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Article

Forecast and Scenarios for the Development of Uzbekistan's Information Services Market Until 2030

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Abstract: The article develops a forecast of Uzbekistan's exports of information and communication technology (ICT) services until 2030. The forecast is based on official statistical data for 2015-2025 and comprises four scenarios: inertial (21.6% per year), baseline (28.0%), target (35.1%) and optimistic (45.0%). According to the calculations, achieving the announced target of USD 5 billion requires annual growth of 35.1% in 2025–2030. The scenarios are assessed in connection with the human resource constraint: at the current level of productivity, the target scenario requires 326.9 thousand specialists, whereas if productivity doubles, 189.4 thousand specialists would suffice. Sensitivity analysis showed that labour supply is the strongest constraint. Based on the forecast results, it is recommended that the target parameters be revised.

Keywords: forecasting, scenario analysis, ICT services exports, human resource constraint, labour productivity, sensitivity analysis, Uzbekistan, 2030.

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1. Introduction

The practical value of a forecast is measured not by its accuracy but by the information it provides for decision-making. Long-term forecasts are rarely fulfilled as precise predictions, and this is natural. Their purpose is different: to show what outcome will be reached if current trends continue and to identify the conditions under which announced targets can be achieved.

In this study, the second purpose is set as the priority. A target has been announced for the industry to raise exports to USD 5 billion by 2030. The main question of the forecast is what growth rate this target requires and under what conditions it can be achieved.

The constraints identified in previous studies are incorporated directly into the forecast. The third article identified the talent base as the main constraint of the industry, and the thirteenth article showed that the target parameters are almost entirely extensive in nature. The forecast is therefore calculated not only for export volume but also for human resource requirements [1].

The development of the information services market has become one of the principal determinants of economic modernization, technological transformation, and long-term competitiveness in emerging economies. In Uzbekistan, the expansion of digital infrastructure, information and communication technologies (ICT), electronic government, software development, cloud computing, and digital business services has

created new opportunities for economic diversification. The implementation of national digital transformation strategies has further increased the importance of developing scientifically grounded forecasts of the information services market through 2030. Consequently, the assessment of future market development requires an integrated analytical framework combining economic growth theory, technological innovation, institutional development, and scenario-based forecasting.

The theoretical foundations of the digital economy were significantly advanced by D. Tapscott who examined the transformation of economic relationships under the influence of network technologies. His research emphasized that digitalization changes traditional business models, reduces information exchange costs, and creates new mechanisms of value generation. The author demonstrated that information technologies should be considered not merely as supporting instruments but as structural components of economic development. This theoretical perspective provides an important foundation for forecasting information services markets, where economic growth is increasingly associated with digital connectivity, knowledge-intensive activities, and technological innovation [2].

A complementary interpretation was developed by E. Brynjolfsson and B. Hitt who investigated the relationship between information technology investments and organizational performance. Their research demonstrated that the economic benefits of digital technologies depend on complementary organizational changes, human capital development, and the restructuring of business processes. The authors emphasized that investments in information technologies do not automatically generate proportional improvements in productivity. Instead, technological investments produce greater economic benefits when accompanied by managerial innovation and organizational adaptation. These findings are particularly relevant to Uzbekistan, where the future expansion of information services depends on both technological infrastructure and the capacity of enterprises to integrate digital solutions into their activities.

The relationship between ICT development and economic growth was further examined by D. Jorgenson and K. Stiroh who investigated the contribution of information technologies to productivity improvements and economic expansion. Their research highlighted the importance of technological capital accumulation and efficiency improvements in explaining economic growth. From the perspective of information services market forecasting, this approach suggests that the expansion of ICT infrastructure, software industries, and digital business services can influence both the supply of information services and the productivity of other economic sectors. Therefore, forecasting models should incorporate technological investment, productivity, and sectoral interdependence indicators.

An important contribution to understanding digital transformation was made by E. Brynjolfsson and A. McAfee who examined the economic consequences of rapidly advancing digital technologies [3]. Their analysis emphasized the transformative potential of automation, artificial intelligence, digital platforms, and data-driven business models. The authors argued that technological progress creates opportunities for productivity growth while simultaneously generating challenges associated with employment transformation, skills development, and economic inequality. These considerations are particularly relevant for developing alternative scenarios of Uzbekistan's information services market, where technological acceleration may generate different outcomes depending on workforce preparedness, institutional effectiveness, and investment conditions .

The role of digital technologies in economic development was systematically examined by the World Bank in its World Development Report 2016: Digital Dividends. The report demonstrated that digital technologies can contribute to economic growth, employment creation, and improved public services, but their benefits depend on

complementary factors such as regulatory quality, human capital, and institutional accountability. The report emphasized that access to digital infrastructure alone is insufficient to ensure inclusive digital development. Accordingly, forecasts of Uzbekistan's information services market should incorporate not only technological expansion but also institutional readiness, digital skills, competition, and the accessibility of digital services across different regions [4].

The United Nations Conference on Trade and Development (UNCTAD) has also made significant contributions to understanding the structural transformation of digital markets. The Digital Economy Report 2019 examined the increasing economic importance of digital platforms, data flows, and the creation and capture of value in the digital economy. The report highlighted the concentration of digital market power and the challenges faced by developing economies in building competitive digital industries. For Uzbekistan, these findings indicate that future information services market development may depend on the ability of domestic enterprises to participate in international digital value chains, develop competitive software products, and expand knowledge-intensive service exports [5].

The Digital Economy Report 2021 further developed this perspective by examining the growing importance of cross-border data flows and their implications for economic development. UNCTAD emphasized that data have become a strategic economic resource, influencing innovation, competition, and the development of digital services. The report also highlighted the importance of appropriate regulatory frameworks and international cooperation. These findings suggest that Uzbekistan's information services market may increasingly depend on the development of data-processing infrastructure, cloud technologies, cybersecurity, and regulatory conditions supporting secure digital transactions [6].

The OECD's Digital Economy Outlook 2024 provides an important contemporary framework for examining the evolution of digital markets. The report identifies artificial intelligence, digital connectivity, technological adoption, and digital transformation as major factors shaping future economic development. It also emphasizes differences in digital capabilities among enterprises, sectors, and population groups. From a forecasting perspective, these findings demonstrate that market growth should be evaluated through a multidimensional approach incorporating digital infrastructure, business adoption, innovation, and workforce competencies. Such an approach is particularly relevant for constructing alternative development scenarios through 2030.

In the context of Uzbekistan, the Digital Uzbekistan–2030 Strategy represents a fundamental institutional framework for the development of the national digital economy. Approved by Presidential Decree No. UP-6079 of October 5, 2020, the strategy establishes priority directions for expanding digital infrastructure, developing electronic government, introducing modern information technologies, and strengthening the digital transformation of economic sectors. The strategy provides an important policy foundation for analyzing the future development of information services, including telecommunications, digital platforms, information processing, and software-related activities [7].

The broader national development framework is established by the Uzbekistan–2030 Strategy, approved in September 2023. The strategy identifies sustainable economic growth, modernization of public administration, technological development, and improvement of human capital as important national priorities. The integration of digital technologies into economic and institutional development creates additional demand for information services and supports the expansion of digital entrepreneurship. Accordingly, the implementation of national development priorities should be considered among the institutional variables influencing medium-term forecasts of the information services market.

Official statistical information provides an essential empirical foundation for assessing the historical dynamics of Uzbekistan's information services market. Data published by the National Statistics Committee indicate that the volume of information services increased from 2,516.0 billion soums in 2022 to 5,866.6 billion soums in 2023 and 7,165.5 billion soums in 2024. These figures demonstrate substantial nominal expansion of information services during the observed period. However, the interpretation of these changes requires consideration of price effects, changes in market structure, and the distinction between information services and the broader communication and information services category [8].

The broader communication and information services sector also demonstrates sustained expansion. Official statistical data indicate that its annual volume reached 56,865.2 billion soums in 2024 and 79,485.5 billion soums in 2025. These developments provide an empirical basis for examining the future trajectory of Uzbekistan's digital services economy. Nevertheless, forecasts based exclusively on historical nominal growth may overestimate future real market expansion. Therefore, scenario-based analysis should incorporate alternative assumptions regarding inflation, technological investment, domestic demand, export growth, and institutional development. From a methodological perspective, forecasting information services market development requires the application of quantitative and qualitative analytical approaches. Hyndman and Athanasopoulos provide a comprehensive framework for time-series forecasting, including trend analysis, exponential smoothing, autoregressive integrated moving average models, and forecast evaluation. Their methodology emphasizes the importance of model selection, diagnostic testing, and the assessment of forecast uncertainty. These principles are particularly relevant to Uzbekistan's information services market, where historical statistical series can be used to estimate baseline growth trajectories while accounting for structural changes and uncertainty.

The development of alternative scenarios can also be supported by the scenario-planning framework proposed by P. Schwartz. The author emphasized that long-term strategic planning should consider multiple plausible futures rather than rely exclusively on a single deterministic forecast. Scenario analysis enables researchers to examine how technological breakthroughs, institutional reforms, economic fluctuations, and external market conditions may influence future development. In the context of Uzbekistan's information services market, this approach provides a methodological basis for constructing conservative, baseline, and accelerated digital transformation scenarios through 2030.

The strategic importance of scenario-based forecasting was further developed by K. van der Heijden who examined scenarios as instruments for organizational learning and strategic decision-making. His approach emphasizes the role of uncertainty, structural change, and alternative development pathways in long-term planning. Unlike conventional forecasting methods that extrapolate historical trends, scenario planning considers the interaction of multiple driving forces and possible disruptions. For Uzbekistan's information services market, this framework is particularly useful because future growth may depend on technological innovations, international digital trade, regulatory reforms, investment conditions, and the availability of qualified ICT specialists [9].

The synthesis of the reviewed literature demonstrates that forecasting the development of Uzbekistan's information services market until 2030 requires a comprehensive methodological framework integrating economic, technological, institutional, and statistical dimensions. The market's future trajectory may be influenced by broadband connectivity, digital infrastructure investment, enterprise digitalization, software exports, artificial intelligence adoption, public-sector digital transformation, and human capital development.

Based on the theoretical and methodological approaches discussed above, three principal development scenarios can be distinguished. The conservative scenario assumes relatively moderate growth under conditions of limited investment, slower technological adoption, and persistent regional digital disparities. The baseline scenario assumes continued implementation of existing digital transformation policies, gradual expansion of digital infrastructure, and stable growth in domestic demand for information services. The accelerated scenario assumes stronger technological investment, rapid expansion of software and IT-enabled services, increasing international competitiveness, and more intensive adoption of artificial intelligence and cloud technologies.

These scenarios should be regarded as analytical alternatives rather than predetermined outcomes. Their quantitative implementation requires explicit assumptions, consistent statistical definitions, and appropriate forecasting methods. In particular, forecast indicators may include the real volume of information services, sectoral value added, ICT investment, employment, labour productivity, digital service exports, and the regional distribution of information service enterprises.

Despite the growing body of research on digital transformation and information economies, several methodological challenges remain. First, forecasts of digital market development frequently rely on aggregate ICT indicators that do not adequately distinguish information services from telecommunications, software development, and other digital activities. Second, the rapid evolution of technological markets creates structural changes that may reduce the reliability of traditional extrapolation methods. Third, regional disparities in infrastructure, skills, and investment conditions complicate the development of uniform national forecasts. Finally, the interaction between policy implementation, private investment, and technological innovation requires more systematic incorporation into quantitative forecasting models [10].

Therefore, the reviewed literature provides a theoretical and methodological foundation for developing an integrated scenario-based forecasting framework for Uzbekistan's information services market through 2030. The combination of official statistical data, econometric forecasting techniques, and scenario planning can improve the reliability and policy relevance of market projections. Such an approach can support strategic investment decisions, identify potential development constraints, and contribute to the formulation of evidence-based measures aimed at strengthening Uzbekistan's digital economy and international competitiveness.

2. Materials and Methods

The information base of the forecast is official data of the National Statistics Committee on ICT services exports [4]. Since the indicators are expressed in US dollars, national currency inflation does not affect the results and no deflation is required.

The average annual growth rate is calculated using the geometric mean:

$$g = \left(\frac{V_t}{V_0}\right)^{1/n} - 1 \quad (1)$$

where V(0) and V(t) are the initial and final values and n is the number of years. The rates calculated for different periods form the basis of the scenarios. The average rate for 2015-2025 is 21.6%, for 2020-2025 45.7%, and for 2022-2025 53.7%. Such a divergence of rates reflects the explosive growth of recent years.

The four scenarios are substantiated as follows. The inertial scenario relies on the ten-year average rate (21.6%) and is the most cautious option. The baseline scenario

assumes 28.0% – an intermediate value between the long-term and recent rates. The target scenario is back-calculated from the announced USD 5 billion target and requires 35.1%. The optimistic scenario assumes 45.0%, corresponding to the continuation of the 2020-2025 rate.

For each scenario, human resource requirements are calculated under two productivity assumptions: the level envisaged in the current target parameters (USD 15.3 thousand per specialist) and a doubling of productivity (USD 26.4 thousand). The calculation formula is simple:

$$L_{2030} = \frac{E_{2030}}{(E/L)_{2030}} \quad (2)$$

where L(2030) is the number of specialists required, Eis the export volume and (E/L)(2030) is export per specialist in 2030.

The limitations of the study are stated openly. First, data on the number of specialists are available only for IT Park residents, and complete statistics for the industry have not been compiled; an approximate estimate is used for 2025. Second, the scenarios assume linear exponential growth, whereas in practice the trajectory is likely to be S-shaped. Third, as noted in a previous study, part of the sharp growth in 2022–2025 may be due to the expansion of statistical coverage.

3. Results

The choice of growth rate is the key assumption of any export forecast, and the rates observed in different periods diverge widely. The growth rates by period and the substantiation of the scenarios are therefore presented first, in Table 1.

Table 1. Export growth rates and substantiation of the scenarios

Period or scenario	Initial value, USD million	Final value, USD million	Growth, times	Average annual rate, %	Basis for scenario
2015–2025 (actual)	156.9	1,111.2	7.08	21.6	Inertial scenario
2020–2025 (actual)	169.5	1,111.2	6.56	45.7	Optimistic scenario
2022–2025 (actual)	305.8	1,111.2	3.63	53.7	Upper bound
Inertial scenario	1,111.2	2,954.3	2.66	21.6	Long-term average
Baseline scenario	1,111.2	3,818.0	3.44	28.0	Intermediate value
Target scenario	**1,111.2**	**5,001.0**	**4.50**	**35.1**	**Announced target**
Optimistic scenario	1,111.2	7,122.3	6.41	45.0	Rate of the last five years

The analysis of the table first shows the sharp divergence of actual rates across periods: 21.6% for the ten-year period and 53.7% for the last three years. Such a gap creates a serious problem for forecasting – the question of which rate to take as the baseline remains open.

Extrapolating the recent rate over the long term would be a methodological error. A high rate is characteristic of growth starting from a low base and inevitably slows as

the base grows. Moreover, as noted in a previous study, part of the growth in this period may be due to the expansion of statistical coverage.

The second result concerns the position of the target scenario. The announced USD 5 billion target requires an annual rate of 35.1%. This value lies between the inertial (21.6%) and optimistic (45.0%) scenarios, i.e. within a range that is achievable in principle [11].

This is an important conclusion: the target is not overly optimistic. It is lower than the rate achieved in recent years and implies only a certain slowdown. The problem lies not in the size of the target but in the resources required to secure it.

The third result concerns the size of the gap between the scenarios. In 2030 the difference between the inertial and optimistic scenarios is USD 4,168 million, i.e. 1.41 times the value of the inertial scenario. Such a wide range means that management decisions have strong leverage – the outcome is not predetermined.

The trajectories behind these figures, and how far apart they drift over time, are shown in Figure 1.

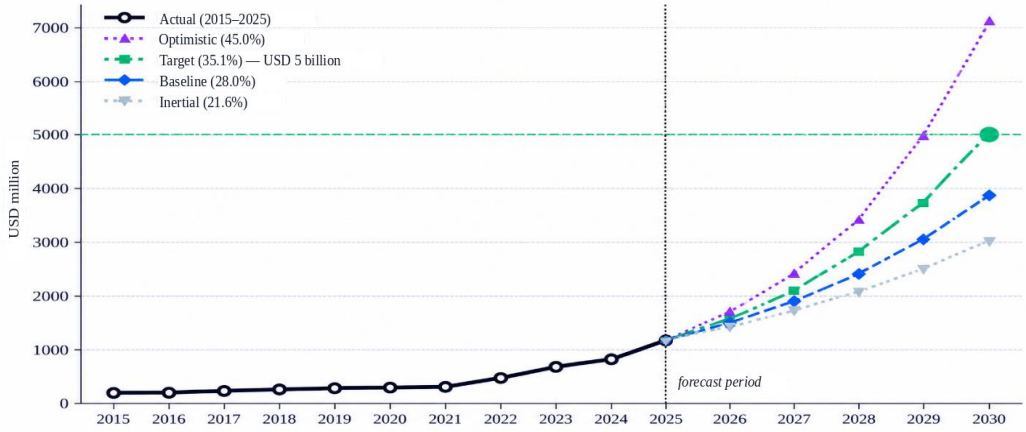


Figure 1. Actual dynamics of ICT services exports and scenarios until 2030

The analysis of the chart calls attention to the shape of the actual series. In 2015–2021 the line is almost horizontal – a period of stagnation in which exports grew from USD 156.9 million to USD 180.7 million, i.e. only 1.15-fold. In the following four years, however, the line rose sharply.

This shape corresponds to the middle, steepest part of an S-shaped trajectory. By this logic, the rate is expected to slow at the next stage, which makes the inertial and baseline scenarios more likely. The optimistic scenario assumes that the steep part of the S-curve continues for another five years and is considered less likely.

The way the scenarios fan out on the chart is also noteworthy. In 2026 the difference between them is only USD 260 million, but by 2030 it widens to USD 4,168 million. This shows that forecast uncertainty increases over time and that the reliability of forecasting beyond five years decreases [12].

A given export volume can only be produced by a corresponding workforce, so each scenario implies a certain human resource requirement. The link between the scenarios and personnel requirements is presented in Table 2 and Figure 2.

Table 2. Human resource requirements by scenario and the conditions for meeting them

Scenario	Exports in 2030, USD million	Personnel required at current productivity, thousand	Personnel required if productivity doubles, thousand	Relative to 2025 level (≈45 thousand), times
Inertial (21.6%)	2,954.3	193.1	111.9	4.3 / 2.5
Baseline (28.0%)	3,818.0	249.5	144.6	5.5 / 3.2
Target (35.1%)	5,001.0	326.9	189.4	7.3 / 4.2
Optimistic (45.0%)	7,122.3	465.5	269.8	10.3 / 6.0

The analysis of the table provides the most important practical result of the forecast. In the target scenario, 326.9 thousand specialists are required at the current level of productivity – which almost exactly matches the announced parameters and confirms the correctness of the calculation.

If productivity doubles, the same export volume is achieved with 189.4 thousand specialists. The difference is 137.5 thousand people – this significantly reduces the demand placed on the education system and increases the likelihood of achieving the target.

The last column provides the most illustrative information for comparison. In the target scenario, at current productivity the number of personnel must increase 7.3-fold; if productivity doubles, a 4.2-fold increase is sufficient. Both figures are high, but they differ qualitatively [13].

The inertial scenario also places serious demands on personnel: 193.1 thousand specialists at current productivity, i.e. a 4.3-fold increase. This means that even in the most cautious scenario the human resource issue remains decisive.

The general conclusion is as follows: labour supply is the binding constraint for all scenarios. Regardless of the size of the export target, the talent base must be expanded several times over to secure it. This task cannot be solved within the industry itself – it depends on the capacity of the education system.

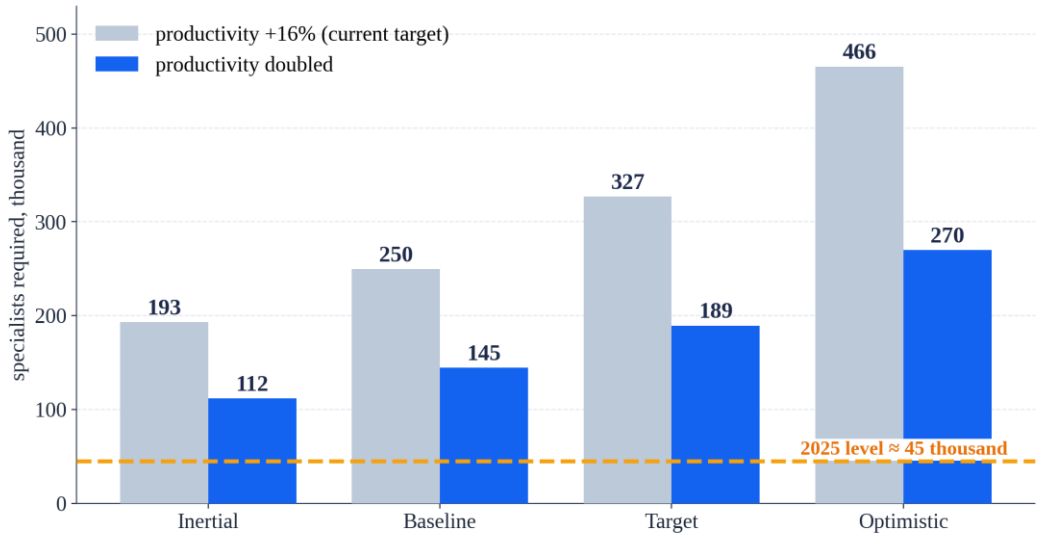


Figure 2. Human resource requirements by scenario and the effect of productivity assumptions

The chart clearly shows the strength of the productivity factor. In each scenario the difference between the two bars is substantial: in the target scenario it amounts to 137.5

thousand people. This difference quantifies the value of measures aimed at raising productivity.

The horizontal line shows the estimated 2025 level, and it lies well below all the bars. This visually conveys the scale of the task: even in the most cautious scenario the talent base must expand several times over.

The practical conclusion from the chart is as follows: since the export target and the personnel target are interdependent, they must be planned together. Setting them in separate documents as independent indicators leads to an internal contradiction – a situation identified in a previous study.

Any forecast is only as robust as its key assumptions, so the next step is to test how sensitive the result is to changes in the main factors. The sensitivity of the forecast is assessed in Table 3 and Figure 3.

Table 3. Sensitivity of the forecast result to the main factors

Factor	Assumed change	Effect on annual rate, pp	Probability	Controllability
Labour supply	The education system cannot provide the required rate	−9.5	High	Partial
Global demand	Slowdown in the global IT outsourcing market	−7.0	Medium	Not controllable
Labour productivity	Shift to high value-added segments	+6.5	Medium	Controllable
Regional base	Expansion of the talent base in the regions	+3.5	Medium	Controllable
Price competition	Falling cost levels in competitor countries	−5.0	Medium	Not controllable

The table shows that the negative factors outweigh the positive ones in both number and strength. Their relative magnitude is easier to compare in graphical form (Figure 3).

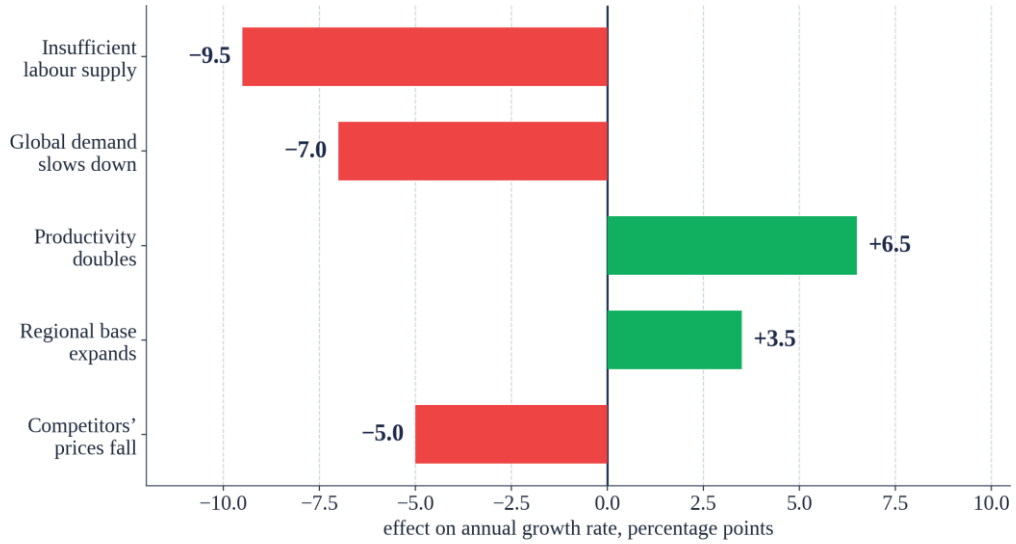


Figure 3. Sensitivity of the forecast result to the main factors

Sensitivity analysis makes it possible to identify the weakest point of the forecast. The factor with the greatest impact – labour supply (−9.5 percentage points) – also has the highest probability. This makes it the main risk.

The second important observation is concentrated in the controllability column. Two of the three negative factors are not controllable: global demand and cost levels in competitor countries. Both positive factors, by contrast, are controllable – productivity and the regional base [14].

This distribution gives a clear direction for policy. Uncontrollable negative factors cannot be influenced, but their effect can be offset by controllable positive factors. Together, productivity and the regional base provide +10.0 percentage points, which partially offsets the expected losses from global demand and price competition (−12.0 points).

The labour supply factor requires separate consideration, as it falls into the partially controllable category. The speed at which the education system can expand is limited, but it can be increased through policy. Furthermore, as shown in a previous study, retraining existing personnel is faster and cheaper than training new personnel.

The overall conclusion of the sensitivity analysis is that the forecast's uncertainty range for the annual rate is about 16 percentage points – from 21.5% to 37.5%. The width of this range confirms that management decisions have strong leverage.

Bringing together the growth rates, personnel requirements and risks makes it possible to assess how realistic each scenario is. The conditions for achieving the scenarios are summarised in Table 4.

Table 4. Conditions, risks and assessment of the scenarios

Scenario	Condition for realisation	Main risk	Probability assessment
Inertial (21.6%)	Current policy is maintained; the talent base expands 4.3-fold	If labour supply is insufficient, the rate falls further	High
Baseline (28.0%)	The personnel programme is expanded; productivity rises moderately	If the regional base does not expand, the labour market in the capital overheats	Medium-high

Scenario	Condition for realisation	Main risk	Probability assessment
Target (35.1%)	The talent base expands 7.3-fold or productivity doubles	Neither condition is met at the same time	Medium
Optimistic (45.0%)	The rate of the last five years is maintained; personnel increase 10.3-fold	As the base grows, the rate inevitably slows	Low

The analysis of the table differentiates the scenarios by probability. The inertial scenario is the most likely, but it too requires a 4.3-fold expansion of the talent base. In other words, in no scenario does the human resource issue resolve itself.

The target scenario is assessed as having medium probability. It can be achieved in two alternative ways: expanding the talent base 7.3-fold, or doubling productivity and thereby reducing the personnel requirement to 4.2-fold. The second way appears much more realistic.

The optimistic scenario is assessed as having low probability, and the reason is economic rather than statistical. As the base grows, the same absolute increase yields an ever lower relative rate. Maintaining a 45% rate would require an absolute increase of USD 2.2 billion per year in 2030 – twice the entire export volume of 2025 [15].

The final practical conclusion of the forecast concerns the revision of the target parameters. As shown in a previous study, the current parameters are almost entirely extensive in nature. Reformulating them with a stronger productivity component would increase the likelihood of achieving the target and at the same time improve the industry's position in the value chain.

As a practical recommendation, it is proposed that at least three indicators be included jointly in the system of targets: export volume, exports per specialist and the share of specialists in the regions. Setting only the first indicator encourages extensive growth and does not ensure long-term sustainability.

4. Conclusions

First, achieving the announced USD 5 billion target requires annual growth of 35.1% in 2025-2030. This rate lies between the inertial (21.6%) and optimistic (45.0%) scenarios, i.e. the target is not overly optimistic.

Second, the problem lies not in the size of the target but in the resources required to secure it. At the current level of productivity, the target scenario requires 326.9 thousand specialists, i.e. a 7.3-fold expansion of the talent base.

Third, if productivity doubles, the same export volume is achieved with 189.4 thousand specialists. The difference is 137.5 thousand people, which quantifies the value of measures aimed at raising productivity.

Fourth, labour supply is the binding constraint for all scenarios. Even in the most cautious, inertial scenario, the talent base must expand 4.3-fold. The human resource issue therefore does not resolve itself in any scenario.

Fifth, sensitivity analysis showed that labour supply is the factor with both the greatest impact and the highest probability (-9.5 percentage points). The controllable positive factors – productivity and the regional base – could together provide +10.0 percentage points.

Sixth, it is recommended that at least three indicators be included jointly in the system of targets: export volume, exports per specialist and the share of specialists in the regions. Setting only a volume indicator encourages extensive growth.

Seventh, it is recommended that the forecast be recalculated at least every two years, as the industry is highly volatile and a single anomalous year can significantly change trend estimates.

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