

UDC 004.4: 338.48

DOI: 10.57111/econ/1.2023.08

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Research of the implementation level of information and communication technologies by tourism enterprises

■ **Abstract.** The implementation of information and communication technologies in the activities of tourism enterprises has significantly transformed all participants of the tourism market. In this context, the purpose of the article was to study the level of implementation of information and communication technologies on the example of Ukrainian tourism enterprises and to compare such implementation with enterprises of various economic spheres. The article uses such methods of scientific research as generalization, observation, comparison, grouping, abstraction, and the graphic method. The paper analyzes scientific works to determine both the essence of information and communication technologies and the main types of modern technologies used in tourism enterprises. Using the example of the Network Readiness Index and the Digital Economy and Society Index, the leading countries that have the highest positions and are those that are developing the digital society the most are determined. Based on the analytical reports of the world's leading consulting companies (Forrester, Capterra), the main types of information and communication technologies are considered with the study of new trends. A comparison of the key Ukrainian software implemented by tourist enterprises was carried out, with an evaluation of the most optimal (by price criteria) on the example of specialized CRMs – IT-tour, Iterios, MoiTouristy. Considerable attention is paid to OTA channels. A comparison of the key software used by hotels and restaurants (and other similar establishments) was made. It has been established that Ukrainian offers most closely meet the requirements of tourism enterprises (for example, Poster, Servio). It was determined that tourism enterprises have a high level of use of information and communication technologies in comparison with other sectors of the economy. The assessment of the level of use was based on the use by Ukrainian enterprises of the Internet, cloud computing services, robotics, electronic commerce, Big Data and skills in the field of information and communication technologies. The results of the research will be useful in the selection of software by tourism enterprises, in the determination of information and communication technologies that best correspond to the field of activity of the enterprise and in the formation of a competitive strategy for the development of tourism business enterprises

■ **Keywords:** tourist business; software; Customer Relationship Management; booking; hotel; restaurant

Article's History: Received: 30/11/2022; Revised: 25/01/2023; Accepted: 27/02/2023

■ INTRODUCTION

Business is very sensitive to various fluctuations in the environment and therefore must have such resources that will allow to either level or, better yet, minimize their impact. The tourism business is not an exception, and given the situation of recent years, it is one of those that has been significantly affected by both the pandemic and the war.

Among the great variety of tools and resources, an important role is attributed to the use of information, communication and digital technologies. The modern world has not only entered the era of digitalization, but has also become an active user of it. The tourism sector is the leader among such implementations, since recreation and travel are of interest

Suggested Citation:

Pohuda, N. (2023). Research of the implementation level of information and communication technologies by tourism enterprises. *Economics of Development*, 22(1), 8-19.

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to almost everyone, and accordingly, the differentiation of modern technologies allows to satisfy the demand of the most demanding user (OECD..., 2022). Moreover, some of these proposals are gaining momentum, thereby becoming global, such as Booking.com, Expedia, Airbnb, TripAdvisor.

Over the past fifty years, the development of modern information and communication technologies has demonstrated a rapid growth trend both quantitatively and qualitatively (Filipiak *et al.*, 2020; Okafor *et al.*, 2022). The study by I. Khatri (2019) deserves special attention, where the author focused on the importance of the implementation of information technologies in the activities of enterprises in the tourism industry, as well as on the fact that they help enterprises to be competitive. In addition, the use of modern technologies has a significant impact on various participants in the tourism market, as research by S. Kurmanov (2023) focuses on. The use of mathematical models only confirmed the existence of such an influence and a close relationship.

H. Samus *et al.* (2023) consider the benefits that tourists receive directly from the use of modern ICT, where they also pay attention to the impact of digitalization on the sustainability of tourism. Consumer behavior also changes under the influence of the use of ICT (Thees *et al.*, 2021), because, according to D. Dredge *et al.* (2018), different groups of stakeholders face various challenges when using relevant types of ICT, but additional ones are also created opportunities.

Results of the research by M. Watkins *et al.* (2018) indicate that the use of modern technologies has great advantages in the promotion of tourism. Considerable attention was focused on the use of the Internet by consumers of tourist services, which had a positive effect on the attractiveness of the territory and the improvement of incomes of local residents.

It is worth noting that modern ICTs have a significant impact on the development of tourism-related areas, which is directly considered in the works of S. Gössling (2021). ICT not only affects tourism, but also transforms it, and these technologies are reflected in the sustainability of tourism, that can be achieved only with considerable efforts. According to Gössling's research, digital detox, big data analysis and modern platforms can be considered as an effective complex. Therefore, the issue of using information and communication technologies (hereinafter ICT) in tourism is particularly relevant, which is confirmed by both the scientific community and practical business (Truyols, 2022).

The purpose of the publication was determined the research of the level of implementation of information and communication technologies on the example of Ukrainian tourism enterprises and the comparison of it with enterprises of various spheres of the economy. The following tasks were formulated to achieve the set goal: identification of key types of ICT, which are most popular; determination of the level of use of ICT by tourism enterprises based on specified indicators; comparative analysis of the use of ICT by other enterprises.

■ MATERIALS AND METHODS

In order to achieve the defined goal of the work and the set tasks, the study analyzed the position of Ukraine according to selected ratings and indices (Network Readiness Index, Innovation Index, Digital Economy and Society

Index) reflecting the level of use of ICT by various participants, identified the leading countries in the implementation of ICT at various levels. On the basis of open data of international organizations (Data Reportal (Digital in Ukraine, n.d.), the Telecommunications Development Sector, the International Federation for Information Technologies in Travel and Tourism (n.d.), a diagnosis of modern ICT consumers was carried out. Based on the statistical data of the State Statistics Service of Ukraine (n.d.), data on the use of ICT by Ukrainian enterprises, including tourism enterprises, were summarized. The data of international consulting companies (Forrester (O'Grady & Joshi, 2022), Capterra (Tour Operator Software..., n.d.) dealing with this problem were also used in the work.

The research was based on the use of the methodology of analysis of theoretical approaches and practical aspects of the implementation of various types of information and communication technologies, which was achieved through the use of methods: generalization – for the formulation of basic concepts and interpretations of key values; analysis – in order to learn about the objectivity of digitalization processes and the use of ICT by tourism enterprises, as well as to identify the main trends in the introduction of new technologies; comparison – first to determine the leading countries in terms of the level of ICT implementation and the readiness of society, the state, business and households to use ICT, then – to determine the software that is presented on the market and evaluate the most optimal, as well as to determine the level of use of ICT by tourism enterprises and compare it with the level of use on the example of 42 branches (spheres) of the economy (State Statistics Service of Ukraine, n.d.); methods of grouping and abstraction ensured the objectivity of the approach to the level of ICT development depending on both the level of development of the country and the use of ICT, as well as the construction of the matrix of the use of ICT by enterprises of Ukraine.

■ RESULTS AND DISCUSSION

■ **Measuring ICT at the global level.** The scientific basis of the diversity of ICT in the theoretical space is reflected not only in the scientific achievements of scientists, but also contains references at the legislative level, for example, the Law of Ukraine “On Information” (1992), “On the Protection of Information in Information and Telecommunications Systems” (1994), “On the National Program of Informatization” (2022), etc.

According to the Global Innovations Tracker (2022), the number of publications devoted to this issue increased by 8.3% in the short-term (i.e., in relation to 2020), but in the long-term (namely, 2011-2021) – annual growth research was 5.7%. At the same time, ICT found an active response, especially among practical business and the state. The share of investments in this area varies between 3.5-5.5% (depending on the review period).

Many organizations are engaged in research on ICT measurement, infrastructure and opportunities for further development. Modern technologies are used not only by business and the state (in the form of state bodies), but also by consumers, so it is advisable to conduct an analysis of the potential audience. According to Data Report (Kemp, 2022), among 7.99 billion people in the world (as of February 2022) almost 65% of the population use the

Internet, of which 4.74 billion people are active users of social networks. Analysis of the dynamics of users of the worldwide web showed a growth of 3.5%, and the growth of social media users increased by 4.2% compared to 2021. Positive growth has been characteristic for several years in a row, which is explained by the expansion of access to the network, and accordingly, the increase in the number of users themselves. So, according to the data of the Telecommunications Development Sector, which evaluated the ICT Development Index (the research data were conducted in the time dimension of 2009-2017, and after that are of a selective nature due to certain discrepancies in the evaluation indicators), the highest level of available ICT infrastructure and access to it is characteristic of Scandinavian countries (100%). Indicators of access to ICT by households and use of the Internet are also high. At the same time, the analysis of individual components of ICT in countries with a high level of economic development has similar data, however, the lower the level of economic development of the country, in most cases, this affects the lower level of ICT and their use. The highest level of available ICT

infrastructure and access to it are characteristic of Scandinavian countries (100%), the indicators of access to ICT by households and Internet use are also high. At the same time, the analysis of individual components of ICT in countries with a high level of economic development has similar data. Various studies also show that the lower the level of development of the country's economy, in most cases it affects the lower level of ICT and its use.

In addition, many organizations are engaged in the problems and evaluation of ICT, the results of which are formed in the form of ratings and indexes. For example, according to the Network Readiness Index of the country (estimated on the basis of 62 indicators) (Benchmarking the Future..., 2022), in 2021, the Netherlands, Sweden and Denmark were determined to be the readiest for the network future, occupying the top three, and with regard to Ukraine, according to the obtained estimates, its position was 53.

Since Ukraine is classified as a low-income country, it is proposed to compare the level of network readiness of the country with the average for the countries of this group (Fig. 1) (Benchmarking the Future..., 2022).

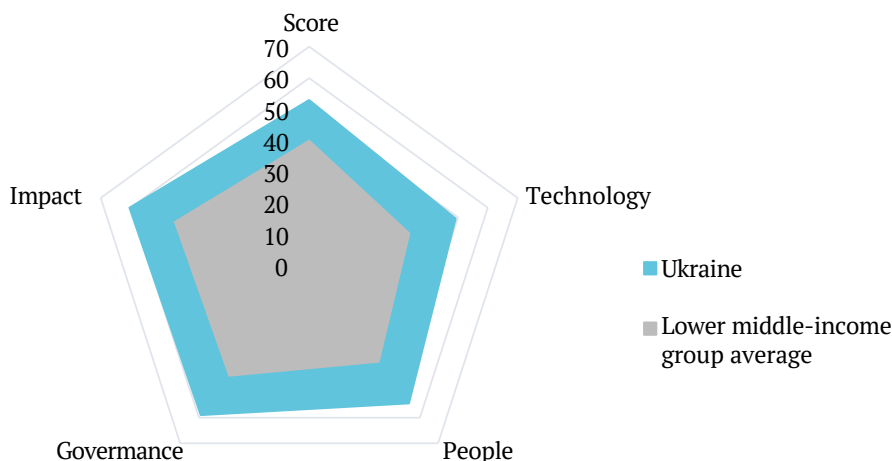


Figure 1. The level of network readiness of Ukraine in 2021

Source: built by the author based on research (Benchmarking the Future..., 2022)

Considering countries according to the level of income (Table 1), it is worth mentioning the Innovation Index, which is aimed at evaluating the development of

innovations in the country (World Intellectual..., n.d.). According to this index, Ukraine took the 57th position among 132 countries.

Table 1. Top-ranked countries by income group

High-income economies (48 in total)		Upper middle-income economies (36 in total)	
1	Switzerland (1)	1	China (11)
2	USA (2)	2	Bulgaria (35)
3	Sweden (3)	3	Malaysia (36)
4	United Kingdom (4)	4	Turkey (37)
5	Netherlands (5)	5	Thailand (43)
Lower middle-income economies (36 in total)		Low-income economies (12 in total)	
1	India (40)	1	Rwanda (105)
2	Vietnam (48)	2	Madagascar (106)
3	Iran (53)	3	Ethiopia (117)
4	Ukraine (57)	4	Uganda (119)
5	Philippines (59)	5	Togo (122)

Source: compiled by the author based on research (World Intellectual..., n.d.)

The level of digitalization of the economy was also not left out, where it is measured using the Digital Economy and Society Index (European Commission..., 2022). These studies are aimed at evaluating high-tech

industries and enterprises located on the territory of the European Union. Leadership in the digital economy and society was given to Finland, Denmark and the Netherlands (Fig. 2).

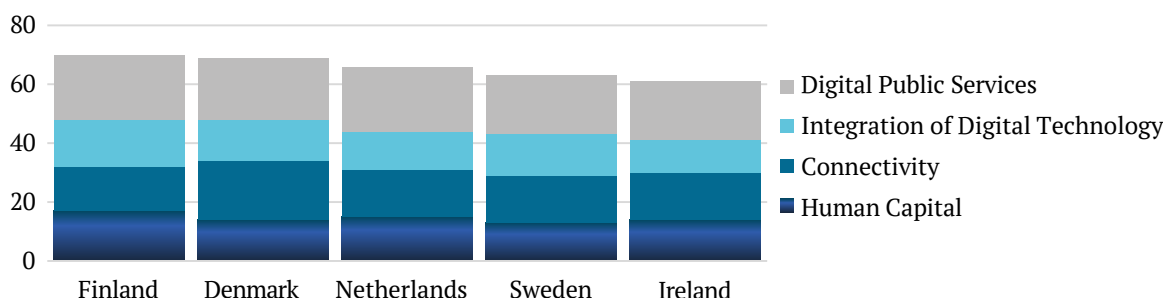


Figure 2. TOP-5 of the DESI rating, 2022

Source: built by the author based on research (European Commission..., 2022)

Comparison of key types of ICT. As more and more Ukrainian business is moving to the online format, it is appropriate to analyze the user audience in Ukraine, which as of the beginning of 2022 (Digital in Ukraine, n.d.) was 31.1 million people (for comparison, in 2017, the number of users was 21.9 million people), and the level of Internet penetration in the country was more than 70%. 28 million people were active users of social networks (in 2017 – 16.2 million people), and in relation to global user trends, the growth of social media users was much higher and reached almost 9% growth (Digital in Ukraine, n.d.).

Regarding Internet connection speed, in Ukraine at the beginning of 2022, the average speed of connecting to the mobile Internet via cellular networks increased by almost 50%, reaching a speed of 27.26 Mbps. The average speed of a fixed Internet connection also had a positive change (+17.2 percent) (Ookla, n.d.).

If estimated the number of users by means of mobile communication, then according to GSMA Intelligence in Ukraine at the beginning of 2022 the number of connections was almost 63 million, having increased by 1.5 million connections compared to 2021 (GSMA, n.d.). It is also worth noting here that this category includes those who use mobile communication services both for personal communication and business.

Analytical reports of the consulting company Forrester (O’Grady & Joshi, 2022) showed that software has the highest value among ICTs (Fig. 3), the growth of which over the last year reached more than 10%. Also, the research focuses on the fact that the software will continue to move to the cloud version, where almost 90% of known software already work in this format. If focused on software for tourism enterprises, it is advisable to group them based on the specifics of the enterprise itself.

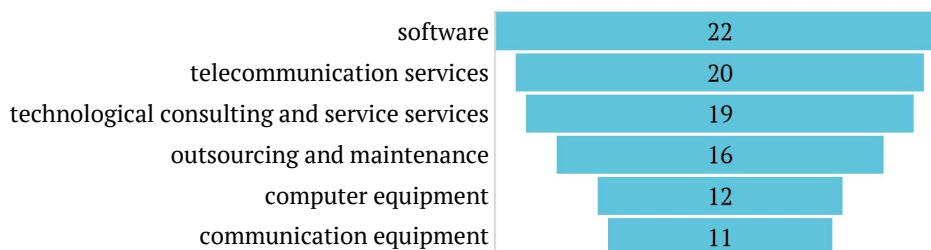


Figure 3. The most significant types of ICT, %

Source: built by the author based on research (O’Grady & Joshi, 2022)

It is also advisable to pay attention to the fact that for tourism enterprises there is both general software (for example, which covers accounting and management accounting, or work with personnel), and specially developed ones, on which attention will be focused. Accordingly, software for:

- tourist operators;
- travel agencies;
- hotels and similar means of accommodation;
- restaurants and other food establishments;
- carriers;
- other participants of the tourist market.

In connection with the war in Ukraine, both Ukrainian software suppliers and consumers faced problems in replacing or using new software, since a significant part of market offers for the tourism sector was represented by the developments of the aggressor country. There was also a question regarding the development of tour operator programs that would have the appropriate functionality that fully meets the requirements of the market and were presented with such a price policy that Ukrainian business could use.

Regarding travel agencies, for them, the use of a personal account, which is placed as a module on the website of the relevant travel operators, special programs, in

particular customer relations, for example, CRM, which allow easy integration with many accounts in one resource, to conduct customer base and effectively work with each client, simultaneously work with the marketing component and work with personnel. An analysis of offers in 2022 by Finances Online (Goldberg, 2022) showed that in the world the software of this type was in the greatest demand represented by HubSpot CRM, Salesforce Essentials, Freshsales, Pipedrive and Zoho CRM. However, as mentioned earlier,

CRM data can be adapted to any type of business, which of course has its own advantages, at the same time, CRM, which specialize exclusively in tourism have much more strengths specifically for users. The analysis of CRMs offered by Ukrainian businesses indicates that there is a fairly significant amount of such support on the market, which is in great demand among both Ukrainian and foreign companies (IT-tour, MoiTouristy, Iterios, Tourism Creatio, etc.). Price offers of key CRMs in tourism are presented in the Table 2.

Table 2. Price comparison of key CRMs in tourism

CRM system	Price per month of use, UAH
IT-tour (per 1 user)	490
MoiTouristy (1-3 users)	600
Iterios (3 users)	1000

Source: compiled by the author based on (IT-tour, n.d.; MoiTouristy, n.d.)

Analyzing software as one of the types of ICT specialized in tourism, it can be noted that Ukrainian representatives create high-quality software, which is evidenced by the number of users, their reviews and reviews of foreign users.

In modern conditions, when the software goes into the cloud version and is fully provided by service developers (from development to full service), with the provision of such software via the Internet for an appropriate payment and in defined volumes of use, it is usually interpreted as “software as a service” (SaaS). Accordingly, CRMs also belong to this type of software. If turned to global statistics in 2022, the SaaS market was estimated at almost \$190 billion, but it is expected to grow to \$370 billion. (Sky, 2022).

According to official data from the consulting company Capterra in America, SaaS in tourism is most represented

by offers from the USA, England, and Germany, the share of which in the sum is almost 70% of all offers (Sky, 2022).

At the same time, despite the activities of “traditional” agencies for the average tourist, OTAs (online travel agencies) are gaining more and more popularity, the share of bookings of which in the total number is growing every year (Booking, n.d.). These OTA channels are web sites that interact with both service providers and the possibility to book the necessary service for a tourist online. There are more than 400 OTA channels in the world, which are becoming global (for example, Booking.com or Expedia) or focused on consumers in certain regions of the world (for example, Despegar or eDreams).

The distribution of key OTA channels is presented in the Table 3.

Table 3. Comparison of the main OTA channels in the world

OTA channel	Specialization
Expedia, Priceline, Booking.com, Tripadvisor, Trip.com	A wide variety of components (booking hotels, air tickets, restaurants, cars, tours, cruises, tickets for various events (concerts, festivals))
Viator, Expedia, Google Things to Do, GetYourGuide and Airbnb Experiences	Tours and various activities
Klook, TourRadar, Travelzoo, Thrillophilia	Individual and independent travel, specialization in certain types of tourism

Source: compiled by the author based on (IT-tour, n.d.; MoiTouristy, n.d.)

At the same time, among the large variety of OTA channels that charge an appropriate commission fee, the platform Touriosity (Torres, 2022) does not take commissions from suppliers. At the same time, various OTA channels have corresponding shortcomings in their work. So, Viator started charging \$29, GetYourGuide – hiding information about customers from operators, EZTix did not refund tourists, some other platforms work with commissions in the amount of 20-40%, which significantly affects service providers (Torres, 2022).

Regarding the size of the commission fee of OTA channels, according to Hotel Price Reporter (Easton, 2020), the size of the commission at the beginning of the development of these platforms fluctuated within 10%, but with the acquisition of popularity of their services, the size of the commission began to grow and currently varies from 15-30%, although for suppliers who want to

appear at the top of the channel offers, the amount of the commission will increase.

Among the wide variety of services offered by OTA channels, a significant share belongs to housing reservations. Accordingly, in order to receive the accommodation service, the guest can make this reservation through one of the mentioned OTA channels, can use a search engine or aggregator site, or book the service either through the hotel website or through contact forms, which are also posted on the supplier’s website. As for hotels or similar accommodation facilities, the market offers different software, which varies from the basic components and price readiness of the buyer. Software for hotels and similar accommodation facilities is, for the most part, narrow-profile, that is, developed specifically for the hotel sector. Among the well-known software, it is worth mentioning the foreign Opera and Fidelio, which are used by well-known

global accommodation facilities, Hotelologic, Ultra, eZee, RoomsWizard, etc. The variety of software shows the saturation of the market with the appropriate software, which differs, first of all, in the size of the enterprise and the number of rooms, the necessary modules for work, and the pricing policy, which also differs very significantly.

The analysis of restaurant offers of the software made it possible to single out the main offers, where Servio-POS, Poster-POS, Rarus, Ultra, jSolutions are most in demand

among restaurants and other catering establishments in Ukraine. Each of these systems can be supplemented with food delivery modules, additional kitchen functionality, and are well integrated with automated systems of hotels or similar accommodation facilities, fitness halls or bowling alleys.

The pricing policy depends on the type of facility and functionality, modules and customer wishes. For example, consider the main proposals offered by Ukrainian software developers (Table 4).

Table 4. Pricing policy of Ukrainian offers among restaurants and other catering establishments

Restaurant management system	Price per month, UAH
Poster	360
Ultra	319
jSolutions	515

Source: compiled by the author based on (Poster, n.d.; Ultra, n.d.; jSolutions, n.d.)

According to Poster analytical data (as of December 2022), the average check in all types of food establishments in 2022 (compared to 2021) shows growth from 19% (cafes) to 49% (fast food), but here it is worth considering attention to cost-food growth and inflation. The case regarding the number of food orders is also interesting, where in 2018 the average consumer who ordered food at home did so 2.6 times, then in 2020 and 2021, this indicator was at the level of 9.8 and 9.7, respectively.

The war could not be reflected on both the producer and the consumer, respectively, the delivery decreased to 6.6. As for the forms of payment, for comparison, in 2018 the ratio between cash and non-cash was 48/52%, then in 2022 – 29/71 in percentage terms. Modern software for restaurants and other catering establishments contains

many modules, one of which is also delivery. In addition to software, types of ICT include the Internet of Things (IoT), mobile applications (Mobile Comm), location-based services, virtual and augmented reality technologies (VR and AR), semantic web.

■ **The level of ICT uses by tourism enterprises.** It is worth noting that in Ukraine, the use of ICT by enterprises, namely legal entities, is recorded using form 1-ICT (annual) (“Usage of information and communication technologies at the enterprise”). The analysis of the use of ICT by enterprises is based on the use of the Internet, cloud computing services and robotics in 2018, 2019 and 2021 (Table 5).

In addition, to assess the use of ICT, it is necessary to conduct an analysis by other types (Table 6).

Table 5. Analysis of the use of ICT by tourism enterprises (legal entities)

Indicator	Travel agency, tour operator, other reservation service and related activities			Accommodation and food service activities		
	Years					
	2018	2019	2021	2018	2019	2021
The number of enterprises that have access to the Internet						
units	162	166	153	1279	1261	1293
in % to the total number of enterprises	86.0	72.8	78.1	81.4	77.2	76.8
Share of the number of enterprises use a fixed internet connection of the total number of enterprises, %	69.7	67.9	65.8	54.6	52.9	54.6
Share of the number of enterprises which have a website of the total number of enterprises, %	66.5	66.3	64.3	37.2	36.8	34.9
Share of the number of enterprises whose website provision the possibility of providing interactive services of the total number of enterprises, %						
description of goods or services, price information	-	-	54.4	-	-	32.8
online ordering or reservation or booking	49.7	46.1	46.3	19.7	20.0	20.2
possibility for visitors to customize or design online goods or services	-	-	19.2	-	-	9.8
tracking or checking the status of placed orders	44.3	40.4	40.4	16.2	16.2	16.2
personalized website content for customers	37.3	32.1	32.1	11.8	12.1	12.3
links or references to the enterprise’s social media profiles	50.8	46.6	46.6	21.3	21.7	21.9
Share of the number of enterprises having a chat service for customer contacts of the total number of enterprises, %	-	-	28.0	-	-	12.3
share of the number of enterprises having chat service where a person replies to customers, of the total number of enterprises, %	-	-	28.0	-	-	11.9

Table 5. Continued

Indicator	2018	2019	2021	2018	2019	2021
share of the number of enterprises having a chatbot or a virtual agent replying to customers of the total number of enterprises, %	-	-	10.4	-	-	3.0
Share of the number of enterprises that purchased cloud computing services of the total number of enterprises, %	22.7	23.8	22.8	8.3	9.5	10.0
Of these by type of cloud computing services, %						
Email	11.4	15.5	12.4	4.5	5.6	7.0
office software	7.6	13.0	10.4	4.5	4.4	4.3
enterprise database hosting	10.8	14.5	14.5	3.1	3.6	3.8
file storage	10.3	10.4	13.5	2.4	3.4	3.8
accounting and finance application software	10.8	12.4	11.4	5.2	5.6	5.9
CRM software application for managing information about customers	9.2	7.8	8.3	2.6	2.9	2.8
computing power to run the software	9.2	9.8	9.7	2.9	3.4	3.3
Share of the number of enterprises which have ICT specialists of the total number of enterprises, %	30.3	31.6	33.2	14.4	13.6	13.7
Share of the number of enterprises using robotics of the total number of enterprises, %	-	-	1.0	-	-	1.5

Note: The given data take into account only the data of legal entities with the number of employees of 10 or more and without taking into account the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the temporarily occupied territories in the Donetsk and Luhansk regions

Source: developed by the author based on research by the State Statistics Service of Ukraine. Use of information and communication technologies at enterprises (State Statistics Service of Ukraine, n.d., 2022)

Table 6. Analysis of the use of ICT by tourism enterprises (legal entities): e-commerce, big data and ICT-related skills, 2018-2020

Indicator	Travel agencies, travel operators, enterprises providing other reservation services and related activities			Accommodation and food service activities		
	Years					
	2018	2019	2020	2018	2019	2020
The number of enterprises which have made e-commerce						
units	57	59	54	147	166	170
in % to the total number of enterprises	30.8	30.6	27.6	9.4	10.2	10.1
Value of the turnover of e-commerce sales						
thousand UAH	2644729.8	1142863.5	1557364.8	2105230.0	2741067.6	2897865.9
in % to the total volume of sold products (goods, services) of enterprises	39.8	11.8	33.2	6.8	8.2	11.6
Share of the number of enterprises which have made e-commerce of the total number of enterprises by type sales, %						
through its own website/ web applications	-	-	27.5	-	-	13.5
website/web applications for e-commerce, which are used by several businesses	-	-	5.7	-	-	11.1
through messages EDI type	-	-	3.6	-	-	1.5
Share of the number of enterprises which have performed big data analysis of the total number of enterprises, %	15.1	20.2	20.2	12.0	11.1	10.6
Of them, the share of the number of enterprises that performed “big data” analysis in the total number of enterprises by “big data” sources, %						
data received from smart devices or sensors	5.4	10.4	11.4	5.5	5.4	5.0
geolocation data obtained from portable devices	2.2	2.6	2.7	2.0	2.4	2.2
data generated from social media	8.6	9.8	9.1	4.6	4.4	4.4
other sources	7.6	10.4	8.4	5.2	4.6	5.0
Share of the number of enterprises which had recruitment of or the attempt to recruit ICT specialists of the total number of enterprises, %	6.3	6.2	6.4	4.6	4.5	4.7
Share of the number of enterprises in which have performed ICT functions by external service suppliers of the total number of enterprises, %	25.9	23.2	25.5	16.0	15.9	16.1

Table 6. Continued

Indicator	2018	2019	2020	2018	2019	2020
Share of the number of enterprises that used 3D printing of the total number of enterprises, %	0.5	3.1	2.1	1.9	2.8	2.9

Note: The given data take into account only the data of legal entities with the number of employees of 10 or more and without taking into account the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the temporarily occupied territories in the Donetsk and Luhansk regions. Years where there was no accounting for specific indicators were marked with “-.”

Source: developed by the author based on research by the State Statistics Service of Ukraine. Use of information and communication technologies at enterprises (State Statistics Service of Ukraine, n.d., 2022)

Comparing the use of ICT by tourism enterprises (based on Tables 5 and 6), it can be noted that almost all types are used, however, for tourism operators and this group, compared to accommodation and catering establishments, the use of web sites and web applications is somewhat higher, cloud technologies and work with Big Data. Also, from the data presented, it is clear that the need for ICT specialists is

growing every year, which is due to their rapid development and differentiation. Tourism enterprises keep pace with modern technologies, and therefore, in the field of tourism, relevant specialists should also be trained. If compared the level of ICT use by tourism enterprises with others, it can be noted that for the first group this level is quite high, and for accommodation and catering establishments it is lower (Fig. 4).

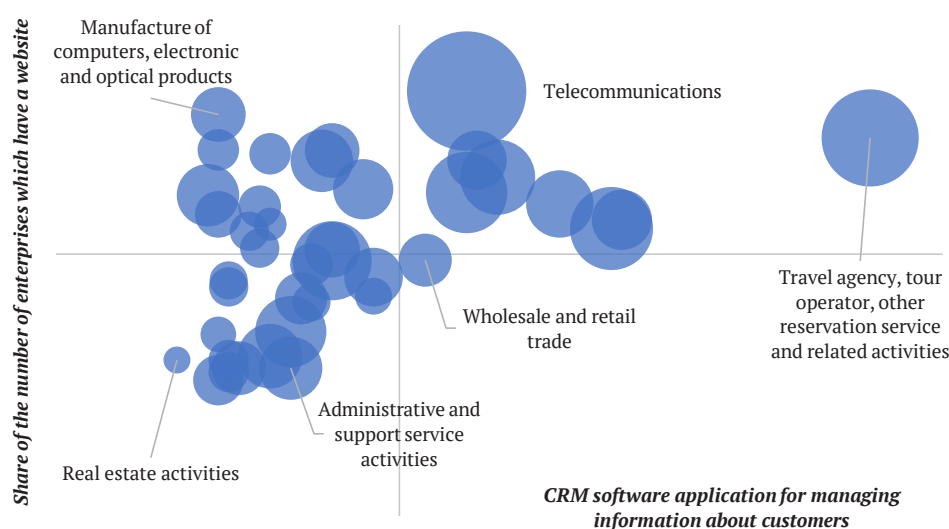


Figure 4. The level of use of certain types of ICT by enterprises of Ukraine

Source: built by the author on the basis of research by the State Statistics Service of Ukraine. Use of information and communication technologies at enterprises (State Statistics Service of Ukraine, n.d.)

The level of software usage, the share of enterprises with a website and the use of a chatbot or virtual agent were selected as the basis of Figure 4. The data include a sample of 42 Ukrainian branches (spheres) of the economy. Of course, it should be taken into account that the analysis was based on information from companies that are legal entities. This, in turn, does not fully characterize the level of use of ICT by the respective enterprises. For example, the ratio of legal entities to the total number among the group of tourist operators was 29% of the total number of enterprises in 2020 (State Statistics Service of Ukraine, 2022).

The study of ICT issues is quite relevant and requires further development in this direction. The variety of types of ICT indicates that tourism enterprises have always used the most modern technologies in their activities (Calvaresi *et al.*, 2021). It is worth noting that the conducted research was based on official data submitted by the subjects -of use of ICT by tourism enterprises, this sample included only legal entities and indicated only certain types

of ICT. Measuring the level of ICT adoption at the global level is carried out not only by the organizations indicated in the study (International Telecommunication Union, but also by the United Nations Statistical Commission (UNSC, 2009), United Nations Department of Economic and Social Affairs, United Nations Conference on Trade and Development (UNCTAD, 2020), where, in their effective interaction and cooperation with the states, recommendations for the informatization and digitization of various stakeholder groups have been developed.

However, there is a simultaneous use of both information technologies and information and communication technologies in tourism. Information and communication technologies are a much broader concept (Gössling, 2021), compared to information technologies (hereinafter IT) (Tang, 2022; Yanyan, 2022). The research by A. Nabieva & O. Orlyk (2015) characterizes information technologies as technologies that combine the technical component of information transformation and communication, and the

authors do not distinguish them into a separate concept. Every year (in 2023 it will be 30), in order to summarize the most significant research in the field of information and communication technologies in tourism, the Springer publishing house holds a conference aimed at familiarizing with modern ICT, their new types and impact both on individual areas of the economy and directly those who implement them (Stienmetz *et al.*, 2022). The conducted research was also based on the works of scientists of this publication, and there is a certain overlap of views on the problems of ICT in tourism.

C. Lee *et al.* (2021) considered research on the existence of a close relationship between ICT and tourism, taking into account the level of economic development. This was confirmed by the study of relevant international indices aimed at identifying the digitalization of society. With the help of appropriate economic models O. Adeola & O. Evans (2020) indicate that the number of tourists visiting the country depends on the development of infrastructure and the level of ICT use. The existence of such a connection is also confirmed in research, J. Machado & J. Silva (2019), M. Ali *et al.* (2022). Since changes in society and the economy occur quite quickly, this is reflected in the existence and emergence of new types of ICT (Tyan *et al.*, 2021). Mobile applications (Thees *et al.*, 2021; Dzhulai, 2023), which have made a significant push in the field of booking tourist services, occupy an important place among the types of ICT that actively influence the behavior of both the tourist enterprises themselves and consumers. On mind C. Morosan (2018) the level of use of mobile applications by hotel guests depends significantly on trust and innovation. Focusing attention on such types of ICT as chat services showed that tourism enterprises use them, but enterprises in other sectors of the economy use them insufficiently, thereby losing benefits and opportunities for themselves (Calvaresi, 2021).

The difference of the conducted research is the examination of the most popular ICT by tourism enterprises, thereby emphasizing the need to use modern ICT for the effectiveness of each of them. The use of CRM, as a type of ICT, by tourism enterprises has many advantages and is easily perceived by consumers (Fennell, 2021; Biliavska *et al.*, 2023), which is also confirmed in research by the high level of their use by Ukrainian tourism enterprises.

Among the scientific community, other types of ICT are gaining popularity, which are already actively used by global tourism enterprises – augmented and virtual reality (Guttentag, 2022), Internet of Things (Car *et al.*, 2019), new technologies (Sousa *et al.*, 2023). V. Verkerk (2022) draws attention to the feasibility of using VR technologies, which will not be able to completely replace traditional tourism, but can improve or replace it (an example of which was

COVID-19) (Okafor *et al.*, 2022). ICT research is expanding every year, focusing on key issues that are important to tourism and all stakeholders (Truyols, 2022). At the same time, this issue is considered much more broadly by D. Buhalis (2022), where, according to the author, tourism enterprises will not be able not to implement various types of ICT, thus, in the future, provoke the creation of new ICT.

Information and communication technologies in tourism are a particularly relevant issue, where the scientific developments of various scientists emphasize this, and are also aimed at identifying not only problematic issues, but also the search for new opportunities.

■ CONCLUSIONS

The study identified the main software that is popular both among Ukrainian and foreign tourism enterprises. Based on the results of the research, it can be concluded that tourism enterprises are actively implementing various types of ICT in their own business activities. The analysis showed that travel operators and agents, accommodation and catering establishments use the software to carry out full-fledged operational activities. At the same time, among modern software, Ukrainian developers offer software that which fully meets both market requirements and the requirements of tourism enterprises themselves. Among the significant differentiation, a certain problem was the presence of the software of the aggressor country, which is easily overcome by the offers of both Ukrainian and foreign service providers. A comparison of the most popular software showed that tourism enterprises choose such software, which allows combining different modules for operational activities, but should also contain integrations with additional modules or applications. And among a significant number of enterprises of various industries and spheres of the economy, tourism enterprises have a fairly high level of ICT use. Trends in the use of existing and introduction of new ICTs will continue to have a growing demand, including among tourism enterprises. The level of ICT implementation showed that among tourism enterprises, the best use is the website, chat services and cloud computing. Along with this, the further direction of the research will be the measurement of the level of use of ICT not only by legal entities, but also by all participants of the tourism market, including tourists. The construction of econometric models of the dependence of the level of ICT use on the economic results of tourism enterprises has a perspective for further research.

■ CONFLICT OF INTEREST

The author declares no conflicts of interest.

■ ACKNOWLEDGEMENT

None.

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Дослідження рівня впровадження інформаційно-комунікаційних технологій підприємствами туризму

■ **Анотація.** Впровадження інформаційно-комунікаційних технологій у діяльність підприємств туризму суттєво трансформувало усіх учасників туристичного ринку. У цьому контексті, метою статті стало дослідження рівня впровадження інформаційно-комунікаційних технологій на прикладі українських підприємств туризму та порівняння такої імплементації з підприємствами різних сфер економіки. У статті використано такі методи наукового дослідження, як узагальнення, спостереження, порівняння, групування, абстрагування та графічний метод. У роботі здійснено аналіз наукових праць задля визначення як сутності інформаційно-комунікаційних технологій, так і основних видів сучасних технологій, які використовуються на підприємствах туризму. На прикладі Індексу мережевої готовності та Індексу цифрової економіки та суспільства, визначено країни-лідери, які мають найвищі позиції та є такими, що найсуттєвіше розвивають цифрове суспільство. Спираючись на аналітичні звіти провідних консалтингових компаній світу (Forrester, Capterra) розглянуто основні види інформаційно-комунікаційних технологій з дослідженням нових тенденцій. Здійснено порівняння ключового українського софту, який впроваджується туристичними підприємствами, з оцінкою найбільш оптимальних (за ціновим критерієм) на прикладі, спеціалізованих CRM – IT-tour, Iterios, MoiTouristy. Значну увагу приділено ОТА (Online Travel Agency)-каналам. Проведено порівняння ключового софту, які використовують готелі та ресторани (та інші аналогічні заклади). Встановлено, що українські пропозиції найбільше відповідають вимогам підприємств туризму (наприклад, Poster, Servio). Визначено, що підприємства туризму мають високий рівень використання інформаційно-комунікаційних технологій у порівнянні з іншими галузями економіки. Оцінка рівня використання базувалася на використанні українськими підприємствами мережі Інтернет, послуг хмарних обчислень, роботехніки, електронної торгівлі, Big Data та навичок у сфері інформаційно-комунікаційних технологій. Результати дослідження стануть корисними при виборі програмного забезпечення підприємствами туризму, визначенні інформаційно-комунікаційних технологій, які найкраще відповідають сфері діяльності підприємства та при формуванні конкурентної стратегії розвитку підприємств туристичного бізнесу

■ **Ключові слова:** туристичний бізнес; програмне забезпечення; управління відносинами з клієнтами (CRM); бронювання; готель; ресторани