Dynamics of development of cash flows and trends in the market of telecommunications services in Ukraine

Lyubov Striy A; Olena Chukurna B; Ekaterina Tanashchuk C

A State University of Intelligent Technologies and Communications, 1, Kuznechna str., Odesa, 65044, Ukraine
B State University «Odessa Polytechnic», 1, Shevchenko Avenue, Odesa, 65023, Ukraine

Received: May 04, 2022 | Revised: May 24, 2022 | Accepted: June 28, 2022

JEL Classification: D26, D47, L11, L86, L96.

DOI: 10.38188/2534-9228.22.2.10

Abstract
The article presents the results of an economic research of the dynamics of the development of telecommunications services markets in Ukraine in 2017-2021. The research was conducted by analyzing the dynamics of annual revenues from the provision of basic telecommunications services. Scientific works in the field of telecommunications, including the works of the author, were chosen as the methodological basis. The results of the research showed that, despite the difficult conditions in 2017-2021, the dynamics of telecommunications development was positive.

The article uses forecasting and regression methods to determine the dynamics of the trend of financial cash flows in the telecommunications services market in Ukraine. It is chosen the linear function of forecasting and building the trend of financial cash flows in the telecommunications services market in Ukraine. The obtained forecasting results allowed us to conclude that financial cash flows in the telecommunications services market in Ukraine will continue to grow. It is determined that the development of the telecommunications services market in Ukraine is not strongly influenced by economic factors.

The originality and scientific novelty of the work consists of detailed research of the dynamics of the development of telecommunications in the context of the introduction of new technologies, in difficult economic conditions. The practical value of the research lies in proving the fact that the dynamics of telecommunications development in the most difficult conditions is positive.

Keywords: development dynamics; internet services; mobile services; telecommunications; fixed-line services.

Introduction
Telecommunications in Ukraine, despite the difficulties in the economy and the impact of the pandemic, have been developing successfully in recent years. The conducted economic study showed that in 2021, compared with 2017, revenues from the provision of telecommunications services (TCS) to consumers increased by 58.47%. Revenues from the provision of mobile communication services (MCS) increased by 69.83%; revenues from the provision of Internet services (IS) increased by 123.32%.

The dynamic development of the communications sector is confirmed by revenues from the provision of communication services in 2021 - almost 81 billion rubles. UAH with an increase of 14% compared to the previous year. The largest share was traditionally accounted for by revenues from the provision of
telecommunications services 53,460 bln. UAN with an increase of 14% compared to the previous year. Mobile Communications continues to generate the largest revenue growth in the telecommunications industry (Reports NKRZI, 2020).

The activities of telecommunications enterprises affect all sectors of the country’s economy, the life and work of all its citizens. The problem of economic research of the dynamics of the development of telecommunication services markets in Ukraine is relevant. However, this problem, the relevance of which is constantly increasing, is practically little studied by scientists. There are not enough available papers for graduate students. This determines the expediency of conducting an economic study and publishing this article.

Material and methods

When writing the article, analytical methods of researching the telecommunications market in Ukraine were used. In the process of research both general and specific methods were used: dialectical, system-functional; abstract-logical; economic and mathematical and others. It was used a regression analysis and linear trend function for obtain a forecast of the dynamics of financial flows and trends in the telecommunications services market.

Results and discussion

The authors of this article have been investigating the problem since 2016, several papers have already been published.

Striy L. and co-authors (Striy L., 2017) in the article «Enterprises of telecommunications in Ukraine: research of the present state and directions of development» investigated the activity of the communication services markets in 2016. This article highlights the main activities of telecom operators this year. Operators continued to master the mobile Internet and third-generation mobile communications using 3G+ technology. Work has begun on the introduction of fourth-generation mobile communications. A clear trend in the development of telecommunications was the constant expansion of the range of services that operators offered to their customers (telephone services, IP telephony services, Internet television, media services, advertising services and others, including infocommunication services). This allows operators to increase profits and attract new customers.

Striy L. and co-authors (Striy L., 2018) in the article «Modern info communications: research of factors affecting innovative development» reviewed the activities of telecom operators in 2017 and earlier. The materials of the article are used in this work.

Tanashchuk Е.A., Kovtunenko K.V., Kovtunenko Yu.V. (Tanashchuk Е.A., 2018) substantiated the theoretical and methodological principles of capital structure management in the innovative activities of telecommunications operators. The authors focused on innovative solutions of telecommunications companies.

Umantsiv Y., Nikolaets K., Lebedeva L., Kononenko E. (Umantsiv Y.and co-authors Y., 2021) focused their research on the development of competition in the mobile market of Ukraine.

Birbirenko & Tolkachova (Birbirenko & Tolkachova, 2021) in the article «Scientific and methodological approach to a comprehensive assessment of the economic stability of a telecommunications company», published in «Baltic Journal of Economic Studies»,
considered the impact of the COVID-19 pandemic on a telecommunications company. The consequences caused by the pandemic, according to the authors' conclusions, had a significant impact on the economic stability of companies and reflected the urgent need to assess economic stability in order to determine its level and directions of further enterprise management development. These findings should be taken into account when addressing the chosen problem.

Birbirenko S. (Birbirenko S., 2021) in the article «Theoretical and methodological bases of assessment of economic stability of the telecommunication enterprise in the conditions of uncertainty», published in Green, Blue & Digital Economy Journal, the analysis of theoretical and methodological bases of formation of a complex of indicators for an assessment of economic stability of the telecommunication enterprise which functions in the conditions of modern uncertainty is executed. The research is conducted on the basis of the study of forms of manifestation, peculiarities of uncertainty and sources of risk for telecommunication enterprise. Theoretical and methodological bases of the assessment of economic stability have been formulated; the analysis of selection criteria has been carried out which are used as the basis for forming the complex of indicators for evaluation of enterprise activity justifying the adequacy of the level of its economic stability. In the course of the study, a list of sources of risk for a telecommunications enterprise has been identified and a set of evaluation indicators of its economic sustainability has been formed. This material can be taken into account in the preparation of this article.

Schwab Karl (Schwab K., 2016) proves that, in his opinion, in the process of the fourth industrial revolution a radical transformation in the organization of economic activities in all sectors of the economy is possible, the birth of new business models, the problem of organizing information interaction between market participants becomes particularly complex and urgent. These ideas of Karl Schwab confirm the relevance of the solution of the problem chosen for this article.

Currently, there are several groups of large-scale processes that create new conditions for the activities of telecommunications companies (Striy L., 2020). In this article, the essence of these processes is explored by studying the works of Schwab K. and other scientific articles and Internet sources (Schwab K., 2016).

When preparing this section, the authors chose the annual reports of NKRZI (Reports NKRZI, 2020) as sources of information, in addition to those already listed above: 2017 (Reports NKRZI, 2017), 2018 (Reports NKRZI, 2018), 2019 (Reports_NKRZI,2019), 2020 (Reports NKRZI, 2020), as well as available information from the NKRZI website (Reports NKRZI, 2020). In the course of the study, the authors studied in detail the dynamics of income development from the provision of basic types of telecommunications services to consumers: mobile, fixed-line and Internet services, as well as telecommunications services in general. The results of the economic study are given in Table 1.

There was a continuous growth in the revenues of telecommunications enterprises from the provision of telecommunications services over the entire 5-year period: the peak of growth in 2019, 11% on average, with a slight decrease in the last year.

2017. Revenues from telecom services as a whole were 51,128 bln. UAH with an increase of +6.7%. Revenues from Mobile communication services amounted to 31,479 bln. UAH; from Fixed line services 5,139 bln. UAH, from rendering Internet services 7,078 bln. UAH. Total revenue from rendering of main services (Mobile communication services+Fixed line services+Internet services) amounted 43,696 bln. UAH. The total market shares: MCS 42,04%; FLS 11,76%; IS 16,20%. The operators continued working on implementation of 4G mobile communications and providing customers with an opportunity to use modern communication services based on LTE-technology. LTE networks should be a part of the solution to the problem
of providing broadband access services throughout the country, as well as the development of information technology infrastructure for broadband access to the Internet and improving the quality of services (Reports NKRZI, 2017). The trend of expanding the range of services that operators directly offered to their customers continues.

Overall, the dynamics of telecommunications development in 2017 are positive.

### Table 1. Dynamics of communication services development in 2017-2021

<table>
<thead>
<tr>
<th>Types of communications services</th>
<th>2017 Aggregate income bln. UAH</th>
<th>2018 Aggregate income bln. UAH</th>
<th>2019 Aggregate income bln. UAH</th>
<th>2020 Aggregate income bln. UAH</th>
<th>2021 Aggregate income bln. UAH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecommunication services TCS in total</td>
<td>51,128 6,7%</td>
<td>56,475 10,46%</td>
<td>66,432 17,60%</td>
<td>73,688 10,92%</td>
<td>81,021 10%</td>
</tr>
<tr>
<td>Mobile communication services MCS</td>
<td>31,479 72,04%</td>
<td>34,978 73,02%</td>
<td>41,868 71,68%</td>
<td>46,943 71,18%</td>
<td>53,460 72,72%</td>
</tr>
<tr>
<td>Fixed line services FLS</td>
<td>5,139 11,76%</td>
<td>4,786 10,00%</td>
<td>4,606 8,23%</td>
<td>4,485 7,58%</td>
<td>4,242 1,97%</td>
</tr>
<tr>
<td>Internet services IS</td>
<td>7,078 16,20%</td>
<td>8,136 16,98%</td>
<td>11,688 20,09%</td>
<td>13,870 21,24%</td>
<td>15,807 29,25%</td>
</tr>
<tr>
<td>All types of services MCS+FLS+IS</td>
<td>43,696 100%</td>
<td>47,900 100%</td>
<td>58,162 100%</td>
<td>65,298 100%</td>
<td>73,509 100%</td>
</tr>
</tbody>
</table>

Source: annual reports NKRZI [ua] and own calculations

The symbols are: TCS—Telecommunication services; MCS—Mobile communication services; FLS—Fixed line services; IS—Internet services.

Note: for the MCS line, % characterizes the increase relative to the previous year; for the remaining lines, % characterize the occupied market share.

**2018.** Revenues from telecommunication services as a whole were equal to 56,475 bln. UAH with an increase of +10,46%. Revenues from mobile communication services amounted to 34,978 bln. UAH with an increase of 10,46%; from Fixed line services amounted to 4,786 bln. UAH with a decrease of -8,43%; from the provision of Internet services 8,136 bln. UAH with an increase of 14,05%. Total revenue from the main types of services (Mobile communication services+Fixed line services+Internet services) amounted to 47,900 bln. UAH with an increase of 9,62%. Total market shares: MCS 73,02%; FLS 10,00%; IS 16,98%.

The main telecom trends in 2018 were: deployment of fourth generation (4G) mobile (mobile) mobile networks by the three largest telecoms operators using International Mobile (Mobile) IMT radio technology in 1800 radio frequency bands; increase in use of mobile Internet by Ukrainians: video content, messengers, online services, electronic administrative services and services which significantly speeds up and facilitates all personal and business interactions increase in consumer demand for multimedia convergent telecommunication services, machine-to-machine (M2M) services, Internet of Things (IoT) services and increase in number of owners of multifunctional terminal equipment with wireless Internet access.

Continued commissioning of telecommunication networks for emergency and disaster medicine services and their connection to public telecommunication networks at the regional center level to enable centralized reception and processing of calls to the unified telephone number 103 providing preparation for use of telecommunication
networks of Ukraine in conditions of emergency, state of emergency and martial law; creating conditions for implementation of virtual operators' activities (Reports NKRZI, 2018). The trend of expanding the range of services that operators directly offered to their customers continues. In general, in 2018 the dynamics of telecommunications development are positive.

2019. Revenues from telecommunication services totalled 66,432 bln. UAH with an increase of +17,63%. Revenues from mobile communication services amounted to 41,868 bln. UAH with an increase of 12,12%; from Fixed line services 4,606 bln. UAH with a decrease of -2,70%; from the provision of Internet services 11,688 bln. UAH with an increase of +18,69%. Total revenue from the main types of services (Mobile communication services+Fixed line services+Internet services) amounted to 58,162 bln. UAH with an increase of 12,69%. Total market shares: MCS 71,18%; FLS 7,58%; IS 21,24% (NKRZI, 2019). In 2019, following the launch of 4G networks in 2018, mass usage of modern communication services using LTE technology became possible and demand for use of mobile internet increased. For 2019, revenues from Internet access services increased year-on-year. During 2019, mobile operators significantly expanded their 4G coverage in Ukraine, increasing to 78% the share of the population that can receive mobile broadband Internet access services, which significantly speeds up and facilitates all personal and business interactions. Continuous work is underway to improve the quality of services and develop networks. In telecommunications in 2019, operators have been actively working on the use of LTE technology in radio frequency bands below 1 GHz. Also, in 2019, the NCRC's Electronic Reporting System became fully operational, which significantly simplified the procedure for reporting by operators, telecommunications providers and the NCRC to obtain objective data on the state of development of the telecommunications market. The key objectives for the next years remain: to maximize the efficient use of the radio frequency spectrum by the existing technologies and to prepare for the launch of 5G.

On the whole, the dynamics of telecommunications development in 2019 are positive.

2020. Revenues from telecommunication services totalled 73,688 bln. UAH with an increase of +16.46%. Revenues from mobile communication services amounted to 46,943 bln. UAH with an increase of 12,12%; from Fixed line services UAH 4,485 bln. UAH with a decrease of -2,70%; from the provision of Internet services 13,870 bln. UAH with an increase of 12,69%. Total revenue from the main types of services (Mobile communication services+Fixed line services+Internet services) amounted to 65,298 bln. UAH with an increase of +18,69%. Total market shares: MCS 71,18%; FLS 7,58%; IS 21,24%.

Despite the global economic trends caused by the pandemic the telecom industry remains in a trend of increasing revenues and the volume of services provided. The growth in Internet connections, especially in rural areas, is noteworthy, with the number of lines (points) growing by 36,5%.

At the beginning of 2020, operators were actively working on the implementation of LTE radio technology in the radio frequency bands below 1 GHz. The required set of measures was successfully implemented and in March 2020 mobile operators obtained licenses and began to use the 900 MHz band for new technologies to provide modern telecommunications services in rural areas and on Ukrainian highways. Further expansion of Ukraine's 4G coverage has ensured an increase in the number of active telecommunication identification cards from which to access the Internet in the 4G network (by 2020 the number of cards exceeded 3G). Our priority objectives for the next years remain to improve the quality of telecommunication services, implementation of IMT radio technology (4G, 5G). In general, in 2020, the dynamics of telecommunications development is positive.

2021. Revenues from the provision of telecommunication services in general were equal to 81,021 bln. UAH with an increase of +10%. Revenues from the provision of Mobile communication services were equal to 53,460 bln. UAH with an increase of 14%; from the provision of Fixed line services 4,242 bln.
UAH with a decline of -5%; from the provision of Internet services 15,807 bln. UAH with an increase of +14%. Total revenues from the provision of basic services (Mobile communication services + Fixed line services + Internet services) amounted to 73,509 bln. UAH with an increase of 12,57%. Total market shares: MCS 72.72%; FLS 1.97%; IS 29.25%. The IS market share has increased, the FLS market share has decreased significantly. Despite global trends in the economy, the cause of the pandemic, the telecommunications industry remains in a downward trend to reach that volume of messages provided.

Despite the global trends in the economy caused by the pandemic, the telecommunications industry remains in the trend of increasing revenues and volumes of services provided (Reports NKRZI, 2020). In general, in 2021, the dynamics of telecommunications development was positive.

Table 2 presents data that characterise the dynamics of the development of telecommunications and communication services by calculating the % growth (or decrease) of quantitative indicators in UAH, characterizing the results of income from the provision of basic types of services at the end of 2021 compared to the results of 2017.

In 2021, compared to 2017, revenues from telecommunications services provided to consumers increased by 58.47%. Revenues from the provision of mobile communication services increased by 69.83%; revenues from the provision of Internet services increased by 123.32%; revenues from Fixed line services decreased by -21.15% as expected. Thus, we can conclude that the dynamics of the telecommunications market in the five-year period 2017-2021 was positive.

Assessment of the dynamics of the telecommunications services market for the period 2017-2021 in Ukraine shows growth. The growth trend of the potential of the telecommunications services market has been constant over the last 5 years, the stability of which is almost unaffected by economic factors and declining incomes.

In order to determine the extrapolation of this trend in the next 2 years, a forecast of financial flows from telecommunications services was built on the basis of the data presented in Fig. 1.

**Table 2. Dynamics of communication services development in 2021 relative to 2017**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>TCS</th>
<th>MCS</th>
<th>FLS</th>
<th>IS</th>
<th>MCS+F</th>
<th>LS+IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 bln. UAH</td>
<td>51,128</td>
<td>31,479</td>
<td>5,139</td>
<td>7,078</td>
<td>43,696</td>
<td></td>
</tr>
<tr>
<td>2021 bln. UAH</td>
<td>81,021</td>
<td>53,460</td>
<td>4,242</td>
<td>15,807</td>
<td>73,509</td>
<td></td>
</tr>
<tr>
<td>Growth, drop %</td>
<td>+58.47%</td>
<td>+69.83%</td>
<td>-21.15%</td>
<td>+123.32%</td>
<td>+68.23%</td>
<td></td>
</tr>
</tbody>
</table>

*Source: data table 1 and own calculations*

The symbols are: TCS-Telecommunication services; MCS-Mobile communication services; FLS-Fixed line services; IS-Internet services.

Table 2 presents data that characterises the dynamics of telecommunication and communication services by calculating the % increase (or decrease) of quantitative indicators in UAH that characterise the results of revenues from the provision of basic types of services at the end of 2021 compared to the results of 2017.

Assessment of the dynamics of the telecommunications services market for the period 2017-2021. In Ukraine shows growth. The growth trend of the potential of the telecommunications services market has been constant over the last 5 years, the stability of which is almost unaffected by economic factors and declining incomes.

In order to determine the extrapolation of this trend in the next 2 years, a forecast of financial flows from telecommunications services was built on the basis of the data presented in Fig. 1.
To predict trends, three functions of data extrapolation were used to: power, exponential, linear. Graphical representation of all three forecast functions is presented in Fig. 2 (a, b) and Fig. 3.

a) Degree function of the forecast

Fig. 2 Functions of forecasting the volume of financial cash flows from the provision of telecommunications services in Ukraine, bln. UAH

(developed by the authors)

In Fig. 3, a linear function for forecasting the volume of financial cash flows from the provision of telecommunications services in Ukraine is provided. Based on the values of the presented functions for forecasting, the linear trend function was chosen because it is relatively simple and accurate in performing calculations.

The results of regression statistics for the construction of forecast values for the volume of financial cash flows from the provision of telecommunications services in Ukraine are presented in Table 3.

Table 3. Regression statistics for the model of forecasting financial cash flows from the provision of telecommunications services in Ukraine (developed by the authors).

<table>
<thead>
<tr>
<th>Regression statistics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plural R</td>
<td>0.994360069</td>
</tr>
<tr>
<td>R-quadrantal</td>
<td>0.988751947</td>
</tr>
<tr>
<td>Rationed R-quadrantal</td>
<td>0.985002595</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.193632413</td>
</tr>
<tr>
<td>Observations</td>
<td>5</td>
</tr>
</tbody>
</table>
The results of regression statistics indicate a sufficient level of accuracy and reliability of the forecasting model. For this forecasting model, the R-quadrantal, which characterizes the percentage of situations or analysis points that was described, is 0,988751947. Thus, in our case, 98,8% of the points of analysis are plausible. The indicator R characterizes the strength of the relationship between the data, which in this case is equal to 0,994360069. This, in turn, indicates a high degree of correlation between the data is 99,4%.

One of the most important indicators of reliability and accuracy of the model is the value of the standard error, which should not exceed 30% of the absolute value of the difference between the maximum and minimum values of the time series. In our case, the difference between the values is: 73509 - 43696 = 29 813. The value of the standard error = 0,193632413. Thus, (0,193632413 / 29 813) * 100 = 6,49% and this figure indicates the high accuracy of our model for forecasting. Dispersion statistics are presented in table 4.

**Table 3.4. Dispersion statistics for the model of forecasting the volume of financial cash flows from the provision of telecommunications services in Ukraine (developed by the authors).**

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>9,887519</td>
<td>9,887519</td>
<td>263,71282</td>
<td>0,000508</td>
</tr>
<tr>
<td>The rest</td>
<td>3</td>
<td>0,112481</td>
<td>0,037494</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The reliability of the model is characterized by the values of the significance factor F and P-values. The model is considered reliable if these coefficients do not exceed the absolute value of 0,05. In our case, the reliability parameters are equal to the F-criterion (0,000508 <0,05). According to P-values, one of them (for Y = 263,71282> 0,5), which in turn indicates sufficient reliability of the model. Indicators of the equation are presented in table 5.

**Table 3.5. - Indicators for the forecast function for the model of forecasting the volume of financial cash flows from the provision of telecommunications services in Ukraine (developed by the authors).**

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard error</th>
<th>t-statistics</th>
<th>P-Value</th>
<th>lower 95%</th>
<th>top 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-section</td>
<td>34,606</td>
<td>-9,49387</td>
<td>0,0024778</td>
<td>-5,8863814</td>
<td>-2,9307</td>
</tr>
<tr>
<td>X 1</td>
<td>7,7024</td>
<td>16,23924</td>
<td>0,000508</td>
<td>0,1032125</td>
<td>0,1535</td>
</tr>
</tbody>
</table>

Thus, the calculation of projected volumes of financial cash flows from the provision of telecommunications services in Ukraine for the next 3 years using the linear function will be:

\[ Y_{2022} = 7,7024x6 + 34,606 = 80,8204 \text{ bln. UAH}; \]
\[ Y_{2023} = 7,7024x7 + 34,606 = 88,5228 \text{ bln. UAH}; \]
\[ Y_{2024} = 7,7024x8 + 34,606 = 96,2252 \text{ bln. UAH}; \]

The constructed trend model indicates that the volume of financial cash flows from telecommunications services will increase over the next two to three years. Thus, we can conclude about the high potential of the telecommunications services market in Ukraine.
Conclusions

This article presents the results of an economic study of the dynamics of telecommunications development in Ukraine in 2017-2021. The results allow us to draw the following conclusions and formulate some proposals.

1. In general, the dynamics of telecommunications development despite difficult economic conditions in 2017-2021 is positive.

2. The introduction of the latest technologies in telecommunications in Ukraine: LTE radio technologies in radio frequency bands below 1 GHz, technologies to provide modern telecommunication services in rural areas and on Ukrainian roads, mobile Internet technologies, further expansion of coverage of Ukraine with 4G networks, contributed to the demand for mobile communication services, for Internet services and, accordingly, increased income of operators from service provision.

3. The conducted economic research has confirmed the previously stated assumption that there is a certain redistribution of revenues in the process of introduction of the latest technologies by telecommunication enterprises. The share of revenues from mobile communication services and traditional Fix line services is decreasing, the share of revenues from Internet services is increasing. Thus, according to the survey results in 2017 the share of revenues from mobile communication services was 72,04%, Fix line services 11,76%. In 2021, the share of revenues from mobile communication services became 71,18%, Fix line services 7,58%. The share of revenues from Internet services in 2017 was 16,20%, in 2021 29,25%.

Further areas of research can be recommended to study the changes in demand for services as a result of changes in the price parameters of services in online modes.

4. The constructed trend with the help of regression and trend model of the linear function of forecasting the volume of financial cash flows from the provision of telecommunications services in Ukraine indicates further growth trends in the telecommunications services market.

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