

Census administration in Ukraine: insight into the Polish experience in the context of international indicators analysis

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Abstract

The latest National Population Census in Poland, like in many EU countries, was conducted in 2021. In Ukraine, during the entire period of independence, a national census was conducted only once, in 2001, while the following rounds kept being postponed. In 2019, a trial census was conducted in several regions of central Ukraine. The working hypothesis is that for the organisation and conduct of the All-Ukrainian Population Census in Ukraine, it is important to use the experience of EU countries in this field (and Poland's experience in particular). The purpose of the article is to substantiate the theoretical foundations and comparative analysis of the processes of conducting censuses in Poland and Ukraine and to study the factors of increasing the level of respondent participation. The article reviews a number of socio-economic factors in the light of the comparison of data census organisation in Poland and Ukraine. Several international indicators were investigated that could have an impact on respondent participation in statistical surveys and censuses. By applying factor analysis, it was possible to identify the factors that could increase the level of respondent participation. To solve these demographic challenges, the following activity should be considered: financial support for the successful functioning of economic entities, improvement of social infrastructure, friendly environment for innovation and investment, and peace and political stability in Ukraine.

Key words: national census, trial census, international comparisons, multifactorial statistical analysis of the civic activity level.

1. Introduction

The role and significance of censuses remain the focus of attention for many researchers, economists and politicians. According to UN standards, a national census

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should be conducted in each country every 10 years. This recommendation is observed in EU countries. The most recent population census in Poland, like in many other EU members, was conducted in 2021, whereas in Ukraine – in 2001. Over the past 21 years, there have been a number of attempts to hold another census in Ukraine, but each time the date was postponed.

However, at the end of 2019, a trial census was conducted in several districts of the Kyiv region. The trial census relied on the latest digital technology, enabling respondents to fill out the census questionnaire via a smartphone app. Direct interviews were also conducted. But the main problem of the trial census was that the realized sample accounted for just 75% of the planned sample, with less than 1% collected by means of the app.

A timely and reliable administration of a national census and its statistical outputs are crucial for the implementation of the main directions of the country's sustainable development, especially the prospects of EU membership. This development is associated with three main goals: overcoming poverty, improving food security indicators, improving the well-being of the population. It should be emphasized that all these goals require information about the number of permanent residents in particular regions and in the country as a whole. In addition, once the hostilities in Ukraine are over, the most urgent task of the authorities will be to restore territorial integrity and start the reconstruction of Ukrainian cities and villages destroyed by the war. Such investment plans will require detailed information about the population in each region.

On June 23, 2022, Ukraine acquired the status of a candidate for EU membership. As a result, the government is now faced with the difficult task of adapting the national laws and standards to the European legislation, ensuring compliance with the rule of law, embracing democratic values and promoting the market economy. In order to continue reforms with a view to becoming an EU member, Ukraine needs to conduct regular population censuses according to EU standards. In addition, reliable and standardized national statistics are necessary for international comparisons made by the UN, the World Bank, the International Bank for Reconstruction and Development, Eurostat, the International Monetary Fund and other world organizations.

Since the declaration of independence in 1991, official statistics in Ukraine has undergone significant changes and the independence and objectivity of statistical information has become the main objective underlying the reforms undertaken in the organization. Today, the task of official statistics is not only to provide objective socio-economic indicators at the macro and micro levels, but also to contribute to the democratization of society by ensuring the sustainable development of all regions (Osaulenko O., et al., 2021).

In recent years, a number of researchers have focused on the trends and challenges connected with the demographic situation in the countries of Central and Eastern

Europe (Krywult-Albańska M., 2012, Marciniak G., 2014, Da Costa J. N., Bielecka E., Calka B., 2017). Dygaszewicz J. (2020) calls for a more extensive use of modern IT technologies in the organization of population censuses and data from administrative registers. Some authors point to differences between countries regarding the conditions that are relevant for conducting national censuses, which are related to significant differences between their national economies. Wisła R. et al. (2020) compare structural changes in the Polish and Ukrainian economies with those observed in other Central and Eastern European countries.

Zayukov I. (2011), Kravchenko V. and Kravchenko N. (2015) emphasize the need to study the causes and consequences of the deep demographic crisis in Ukraine. Libanova E., 2013, Melnik S., 2014 and Malish N., 2016 highlight the need to solve demographic problems in order to ensure social development of different regions. However, the problems associated with the organization of a national population census and other statistical surveys, especially now in the conditions of martial law, remain unresolved.

Since the latest census data are over 20 years old, information about the population in the country's regions comes only from the Civil Registration of the Population Office and the State Migration Service. Because of high rates of migration, including refugee and labour migration, the accurate measurement of the population remains a challenge (Libanova E., 2019, Malynovska O., 2016). Since 2014, the country has experienced high levels of refugee migration resulting from political processes and Russia's invasion of the Crimean Peninsula. Migration flows intensified following Russia's aggression against Ukraine on February 24, 2022. As war hostilities escalated, large groups of the population were forced to leave their homes and move to neighbouring countries: Poland, Slovakia, Germany, Bulgaria, the Czech Republic, etc. (Kolomiets O., 2022).

Will these people be able to return home and if so, when? Will they be able to participate in the census? How will it be possible to organize and conduct a census given such a high level of migration and political instability in the country? What experiences of the EU countries regarding census administration can be used to help Ukraine overcome these challenges?

The authors believe that in order to conduct a successful population census in Ukraine, it is important to implement the experience of the EU countries, particularly Poland, regarding the organization of censuses and household surveys. The main results of the study were presented at the 40th International Conference MSA-2022, Lodz, November 7-10, 2022⁴. The authors are sincerely grateful to the organizers of the Conference for the high evaluation of the research and the recommendations.

The purpose of the article is to provide the theoretical foundations and compare the processes of conducting censuses in Poland and Ukraine, with emphasis on factors

⁴ <https://sites.google.com/view/msa-lodz>

that increase respondent participation. The authors compare the 2021 census in Poland and the 2019 trial census in Ukraine, by analyzing census forms, effectiveness indicators of various response modes: online, mail, telephone or personal interview, indices of the socio-economic development of the countries, which can stimulate respondent participation.

2. Data and methodology

The following comparative analysis is based on publicly available data published online by national statistical institutes in Poland⁵ and Ukraine⁶.

A comparative analysis of the census forms composition and respondent participation rates is based on information included in methodological reports accompanying each census. Factors that can affect the degree of respondent participation were selected from among international economic indices for each country, published by the World Bank⁷, the European Commission and Eurostat⁸, the International Labor Organization⁹ and the World Economic Forum¹⁰.

When selecting data to describe respondent participation in both countries, three groups of indices were considered:

- 1) indicators relating to electronic document flow: E-Participation Framework Index (EPFI)¹¹ and the UN Global E-Government Development Index (EGDI)¹². The first characterizes the use of state electronic services, the second – the use of electronic services in state document circulation.
- 2) indicators of the country's sustainable economic development: Fragile States Index (FSI)¹³, Global Innovation Index (GII)¹⁴ and The Economic Complexity Index (ECI)¹⁵. The first one characterizes the instability of state institutions, weak protection of the population, lack of access to medical and educational services, etc. The second measures the level of innovative processes, such as the use of new technologies, energy production and sustainable products, etc. The third index is based on the diversity and complexity of their export basket. It reveals the diversity

⁵ <https://stat.gov.pl/en>

⁶ <http://www.ukrstat.gov.ua>

⁷ <https://data.worldbank.org/>

⁸ <https://ec.europa.eu/eurostat/data/database>

⁹ <https://www.ilo.org/global/about-the-ilo/newsroom/lang--en/index.htm>

¹⁰ <https://www.weforum.org/reports/>

¹¹ <https://publicadministration.un.org/egovkb/en-us/About/Overview/E-Participation-Index>

¹² <https://publicadministration.un.org/egovkb/en-us/About/Overview/-E-Government-Development-Index>

¹³ <https://fragilestatesindex.org/indicators/>

¹⁴ <https://www.globalinnovationindex.org/Home>

¹⁵ <https://oec.world/en/rankings/eci/hs6/hs96?tab=table>

and sophistication of the productive capabilities embedded in the exports of each country.

- 3) social indicators: Human Development Index (HDI)¹⁶ and Social Progress Index (SPI)¹⁷. The first is a measure of average achievements in key dimensions of human development: a long and healthy life, education and decent standards of living. The second one is an aggregate country score with respect to three dimensions: basic human needs, foundations of well-being and opportunities. It relies exclusively on social and environmental indicators and measures outputs not inputs.

Guided by the principle of data comparability, the authors chose a single common series of data regarding the selected international indices for Poland and Ukraine – from 2009 to 2021. However, it turned out that some of these indices are calculated once every two years, which means no data were available for some years. For some indices, information for 2021 has not been published yet. In such cases, the authors applied a method of working with missing data developed by Fichman M. (2003). The empty cells were filled with values consistent with the general trend observed for a given index and the application of regression equations.

Sociometric, economic and statistical methods were used in the analysis. By comparing absolute, relative and average indicators of realized sample size with the planned number of respondents, it was possible to determine response rates for personal interviews and the electronic mode of response (Mokin B., Mokin O., 2015).

In the assessment of census forms used in Poland and Ukraine, the authors selected 8 groups of questions: 1) demographic characteristics (age, gender, place of birth, etc.); 2) ethnic origin, language, religion, citizenship; 3) education; 4) employment; 5) migration activity; 6) living conditions; 7) family connections; 8) health characteristics, disability status.

The method of principal components analysis (PCA) was used to identify the most important factor affecting respondent participation in national surveys (Dunteman G., 1989). The PCA method made it possible to reduce the size of the initial database in order to select factors with the greatest importance for the issue of interest – the level of respondent participation. The method was applied in the following stages.

In the first step, data approximation was performed by linear images, where the Euclidean distance between each of the vectors and its linear image is minimized. In this study, the source dataset includes a finite set of vectors: $I_1, I_2, \dots, I_m \in R^n$ for each $k = 1, 2, \dots, n - 1$ among all k -dimensional linear images one must find one where

¹⁶ <https://ourworldindata.org/human-development-index>

¹⁷ <https://www.socialprogress.org>

$L_k \in R^n$ and the sum of the squares of the Euclidean distances from each vector to the linear image is minimal:

$$\sum_{i=1}^7 \text{dist}^2(x_i, L_k) \rightarrow \min \quad (1)$$

On the other hand, when any k -dimensional linear image in the R^n space can be represented as a set of linear combinations:

$$L_k = \{a_0 + a_1\beta_1 + a_2\beta_2 + \dots + a_k\beta_k\}, \quad (2)$$

where β_i denotes some parameters of this linear combination, a_0 is a free element and $\{a_1; a_2; \dots; a_k\}$, which belong to the R^n space, is called an orthonormal set of vectors or vectors of principal components.

In this case, we present the sum of the squares of the Euclidean distances as the Euclidean norm:

$$\sum_{i=1}^7 \text{dist}^2(x_i, L_k) = \|x_i - a_0 - \sum_{j=1}^k a_j ((a_j, x_i) - a_0)\|^2 \quad (3)$$

The solution of this approximation problem was to find a series of nested linear images $L_0 \subset L_1 \subset L_2 \dots \subset L_{n-1}$, where:

$$L_k = \{a_0 + a_1\beta_1 + a_2\beta_2 + \dots + a_k\beta_k\},$$

and these images were determined by a set of vectors' main components.

In the second step, we looked for orthogonal projections with the largest value of dispersion. The first principal component was selected, where the sample variance of the data on the first coordinate is maximal. Next, the second main component was selected, where the sample variance along the second coordinate is maximal, provided that it is orthogonal to the first coordinate. And so on for the k -th principal component. Each sample variance for the k -th principal component in this study was determined by the formula:

$$S^2_{\max}(a_k, x_i) = \frac{1}{m} \sum_{k=1}^m (a_k, x_i)^2 \quad (4)$$

In the third step, we looked for orthogonal projections with the largest root mean square distance between points. This enabled us to compare and weight different pairwise distances between indices of respondent participation.

In the last, fourth step, correlations between the coordinates and indices used were cancelled. That is, we selected only those main components for which the coefficient of covariance between their various coordinates was equal to zero. This enabled us to select the factors which are relevant to conduct of a census and increase the level of respondent participation.

The method of scientific generalization was used to develop directions for improving the administration of a population census in Ukraine as soon as military operations in the country end. Results of the factor analysis of international economic indices were used to propose directions for improving respondent participation in statistical surveys.

3. Socio-economic conditions of relevance for census administration in Poland and Ukraine

Before one draw on the Polish experiences of census administration to inform Ukrainian reforms in this respect, it is necessary to note a significant difference between the two countries. Poland's accession to the EU in 2004 was an important moment in the process of transformation. Today, Poland is one of the most dynamically developing economies in the EU and ranks quite high in terms of the Human Development Index. It is a country with relatively high indicators of income and the quality of life, the level of security, the quality of education and economic freedom. In 2000, Poland's nominal GDP per capita was USD 4,501, whereas in 2021 it was USD 17,840, which represents a 4-fold increase. As a result, Poland was 44th in the ranking of countries by GDP per capita. In the same period, Ukraine's GDP per capita rose from USD 636 to 4835 USD, i.e. 7.6 times. However, in terms of GDP per capita, Ukraine ranks 101st in the world and is the "poorest country in Europe". According to the preliminary results of the 2021 census, the population of Poland is over 38.5 million, making it the fifth most populous country in the EU, and the eighth in Europe. It is also the ninth biggest country in Europe.

Currently, Ukraine is an industrial-agrarian economy, with a predominance of raw material production. The country is one of the leading exporters of many types of agricultural products. Major sectors of the Ukrainian economy include the mining industry, separate branches of mechanical engineering, ferrous and non-ferrous metallurgy, etc. Ukraine is an important producer of electricity as well as military equipment and weapons. Although the country ranks 74th in terms of the Human Development Index, (for comparison, Poland is 33rd), the standard of living and indicators of the quality of life vary greatly for different categories of the population. Other problems the country faces include a high level of corruption as well as poor security and legal protection of citizens. Since February 2014, Ukraine has been defending itself against the armed invasion of the Russian Federation, which led to the annexation of Crimea and the occupation of parts of the Donetsk and Luhansk regions. The next stage of the Russian-Ukrainian war began on February 24, 2022, with Russia's large-scale invasion of Ukraine. The war has contributed to a strong growth of patriotic sentiments among Ukrainians, which is reinforced by humanitarian aid and military support provided by the international community. According to the 2001 census, the Ukrainian population was 48.5 million, and according to estimates based on the population register, it was 41.3 million at the start of 2021.

The authors believe that the low level of non-response bias is correlated with high standards of living when part of the information comes from administrative databases.

Therefore, having considered Poland's experience in organizing and conducting censuses, the authors singled out 3 groups of international indices:

- 1) indicators characterizing the degree of electronic document circulation;
- 2) indicators characterizing the stability of the country's economic development;
- 3) indicators characterizing the standard of living (Table 1).

Considering these indices, the situation of Poland looks much more favourable compared to that of Ukraine. In the case of the FSI index, the higher the country's position in the ranking, the more fragile it is.

Table 1. Socio-economic factors of relevance for respondent participation a year before the national census in Poland and the trial census in Ukraine

Indices	Country's rank for a given index	
	Poland, 2020	Ukraine, 2018
<i>Indicators of electronic document flow</i>		
1. E-Participation Framework Index (EPFI) ¹⁸ , I1	9	75
2. The UN Global E-Government Development Index (EGDI) ¹⁹ , I2	24	82
<i>Indicators of sustainable economic development</i>		
3. Fragile States Index (FSI) ²⁰ , I3	145	86
4. Global Innovation Index (GII) ²¹ , I4	38	43
5. The Economic Complexity Index (ECI) ²² , I5	24	41
<i>Social indicators</i>		
6. Human Development Index (HDI) ²³ , I6	35	78
7. Social Progress Index (SPI) ²⁴ , I7	31	64

Source: based on data published on the official websites listed in the footnotes.

The E-Participation Framework Index (EPFI), included in the first group of indicators, is a complementary index to the UN E-Government Survey. It focuses on the use of online services that governments use to facilitate the provision of information to citizens (e-information exchange), engagement with stakeholders (e-consultation)

¹⁸ <https://publicadministration.un.org/egovkb/en-us/About/Overview/E-Participation-Index>

¹⁹ <https://publicadministration.un.org/egovkb/en-us/About/Overview/-E-Government-Development-Index>

²⁰ <https://fragilestatesindex.org/>

²¹ <https://www.globalinnovationindex.org/Home>

²² <https://oec.world/en/rankings/eci/hs6/hs96?tab=table>

²³ <https://ourworldindata.org/human-development-index>

²⁴ <https://www.socialprogress.org>

and participation in decision-making processes (e-decision-making). It includes the following sub-indexes: framework system of e-participation (the degree of citizens' e-participation in various events organized by the state), electronic information ("enabling participation by providing citizens with public information and access to information without or upon demand"), electronic consultation ("engaging citizens in contributions to and deliberation on public policies and services") and electronic decision-making ("empowering citizens through co-design of policy option and co-production of service components and delivery modalities").

It should be noted that in 2010, the values of the EPI were almost the same for both countries (0.249 for Poland and 0.2571 for Ukraine). However, in the following years, e-participation of the Polish population improved, especially between 2014 and 2016, when the value of the index almost doubled from 0.4902 to 0.8814, which is reflected by a jump in the world ranking from 65th to 14th place. In 2020, the EPI for Poland was 0.9643, while the corresponding value for Ukraine was 0.8095 (Figure 1).

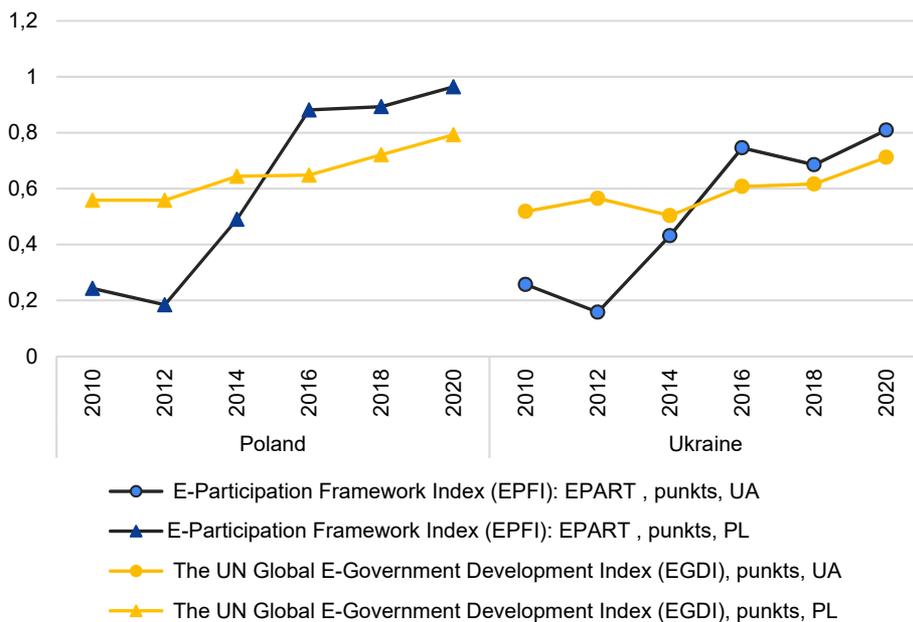


Figure 1. A comparison of indicators of electronic document flow in Poland and Ukraine, 2010–2020
Source: based on data published on the official websites listed in the footnotes²⁵.

²⁵ <https://publicadministration.un.org/egovkb/en-us/About/Overview/E-Participation-Index>;
<https://publicadministration.un.org/egovkb/en-us/About/Overview/-E-Government-Development-Index>

The second indicator of electronic document flow is the UN Global E-Government Development Index (EGDI). In addition to assessing the website development patterns in a country, the EGDI considers access characteristics, such as the infrastructure and educational levels, to reflect how a country is using information technologies to promote access and inclusion of its people. The EGDI is a composite measure of three dimensions of e-government: provision of online services (Online Services Index, OSI), development status of telecommunication infrastructure (Telecommunication Infrastructure Index, TII), and inherent human capital (Human Capital Index, HCI).

The values of the EGDI confirm the pattern observed in the case of the EPI. While in 2010 its respective values for Poland and Ukraine were approximately the same (0.5582 vs 0.5181), a decade later the situation in Poland improved considerably: the index risen to 0.7986, but at the same time the country dropped from the 45th place in 2010 to the 24th in 2020. As for Ukraine, because of political instability and Russia's military aggression, the evident improvement from 0.5181 in 2010 to 0.7119 in 2019 was not big enough to secure a better position in the ranking – the country actually dropped from 54th to 69th place.

In addition to having an efficient system of e-participation and e-government, which can have an impact on respondent participation in statistical surveys, another group of indicators is connected with the development of a competitive national economy and the quality of life.

The first indicator in this group is the Fragile States Index, which is based on a Conflict Assessment System Tool (CAST) developed by the Fund for Peace (FFP) nearly a quarter of a century ago to assess “vulnerabilities which contribute to the risk of state fragility”²⁶. The CAST framework was originally developed to measure these vulnerabilities and assess how they might affect projects in the industry, and continues to be widely used by policy makers, field practitioners and local community networks. An unstable situation in a state can have serious consequences not only for that state and its population, but also for its neighbours and other countries elsewhere in the world. Internal conflicts, humanitarian and political crises can arise from ethnic tensions; some turn into civil wars; others take the form of revolutions, and lead to complex humanitarian emergencies.

The Fragile States Index (FSI) is “is a critical tool in highlighting not only the normal pressures that all states experience, but also in identifying when those pressures are outweighing a states' capacity to manage those pressures”. The FSI is based on 12 indicators of the CAST framework, which are grouped into 4 categories²⁷: Cohesion Indicators (C1 – Security apparatus, C2 – Fractional elites, C3 – Group grievance); Economic Indicators (E1 – Economic decline, E2 – Uneven economic development,

²⁶ <https://fragilestatesindex.org/methodology/>

²⁷ <https://fragilestatesindex.org/indicators/>

E3 – Flight of people and brain drain); Political Indicators: (P1 – Legitimacy of the state, P2 – Public services, P3 – Human rights and the rule of law) and Social and Interdisciplinary Indicators (S1 – Demographic pressure, S2 – Refugees and IDPs, X1 – External intervention). Unlike the previous indices, a higher value indicates a more fragile state, with a more unstable economy.

In terms of the FSI, Ukraine's situation deteriorated from 69.7 in 2009 to 91.0 in 2021, which is reflected by the higher position in the ranking of fragile states: from 110th to 69th place, indicating high instability and the presence of conflicts in society. This is the result of two political revolutions in 2008 and 2014, as well as Russia's military aggression followed by the annexation of parts of the Ukrainian territory. The situation of Poland has been considerably more stable, as evidenced by the decline in the ranking from 49.6 (142nd place) in 2009 to 43.1 in 2021 (147th place) (Figure 2).

The second indicator of economic development is the Global Innovation Index (GII), which tracks the latest global innovation trends. Every year, it evaluates the efficiency and innovativeness of world economies. It also highlights indicator strengths and weaknesses of each country to give a more detailed description of its innovation activities. Currently, the overall GII ranking is based on 81 indicators grouped into two sub-indices: Innovation Input Sub-Index, consisting of 5 pillars (including measures of political environment, education, infrastructure and knowledge creation) and Innovation Output Sub-Index, consisting of two pillars²⁸.

As can be seen in Figure 2, the values of the GII for Poland are always slightly better than for Ukraine. In 2010, when the measurement started, the index for both countries was very low: 3.06 for Ukraine and 3.28 for Poland. But the next year, it jumped to 35.01 for Ukraine, and 38.02 for Poland. Over the next decade, there was little improvement with both countries reaching the highest value in 2018: 38.52 for Ukraine and 41.7 for Poland. As a result of the Covid-19 pandemic and political instability, the GII for Ukraine decreased to 35.6 in 2021. It should be noted that despite a relatively small change in the index value, Ukraine dropped in the world ranking from 60th place in 2011 to 49th place in 2021. In the same period, Poland rose from 43rd to 40th place, also registering a fall in the index value to 39.9.

The third indicator in this group, the Economic Complexity Index (ECI), is a “measure of an economy's capacity, which can be inferred from data connecting locations to the activities that are present in them. It has been shown to predict important macroeconomic outcome, including economic growth (...) [It is calculated using] the Product Complexity Index, (PCI), which is a measure of the complexity required to produce a product or engage in an economic activity and is correlated with the spatial concentration of economic activities”²⁹.

²⁸ <https://www.globalinnovationindex.org/about-gii#framework>

²⁹ <https://oec.world/en/resources/methods#eci-intuitively>

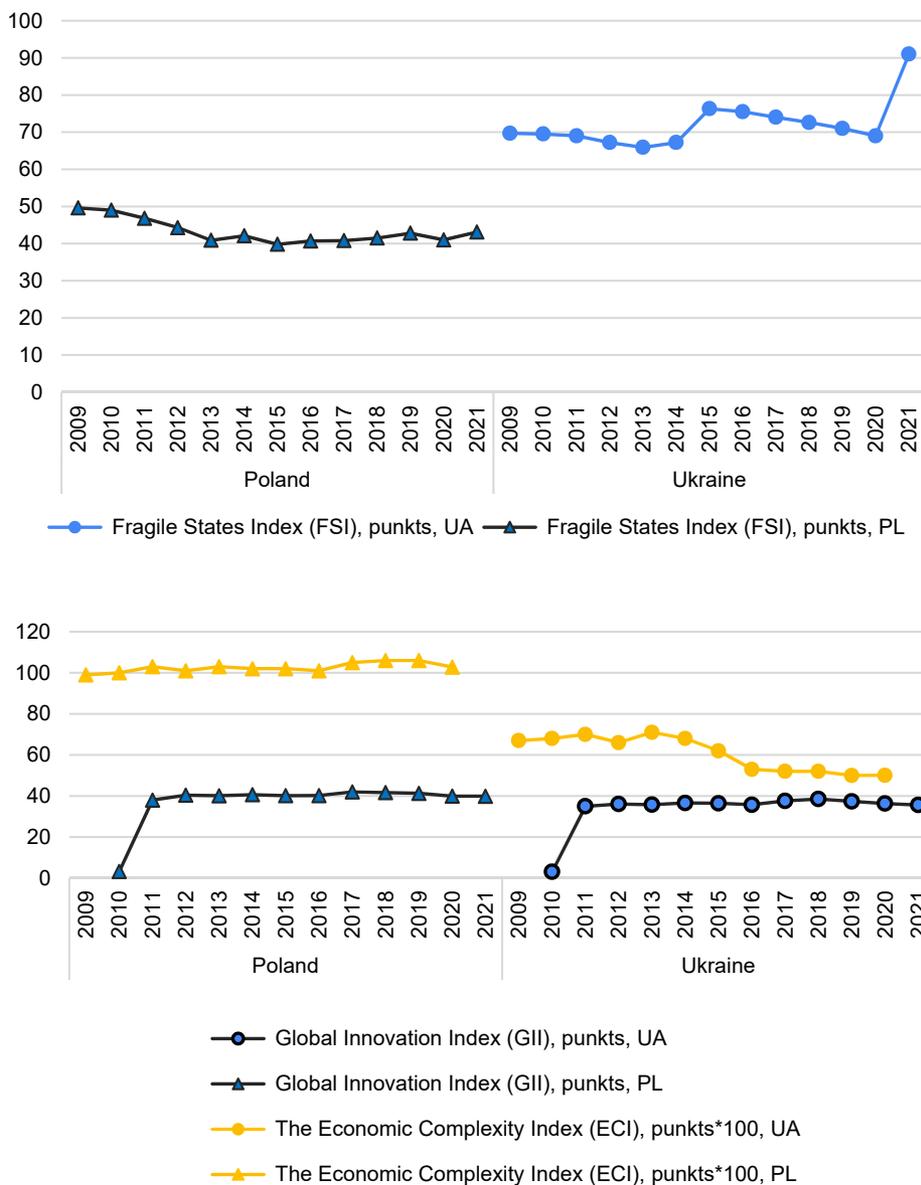


Figure 2. A comparison of indicators of sustainable economic development in Poland and Ukraine, 2009–2021³⁰

Source: based on data published on the official websites listed in the footnotes³¹.

³⁰ The available data series for the ECI does not include 2021.

³¹ <https://fragilestatesindex.org/>; <https://www.globalinnovationindex.org/Home>; <https://oec.world/en/rankings/eci/hs6/hs96?tab=table>

As shown in Figure 2, for Poland the ECI increased from 0.99 in 2009 to 1.028 in 2020, that is, by 0.039 points, with little effect on the country’s position in the world ranking (from 23rd in 2009 to 24th in 2020). In same period the value of the index for Ukraine decreased from 0.67 to 0.50, which caused a fall in the ranking from 34th to 41st place.

The last group of indices in Table 1 includes two social indicators: The Human Development Index (HDI) and Social Progress Index (SPI). The HDI is the most widely used composite measure of average achievement in three dimensions of human development: a long and healthy life, access to education and a decent standard of living. It is a standard tool for general comparisons of the standard of living of different countries and regions and is published as annually part of the UN development program.

As can be seen in Figure 3, both Poland and Ukraine registered a slight increase in the value of the HDI between 2009 and 2019: it rose from 0.834 to 0.88 for Poland (+0.046), but the country’s position in the world ranking (35th) remained unchanged. In the case of Ukraine, despite a bigger rise from 0.749 to 0.779 (+0.03), the country actually dropped 2 places in the ranking, from 72nd to 74th place.

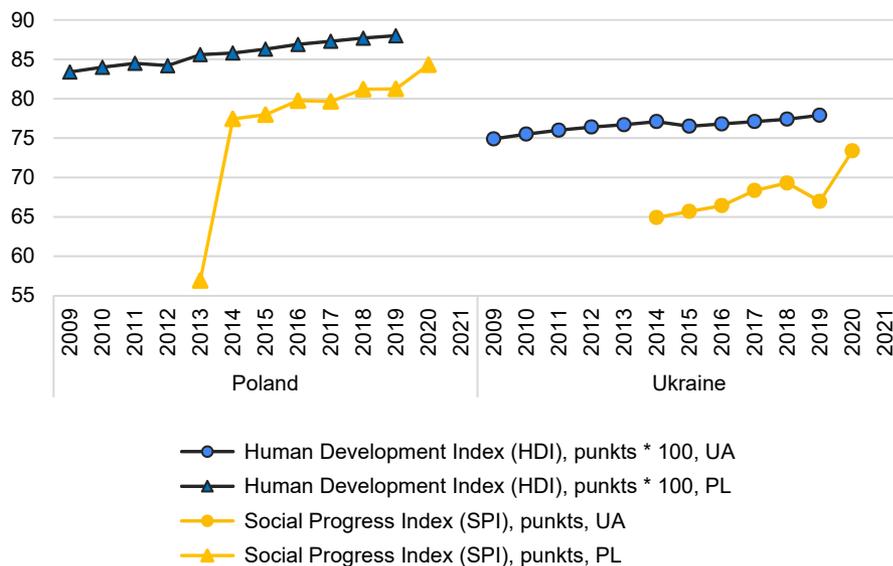


Figure 3. A comparison of social indicators for Poland and Ukraine, 2009–2020³²

Source: based on data published on the official websites listed in the footnotes³³.

³² The available data series for the HDI does not include 2020 for Poland and Ukraine; for the SPI does not include 2009–2012 for Poland and 2009–2013 for Ukraine.

³³ <https://ourworldindata.org/human-development-index>; <https://www.socialprogress.org/>

The second indicator in this category is the Social Progress Index (SPI), published by Social Progress Imperative a US-based nonprofit. SPI measures how well countries meet the social and environmental needs of their citizens. It currently uses 60 indicators to measure the social performance of 169 countries³⁴. The indicators are grouped into 12 components, which represent three main dimensions of social progress: basic human needs, foundations of well-being and opportunities.

As in the case of the previous indicators, the situation of Poland in terms of the SPI was better than that of Ukraine. Between 2013, when the index was launched, and 2020, the index for Poland rose from 56.92 to 84.32, (+27.4), or almost 1.5 times. It makes no sense to consider the position in the ranking, because the list of participating countries has changed significantly over the years. As for Ukraine, which was included in the ranking in 2014, the initial value of the index was 64.91, which grew to 73.38 in 2020, that is by 13%.

In summary, not only were values of the indices for Poland higher throughout the reference period than those for Ukraine, but their rate of growth was also greater in most cases. The subsequent parts of the study focus on the factors that are directly related to respondent participation in statistical surveys.

4. Basic facts about the latest census rounds in Poland and in Ukraine

Many countries, including Great Britain, Bulgaria, Hungary, Greece, Italy, Lithuania, Ireland, Poland, Portugal, Estonia, Romania, Czech Republic used to conduct traditional censuses using paper forms and direct interviews. In recent years, NSIs have been increasingly relying on information from administrative registers. The latest censuses in Austria, Denmark, Sweden, Finland and Norway were based entirely on data from state registers; Belgium, Spain, Slovenia, Luxembourg and Latvia combined register data with conventional methods.

Since joining the EU in 2004, Poland has conducted two censuses – in 2011 and 2021. After 2011, Statistics Poland decided to abandon the use of paper forms in favour of the CAPI mode, which contributed to a significant reduction of census costs. The cost of a Ukrainian census in 2023 was estimated to be about USD 243 million USD in September 2021³⁵. In comparison, the cost of the 2021 census in Poland, where the number of respondents is comparable to that in Ukraine, was just a third of that amount (about USD 80 million). Also, a lot has been done over the years to modernize the IT infrastructure supporting the collection and processing of statistical information in all departments of Statistics Poland. For example, during the last census data were

³⁴ 2022 Social Progress Index Executive Summary

³⁵ <https://forbes.ua/news/vtroe-dorozhe-chem-v-polshepochemu-perepis-naseleniya-v-ukraine-stoit-73-mlrd-grn-i-pri-chem-zdes-apple-21092021-2461>

collected by the CAWI method, i.e. using a respondent-friendly online form, which was also accessible via a smartphone app. In addition, the census was preceded and accompanied by a nationwide advertising campaign designed to boost respondent participation in self-enumeration: census ads were visible in public transport, on television, on billboards, in hospitals, schools, etc. Much of the information was obtained from administrative registers even before the start of the census. All these measures contributed to a significant reduction in the census budget and made it possible to conduct it and process the data in a timely manner.

The 2001 census in Ukraine was conducted in a traditional way, using paper forms with a questionnaire containing only 19 questions. In the trial census of 2019, in addition to direct interviews, respondents could provide data via an online form, and information from state registers was also used. For the purpose of the trial census in 2019 and the planned census in 2023, the Ukrainian government approved a questionnaire containing 50 questions (Table 2). The Polish census questionnaire included more questions about gender equality in the family, religion, the use of energy-saving technologies and questions about family connections and health status.

Table 2. The number of questions in different categories of the census questionnaire used in Poland and Ukraine

Main categories of census questions	Poland, 2021	Ukraine, 2019
demographic characteristics (age, gender, place of birth, etc.)	7	4
ethnic origin, language, religion, citizenship	9	5
education	1	4
employment	14	4
migration activity	7	8
living conditions	26	24
family connections	5	-
health characteristics, disability status	4	1
<i>Total</i>	73	50

Source: based on data published by Statistics Poland³⁶ and State Statistics Service of Ukraine³⁷.

³⁶ https://spis.gov.pl/wp-content/uploads/2021/03/NSP2021_Wytyczne-do-samospisu_20210311_jezyk-polski.pdf

³⁷ <http://www.ukrcensus.gov.ua/>

The budget of the 2001 census amounted to UAH 194.2 million (USD 36.1 million). By the start of 2022, UAH 416 million (USD 14.9 million USD) had already been allocated for the preparation of the census in 2023. According to the forecast of the National Academy of Sciences of Ukraine, the total cost of the 2023 census is expected to be about UAH 6 billion (about USD 214.4 million at the exchange rate from the beginning of 2022)³⁸.

5. Respondent participation in Ukrainian census, 2019

In order to conduct the trial census in 2019 and the actual census in 2023, it was necessary to adopt new legislation in accordance with new standards and the country's pro-European development. In July 2022, amendments to certain laws of Ukraine regarding state statistical activities were approved. The new legislation amends the laws on state statistics and the law on the all-Ukrainian population census. Some of the key provisions include:

- the requirement of conducting a general population census at least once every 10 years;
- the use of information from administrative registers, in compliance with the requirements of Ukrainian legislation regarding personal data protection;
- the possibility of completing the census form online;
- new requirements for temporary census personnel to guarantee confidentiality of personal information;
- protection of respondents' rights.

The legal changes were made considering international agreements and obligations of Ukraine and are based on the fundamental principles of the UN and EU regarding official statistics, in particular the European Statistics Code of Practice, with the aim of harmonizing the Ukrainian statistical system with European norms and standards.

The trial census held in December of 2019 consisted of the following stages:

- 1) respondents filled out the questionnaire on their own (in response to a census letter) using a special online form;
- 2) those who had not responded online were interviewed by census enumerators equipped with tablets;
- 3) enumerators, together with instructor-controllers, conducted a selective control round of dwellings in order to check the quality of the work of the enumerators and coverage of the trial census.

³⁸ <https://fakty.com.ua/ua/ukraine/suspilstvo/20211130-perepys-naselennya-ukrayiny-u-2023-roczy-yak-organizovuvatymut-ta-skilky-koshtuvatyme/>

According to the State Statistics Service of Ukraine, there were 14882 thousand households in Ukraine. This means that the trial census covered only 0.1% of the country's households. Actually, during the planning stages, the coverage goals in terms of the number of respondents were not set. The main goal was to check the capacity of statistical services, the quality of tablets used by enumerators, to identify weaknesses in the questionnaire and develop proposals for improving the implementation of the survey on the places.

During the trial census in Ukraine, the level of population participation was quite high and amounted to 11.9 out of 15.7 thousand households, or 75.8%. However, among them, only 0.1 thousand households (0.6%) took part in the observation in an online format, without visiting census points, but using a special application with an electronic form in their gadgets. Information about the settings of this application was not widespread enough among young and middle-aged people. At the same time, information from administrative registers was not used for technical reasons. The budget of the trial census was 1.4 billion UAH or 54.3 million USD. In the next part of the study, the authors set the task of selecting such factors that can further contribute to increasing the level of respondents' participation in the Ukrainian national census, a special role in this case belongs to the possibility of online participation based on the use of modern digital technologies.

6. Factor analysis of international indicators for Poland and Ukraine using Principal Components Analysis

Before analyzing which indicators to select as the main components of the measure of respondent participation during in statistical surveys, it was clear that for some indices data in the time series were missing. In particular, the EPFI and EGDI are calculated by the World Economic Forum once every two years; the GII for both countries only became available from 2010, the ECI data for 2021 are not available yet. There were also no HDI data for 2020-2021 at the time when this article was prepared. The SPI index was launched in 2014 and for 2021 were also unavailable at the time when this article was prepared. For this reason, missing data were imputed based using a regression equation of the general trend and checking its reliability by calculating the coefficient of determination. The years with missing data and imputed values used in further analysis are presented in Table 3.

The original data series with values imputed for missing years were used in Principal Components Analysis to select factors that have the biggest effect on respondent participation in statistical surveys in Poland and Ukraine. The analysis was performed using the SPSS software. Figure 4 shows the correlation matrix for the selection of factors using PCA. The first column in each table contains values for 2009-

2021. The variable numbers in Figures 4 and 5 should be reduced by one to denote the index numbers shown in Table 3.

Table 3. Data imputation for missing values of indices for Poland and Ukraine, 2009–2021

Index	Years with missing data	Poland		Ukraine	
		Regression equation, coefficient of determination	Imputed value	Regression equation, coefficient of determination	Imputed value
1.EPFI	2009	$y=0.1489\exp(0.1745x)$ $R^2=0.9240$	0.1773	$y=0.1511\exp(0.1527x)$ $R^2=0.8844$	0.1760
	2011		0.2513		0.2389
	2013		0.3563		0.3242
	2015		0.5051		0.4400
	2017		0.7161		0.5972
	2019		1.0151		0.8105
	2021		1.4391		1.1000
2. EGDI	2009	$y=0.0238x+0.4873$ $R^2=0.9753$	0.5111	$y=0.0175x+0.4644$ $R^2=0.8798$	0.4819
	2011		0.5587		0.5169
	2013		0.6063		0.5519
	2015		0.6539		0.5869
	2017		0.7015		0.6219
	2019		0.7491		0.6569
	2021		0.7967		0.6919
3. FSI	-	-	-	-	-
4. GII	2009	$y=-0.548x^2+8.6568x+10.719$; $R^2=0.5782$	10.72	$y=-0.4891x^2+7.739x+9.8714$; $R^2=0.5727$	9.87
5. ECI(%)	2021	$y=0.4573x+99.594$; $R^2=0.5459$	105.5	$y=-2.1115x+74.483$; $R^2=0.7909$	47.0
6. HDI(%)	2020	$y=0.4755x+82.938$ $R^2=0.9771$	88.6	$y=-1.1609x+75.425$ $R^2=0.6402$	77.4
	2021		89.1		77.5
7. SPI	2009	$y=-0.7574x^2+9.4411x+54.146$ $R^2=0.7597$	19.01	$y=0.1x^3-1.3107x^2+4.9871x+60.687$ $R^2=0.7848$	12.09
	2010		32.23		30.69
	2011		43.95		44.51
	2012		54.15		54.27
	2013		56.92		60.69
	2021		77.77		78.14

Sources: authors' calculations.

As can be seen from the correlation matrices, for both countries, there is a strong correlation between the first two indices, classified as indicators of electronic document circulation, namely the E-Participation Framework Index (EPFI) and the UN Global E-Government Development Index (EGDI). In the case of Poland, a rather strong correlation can also be observed in the case of the last two indices included in the group of social indicators, namely the Human Development Index (HDI) and the Social Progress Index (SPI).

Poland

Correlation Matrix

		VAR00002	VAR00003	VAR00004	VAR00005	VAR00006	VAR00007	VAR00008
Correlation	VAR00002	1,000	,933	-,523	,478	,713	,954	,756
	VAR00003	,933	1,000	-,647	,570	,771	,987	,851
	VAR00004	-,523	-,647	1,000	-,837	-,520	-,700	-,901
	VAR00005	,478	,570	-,837	1,000	,647	,620	,813
	VAR00006	,713	,771	-,520	,647	1,000	,779	,679
	VAR00007	,954	,987	-,700	,620	,779	1,000	,874
	VAR00008	,756	,851	-,901	,813	,679	,874	1,000

Ukraine

Correlation Matrix

		VAR00002	VAR00003	VAR00004	VAR00005	VAR00006	VAR00007	VAR00008
Correlation	VAR00002	1,000	,879	,704	,464	-,919	,766	,753
	VAR00003	,879	1,000	,537	,529	-,904	,754	,772
	VAR00004	,704	,537	1,000	,165	-,627	,392	,411
	VAR00005	,464	,529	,165	1,000	-,414	,805	,852
	VAR00006	-,919	-,904	-,627	-,414	1,000	-,625	-,657
	VAR00007	,766	,754	,392	,805	-,625	1,000	,970
	VAR00008	,753	,772	,411	,852	-,657	,970	1,000

Figure 4. Correlation matrices of the factor analysis based on PCA for Poland and Ukraine

Sources: calculated in the SPSS software.

The total variance distribution table is presented in Figure 5. In the case of Poland, only one common component is proposed, which accounts for 78.157% of the total variance of the investigated indices. In the case of Ukraine, the PCA method revealed

two components that explain 89.186% of the total variance. Thus, the residual variance of the influence of the other indices is 21.843% for Poland, and 10.814% for Ukraine.

Poland

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,471	78,157	78,157	5,471	78,157	78,157
2	,904	12,911	91,069			
3	,413	5,901	96,970			
4	,119	1,701	98,672			
5	,051	,730	99,402			
6	,040	,566	99,968			
7	,002	,032	100,000			

Extraction Method: Principal Component Analysis.

Ukraine

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,052	72,171	72,171	5,052	72,171	72,171
2	1,191	17,014	89,186	1,191	17,014	89,186
3	,433	6,183	95,369			
4	,177	2,527	97,896			
5	,095	1,355	99,251			
6	,037	,527	99,778			
7	,016	,222	100,000			

Extraction Method: Principal Component Analysis.

Figure 5. Distribution of the total variance into main components for Poland and Ukraine

Sources: calculated in the SPSS software.

Having evaluated the component matrix included in Figure 6, the indices to be included in the main component were provided. In the case of Poland, almost all the selected indices were assigned to the main component, which is why only one group was created for all indices. The only exception is the fourth indicator, the Global Innovation Index (GII), for which the total correlation coefficient is 0.794.

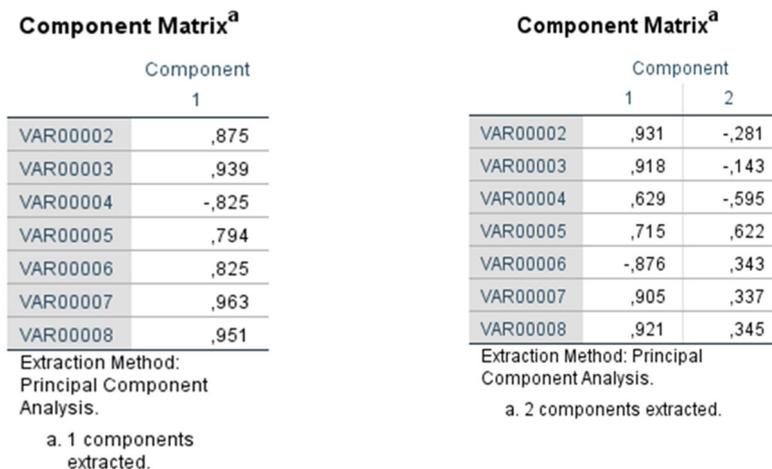


Figure 6. Matrices of the main components for Poland and Ukraine

Sources: *calculated in the SPSS software.*

In the case of Ukraine, the software recommends separating two main components. The first main component includes the first, seventh, second and sixth indices: the E-Participation Framework Index (EPFI), the Social Progress Index (SPI), the UN Global E-Government Development Index (EGDI) and the Human Development Index (HDI), their total correlation coefficients are 0.931, 0.921, 0.918 and 0.905, respectively.

It can thus be concluded that the best way of stimulating respondent participation in statistical surveys and censuses is to improve electronic document circulation, which is measured by the first two indices, namely the E-Participation Framework Index and the UN Global E-Government Development Index. The analysis has also shown that the two social indicators are strongly correlated, which could have an effect on respondent participation. Poland’s experience in organizing and conducting the census suggests that the introduction of digital technologies in the public administration sector plays a significant role. After all, the indicators of electronic document circulation were included in the group of main components in the analysis of international indices, in the case of both countries. The degree of citizens’ e-participation in various events organized by the state depends on the volume and quality of online services, the level of telecommunication infrastructure and the availability of online services for citizens (Figure 7).

As demonstrated by the statistical analysis above, the various social indicators are also important in this context: the quality of life, access to education, medical services, indicators of life expectancy and health, income and expenses of households. It is obvious that the socio-humanitarian component, together with the return of peace, will encourage Ukrainian migrants to return home.

Given that about 30% of the population in most regions live in rural areas, it is important to ensure that the census can be conducted in remote regions, where enumerators could find it difficult to visit respondents (pensioners, disabled people, people with special needs). In such cases, cooperation with representatives of united territorial communities is necessary to make sure that the census can be conducted by employing workers from local communities or social services instead of professional enumerators.

Another important measure is nationwide census promotion in the mass media. It is important to create a positive attitude to the participation in the census and to emphasize its importance for the country's European aspirations. It will also be necessary to adopt uniform classifiers and terminology in accordance with EU standards when processing collected data. For this reason, European statistical standards should be promoted in Ukrainian statistics.

To encourage the use of smartphones, the mobile app with the census form should be adjusted to run on phones with different operating systems. Such an app is likely to appeal to young people and middle-aged people who would not need to visit the territorial district at their place of residence. It could also be used by those who have temporarily gone abroad or migrated in connection with hostility actions, but they are citizens of the state, who should participate in the census.

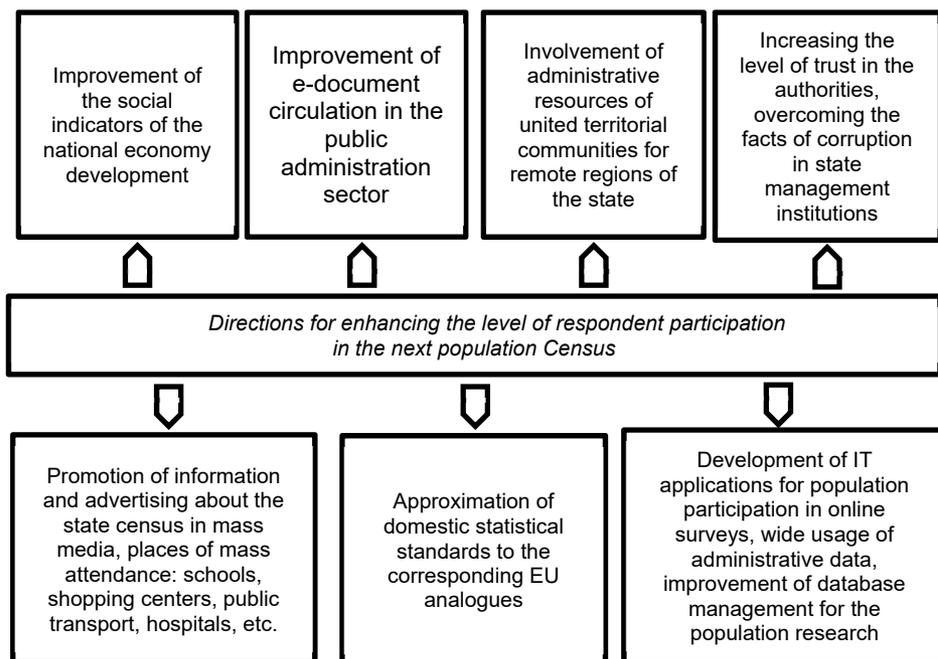


Figure 7. Directions for improving the level of respondent participation in official statistical surveys

Sources: results of performed authors' research.

7. Conclusions

The authors have analyzed a number of international indices that are relevant for respondent participation in statistical surveys, and particularly in the context of the next population census. Three groups of indices were identified: indicators of electronic document circulation, indicators of sustainable economic development, and social indicators. Considering each of these indices, the situation of Poland is significantly better compared to that of Ukraine, where the last national census was conducted only once in 2001.

A comparative analysis of census questionnaires used in Poland in 2021 and in Ukraine in 2019 revealed that the Polish census form was not only longer (73 vs 50 questions), but also included some aspects that were absent from the Ukrainian questionnaire, e.g. a section about family ties in the household.

As regards respondent participation, a very low percentage of young respondents self-enumerated online, probably because of insufficient information about how to use the web application.

The factor analysis of the indices for Poland and Ukraine was carried out using Principal Component Analysis. The matrix analysis of the main components for Poland showed that almost all the selected indices had an impact on the successful implementation of the National Census. In the case of Ukraine, the main components include the E-Participation Framework Index (EPFI), the Social Progress Index (SPI), the UN Global E-Government Development Index (EGDI) and the Human Development Index (HDI).

The authors have proposed a number of recommendations regarding the main areas that should be improved to ensure a successful administration of the next census in Ukraine. The most important of these measures include the digitization of the public administration sector, the use of smartphone apps and census promotion in the mass media.

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