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# THEORETICAL CONCEPT OF THE COMPETITIVE ENVIRONMENT IN INFORMATION AND COMMUNICATION TECHNOLOGIES: SUBJECTS, OBJECTS AND MEANS OF COMPETITION

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## Zavhorodnya E. O., Melnyk T. M. Theoretical Concept of the Competitive Environment in Information and Communication Technologies: Subjects, Objects and Means of Competition

The study is focused on forming a theoretical perspective on the objects and means of competition relevant to definite subjects of competition in the global market of information and communication technologies (ICT market), since such a comprehensive understanding is important for making strategic decisions, promoting economic development, optimising the career growth of specialists and adapting educational programmes to the emerging needs and requirements of the ICT market. The aim of our research is to elucidate the nature of the interactions and relationships among the key elements of the competitive landscape – namely, the subjects, objects, items, and means of competition – while placing a particular emphasis on the objects and means of competition in the global information and communication technologies market. The information basis for our study is a number of scientific and industry papers on competition in the ICT market. The study uses analysis, synthesis, generalisation, abstraction and graphical methods. The study expands theoretical concepts of the nature of interaction between the key components of the global ICT market (with a generalised scheme of interrelationships between them). It describes how the daily activities and interaction of users with ICTs form their needs and specific requirements/expectations (objects of competition in the ICT market) for technological products, services and solutions (items of competition in the ICT market) with the accompanying graphical generalised display. Based on the typical operations of users with ICTs, the authors have proposed a classification of objects of competition in the ICT market. The motivation, goals, items and means of competition for the main subjects of competition in the global ICT market are briefly outlined. The key means used by ICT companies, ICT specialists, research institutions and governments to form their competitive advantages and to compete effectively in the global ICT market are indicated and grouped in the study.

**Keywords:** competition, competitiveness, ICT sector, ICT market, subject of competition, object of competition, item of competition, means of competition.

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## Завгородня Є. О., Мельник Т. М. Теоретична концепція конкурентного середовища в ІКТ: суб'єкти, об'єкти та засоби конкуренції

Дослідження спрямоване на формування теоретичного уявлення про об'єкти та засоби конкуренції, що актуальні для конкретних суб'єктів конкурентної боротьби на глобальному ринку інформаційно-комунікаційних технологій (ІКТ-ринку). Таке комплексне розуміння є важливим для прийняття стратегічних рішень, сприяння економічному розвитку, оптимізації кар'єрного зростання фахівців та адаптації освітніх програм до нових потреб і вимог ІКТ-ринку. Метою нашого дослідження є з'ясування характеру взаємодії та взаємозв'язків між ключовими елементами конкурентного середовища, а саме: суб'єктами, об'єктами, предметами та засобами конкуренції, приділяючи особливу увагу об'єктам і засобам конкуренції на глобальному ринку інформаційно-комунікаційних технологій. Інформаційною основою нашого дослідження є низка наукових і галузевих праць з питань конкуренції на ІКТ-ринку. У дослідженні застосовано аналіз, синтез, узагальнення, абстрагування та графічний метод. Розширено теоретичні уявлення щодо сутності та характеру взаємодії ключових складових світового ІКТ-ринку (із пропозицією узагальненої схеми взаємозв'язків між ними). Охарактеризовано, як повсякденна діяльність і взаємодія ІКТ-користувачів формує їхні потреби та специфічні вимоги/очікування (тобто об'єкти конкуренції в ІКТ) до технологічних продуктів, послуг та рішень (предметів конкуренції на ІКТ-ринку) із супровідним графічним узагальненим відображенням. На основі типових операцій ІКТ-користувачів запропоновано класифікацію об'єктів конкуренції на ІКТ-ринку. Крім того, коротко окреслено мотивацію, цілі, предмети та засоби конкуренції основних суб'єктів конкуренції на глобальному ІКТ-ринку. У дослідженні визначено та згруповано ключові засоби, які використовують ІКТ-компанії, ІКТ-спеціалісти, науково-дослідні установи та уряди для формування своїх конкурентних переваг та ефективного конкурентності на глобальному ІКТ-ринку.

**Ключові слова:** конкуренція, конкурентоспроможність, ІТ-сектор, ІКТ-ринок, суб'єкт конкуренції, об'єкт конкуренції, предмет конкуренції, засіб конкуренції.

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Given the global great complexity and enhanced impact of information and communication technologies (ICTs) on economic growth, innovation and social development (with the gradual intensification of competition in the global ICT market), creating a comprehensive theoretical framework that outlines the objects and means of competition becomes crucial for understanding this particular market dynamics, as well as for policy making, developing business strategies and encouraging academic and industry research.

For ICT companies, conceptualising the competitive environment through a clear understanding of the objects and means of competition is important because ICT businesses will be able to identify areas of competitive advantage, allocate resources more efficiently, and make informed decisions about market entry, partnerships, and investments, thus giving greater control over expected outcomes.

For ICT professionals, the theoretical framework of competition in the global ICT market provides insight into specific skills and experience required to succeed in a global industry, as this understanding allows professionals to anticipate and assess changes in the demand for technology products, services and solutions; clearly identify competitive gaps; and align their career development goals with technological environment trends.

In turn, for governments, a comprehensive theoretical concept of competition in ICTs enables the development of a favourable regulatory environment for entrepreneurship, R&D, encouragement of investments in the national ICT sector (e. g., in the development of ICT infrastructure, digital transformation, human resources development initiatives, etc.), and effectiveness in international diplomatic efforts (e. g., in negotiating trade and economic agreements, harmonising regulation and protection of intellectual property rights, as well as technology transfer that moves inventions from creators to businesses and public/private users, etc.).

With regard to universities, as institutions for the education and training of future ICT specialists,

a coherent theoretical framework on the objects and means of competition in the ICT market is the basis for developing adapted curricula with a focus on new technologies, interdisciplinary cooperation, innovation management, etc., ensuring that students acquire knowledge and skills that meet the needs of the ICT market and competitive trends in it.

Theoretical studies of economic competition with clearly identified and defined terms and concepts (such as the subject, object, means and item of competition), in which key terms and concepts (such as the object, subject and item of competition) are identified and defined, are proposed in the research papers of domestic [1–8] and foreign scholars [9–12]. However, the use of theoretical concepts developed by the scientists for other sectors of the economy to determine the objects and means of competition in the ICT market has drawbacks, as it does not take into account its specifics and features, thus leading to incomplete or erroneous conclusions about competitive dynamics in it. Therefore, specific sectoral theories are needed to accurately define the objects and means of competition in ICTs, providing more relevant information for policy makers, business leaders and other stakeholders.

The study [13] raises the issue of the peculiarities of competition and competitiveness of the ICT sector of the national economy, noting the inherent features and strategic directions of competition in ICTs, and also emphasises the impact of the ability of ICT companies to create value propositions on the competitiveness of individual business entities and the ICT sector as a whole at the national and international levels. However, this study does not focus on the identification and characterisation of the objects and means of competition in the ICT market.

Finally, the study [14] examines and classifies the main elements of the competitive environment in the global ICT market, in particular, the subjects of competition (in general and on the example of ICT companies, research institutions and ICT sectors) and

defines the concepts of the subject of competition, the object of competition, and the means of competition.

Therefore, the *purpose* of our study is to develop and propose a theoretical framework to clarify the essence of interaction and interconnection of the main components of the competitive environment (subjects, objects, items and means of competition) with a focus on the objects and means of competition in the global market of information and communication technologies.

The *research methods* include: analysis and synthesis of relevant scientific and industry literature on the research topic, abstraction and generalisation (for classification of objects and means of competition), graphical (tables and figures). The information basis of the study is the scientific and industry research of national and foreign scientists and experts.

Taking into account the analysed scientific works [1–14], the key elements of competition in the global information and communication technologies market can be conditionally defined and understood as follows: 1) *the subjects of competition* (ICT companies, research institutions, ICT professionals and governments) are key players that interact with each other in various ways in order to develop, innovate and regulate the ICT sector; 2) their efforts, in turn, are focused on *the objects of competition*, which are the needs and demands of ICT users (i. e., the subjects seek to meet these needs by developing new products and services more efficiently than their competitors); 3) users' needs lead to the creation of *the items of competition*, represented by ICT products and services that the subjects develop and deliver more efficiently than their competitors; 4) *the means of competition* include both micro-level influences (such as innovation, pricing and branding) and macro-level influences (such

as government policies and regulations) that determine how competition unfolds in the ICT market.

In addition, according to [14], the interaction of these components of competition can be represented in the form of a generalised scheme that reflects how key competitive actors (subjects of competition) – ICT companies, professionals, research institutions and governments – direct their efforts to meet the needs of ICT users and are supported by strategies at both the micro and macro levels (*Fig. 1*).

In particular, Fig. 1 shows the following relations and interconnections between the subjects, objects, items and means of competition in the global ICT market:

1) *the arrows between the main subjects of competition demonstrate the following characteristic interactions:*

- 1.1) ICT companies interact with ICT professionals, attracting talent and expertise;
- 1.2) governments influence competition for both ICT companies and R&D institutions through regulation, policy and funding (moreover, the government's dual role as both regulator and stakeholder makes it a key force in the ICT competitive environment);
- 1.3) research institutions collaborate with ICT companies and ICT professionals to drive innovation and technological progress (the arrows between them indicate the flow of knowledge, technology and possibly talents that are crucial factors for the development of advanced ICT solutions);

2) *the needs and demands of ICT users* are represented as the ultimate goal of all the subjects, and thus all competitive actions – whether by companies, professionals or governments – are aimed at meeting the changing preferences and needs of end users (ac-

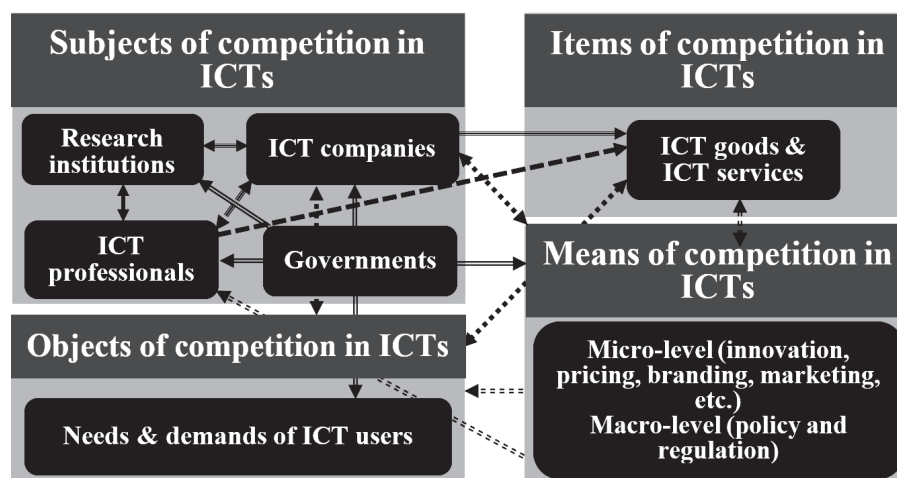


Fig. 1. Interaction of key components of competition in the global ICT market

Source: developed by the authors based on [14].

Accordingly, the arrows from subjects point to the object, indicating that competition revolves around who can best meet user expectations);

3) **the items of competition** are the actual ICT products and ICT services with which subjects compete, and are both the result of competition and the tools for meeting the needs of users (respectively, ICT companies and governments are actively involved in creating a market for these products and services);

4) **the means of competition** determine how competition in the ICT market takes place; they are applied to the items of competition and are influenced by both subjects and objects, being divided into:

- 4.1) micro-level, which are used by companies and professionals to outperform others in the market by creating competitive advantages;
- 4.2) macro-level, which shape the competitive environment on a broader scale through policies and regulations, influencing the ICT market conditions and industry standards.

The daily activities of users largely shape their ICT needs, as different tasks require specific technological tools, systems and services, for example:

- 1) the nature, complexity and frequency of daily activities determines the capacity, performance and technical requirements (e. g. high performance speed processors, memory and connectivity) of hardware components;
- 2) the volume and complexity of users' activities affect the functional requirements for the installation, compatibility and upgradeability of software components (i. e., tools for communication, processing, management and protection of data and systems);
- 3) users' daily activities (e. g., remote work, online learning, social networking, etc.) require uninterrupted communication and access to online resources, thus motivating users to seek ICT solutions with stable connectivity across devices and locations;
- 4) daily activities of users lead to the need for sufficient and secure data management and storage (both in local and cloud environments);
- 5) daily activities involve the processing of personal and confidential information, thus affecting the need for reliable security measures (encryption, firewalls (brandmauers), multi-factor authentication, etc.) to protect against cyber risks;
- 6) the nature of user interaction with digital systems affects the need for intuitive, functional and easy-to-use interfaces;
- 7) participation in teamwork, group projects, social interaction, etc. affects the demand for

tools that facilitate effective collaboration in real time and in different environments;

- 8) users' daily routines affect the requirements for flexibility and mobility in choosing the place and method of using ICTs (e. g., laptops, tablets, mobile applications and cloud services);
- 9) daily interaction with ICTs (work, study or entertainment) creates needs for reliable and efficient technological solutions (e. g., hardware durability, software stability and overall system reliability).

In accordance with the above, the authors propose a scheme that summarises the sequence of influence of users' daily interaction with ICTs on the formation of their consumer habits and new needs for technological solutions (Fig. 2).

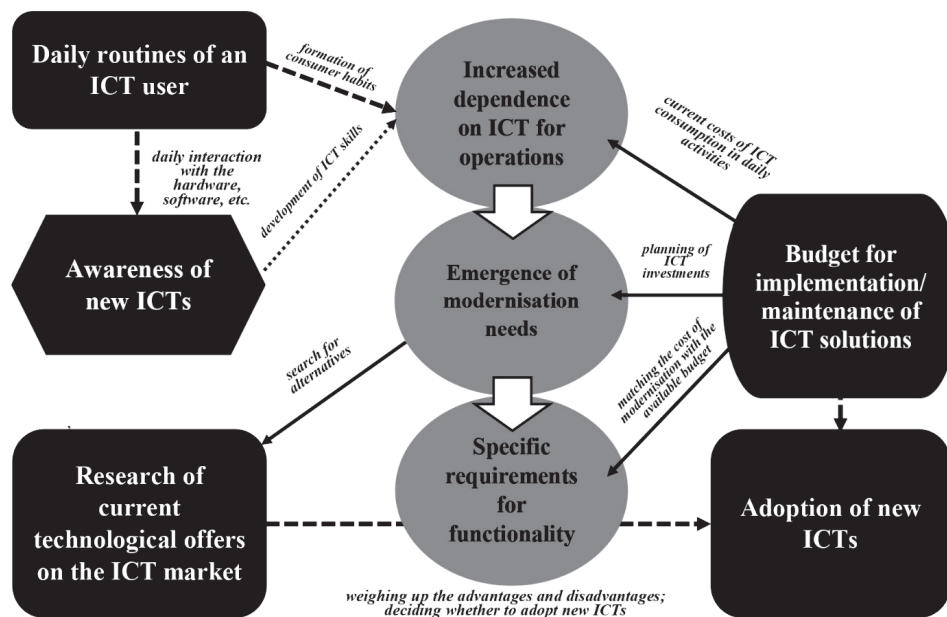
Based on the most typical operations and patterns of interaction of users with data and ICTs, it is appropriate to propose the author's classifications of objects of competition in the ICT market (Tbl. 1). Accordingly, the criteria applied in classifying the objects of competition in the ICT market (users' needs for technological solutions) take into account the needs for: 1) efficient, accurate data collection and input methods; 2) secure, scalable and structured storage systems; 3) processing to convert raw data into usable formats; 4) simple, convenient and fast data analytics; 5) encryption, access control, data protection compliance and intrusion detection; 6) seamless data exchange and data sharing; 7) data transformation; and 8) data integrity and continuity.

Consideration of the concept of '**means of competition in ICT**' separately for the main subjects of competition in the global ICT market is appropriate because it factors in their unique roles in shaping competitive dynamics and differences in strategies, resources and goals. Below is a summary of the motivation, goals, items and means of competition for the key subjects of competition in the global ICT market (Fig. 3).

Accordingly, in the global ICT market, ICT companies directly stimulate market competition by introducing new products and services and competing mainly for market share, revenues and technological leadership (in addition, they are mainly focused on short- and medium-term competition, seeking immediate results and market success). For ICT companies, the means of competition include distinctive capabilities, technological assets and strategic approaches used to strengthen market positions and achieve business goals.

**The means of competition of ICT companies in the national (domestic) ICT market** refer to the various strategies, resources and capabilities that ICT companies use to gain a competitive advantage in





**Fig. 2. Scheme of formation of user needs in ICTs**

Source: developed by the authors.

**Table 1**

**Classification of objects of competition in information and communication technologies market**

Classification criterion	Groups of objects of competition in the ICT market
By data collection and input	Basic data entry needs, automated data collection needs, ICT needs for real-time data collection, ICT needs for aggregating data from different sources, ICT needs for mobile data entry, crowdsourced data collection needs, biometric data collection needs, sensor data collection needs, remote data entry needs
By data storage and organisation	Basic ICT needs for data storage, cloud storage needs, ICT needs for data classification and indexing, distributed data storage needs, ICT needs for data archiving, object-oriented storage needs, edge storage needs, serverless storage needs
By data processing and transformation	Basic ICT needs for processing, ICT needs for batch processing, ICT needs for real-time data processing, ICT needs for data transformation based on artificial intelligence, cloud processing needs, edge computing needs, serverless computing needs, big data processing needs
By data analytics and conclusions	ICT needs for basic analytics, ICT needs for advanced analytics, ICT needs for real-time analytics, ICT needs for big data analytics, ICT needs for artificial intelligence-based analytics, ICT needs for cognitive analytics, ICT needs for prescriptive analytics
By data security and privacy	Basic ICT security needs, data encryption and masking, ICT needs for compliance and privacy, ICT needs for threat detection, ICT needs for enhanced security, ICT needs for data loss prevention
By data exchange and collaboration	ICT needs for joint use, ICT needs for cloud collaboration, ICT needs for secure data sharing, ICT needs for multi-party collaboration, ICT needs for API-based data sharing, ICT needs for blockchain-based data sharing, ICT needs for cross-border data collaboration
By data visualisation and reporting	ICT needs for basic reporting, ICT needs for interactive visualisation, ICT needs for real-time visualisation, ICT needs for complex reporting
By data backup and recovery	Basic backup needs, automated backup needs, disaster recovery needs, real-time backup needs, operational continuity needs

Source: developed by the authors.

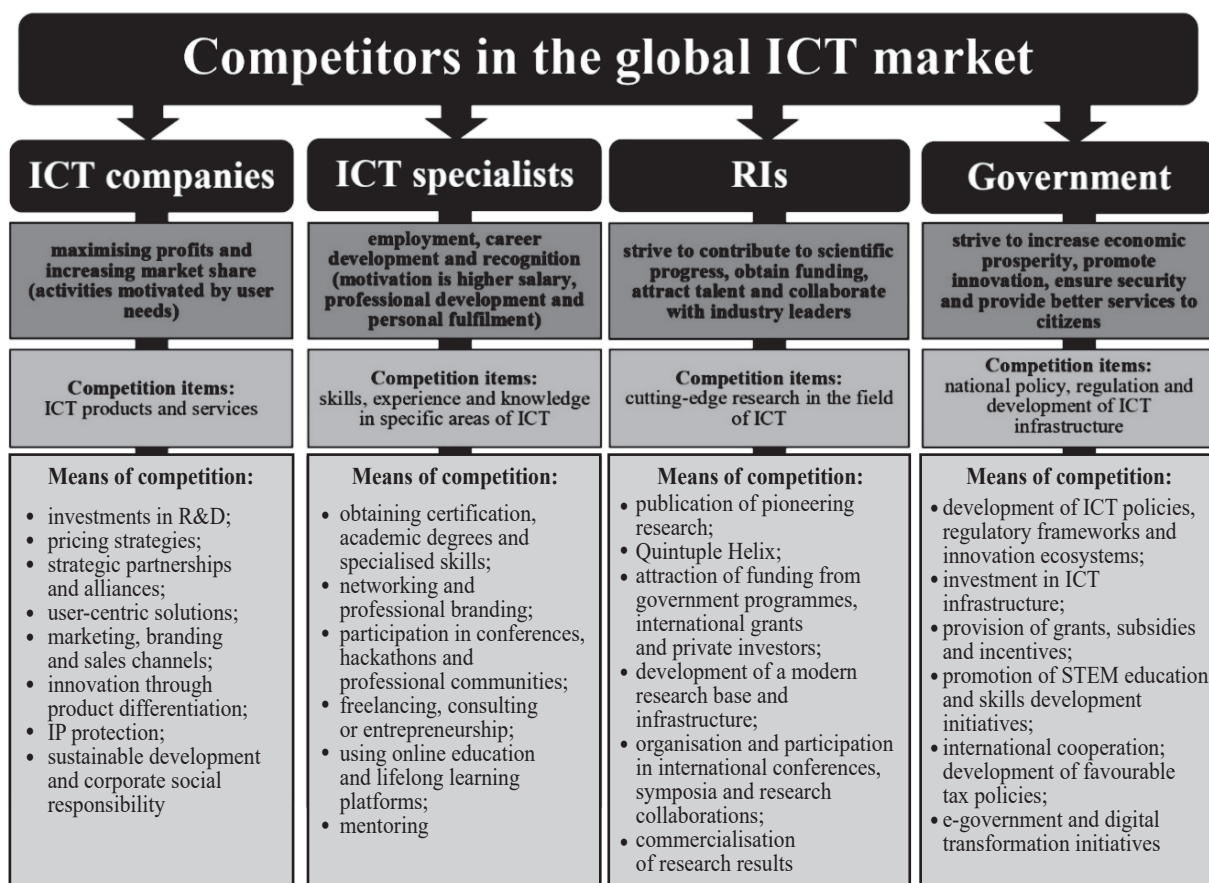


Fig. 3. Motivation, items and means of competition of the main subjects of competition of the global ICT market

Source: developed by the authors.

their country, focusing on meeting the needs of local consumers, complying with national regulations and effectively differentiating themselves from domestic and foreign competitors present in the market (Tbl. 2).

*The means of competition of ICT companies in the international ICT market* cover the approaches and resources that ICT companies use when competing in foreign markets, including the adaptation of products and services in accordance with the regulatory, cultural and market requirements of each country in which they enter. Accordingly, the main means of competition of ICT companies at the international and global levels include:

- 1) *means related to the localisation of products/services* to the needs, preferences and regulatory requirements of each specific country/region (e. g., language translation, data security and privacy settings for certain regions, cultural adaptation of the interface, support for local payment methods, compatibility with local devices, etc.);
- 2) *means related to compliance with both international standards and specific legal requirements* of each target country (e. g., compliance with global and regional privacy

standards, certification of products for compliance with local standards, compliance with cybersecurity rules, obtaining local operating licences, establishing local legal teams to ensure compliance, adaptability to changing regulations, regular monitoring of international legal trends, etc.);

- 3) *means related to the development of competitive pricing models* taking into account economic conditions in each market (e. g., regional price adjustments, tiered pricing strategies, offering starter versions or free models (for price-sensitive markets), currency linkage, volume/loyalty/referral discounts, pay-as-you-go options, etc.);
- 4) *means of cooperation with local counterparts in host markets* (e. g., strategic partnerships with local suppliers, joint ventures for product localisation, agreements with trade intermediaries, distribution partnerships, cooperation with local technology communities or universities, sponsorship of local tech events, alliances with industry associations, etc.);
- 5) *means related to marketing and creation of a brand identity* that resonates with the cul-

**Table 2**

**The main means of competition of ICT companies in the domestic market**

<b>Groups of competitive means</b>	<b>Essence</b>	<b>Examples of means of competition</b>
Product/service-related means	Methods focused on differentiating the company's products and services	High quality of products/services, customer support, industry solutions, integration with popular platforms, user-friendly interfaces, scalability, reliable security features, trial versions, free feature updates, product performance guarantees, etc.
Means related to company management	Approaches that ensure an effective organisational structure	Flexible project management, transparency in decision-making, talent management, strategic planning, effective team structure, mentoring programmes, remote and hybrid work policy, crisis management, etc.
Financial efficiency means	Methods aimed at improving financial performance	Cost optimisation strategies, use of financial analytics, cost-effective outsourcing, effective cash flow management, financial audits, automation to reduce labour costs, tax optimisation, etc.
Means related to major competitors	Strategies aimed at favourable positioning and responding to competitors' moves	Competitive pricing strategies, market research and segmentation, differentiation of offers, loyalty programmes, customer relationship management, rapid adaptation to competitor innovations, tracking competitor product launches, exclusive partnerships, brand identity development, competitor intelligence, etc.
Means related to compliance with the law	Ensurance of compliance with legal and regulatory standards	GDPR compliance, intellectual property protection, data protection, labour law compliance, cybersecurity compliance standards, ISO certification, transparent data processing practices, secure data storage policies, anti-corruption compliance, technology licences, monitoring of changes in regulations, etc.

**Source:** developed by the authors.

tural and social context of the markets (for example, *at the international level* – regionally adapted marketing campaigns, adaptation of brand messages to cultural norms, use of region-specific marketing channels, etc.; *at the global level* – global branding campaigns, sponsorship of international events, creation of recognisable brand symbols and slogans, global advertising, maintenance of high customer satisfaction ratings, etc.);

- 6) *means related to the provision of customer support* that is accessible, reliable and able to handle requests in multiple languages and time zones (e. g., round-the-clock customer support, regional support centres, multilingual online help centres, localised FAQs and knowledge bases, support through local social media platforms, dedicated local account managers for corporate clients, etc.);
- 7) *means related to supply chains and distribution networks* (e. g., partnerships with local logistics providers, local data centres, adaptation of packaging to import/export requirements, multi-regional component sourcing (that is,

- a more geographically diversified approach to sourcing), creation of regional warehouses, diversified supplier networks, contingency plans in case of geopolitical problems, a natural disaster, fraudulent activity, or a terrorist attack, etc.);
- 8) *means related to effective human resources management* (e. g., developing global recruitment strategies, hiring local sales and customer support staff, working with local consultants, offering remote work options for foreign employees, offering international training programmes, establishing research and development centres in target markets, adapting HR policies to local labour laws, etc.);
- 9) *means related to technological adaptation*, i. e., modification or optimisation of products and services to match the technological infrastructure of different markets (e.g. adaptation of products/services in developing regions, implementation of offline functions, adaptation of data storage in accordance with regional legislation, localisation of servers to reduce delays, compatibility with local operating systems, etc.);

- 10) **means related to ensuring global technological leadership** (e. g., investments in R&D for new technologies, implementation of advanced cybersecurity features, launching new features before competitors, cooperation with global technological institutes, patenting new technologies, etc.);
  - 11) **means related to the protection of intellectual property (IP) and brand assets at the international and global levels** (e. g., registration of trademarks in foreign markets, patent protection, development of brand awareness to reduce infringement risks, establishment of anti-counterfeiting measures, attracting legal teams with global experience, monitoring of global IP infringements, use of digital rights management tools, etc.);
  - 12) **means related to economies of scale and cost efficiency** (e. g., global procurement strategies, process optimisation and automation, outsourcing production to low-cost regions, establishing regional production hubs, using standardised products with limited localisation, usage of global distribution networks, implementing energy-efficient operations to reduce costs, etc.);
  - 13) **means related to adaptability to different regulatory environments** (e. g., compliance with global and regional privacy standards, cybersecurity certification, establishment of local legal teams to ensure compliance, adaptability to changing regulations, regular monitoring of international legal trends, etc.).
- ICT professionals compete in the global ICT market on the basis of their skills, experience and industry expertise, forming a talent pool and driving innovation in ICT companies. Mostly acting in the short- and medium-term perspective, they compete for employment opportunities, higher salaries or leadership positions. ICT professionals depend on individual skills and are focused on professional and career development, continuous learning, networking in the global ICT community, etc. Thus, for ICT professionals, the means of competition encompass the following range of factors:
- 1) formal ICT education, such as academic degrees (Master's, PhD), ICT specialisation, continuing education certificates, etc.;
  - 2) skills, i. e., core competencies and specific technical skills that shape the competitiveness of ICT professionals in the labour market (e. g., effective use of a wide range of software tools, platforms and resources to improve productivity and results);
  - 3) professional certification, which validates industry experience and increases confidence in the competence of the specialist;
  - 4) a professional experience portfolio to highlight achievements and expertise effectively, i. e., completed projects that showcase professional abilities and success in previous work (e. g., social media links, personal websites, professional blogs, contributions to open source projects);
  - 5) the ability to quickly learn and apply various technologies, frameworks and tools (implies a commitment to lifelong learning and professional development to stay relevant and competitive);
  - 6) connections with industry colleagues, participation in professional associations, online communities, forums, conferences, joint projects, etc. as this provides access to exclusive tools/resources including industry insights, best practices, potential partnerships, etc.;
  - 7) the ability to bring innovative ideas and creativity in developing solutions, as well as problem-solving skills;
  - 8) social and interpersonal skills that help ICT professionals manage business relationships and communicate effectively with stakeholders;
  - 9) the ability to maintain strong, productive and lasting relationships with clients and the ability to collaborate and manage relationships with technology providers to optimise resources and costs;
  - 10) securing competitive pricing, i. e., optimal value for money (the optimal combination of financial and non-financial factors) in delivering services;
  - 11) stable quality, compliance with deadlines and ethical standards in professional activities;
  - 12) willingness and ability to work remotely or move to other locations for project work, including multilingualism and intercultural adaptation;
  - 13) understanding of business operations, market dynamics and trends, as well as industry knowledge that will contribute to the creation of products or solutions tailored to user needs and delivering superior user experience.

Research institutions compete for intellectual leadership (by contributing to the scientific knowledge base) and research funding by focusing on publishing ground-breaking research, obtaining patents, and establishing partnerships with companies (by indirectly contributing to market dynamics) or governments. For research institutions, therefore, the



means of competition relate to the expertise, resources and research-based approaches that enhance their role and influence in the ICT market. Research institutions, in turn, take a long-term approach, often working on projects that last from several years to decades (the results are less immediate, but can potentially lead to significant breakthroughs). Thus, according to the authors' perspective, the main means of competition that help research institutions make a significant contribution to the value of ICT achievements should include:

- 1) building a strong reputation through effective research, publications and recognition in the global research community, as academic prestige attracts cooperation, funding and the best talent;
- 2) transformation of research results into market-ready products or solutions that generate revenue and industry impact (e. g., through technology start-ups from university research, licensing agreements, technical incubators, commercial partnerships, etc.);
- 3) cooperation with the public, institutions, universities and private sector firms to leverage shared experience, resources and knowledge (e.g., implementation of research programmes, interdisciplinary research centres and project teams focused on industry solutions, etc.);
- 4) securing funding from government grants, private investment and public funding sources to support research and innovation;
- 5) investing in high-quality equipment, facilities and technologies that enhance research capabilities and support complex ICT projects;
- 6) ensuring competitive advantage through the recruitment, development and retention of highly qualified researchers, scientists and ICT professionals;
- 7) actively contributing to the development of ICT policies, standards and regulations, positioning the institution as a leader in shaping the global ICT landscape.

Considering the means of competition of states (as subjects of competition), it is worth noting that national governments play a unique role in the competitive landscape, protecting national security interests and strengthening the digital national economy. Thus, states compete through policies, trade agreements and international cooperation, regulatory frameworks (regulations, taxes, education policies, etc.), incentives, infrastructure development, and policies that attract investment or promote digital innovation, influencing competition at the macro level by setting the rules of the game. Furthermore, governments take a long-term perspective, seeking to ensure the

growth of ICT sectors through policy decisions that lay the foundation for sustainable technology ecosystems, creating favourable conditions for the other subjects of competition – companies, professionals and research institutions (*Tbl. 3*).

According to *Tbl. 3*, the classification of the means of competition of states in the global ICT market take into account: 1) measures with different nature of government actions, levels of application and duration of influence; 2) direct or indirect government participation in shaping market dynamics; 3) influence of governments on the key factors of industry competitiveness; 4) various types of policy instruments; 5) the degree of support for innovation in ICT; 6) implemented strategies for developing human capital skills in the ICT sector; 7) measures aimed at improving competition and reducing monopoly in the ICT sector; 8) measures aimed at increasing the global presence of national ICT suppliers, etc.

## CONCLUSIONS

The comprehensive study of the key components of competition (subjects, objects, items and means of competition) in the context of ICTs has enabled the authors to develop and propose a theoretical framework to clarify the essence of their interaction and interconnection with a focus on the objects and means of competition in the global market of information and communication technologies. We have formed detailed classifications of the objects and means of competition and provided an in-depth analysis and graphic presentation of interrelationships of the main components of competition to show their specifics and interactions with regard to the ICT market environment.

Thus, our research has outlined four key components driving competition in the global ICT market: subjects, objects, items, and means of competition. The primary actors, or *subjects of competition*, interact to innovate and guide ICT sector development. Their collective aim is to address the evolving needs of ICT users, the core *objects of competition*. These needs give rise to items of competition – ICT products and services – that subjects of competition strive to create and deliver more effectively than other market players. Besides, competition is shaped by *means of competition* at both micro and macro levels. Accordingly, we have proposed and characterised the main interrelationships and patterns of interaction of subjects, objects, items and means of competition in the global ICT market.

Furthermore, we have specified that users' daily activities shape their ICT needs, influencing the required standards to performance, functionality, and security of hardware and software, as well as connectivity, data management, usability, etc. These needs

Classification of means of competition of states in the ICT market

Classification criterion	Groups of means of competition
By type of intervention	Regulatory, financial, institutional and technical support
By sphere of influence	Local/regional digitalisation initiatives, national digital development initiatives, international cooperation, cross-sectoral integration
By the level of government involvement	Direct intervention, public-private partnerships (PPPs), incentive and support programmes, public awareness and engagement campaigns, regulatory oversight
By focus on the competitiveness factor	Cost competitiveness (tax cuts, subsidies for operating costs, etc.), compliance with international standards and quality certification programmes, incentives for innovation, attracting and retaining talent, and ensuring a safe and secure digital environment
By time frame	Short-term, medium-term, long-term, permanent, crisis response and recovery measures
By the degree of innovation promotion	High incentives for innovation, moderate support for innovation, funding for basic research, pilot programmes and experimental policies, risk-sharing programmes, protection of intellectual property and support for commercialisation
By focus on workforce development	STEM education initiatives, vocational training programmes, entrepreneurial skills training, internship and mentoring programmes, attraction of global talent, and leadership development
By focus on infrastructure development	Development of broadband, 5G and next generation networks; development of data centres and cloud services, development of digital payments and banking infrastructure, Smart City initiatives, public Wi-Fi and digital access programmes
By focus on market structure	Antitrust regulation, transparency initiatives, price regulation, market entry facilitation, support for small and medium-sized businesses and start-ups, consumer rights protection
By focus on international competitiveness	Promotion of the export of ICT products and services, support of access to foreign markets, national branding campaigns, digital export strategies, ensurance of compliance with global standards, incentives for foreign direct investment, participation in international organisations and initiatives

Source: developed by the authors.

(defined as “objects of competition”) arise from such tasks as remote work, online learning, and collaboration, which demand reliable, flexible, and secure technological solutions tailored to individual and group requirements. On this basis, we have developed a generalised scheme that reflects the sequence of formation of the needs and requirements of ICT users to information and communication technologies. Specifying the needs of ICT users allowed us to develop the classification of objects of competition, taking into account typical data processing operations according to the set criteria.

Additionally, we have specified the motivation, goals, items and methods of competition in terms of four subjects of competition in the global ICT market (namely ICT companies, professionals, research institutions, and governments). Key strategies and tools used by these subjects to build competitive advantages

and sustain their market positions have been identified and systematically organised (defined as “means of competition”). Along with that, we have identified and reviewed the means of competition for the main competition actors, taking into account the national and international levels. Besides, for each of the subjects, we have indicated the time ranges within which the subjects use the means of competition to achieve their goals.

Further research could explore in greater depth the individual roles and interactions of each ICT market subject of competition, perhaps through empirical studies that measure the effectiveness of various competitive strategies. Additionally, examining region-specific or sector-specific competition could reveal unique competitive dynamics in different ICT sub-markets, as such expanded research would provide a more granular understanding of how the evol-

ing competitive landscape shapes global technological development, workforce trends, as well as educational and research priorities. ■

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## ОСОБЛИВОСТІ ФІНАНСУВАННЯ ПРОЄКТІВ РОЗВИТКУ СМАРТ-МІСТ

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### Богун М. М. Особливості фінансування проєктів розвитку смарт-міст

Поширення практик розумного міста базується на використанні технологій для підвищення якості життя городян, ефективності управління та розвитку сталого міського середовища. Реалізація проєктів упровадження смарт-технологій в життя міст потребує значних інвестицій, які часто перевищують можливості міських бюджетів. Метою статті є систематизація сучасних підходів до фінансування проєктів розвитку розумних міст. У статті систематизовано практику глобальних розумних міст і доведено використання більш диверсифікованих і складних механізмів фінансування проєктів розвитку, які включають: прямі інвестиції (державні, приватні, корпоративні, змішані тощо); краудфандинг через залучення коштів від максимально широкої мережі спільного фінансування; гранти та субсидії на конкретні проєкти; муніципальні облигації та позики; інноваційні форми залучення фінансових ресурсів (фінтех, блокчейн тощо). Узагальнено проблеми та виклики, з якими стикається проєктне фінансування в смарт-містах, до яких віднесено: постійне зростання вартості сучасних технологій, їх упровадження й обслуговування, розвиток технологічних платформ і необхідність пошуку нових інфраструктурних рішень; недостатність державного фінансування (як загальнодержавного, так і місцевого); відсутність стандартизації та інтеграції технологій; проблеми з конфіденційністю або безпекою зберігання й обробки даних; проблеми з реалізацією екологічних проєктів та побудовою циркулярної економіки. Усі ці питання потребують подальших досліджень і розробки практичних рішень. Для кожного міста, яке починає шлях до розумного та потребує великих інвестицій, важливо представляти систематизовану інформацію про світовий досвід фінансування масштабних і високовитратних проєктів розвитку, успішну практику подолання викликів та загроз.

**Ключові слова:** краудфандинг, смарт-місто, смарт-технології, цільове фінансування, гібридне фінансування.

**Рис.:** 3. **Табл.:** 1. **Бібл.:** 20.

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### Bohun M. M. Features of Financing Smart City Development Projects

The spread of smart city practices is based on the use of technology to improve the quality of life of citizens, management efficiency and the development of a sustainable urban environment. The implementation of projects to introduce smart technologies into the life of cities requires significant investments, which often exceed the capabilities of city budgets. The aim of the article is to systematize modern approaches to financing smart city development projects. The article