordable alternative to traditional fuel energy today. The main directions of building energy efficiency have become the principles of energy passivity and energy activity. The idea of energy-active and energy-passive buildings is the result of searching for the most economical means of energy supply for construction objects and implies achieving this goal thanks to the possibility of energy production directly at the site, promising the prospect of a complete refusal to set up expensive and unreliable in operation external engineering networks.

Economic crisis. This crisis is based on the changing nature of internal and external economic relations caused by the information and technological revolutions. As a result of the changes, many cities, oriented in the process of globalization of industries to produce a narrow range of products are losing sustainability and attractiveness for the most active and productive members of society to live in them.

A prominent example of the economic crisis impact on a metropolis is the city of Detroit, the former automotive capital of the world. After the withdrawal of many automotive productions from the USA to third-world countries, the central part of the city turned into a ghetto. The narrow specialization of cities on a certain type of product put them in an extremely dependent on external economic conditions position. Consequently, shifts in demand and alterations in external economic circumstances lead to the appearance of "ghost towns", settlements from which residents have left, having lost their main sources of income due to changes in the world market situation.

Cultural crisis. It is characterized by the deviation of most of the culture's components from their stable state. The cultural crisis was the cause of the destruction not only of individual cities but even entire civilizations such as ancient Babylon. In the Book of Prophet Jeremiah, ch. 51, v. 6 about Babylon is written as follows: "Flee from the midst of Babylon and save every man his soul; lest you perish in her iniquity, for this is the time of the Lord's vengeance, He is rendering her a recompense. Babylon was a golden cup in the Lord's hand that made all the earth drunk; the nations drank her wine; therefore, the nations are mad".

Social crisis. The problem of the disintegration of social connections within society, the loss of intra-group connections by many social groups becomes a problem that does not allow effectively solving the tasks of urban ecology. An interesting example of the power of social crisis impact on the state is ancient Sparta. For centuries, Spartan society was built as an aristocratic militarized state based on the oppression of the indigenous population – helots. Thanks to the discipline and excellent combat qualities of Spartan troops, Lacedaemon played a leading role in the politics of ancient Greece for a long time, but the static nature and unwillingness to change created social relations did not allow the Spartans to adapt to the changed external conditions.

Crises can also be systematized and analyzed according to the following characteristics:

Cause of occurrence. Natural crises are those caused by changes in the functioning of the environment that are not dependent on human actions. An example of this would be cities abandoned by inhabitants due to changes in river beds. For instance, Kanka – the first capital of the Tashkent oasis, was one of the largest urban centres in Uzbekistan during the antiquity and medieval periods, existing from the 3rd century BC to the 13th century AD [17].

Civilizational crisis. Such crises result from human activity. In Ancient Hellas, only a small part of the land was suitable for cultivation and crops. In order to get new territories for farming and orchards, forests covering the mountain slopes were cut down, and sheep and goats, which had long been bred by the Greeks, ate and trampled young tree shoots. By disturbing the natural balance, the Greeks faced droughts and famine.

Nature of manifestation. Predictable crises are those that occur as the next stage of system development, which can be forecasted and are caused by known reasons. Today, the imminent predictable crisis is the freshwater crisis. According to the UN, more than 1.2 billion people already live in conditions of constant freshwater shortage, and about 2 billion suffer from it regularly (in the dry season, etc.). According to FAO forecasts, by the middle of the third decade of the XXI century,

the number of people living under permanent water scarcity will exceed 4 billion people [18].

An example of an urban freshwater crisis is the crisis in Cape Town, South Africa that occurred in 2017-2018. This crisis became known as the "Day Zero" or the "Day Zero Crisis".

Time factor. Long-term crisis. A crisis whose progression through the system extends over a significant period. A long-term crisis in a city can occur due to various factors, such as political, economic, social, or ecological. An example of such a crisis is the crisis in Detroit, Michigan, USA.

The crisis of re-generation occurs when a city or district faces difficulties in attracting new residents and businesses, maintaining jobs and improving the lives of residents.

An example of such a crisis can be seen in the South Bronx area in New York, USA. In the 1970s and 1980s, the South Bronx faced various problems. Housing and infrastructure deterioration: many buildings were in disrepair, and the infrastructure required renewal; High levels of crime: the area was one of the most criminal in the USA, creating a negative image and deterring potential residents and investors; High unemployment: reductions in production and economic transformation led to job losses, affecting the economic well-being of the area.

A short-term crisis. A short-term crisis in a city can arise due to sudden events or emergencies that quickly threaten normal life and the functioning of the city. An example of such a recent crisis is the Morandi Bridge disaster in Genoa, Italy. In August 2018, the Morandi Bridge collapsed, causing a short-term crisis. The bridge was a vital transport artery and collapsing halted traffic, which hindered movement and further increased fear and anxiety among citizens. This example demonstrates how short-term crises can arise suddenly and require immediate action by authorities and emergency services to minimize damage and restore normal city life.

The character of the crisis development allows for forecasting the vector of its possible development and the consequences of its progress setting the relevance of the study. Crisis of birth; Crisis of avalanche growth; Turnaround crisis; Transformation crisis; Regression crisis; Rupture crisis; Merger crisis; Crisis of accumulating errors; Degradation crisis; Resource exhaustion crisis; Destruction crisis [19].

The birth crisis – the appearance of a new system. The establishment of world religions, revolutions, the appearance of global styles in architecture and art can all be considered as crises of birth, with processes in emerging systems possessing an extremely high potential leading to global changes.

An example of a "birth crisis" in urban architecture is the city of Astana, which was renamed to Nur-Sultan in 2019, the capital of Kazakhstan. This city started life as a new capital from scratch, and architects and urban planners began designing and constructing new buildings and infrastructure. The architectural style of Astana includes many modern and unique buildings, such as Bayterek, the Palace of Peace and Reconciliation, Astana Towers, and others. However, these architectural innovations have caused much controversy and debate among residents and architects. Some argue that the city's architectural style is too different from the historical architecture of other Kazakh cities.

An avalanche growth crisis is the occurrence of a chain reaction of system multiplication leading to widespread distribution of the system, in some cases more than the environment can sustain, and such an outburst can end tragically. The consequences of the planet's population growth and, correspondingly, the growth of urban populations over the last hundred years represent a clear example of this crisis.

A turnaround crisis. A turnaround crisis occurs when a system, although it does not change much or at all, begins to develop along a different trajectory. For social systems and individuals, this could be a process of change or disruption that alters goals, value systems, tools, etc.

An example of a "turnaround crisis" in urban development is the city of Barcelona, Spain, from the middle of the 20th century to the beginning of the 21st century. In the 1980s and 1990s, Barcelona faced a number of serious problems such as:

Infrastructure overage from the Olympic Games: after the 1992 Olympic Games in Barcelona, the city was left with an excess of infrastructure that needed readaptation and further use; Urban neglect: in some areas of the city, there were many illegal constructions and urban chaos;

Population dissatisfaction: the city's population was dissatisfied with the uncontrolled growth of tourism, the loss of traditional culture, and other socio-cultural aspects.

However, this crisis helped Barcelona overcome these problems and become one of the vibrant examples of sustainable and innovative urban development while preserving its unique cultural and architectural identity [20].

A regression crisis. A regression crisis occurs when a system that has been moving along a certain trajectory as if rolls back, losing what was "conquered". An interesting example of "regression" is the "Khrushchev Thaw". This period was characterized by the condemnation of Stalin's personality cult, the repressions of the 1930s, the liberalization of the regime, the release of political prisoners, the dissolution of the GULAG, the weakening of totalitarian power, the emergence of some freedom of speech, relative democratization of political and public life, openness to the Western world and more creative activity freedom [21].

A breakup crisis. A breakup crisis occurs when having reached a bifurcation point the system splits into two or more parts, each continuing their development along different trajectories. Moreover, such breaks in the system's development can occur repeatedly. An example is the division of the Roman Empire – an event that took place in 395 AD, after the death of the ancient Roman emperor Theodosius I, resulting in the division of the empire into Western and Eastern parts, each with its own emperor. Flavius Arcadius, Theodosius' elder son, became the governor of the Eastern Roman Empire, while his younger son Honorius became the governor of the West. The capital of the Eastern Empire became Constantinople, while the Western emperor resided initially in Mediolanum, later mostly in Ravenna, and only rarely in Rome.

Also, as an example of a "rupture crisis" could be Paris and the construction of high-rise skyscrapers in the La Défense district. In the second half of the 20th century, construction of skyscrapers began in La Défense, located in the west of Paris. These tall glass and metal structures contrasted with traditional Parisian architecture, causing debates and disagreements among Parisians and architects about preserving the historical appearance of the city and the influence of new skyscrapers on the city's aesthetics. Some believed that the skyscrapers could disrupt the harmony of Paris and detract from its cultural and historical values.

A breakup crisis in urban architecture can lead to a need for balance between modern development and the preservation of historical value. In the case of Paris, the discussion and development of strict architectural norms and rules for construction in the city's most meaningful districts were among the ways to address this breakup crisis.

A merging crisis. A merging crisis occurs when two independently evolving systems merge and continue to develop along a unified trajectory. The merging of nonlinear systems can often create over-summary effects that can be either beneficial or sometimes harmful to the system. An example is the merging of metropolises when two or more large cities combine, which can lead to coordination issues in urban planning, transportation infrastructure, and housing policy. The merging of New York and Brooklyn in 1898, for instance, led to difficulties in providing adequate infrastructure for the new metropolis. The merging of cities can also create problems with maintaining transportation infrastructure, as happened with the consolidation of Berlin in 2001. Issues with transportation, road traffic, and public transportation can create a crisis in ensuring the mobility of residents and so on.

These examples demonstrate that a merger crisis in urban architecture can be caused by various factors, and solving these problems requires a comprehensive approach to planning, management, and ensuring the sustainable development of cities.

An error accumulation crisis. An error accumulation crisis occurs when the harmful effects created by the system itself or acting upon it from outside accumulate to a level where attempts at self-regulation by the system and the number of errors come into resonance making it impossible for the system to adapt to the negative impacts being inflicted. An example is the Pruitt-Igoe residential district. The emigration from the area of the most financially capable population leads to a crisis of non-payment, which leads to the degradation of buildings and technological disasters, degradation leads to habitation of houses by a marginal population, and marginalization of the

population leads to an increasing crime rate. As the result, thirty-three 11-story residential buildings were demolished 20 years after their construction.

A degradation crisis. A degradation crisis is one in which the system partially collapses, simplifies, loses functions, efficiency, etc. An example is the city of Brasilia, designed by architects Lucio Costa and Oscar Niemeyer. The architects intended the city to become a model of social justice, which was not achieved. Instead, Brasilia became a "city of bureaucrats" and does not perform any significant economic functions, owing its prosperity exclusively to its capital status. This status leads to the fact that a huge number of internal migrants from other regions of the country arrive in Brasilia, who, unable to buy quality housing in the city itself, form a suburban belt around the capital with a very different quality of life and living conditions.

A resource exhaustion crisis. A resource exhaustion crisis occurs when resources needed for development are depleted or disappear altogether for various reasons. An example is the new Hebi. The economy of Hebi, a large city in Henan province, survives on coal mining. More than 20 years ago, the government decided to develop new minefields 40 kilometres from the historical part of the city – in the Qibin area. This is how appeared "New Hebi", a zone covering several hundred square kilometres, which has not been developed in 20 years.

Conclusions. The article examines the processes of architectural development as a system in the context of mutations under the influence of crises. It has become an axiom today that no crisis exists in isolation, and each of its manifestations, to some extent, affects many aspects of human life. Attempts to systematize existing representations of global crises are practically being made in all paradigms by thousands of scientists, and each tries to adapt the data they have to their own circle of knowledge and conceptions, based on personal competence.

As architects, we must primarily take a systematic approach to the study of this problem. Examining the city as a dynamic system that adapts and evolves under the influence of various factors is one of the key factors. Each mutation caused by a crisis can have a profound impact on the development of urban architecture. This system evolves and changes under the influence of various factors, including crises.

To successfully implement concepts for the transition of architecture to a new level of existence and development, one should have an understanding of the factors that will shape the vectors of future development of the city and architecture. It is important to note that crises can also stimulate innovative approaches and changes, contributing to the development of new solutions in the sustainable development of urban architecture, for example:

Crises can cause changes in societal needs. For instance, the COVID-19 pandemic forced many cities to adapt architectural solutions to ensure safety and social distancing. This may include the creation of open spaces for recreation, expansion of pedestrian zones, and improvement of public transportation systems.

Crises can promote innovation in architecture and construction. For example, energy crises can stimulate the development of more efficient and sustainable buildings that use renewable energy sources.

Crises such as floods, earthquakes, and hurricanes may require the creation of architectural solutions to protect cities and buildings. This may involve the construction of disaster-resilient buildings and infrastructure.

Crises can emphasize the importance of community participation in urban planning and architectural design processes. Citizens and local communities can play an active role in setting priorities and creating sustainable and functional cities.

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РОЛЬ КРИЗ У ПРОЦЕСАХ ФУНКЦІОНУВАННЯ ТА РОЗВИТКУ МІСТА

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Анотація. У статті представлено та розгорнуто висвітлюється систематизацію кризових подій, що виникають у процесі функціонування та розвитку міста інтерпретованого як складної системи, з великою кількістю різноманітних компонентів, що взаємодіють у динамічному ритмі. Місто розглянуто як об'єкт, що складається з безлічі систем і підсистем, життєві інтереси яких, з одного боку, розвивають, а з іншого – обмежують розвиток один одного. Змінюючись під тиском зовнішніх і внутрішніх чинників, ці елементи стикаються з обмеженнями, що накладаються суміжними системами. При цьому виникають суперечності життєвих інтересів підсистем міста. Якщо в результаті таких складних динамічних процесів не встановлюються нові межі компромісів, система міста переходить у стан кризи. При цьому самі суперечності є необхідними і неминучими умовами розвитку будь-якої системи, забезпечуючи її мутабельність при зміні зовнішніх умов існування. Фактично вони і є двигуном розвитку, змушуючи систему змінювати свої властивості. Без конфліктів і компромісів місто ризикує втратити здатність до адаптації, стаючи вразливим до зовнішніх впливів та внутрішніх збурень.

У дослідженні використовуються уявлення, взяті з теорії систем і синергетики, які дають можливість зробити глибші висновки про те, що місто як система демонструє класичний випадок втілення "Закону про єдність і боротьбу протилежностей", де відбувається постійне балансування між потребою максимально себе зберегти та вижити у мінливому світі. З іншого боку – прагненням до змін, що подекуди ведуть до кризи. Зазначені системні суперечності можуть бути усунені продуманим регулюванням, а можуть бути посилені через неправильно ухвалені рішення. Цей підхід відкриває нові горизонти для міського планування, де кожен крок повинен бути обміркованим і спрямованим на забезпечення сталого розвитку, зміцнення соціальної структури та підвищення якості життя городян. З такою перспективою керівництво міста може трансформувати потенційні кризи в можливість для розвитку та вдосконалення міського простору.

Ключові слова: архітектура, місто, криза, біфуркації, система.

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