COMMUNICATIONS AND INFORMATIZATION SERVICE ENTERPRISES’ COMPATIBILITY AND INTEGRATION FEASIBILITY ASSESSMENT

Purpose. Development and scientific substantiation of the methodological approach and the expediency of communications and informatization service enterprises’ integration and compatibility at association, thus elaborating practical recommendations for that methodological approach application.

Methodology. A combination of integral assessment methods, computational and constructive method, structural­logical and qualitative system analysis and synthesis methods was used in this study.

Findings. As a result of introducing the methodological approach, the calculation is suggested of communications and informatization service enterprises’ adaptivity indicators to interoperate with other enterprises within the integrated system frame, which indicate the need for the chosen enterprises integration. These indicators reflect the presence of their reciprocal production, technological and personnel links, i. e. the enterprises’ tendency to integrate. The choice of expectedly integrable enterprises cannot be random. Therefore, to justify economic feasibility of the integration it is necessary to calculate the compatibility indicators.

Originality. The proposed scientific and methodological approach gives the possibility of identifying the most favorable preconditions for the establishment of communications and informatization enterprise’s integrated activity form in a particular economic region. In contrast to the existing ones, this approach involves the following stages: 1. Assessment of influence rendered by the communications and informatization enterprises’ integration form of activity factors taking into account the development peculiarities of that economic region where the integration system is located. 2. Analysis of financial condition of communications and informatization enterprises integrated to the system. 3. Evaluation of efficiency of resource use at the integrated system’s communications and informatization enterprises in order to identify savings or excessive spending as to the particular type of resources. 4. Analysis of communications and informatization enterprises’ compatibility with other enterprises making part to the integrated system.

Practical value. The study results can be used by scientists and practitioners in the field of communications and information service enterprise management to determine the feasibility and effectiveness of these enterprises’ integration, depending on the motives and goals of integration, as well as to determine the compatibility potential of enterprises making part to the integration structures.

Keywords: integrated structure, communication services, informatization services, potential, efficiency

Introduction. Under 2020 worldwide crisis the individual businesses and the global economy faced the necessity to choose their further action scheme. The interconnectedness and interdependence of all globalization processes and their participants become obvious. The coronavirus spread slows down the processes related to the scheduled trade integration of Ukraine with other countries, so the integration processes become more relevant and important. The development of new forms of integration in the entrepreneurial activity of Ukrainians becomes a prerequisite for economic stabilization, and the key role in further sustainable development of both the economy and society is attributed to the communications and informatization sphere. Just this sphere creating an innovative and technological component of socio-economic development of the state is one of the national economy top priority and importance areas on the stage of globalization with the transition to digital economy on the way of Ukraine’s integration into the global information space.

However, in the communications and informatization sphere the integration process development rate is slow due to several factors, among which worth to mention is the incompleteness of applied methodological tools for enterprise development on the integration basis. Therefore, there arises a scientific and applied problem of methodological support to the practical implementation of communications and informatization field enterprises’ development integration forms.

The proposed method to assess the integration expediency is based on the assessment of enterprises’ financial condition, assessment of efficient resource use and the enterprise compatibility assessment, including all these parameters, which does mean it uses a comprehensive approach to assessing the need for integration. The entity’s financial condition assess-
ment is based on the publicly reported statements and a comprehensive assessment of the enterprises’ compatibility does necessarily include their interconnected components analysis.

**Literature review.** The significant number of publications exposes the integration effectiveness studies concerning enterprises in various sectors of economy. A particular attention has been paid to the study on such integration principles, its advantages and disadvantages [1]. Numerous works expose different methods and algorithms to assess the feasibility and effectiveness of telecommunication and informatization enterprises’ integration. The sought approaches to the integration efficiency assessment have several advantages while their applicability is limited as a rule. Many of these methods [2] do not include a comprehensive study on the possibility of integration, do not justify the choice of enterprises and do not take into account their strategic direction. Among other methods worth to be mentioned are this one of economic potential assessing, by N. Sedykh (2009) and the method of potential effectiveness assessing, by S. Shubin (2007). The method by N. Sedykh (2009) allows establishing the integrated structure interest’s equilibrium extent and thus the ranking of enterprises in order to choose strategies for their effective development. S. Shubin (2007) developed a method for assessing the potential effectiveness of vertical integration. The method by S. Shubin (2007) allows evaluating the feasibility of vertically integrated structure forming in the relevant economical sector. Peculiarities of the development of methods for assessing the integration of enterprises in various fields of activity are investigated in the papers by Vereskun, et al. [3], Rekova, et al. [4] and Kvilinski [5]. Nowadays, Knayzeva and Littianskas have proposed an approach that allows identifying potential synergies from the integration of Ukrposhta and State Savings Bank of Ukraine. To this end, the authors formed a set of key success factors for each enterprise, an example of calculating the degree of both enterprises complementarity on the key success factors. The obtained results give evidence in favor of these enterprises’ association and the possibility of obtaining a synergistic effect from that association [6]. The practical implementation of the presented model of a communications enterprise interaction with all other market players in the study by Striy, et al. [7] can contribute to increasing the efficiency of communications enterprises’ economic activities in the context of new technologies introduction. The conceptual provisions of state regulation of integration processes of the Ukrainian telecommunications business activity are defined in research by Yatskevych [8]. Those conceptual provisions for state regulation of the telecommunications industry’s activity integration processes are based on methodological regulation tools with process approach, which, in turn, allows clearly structuring main components of conceptual provisions to ensure integration processes based on all its components equilibrium. The topic of balancing factors in communications and telecommunication enterprises is continued by [9, 10], assessing it as one of the important stages of the enterprise’s study aimed to make a decision on the need for integration. In [11, 12], they propose a methodology for calculating the synergistic effect, which is advisable to use immediately after the integration and the start of operating activities of a corporate integration association, since it can be adjusted depending on the type of corporate integration association being created and its formation motives [13, 14].

Referring to the foregoing discussion and due to the desire to achieve a deep understanding of the feasibility assessment as to the communication and informatization service enterprises’ integration and interoperability, our research puts forward the following hypothesis: the creation of integrated enterprises can provide employment opportunities based on their own reforms, reduce costs and increase efficiency through synergy and harmonization of approaches in logistics [15, 16], engineering [17], information technology [18], quality management fields [19], etc.

**Unsolved aspects of the problem.** The scientific achievements of these scientists are undoubtedly important to form theoretical foundations for assessing the communications and informatization enterprises’ integration feasibility. However, the issues of complex research on communications and informatization enterprises integration factors and their influence duration intertwined are open. Methodological tools for assessing indicators, as well as analytical characteristics of the compatibility potential impact on the degree of integration ties between enterprises, that is potential participants in an integrated enterprise, need to be improved.

**The purpose** refers to the development and scientific substantiation of both the methodology and the expediency of communications and informatization service enterprises’ integration and alignment in an association, thus elaborating practical recommendations for that methodology application.

**Methods.** A combination of integral assessment methods, computational and constructive method, structural-logical and qualitative system analysis and synthesis methods was used in this study. The integral assessment method is used in the methodology development for assessing the efficiency of resource use and compatibility of communications and informatization enterprises. In order to develop a mechanism for enterprises’ integration, a calculation and design method was introduced. Methods of structural-logical and qualitative system analysis and synthesis were used in the development of theoretical and methodological foundations and applied forms of enterprise integration. Using these methods, an attempt was made to determine the uniqueness and novelty of the proposed method to evaluate the integration expediency and compatibility of enterprises operating in the field of communications and informatization services.

**Methodology results.** In order to identify savings or cost overruns in a particular type of resource, it is convenient to evaluate resource efficiency in communications and informatization service enterprises of the integrated system. Analyzing by this method, one can examine exactly what “bottleneck” exists at each of the enterprises and what resources should be used more effectively. In addition, in order to find reserves for efficiency increase by the enterprise’s partial integration a comparative assessment of the resource efficiency at target enterprises can be carried out.

To calculate relative ratios, the authors developed a corresponding system as follows:

1. Relative deviation of gross payroll: taking into account the dynamics of revenue from sales of products (goods and services) (Δ) it is advisable to calculate that value as a difference between labor costs and deductions for social coverage in the reported and the previous period multiplied by the ratio of income from products (goods and services) sale in the reported and previous periods

\[
\Delta P = (2505_{(2, c, 3)} + 2510_{(2, c, 3)}) \cdot (2505_{(2, c, 4)} + 2510_{(2, c, 4)}) \cdot K_p,
\]

where \(K_p\) is dynamics coefficient of revenue from products (goods and services) sales.

\[
K_p = \frac{2000_{(2, c, 3)}}{2000_{(2, c, 4)}},
\]

2. Relative deviation of material costs; taking into account the dynamics of revenue from products (goods and services) sales (ΔMC) it is advisable to calculate that value as a difference between the material cost in the reported and previous periods multiplied by the ratio of income from sale of products (goods and services) in both the reported and previous periods

\[
\Delta MC = 2500_{(2, c, 3)} - 2500_{(2, c, 4)} \cdot K_p.
\]

3. Relative depreciation deductions deviation: with the account of revenue from products (goods and services) sales dy-

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Evaluating the effectiveness of resource use in the communications and informatization service enterprise PJSC “Ukrposhta” for the years 2017–2019

| Parameter | Initial characteristics | Years | 2017 | 2018 | 2019 |
|-----------|-------------------------|-------|------|------|------|
|           |                         | Line code |      |      |      |
| Fixed assets |                         | 1010 | 1822 675 | 7 160 567 | 3 163 663 |
| Current assets |                         | 1195 | 1 861 277 | 2 218 431 | 4 282 827 |
| Current liabilities and securities |                         | 1695 | 1 815 664 | 2 222 679 | 4 916 156 |
| Net income from sales of products (goods and services) |                         | 2000 | 3 902 454 | 4 483 659 | 5 484 044 |
| Cost of products (goods and services) |                         | 2050 | 3 619 626 | 4 190 939 | 5 243 970 |
| Material costs |                         | 2500 | 432 290 | 482 598 | 507 853 |
| Salary expenses |                         | 2505 | 1 991 110 | 2 487 682 | 3 350 848 |
| Allocations for social deductions |                         | 2510 | 739 317 | 550 924 | 808 216 |
| Depreciation |                         | 2515 | 123 548 | 336 932 | 197 164 |
| Other operating expenses |                         | 2520 | 936 813 | 873 964 | 978 653 |
| Calculated |                         |       |      |      |      |
| 1. The relative deviation of total payroll, taking into account the dynamics of revenue from sales of products (goods and services) | | $\Delta P$ | $-64 266.15$ | $-98 472.26$ | $442 490.33$ |
| 2. The relative deviation of material costs, taking into account the dynamics of revenue from sales of products (goods and services) | | $\Delta MC$ | $19 383.95$ | $-14 074.34$ | $-82 421.30$ |
| 3. The relative deviation of depreciation deductions, taking into account the dynamics of revenue from sales of products (goods and services) | | $\Delta A$ | $-16 928.72$ | $194 983.60$ | $-214 943.59$ |
| 4. The relative deviation of other operating costs, taking into account the dynamics of revenue from sales of products (goods and services) | | $\Delta OC$ | $259 707.25$ | $-202 371.57$ | $-90 308.09$ |
| 5. The relative deviation of fixed assets in view of the dynamics of revenue from products (goods and services) | | $\Delta FA$ | $-97 033.08$ | $5 066 435.16$ | $-5 594 555.34$ |
| 6. The relative deviation from current assets taking into account the dynamics of revenue from products (goods and services) | | $\Delta CA$ | $-896 092.06$ | $79 948.04$ | $1 569 424.13$ |
| 7. The relative deviation of current liabilities and securities taking into account the dynamics of revenue from sales of products (goods and services) | | $\Delta CL$ | $-994 454.91$ | $136 671.27$ | $2 197 557.32$ |
| Provision costs | | $\Delta C$ | $-4 772.93$ | $32 230.48$ | $117 957.10$ |
| Cumulative efficiency of business enterprises | | $\Sigma_{eff.}$ | $-1 789 683.72$ | $5 163 119.91$ | $-1 772 756.55$ |

$\Delta A = 2515(f_{1,2,3}) - 2515(f_{1,2,4}) \cdot K_p$

$\Delta OC = 2520(f_{1,2,3}) - 2520(f_{1,2,4}) \cdot K_p$

$\Delta FA = 1010(f_{1,2,4}) - 1010(f_{1,2,3}) \cdot K_p$

$\Delta CA = 1195(f_{1,2,4}) - 1195(f_{1,2,3}) \cdot K_p$

$\Delta CL = 1695(f_{1,2,4}) - 1695(f_{1,2,3}) \cdot K_p$

If the calculation result is positive, the resource use effect goes negative. On the contrary, if we get a negative value, the comprehensive economic effect is positive. On the basis of calculations one can assess the availability of reserves to increase efficiency. Also, the result is used to assess feasibility of transition to a new form of production. We apply the proposed methodology for the analysis of communications and information services rendering enterprises for the years 2017–2019 (Tables 1–6).

Table 1

Evaluating the effectiveness of resource use in the communications and informatization service enterprise PJSC “Ukrposhta” for the years 2017–2019

\[\Delta eff. = \Delta P + \Delta MC + \Delta A + \Delta OC + \Delta FA + \Delta CA + \Delta CL.\]

The cost reserve calculation is carried out by the formula

\[\Delta C = 2050(f_{1,2,3}) - 2050(f_{2,3,4}) \cdot K_p.\]
Evaluating the effectiveness of resource use in the communications and informatization service enterprise PJSC “Ukrtelecom” for the years 2017–2019

| Parameter                                                   | Line code | 2017          | 2018          | 2019          |
|-------------------------------------------------------------|-----------|---------------|---------------|---------------|
| Fixed assets                                               | 1010      | 8 983 451     | 8 839 758     | 8 627 127     |
| Current assets                                             | 1195      | 1 632 136     | 1 859 780     | 2 249 266     |
| Current liabilities and securities                         | 1695      | 2 295 526     | 2 729 547     | 3 170 960     |
| Net income from sales of products (goods and services)      | 2000      | 6 394 757     | 6 327 113     | 6 177 115     |
| Cost of products (goods and services)                      | 2050      | 3 620 700     | 3 830 125     | 3 577 332     |
| Material costs                                             | 2500      | 887 327       | 954 305       | 846 096       |
| Salary expenses                                            | 2505      | 1 793 323     | 1 901 924     | 1 860 217     |
| Allocations for social deductions                          | 2510      | 592 412       | 362 969       | 377 158       |
| Depreciation                                               | 2515      | 472 529       | 500 125       | 518 996       |
| Other operating expenses                                   | 2520      | 1 536 406     | 1 779 634     | 1 593 344     |
| Calculated Abbreviation                                   |           |               |               |               |
| 1. The relative deviation of total payroll, taking into account the dynamics of revenue from sales of products (goods and services) ΔP | 470 852.62 | −95 605.60 | 47 654.20 |
| 2. The relative deviation of material costs, taking into account the dynamics of revenue from sales of products (goods and services) ΔMC | 32 791.61 | 76 364.18 | −76 535.45 |
| 3. The relative deviation of depreciation deductions, taking into account the dynamics of revenue from sales of products (goods and services) ΔA | −79 998.62 | 32 594.43 | 35 470.24 |
| 4. The relative deviation of other operating costs, taking into account the dynamics of revenue from sales of products (goods and services) ΔOC | 42 292.48 | 259 480.17 | −127 223.63 |
| 5. The relative deviation of fixed assets in view of the dynamics of revenue from products (goods and services) sales ΔFA | 4 447 538.56 | −48 665.69 | 80 762.13 |
| 6. The relative deviation from current assets taking into account the dynamics of revenue from products (goods and services) sales ΔCA | 127 328.79 | 244 908.80 | 451 212.43 |
| 7. The relative deviation of current liabilities and securities taking into account the dynamics of revenue from sales of products (goods and services) ΔCL | −717 309.93 | 458 303.17 | 532 007.15 |
| Provision costs                                            | ΔC        | −466 263.37   | 247 724.91    | −125 670.47   |
| Cumulative efficiency of business enterprises               | Σeff.     | 3 381 790.27  | 927 379.46    | 943 347.06    |

Evaluating the effectiveness of resource use in the communications and informatization service enterprise CJSC “Kyivstar” for the years 2017–2019

| Parameter                                                   | Line code | 2017          | 2018          | 2019          |
|-------------------------------------------------------------|-----------|---------------|---------------|---------------|
| Fixed assets                                               | 1010      | 6 993 237     | 6 128 482     | 7 148 400     |
| Current assets                                             | 1195      | 3 784 028     | 5 315 192     | 8 928 856     |
| Current liabilities and securities                         | 1695      | 6 061 287     | 4 934 139     | 4 315 927     |
| Net income from sales of products (goods and services)      | 2000      | 14 925 358    | 15 753 027    | 17 078 988    |
| Cost of products (goods and services)                      | 2050      | 7 927 329     | 8 699 457     | 7 372 418     |
| Material costs                                             | 2500      | 3 347 186     | 2 275 894     | 2 139 190     |
| Salary expenses                                            | 2505      | 837 710       | 841 395       | 990 737       |
| Allocations for social deductions                          | 2510      | 208 299       | 126 932       | 152 485       |
| Depreciation                                               | 2515      | 1 737 246     | 3 671 345     | 2 255 480     |
| Other operating expenses                                   | 2520      | 4 364 238     | 4 746 638     | 5 363 954     |
| Calculated Abbreviation                                   |           |               |               |               |
1. The relative deviation of total payroll, taking into account the dynamics of revenue from sales of products (goods and services) \[ \Delta P \]

| Parameter                                                                 | Line code | 2017          | 2018          | 2019          |
|---------------------------------------------------------------------------|-----------|---------------|---------------|---------------|
| Fixed assets                                                              | 1010      | 5 367 511     | 6 501 670     | 7 602 685     |
| Current assets                                                            | 1195      | 3 506 880     | 3 519 713     | 3 244 631     |
| Current liabilities and securities                                       | 1695      | 5 501 962     | 5 197 995     | 6 233 277     |
| Net income from sales of products (goods and services)                    | 2000      | 10 087 908    | 11 175 861    | 11 745 324    |
| Cost of products (goods and services)                                     | 2050      | 5 285 331     | 6 767 731     | 6 345 629     |
| Material costs                                                            | 2500      | 3 547 174     | 4 537 584     | 3 847 369     |
| Salary expenses                                                           | 2505      | 542 689       | 619 726       | 682 692       |
| Allocations for social deductions                                         | 2510      | 165 272       | 113 044       | 125 879       |
| Depreciation                                                             | 2515      | 1 791 681     | 2 379 718     | 2 755 761     |
| Other operating expenses                                                 | 2520      | 3 914 072     | 2 740 672     | 2 377 369     |

2. The relative deviation of material costs, taking into account the dynamics of revenue from sales of products (goods and services) \[ \Delta MC \]

3. The relative deviation of depreciation deductions, taking into account the dynamics of revenue from sales of products (goods and services) \[ \Delta A \]

4. The relative deviation of other operating costs, taking into account the dynamics of revenue from sales of products (goods and services) \[ \Delta OC \]

5. The relative deviation of fixed assets in view of the dynamics of revenue from products (goods and services) sales \[ \Delta FA \]

6. The relative deviation from current assets taking into account the dynamics of revenue from products (goods and services) sales \[ \Delta CA \]

7. The relative deviation of current liabilities and securities taking into account the dynamics of revenue from sales of products (goods and services) \[ \Delta CL \]

Provision costs \[ \Delta C \]

Cumulative efficiency of business enterprises \[ \sum_{\text{eff.}} \]

Provision costs \[ \Delta C \]

Cumulative efficiency of business enterprises \[ \sum_{\text{eff.}} \]
Evaluating the effectiveness of resource use in the communications and informatization service enterprise SE “Ukrainian State Center of Radio Frequencies” for the years 2017–2019

| Parameter | Initial characteristics | Line code | 2017 | 2018 | 2019 |
|-----------|-------------------------|-----------|------|------|------|
| Fixed assets | 1010 | 238 992 | 303 968 | 344 860 |
| Current assets | 1195 | 467 768 | 409 559 | 337 090 |
| Current liabilities and securities | 1695 | 9693 | 16 986 | 22 501 |
| Net income from sales of products (goods and services) | 2000 | 451 956 | 482 136 | 514 878 |
| Cost of products (goods and services) | 2050 | 189 606 | 208 480 | 266 858 |
| Material costs | 2500 | 15 308 | 16 269 | 14 721 |
| Salary expenses | 2505 | 104 929 | 130 592 | 161 760 |
| Allocations for social deductions | 2510 | 37 032 | 28 371 | 34 399 |
| Depreciation | 2515 | 47 443 | 52 076 | 69 172 |
| Other operating expenses | 2520 | 165 843 | 178 260 | 170 644 |
| Calculated | | | | |
| ΔP | –18 442.50 | 7522.35 | 26 400.78 |
| ΔMC | 694.93 | –61.21 | –2652.83 |
| ΔA | –7860.49 | 1464.93 | 13 559.50 |
| ΔOC | 102 309.09 | 1342.60 | –19 721.69 |
| ΔFA | –27 117.22 | 49 016.97 | 20 249.44 |
| ΔC | –19 244.40 | –89 444.87 | –100 282.27 |
| ΔCL | –3544.18 | 6645.74 | 4361.48 |
| Provision costs | | | |
| C | –5544.24 | 6212.79 | 44 220.06 |
| Cumulative efficiency of business enterprises | | | |
| ∑ eff. | 26 795.23 | –23 513.49 | –58 085.60 |

Thus, following the assessment of communication and informatization service enterprises’ resource efficiency for the period of 2017–2019, one could argue that there is both a negative effect and a positive one. Thus, at PJSC “Ukrposhta” and JSC “Kyivstar” in 2017 and 2019 respectively the cumulative economic impact of resource use is positive because the values are negative. And in 2018, it is the opposite: that year’s effect is negative. PJSC “Ukrtelecom” during the analyzed period demonstrates a stable negative effect from the use of resources, since the evaluation always comes out positive. Both PJSC “VF Ukraine” and SE “Ukrainian State Center of Radio Frequencies” had a negative effect in 2017, but during 2018–2019 the cumulative economic effect from the resource use is positive. That is, we can argue that all enterprises except PJSC “Ukrtelecom”, have available reserves to increase efficiency, i.e. the possibility to increase the services — per unit of total costs parameter through more rational use of all resources. Thus, enterprises can focus certain reserves, aimed to streamline the use of resources, on improving the efficiency of their key business processes, widening the scope of research activity, to staff motivation, to the improvement of technical and technological basis, to maintain social and environmental responsibility, information management, energy saving.

Results. The next stage refers to the calculation of communications and informatization service enterprises’ compatibility with other integrated system companies, this parameter identifying the need to integrate the target companies. These figures reflect the presence of industrial, technological and human relations between them, i.e. the enterprises’ propensity to integration. The parameter identifying companies’ susceptibility to integration can never bear the random character. Therefore, for the integration feasibility study required is the calculation of compatibility.

To calculate the companies’ potential compatibility we suggest using several integration indicators as follows:

| Company name | Years |
|--------------|-------|
| PJSC “Ukrposhta” | –1 789 683.72 | 5 163 119.91 | –1 772 756.55 |
| PJSC “Ukrtelecom” | 3 381 790.27 | 927 379.46 | 943 347.06 |
| CJSC “Kyivstar” | –1 306 998.33 | 14 538 699.03 | –33 662 643.48 |
| PJSC “VF Ukraine” | 191 221.18 | –1 351 823.19 | –45 415.90 |
| SE “Ukrainian State Center of Radio Frequencies” | 26 795.23 | –23 513.49 | –58 085.60 |
1. Market integration value reflects the share of total direct sales in their entirety 

\[ K_P = \frac{V_0}{\sum_i V_i} \]

where \( V_0 \) is the volume of direct sales of products generated at the integrated group; \( \sum_i V_i \) is the total sales of companies which are the integrated structure potential participants; \( i \) is enterprise – potential participant of the integrated structure; \( n \) is the number of companies potential participants in the integrated structure.

2. Value of production capacity integration shows the proportion of production facilities involved to ensure the integrated enterprises’ internal production processes in the total production capacity

\[ K_{IPC} = \frac{PC_{PC}}{\sum_i PC_{pc,i}} \]

Where \( PC_{PC} \) is the number of production facilities involved to ensure domestic supplies; \( \sum_i PC_{pc,i} \) is total production capacity of enterprises potential participants of the integrated structure.

3. Value of the enterprise scientific integration reflects the share of joint scientific research in total research volume

\[ K_{RD} = \frac{V_{RD}}{\sum_i V_{RD,i}} \]

where \( V_{RD} \) is the total amount of R&D performed by each of the participants; \( \sum_i V_{RD,i} \) is the amount of R&D performed by joint efforts of association potential participants.

4. Value of enterprise informational integration (organizational compliance unit) shows the share of shared/jointly used information, software and other intangible assets (patents, licenses, etc.) used by the integrated system enterprises in these assets total amount

\[ K_{pol} = \frac{K_{prop,i}}{\sum_i K_{prop,i}} \]

where \( K_{prop,i} \) is the number of shared programs used by each enterprise; \( \sum_i K_{prop,i} \) is the total number of applications used in the \( i^{th} \) enterprise.

5. Target market integration index expresses the degree of joint market presence and services rendered to one target audience

\[ K_{M} = \frac{K_{tm}}{\sum_i K_{tm,i}} \]

where \( K_{tm} \) is the number of consumers who are at once customers of several companies within one integrated structure; \( \sum_i K_{tm,i} \) is total target audience (consumers) integrated structure.

6. Value of technology integration (compatibility) reflects the degree of technological solutions, production capacity and logistics networks compatibility

\[ K_{TI} = \frac{K_{rol}}{\sum_i K_{rol,i}} \]

where \( K_{rol} \) is the volume of technological solutions, production facilities and logistics networks, integrated (or eligible for integration) into a single system; \( \sum_i K_{rol,i} \) – total technological solutions, production capacity and logistics networks.

7. Indicator of flexible management by personnel rotation demonstrating how effectively and quickly staff rotation is carried out

\[ K_{FM} = \frac{K_{np}}{\sum_i K_{np,i}} \]

where \( K_{np} \) is the number of employees whose position was shifted, including the internal staff rotation (within the same company or unit), external (between branches and departments of the entity located in the same region) and interregional (position change with the relocation to another region on a branch or structural unit of the entity); \( \sum_i K_{np,i} \) is the total number of employees involved in the companies which are potential participants of the integrated structure; \( T \) is period, for which employees are repositioned; \( T_{np} \) is the total time period being analyzed.

8. Index of business activity (or turnover growth rate) reflecting the degree of increase in the number of stock round cycles

\[ K_{BA} = \frac{V_i - S_i \cdot S_{i-1}}{V_{i-1} \cdot S_{i-1}} \]

where \( V \) is volume of sales; \( S \) is average balance of reserves; \( i \) is the current period; \( i - 1 \) is the previous period.

9. Indicator of integrated structure maneuverability shows how the company without significant costs and losses in output may change product lines

\[ K_M = \left(1 - \frac{1}{n}\right) \left[1 + \sum_{j=1}^{m} \frac{FS_{ij} \cdot Activ}{FS_{ij}}\right] \]

where \( n \) is the number of different functional states of the enterprise within its technological capabilities; \( m \) is the number of services provided by the enterprise; \( FS_{ij} \) is transition from \( j^{th} \) to \( k^{th} \) functional status of the enterprise; \( Activ \) is reference period of company activity.

10. The level of diversification value reflects the multiplicity of the enterprise’s services and markets vectors

\[ K_D = 1 - \frac{m}{\sum_{j=1}^{m} \phi_j^2} \]

where \( -\phi_j^2 \) is the proportion of \( j^{th} \) type of services/products in the total services/products volume.

11. Indicator of consumers’ tolerance to the integrated structure expresses the probability of consumers’ refusal from the enterprise’s product/services

\[ K_T = \frac{C}{C_{r}} \]

where \( C \) is the number of surveyed consumers which refuse from a company’s services when it joins the integrated structure; \( C_{r} \) is the total number of surveyed consumers of companies potential participants of the integrated structure.

12. The marketing activity efficiency factor expresses the relationship between the financial results and activities of marketing services that affect the enterprise’s financial stability and competitiveness

\[ K_{EM} = \frac{ME}{R} \]
where $ME$ is volume of marketing expenses related to the advancement of design services/products, expected for introducing the integration process completed; $R$ is revenues from expected services/products project implementation.

We apply the proposed methodology regarding the calculation of communications and informatization enterprises compatibility with other enterprises integrated into system (Table 7).

For a balanced assessment of interoperability, the compatibility indicators shall be assigned scores to summarize the potential compatibility of comparable enterprises by placing weight coefficients. Then to proceed with potential compatibility evaluation based on the scores, an expert assigns a compatibility score from 0 to 10 points to each indicator corresponding to the degree of its importance within the indicators range. Next, determined is the weight coefficient value as the arithmetic mean of each indicator score assigned by the expert. Then, the integral compatibility indicator is calculated based on the data from Table 8.

The overall indicator of compatibility for each company is defined in points as follows

$$IIC = \sum_{j} x_j \cdot f_j.$$ (23)

Now we calculate the integral compatibility index for the analyzed enterprises (Table 9).

Thus, evaluated is the integral indicator of interoperability, which suggests that the most compatible for integration is CJSC “Kyivstar”, since its integral index value exceeding all others’ one, amounts to 41.27.

Conclusions. Assessing the existence and role of integration ties between the companies which are potential participants of the integrated structure implies the possibility to calculate the companies' compatibility potential prior to their association into an integrated structure. Such analysis still at the integration planning stage will help in evaluating the risk of companies' non-compliance.

### Table 7

Indicators of communications and informatization enterprises’ interoperability with other enterprises integrated into system

| Parameter | Enterprises |
|-----------|-------------|
|           | PJSC “Ukrposhta” | PJSC “Ukrtelecom” | CJSC “Kyivstar” | PJSC “VF Ukraine” |
| 1. Indicators of market integration | 0.07 | 0.13 | 0.22 | 0.17 |
| 2. Key integration of production capacity (production conformity unit) | 0.05 | 0.07 | 0.03 | 0.04 |
| 3. Enterprise scientific integration indicator | 0.10 | 0.32 | 0.47 | 0.43 |
| 4. Enterprise information integration (organizational compliance unit) indicator | 0.78 | 0.81 | 0.85 | 0.85 |
| 5. Target markets integration indicator | 0.19 | 0.12 | 0.19 | 0.17 |
| 6. Technology integration (compatibility) indicator | 1.05 | 1.15 | 1.17 | 1.17 |
| 7. Flexibility by personnel management rotation indicator | 0.00025 | 0.00069 | 0.00661 | 0.00601 |
| 8. Business activity (growth rate or turnover rate) indicator | 1.07 | 1.13 | 1.21 | 1.23 |
| 9. Integrated structure maneuverability indicator | 0.72 | 0.84 | 0.97 | 0.96 |
| 10. Diversification level indicator | 0.28 | 0.05 | 0.0063 | 0.0098 |
| 11. Indicator of consumers tolerance to the integrated structure | 0.01 | 0.01 | 0.01 | 0.01 |
| 12. Efficiency of marketing activities | 0.041 | 0.070 | 0.084 | 0.089 |

### Table 8

Initial data for determining the effectiveness of enterprise integration

| Compatibility Index | Potential $i$ participant of the integrated economic structure | Weight coefficients |
|---------------------|---------------------------------------------------------------|---------------------|
| 1. Indicators of market integration | $x_1$ | $x_1$ | $x_1$ | $x_1$ | $x_1$ | $x_1$ | $f_1$ |
| 2. Key integration of production capacity (production conformity unit) | $x_2$ | $x_2$ | $x_2$ | $x_2$ | $x_2$ | $x_2$ | $f_2$ |
| 3. Enterprise’s scientific integration indicator | $x_3$ | $x_3$ | $x_3$ | $x_3$ | $x_3$ | $x_3$ | $f_3$ |
| 4. Enterprise’s information integration (organizational compliance unit) indicator | $x_4$ | $x_4$ | $x_4$ | $x_4$ | $x_4$ | $x_4$ | $f_4$ |
| 5. Target market integration indicator | $x_5$ | $x_5$ | $x_5$ | $x_5$ | $x_5$ | $x_5$ | $f_5$ |
| 6. Technology integration (compatibility) indicator | $x_6$ | $x_6$ | $x_6$ | $x_6$ | $x_6$ | $x_6$ | $f_6$ |
| 7. Flexibility by personnel management rotation indicator | $x_7$ | $x_7$ | $x_7$ | $x_7$ | $x_7$ | $x_7$ | $f_7$ |
| 8. Business activity (growth rate or turnover rate) indicator | $x_8$ | $x_8$ | $x_8$ | $x_8$ | $x_8$ | $x_8$ | $f_8$ |
| 9. Integrated structure maneuverability indicator | $x_9$ | $x_9$ | $x_9$ | $x_9$ | $x_9$ | $x_9$ | $f_9$ |
| 10. Diversification level indicator | $x_{10}$ | $x_{10}$ | $x_{10}$ | $x_{10}$ | $x_{10}$ | $x_{10}$ | $f_{10}$ |
| 11. Indicator of consumer tolerance to the integrated structure | $x_{11}$ | $x_{11}$ | $x_{11}$ | $x_{11}$ | $x_{11}$ | $x_{11}$ | $f_{11}$ |
| 12. Efficiency of marketing activities | $x_{12}$ | $x_{12}$ | $x_{12}$ | $x_{12}$ | $x_{12}$ | $x_{12}$ | $f_{12}$ |
| The overall indicator of compatibility | $IRS$ | $IRS$ | $IRS$ | $IRS$ | $IRS$ | $IRS$ | $IRS$ |
Finding the integrated compatibility parameter for communications and informatization enterprises with other branches’ companies in the integrated system

| Parameter                                                                 | weight coefficient | Enterprises | PISC “Ukroposhta” | PJSC “Ukrtelecom” | CJSC “Kyivstar” | PISC “VF Ukraine” |
|---------------------------------------------------------------------------|--------------------|-------------|-------------------|------------------|----------------|------------------|
| 1. Indicators of market integration                                      | 9.10               |             | 0.64              | 1.38             | 2.00           | 1.55             |
| 2. Key integration of production capacity (production conformity unit)    | 9.76               |             | 0.49              | 0.68             | 0.29           | 0.39             |
| 3. Enterprise’s scientific integration indicator                          | 8.27               |             | 0.83              | 2.65             | 3.89           | 3.56             |
| 4. Enterprise’s information integration (organizational compliance unit)  | 5.36               |             | 4.18              | 4.34             | 4.56           | 4.56             |
| 5. Target market integration indicator                                    | 7.64               |             | 1.45              | 0.92             | 1.45           | 1.30             |
| 6. Technology integration (compatibility) indicator                       | 6.89               |             | 7.23              | 7.92             | 8.06           | 8.06             |
| 7. Flexibility by personnel management rotation indicator                 | 5.24               |             | 0.00313           | 0.00362          | 0.03464       | 0.03149          |
| 8. Business activity (growth rate or turnover rate) indicator             | 8.77               |             | 9.38              | 9.91             | 10.61          | 10.79            |
| 9. Integrated structure maneuverability indicator                         | 9.84               |             | 7.08              | 8.27             | 9.54           | 9.45             |
| 10. Diversification level indicator                                       | 7.97               |             | 2.23              | 0.40             | 0.05           | 0.08             |
| 11. Indicator of consumer tolerance to the integrated structure           | 4.23               |             | 0.04              | 0.04             | 0.04           | 0.04             |
| 12. Efficiency of marketing activities                                    | 8.81               |             | 0.36              | 0.62             | 0.74           | 0.78             |
| The overall indicator of compatibility                                    | 33.92              |             | 36.93             | 41.27            | 40.58          |                  |

Clearly obvious are the benefits of the proposed methodology for assessing the integration feasibility:

1) methods based onto (and including as tools) the assessment of enterprises’ financial condition, resource efficiency evaluation and the enterprises’ compatibility assessment, in other words, the use of a comprehensive approach to assessing the need for integration;

2) the entity financial condition assessment is based on publicly reported statements;

3) when analyzing entities’ interlinked objects, a comprehensive assessment of enterprises compatibility is carried out. The concomitant use of economic activities efficiency complex analysis and the existing compatibility potential evaluation which give grounds to substantiate the enterprise integration represents this methodology novelty. The method for assessing the integration feasibility can be used especially for high technology companies with a limited applicability to other types companies. Thus, the proposed methodology for assessing the feasibility of integration allows the simultaneous assessment of prospects for businesses integration and interoperability with the ability to assess potential risks and to develop a system of measures to eliminate or minimize the association’s negative effects. In addition, the developed technique provides for evaluating both external and internal environments: creation of integrated enterprises allows staff employment the employer entity’s reform running, it serves to reduce costs and increase efficiency through synergy and harmonization of approaches in logistics, engineering, information technology, quality management.

Thus, the decision-making on the complementary interoperability of communications and informatization service enterprises as well as on their compatibility potential becomes with the proposed method possible even at reintegration stage that circumstance being of key importance when creating the integration structure.

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Методика. У даному дослідженні використовувалося поєднання методів інтегральної оцінки, розрахунково-конструктивного методу, структурно-логічного та якісного системного аналізу й методів синтезу.

Результати. У результаті впровадження методологічного підходу запропоновано розрахунок показників адаптивності підприємств послуг зв’язку та інформатизації до взаємодії з іншими підприємствами в рамках інтегрованої системи, що вказують на необхідність інтеграції обраних підприємств. Ці показники відображають наявність у них взаємних виробничих, технологічних і кадрових зв’язків, тобто прагнення підприємств до інтеграції. Вибір очікуваної інтеграції підприємств не може бути випадковим. Тому для обґрунтування економічної доцільності інтеграції необхідно розрахувати показники сумісності.

Наукова новизна. Запропонований науково-методологічний підхід дозволяє виявити найбільш сприятливі передумови для створення інтегрованої форми діяльності підприємства зв’язку та інформатизації в конкретному економічному регіоні. На відміну від існуючих, даний підхід включає в себе наступні етапи: 1. Оцінка впливу чинників інтеграційної форми діяльності підприємств сфери зв’язку та інформатизації в конкретному економічному регіоні. На відміну від існуючих, даний підхід включає в себе наступні етапи: 1. Оцінка впливу чинників інтеграційної форми діяльності підприємств сфери зв’язку та інформатизації в конкретному економічному регіоні. На відміну від існуючих, даний підхід включає в себе наступні етапи: 1. Оцінка впливу чинників інтеграційної форми діяльності підприємств сфери зв’язку та інформатизації в конкретному економічному регіоні. На відміну від існуючих, даний підхід включає в себе наступні етапи: 1. Оцінка впливу чинників інтеграційної форми діяльності підприємств сфери зв’язку та інформатизації в конкретному економічному регіоні. На відміну від існуючих, даний підхід включає в себе наступні етапи: 1. Оцінка впливу чинників інтеграційної форми діяльності підприємств сфери зв’язку та інформатизації в конкретному економічному регіоні. На відміну від існуючих, даний підхід включає в себе наступні етапи: 1. Оцінка впливу чинників інтеграційної форми діяльності підприємств сфери зв’язку та інформатизації в конкретному економічному регіоні. На відміну від існуючих, даний підхід включає в себе наступні етапи: 1. Оцінка впливу чинників інтеграційної форми діяльності підприємств сфери зв’язку та інформатизації в конкретному економічному регіоні. На відміну від існуючих, даний підхід включає в себе наступні етапи: 1. Оцінка впливу чинників інтеграційної форми діяльності підприємств сфера