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REGIONAL DEVELOPMENT LEVEL BASED ON PRINCIPAL COMPONENT ANALYSIS: CASE STUDY UZBEKISTAN

Abstract: This study aims to define the interstate disparities in provisions of level of socio-economic development in Uzbekistan, compare regions' level of development, and identify backward parts units of Uzbekistan.

For this study, the regional administrative division has been taken as the unit of analysis. Fourteen regional administrative divisions of Uzbekistan have been included in the analysis. The present investigation is exclusively obtained through the use of multivariate statistical methods—factor and cluster analysis, and based on secondary data sources. The data is collected from database of State committee of the Republic of Uzbekistan on statistics. Multivariate techniques were successful in identifying the main axes of socio-economic characterization and the regions of the observed counties with different degrees of development.

The results show that wide disparities in the level of socioeconomic development exist among different regions of Uzbekistan. The results show that in low development regions of Uzbekistan the level of industrial development does not significantly influence the agricultural and overall socioeconomic development while agricultural development influences overall socio-economic development. The study suggests that low developed regions require improvement in most of the indicators for enhancing their levels of overall socio-economic development.

By means of the statistical analysis of socioeconomic indicators and empiric study, 6 regions were found to belong into a group of regions with low level of socioeconomic development: Republic of Karakalpakstan, Surkhandarya, Kashkadarya, Namangan, Jizzakh and Syrdarya. Even though the absolute elimination of regional disparities is not possible, if they continue to be ignored, they could undermine the socioeconomic and political situation in the country.

Key words: socioeconomic development; regional disparities; Principal component analysis (PCA), Composite Index.

Language: English

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Introduction

At the present time, achieving sustainable development of regions through effective and optimal utilization of the existing potential of social and economic development of the regions, cities and towns, as well as ensuring the rational use of all available resources is one of the pressing issues.

It's a fact that differences between development of regions and close areas are inevitable. Disproportions in development of regional areas, appeared as result of different factors:

- the difference in the level of knowledge and talent of human factor;
- unequal usage of technical-technological progress;
- diversity of natural resources, availability of financial capital;
- unequal level of investment;
- thenature of the existing economy structure and etc.

In the Strategy Uzbekistan's Five-Area Development Strategy for 2017-2021 (defined by the Decree of the President of the Republic of Uzbekistan

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"On Uzbekistan's Development Strategy ")focuses on **Integrated and balanced socio-economic development of provinces, districts and cities, optimum and efficient use of their potential** as one of the priorities. In addition, a decree "On priority measures to ensure the accelerated socio-economic development of the regions"

(signed by President of the Republic of Uzbekistan Sh. M. Mirziyoyev on August 8, 2017). The document was adopted to analyzes the socio-economic development of the regions, radically improve the forms and methods of organizing work and the quality and living standards of the population, and other important tasks. A major objective of the development programmes lunched in Uzbekistan is to bring the balanced regional development. In order to achieve the goal, the economic planning in the country has traditionally been focused upon the need to provide special support to the disadvantaged areas. Although the country remains on course to achieve its socio-economic development goals, related challenges such as inequality and rural-urban and regional disparities persist.

Realizing the seriousness and importance of the problem of regional socio-economic disparities, the study measures and compares the levels of socio-economic development of different regional administrative division of Uzbekistan (i.e., 12 [regions](#) (Andijan, Bukhara, Jizzakh, Kashkadarya, Navoi, Namangan, Samarkand, Surkhandarya, Syrdarya, Tashkent, Fergana, Khorezm), one [autonomous republic](#) (Republic of Karakalpakstan) and one [independent city](#)-the capital of Uzbekistan(Tashkent

city)) based on the levels of their development. It is hoped that the results of the study would be useful for regional planning in [Uzbekistan](#).

METHODOLOGY-MATERIALS AND METHODS OF ANALYSIS

The present investigation is exclusively based on secondary data sources. The data is extracted from the database of the State committee of Uzbekistan on statistics. For this study, the regional administrative division has been taken as the unit of analysis. Fourteen regional administrative divisions of Uzbekistan have been included in the analysis.

Socio-economic development is a multi-dimensional process and it cannot be fully evaluated by a single indicator. Moreover, a number of indicators when analyzed individually do not provide an integrated and easily comprehensible picture of the reality. It necessitates for construction of a composite index of socio-economic development based upon optimal combination of different developmental indicators. There are several methods (e.g., principal component analysis, multiple factor analysis, aggregation method, monetary index, ratio index and ranking method) for combining the effect of various indicators. While one cannot deny usefulness of these methods but most of these methods are having their own limitations.

The following table outlines the advantages and disadvantages of most widely used methods of analysis of developmental level analysis.

Table 1. Methods of analysis of developmental level analysis

Methods	Advantages	Disadvantages
Principal Component Analysis	Since this method measures variances, it is determined by the scaling of the variables, and really only makes sense if the variables are on comparable scales.	The variable indicators must be linearly related. When non-linearity is present, the component analysis is not appropriate.
Multiple Factor Analysis	The 'factor loading' can be used as weights for combining the effect of various socio-economic indicators. This method avoids, to some extent, the arbitrariness in choosing weights.	It does not serve the purpose to arrive at a meaningful and comparable composite index of development when the indicators are presented in different scale of measurements.
Monetary Index	Monetary values of developmental indicators may change from place to place and from time to time. In this way, this method affects the composite index adversely.	All the indicators cannot be converted into monetary values. Indicators like urbanization, population density, gender ratio, education level, etc. cannot be converted into monetary values.
Aggregation Method	Simple way of calculation	The composite index of development obtained by use of this method depends on the unit in which the data are recorded.

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Ranking Method	Sum of ranks for all the socio-economic indicators of the unit is taken as the composite index of development.	Ranking procedure does not take into account the magnitude of differences between indicators and units.
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Source: Author's research.

A survey of literature on measurement of the level of socio-economic development indicates that the majority of studies has been used principal component analysis approach.

Principal component analysis (PCA) is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components (Davis, 1986). The number of principal components is less than or equal to the number of original variables. This transformation is defined in such a way that the first principal component has the largest possible variance (that is, accounts for as much of the variability in the data as possible), and each succeeding component in turn has the highest variance possible under the constraint that it be orthogonal to the preceding components (Cattel, 1966). PCA was invented in 1909 by Karl Pearson and H. Hotelling (1993) has been advanced this method. Now it is mostly used as a tool in exploratory data analysis and formatting predictive models.

According to the principal component features and the component index value we use this formula to calculate composite score:

Composite Z-score = principal components variance contribution rate
*principal component coefficients

Assign each of the Z-Scores to a score in the range 0 to 1 by mapping to the cumulative normal distribution.

The inter-district variations are grouped into four categories of less developed region, moderate developed region, developed region and highly developed region on the basis of natural break (Jenks) method.

Statistical data processing was conducted using SPSS software.

RESULTS AND DISCUSSIONS

1. Preliminary data analysis using PCA

Principal components analysis (PCA) is justified by data set dimension (12 characteristics for the 14 regional administrative divisions), all the 12 variables being quantitative continuous. Using PCA the dimensionality of data is reduced by creating principal components from the original variables in the context of this study, principal components analysis is used in order to explore the original data set and to select the appropriate variables used to identify a regional profile of economic development in Uzbekistan.

In order to verify the adequacy of data for a factorial analysis, the Bartlett's test of sphericity (to test the null hypothesis that the variables in the correlation matrix of the population are uncorrelated), and the indicator MSA (Measure of Sampling Adequacy) of Kaiser-Meyer-Olkin (to evaluate in which degree each variable may be predicted by all the other variables) were used. The results obtained by data processing with SPSS are presented in Table 1.

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.710
Bartlett's Test of Sphericity	Approx. Chi-Square
	df
	Sig.
	196.696
	78
	0.000

Source: Author's calculations.

The significance level associated to Bartlett's test of sphericity, Sig 0.000, is smaller than 0.05 (conventional value), which means the null hypothesis of variables' uncorrelation is rejected.

Therefore one can conclude that the considered variables are adequate for a PCA. The value of the indicator MSA of KMO (0.71), greater than 0.5, also indicate the suitability of the considered data for factor analysis (Richarme, 2001).

Table 3 represented the varimax rotated factor structure and majority of the variables under study have been appropriately focused on the structure exposed by this factor matrix. The socio-economic communalities value varied from 0.55 for the percentage of household by availability of gas to 0.92 for the services per capita. Others remaining social and economic indicators are suitably represented in the form of two extracted factors. Two factors meet not only the eigenvalue criterion, but also the variance

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proportion criterion. In social sciences, the lowest limit of acceptability is 60 percent of variance accounted by obtained factors (Hair, Anderson and

Tahtam,1987). This solution accounts for 79 percent of total variance.

Table 3. Rotated Component Matrix

	Component		Communalities
	F ₁	F ₂	
Poverty rate,%	-0.38	-0.64	0.55
Industrial products per capita(in thousand soums)	0.89	0.02	0.79
Total per capita income(in thousand soums)	0.91	0.28	0.90
The number of enterprises (per 1.000 people)	0.79	0.49	0.86
Unemploymentrate, %	-0.91	-0.31	0.92
Percentage of household by availability of gas	0.72	0.18	0.55
Number of Students per Teacher with higher education in secondary school	-0.07	0.91	0.84
Percentage of household having vehicles	0.52	0.62	0.65
Persons employed in agriculture, hunting and fisheries as percentage of total	-0.54	-0.68	0.75
Persons employed in trade, transportation and storage, housing and food services as percentage of total employment	0.24	0.87	0.82
The morbidity of the population by main classes of diseases(per 1000 population)	0.65	0.60	0.79
Services per capita(in thousand soums)	0.70	0.66	0.92
Export per capita(in USD dollars)	0.74	0.57	0.88
Eigenvalue	5.80	4.42	

Source: Database of the State committee of Uzbekistan on statistics, author's calculations.

The first factor has a high positive factor loading on variables: Industrial products per capita, total per capita income, the number of enterprises per 1,000 population, percentage of household by availability of gas, services per capita, export per capita. This means that it positively correlates to the respective characteristics of local government units. The first factor has a high negative factor loading on "Unemployment rate".

The second factor has a high positive factor loading on the "Number of students per teacher with higher education in secondary school", "Persons employed in trade, transportation and storage, housing and food services as percentage of total employment", "Percentage of household having vehicles", a negative

factor loading on the "Poverty rate" and "Persons employed in agriculture, hunting and fisheries as percentage of total".

2.Regional disparities in the level of development in Uzbekistan

By using the method of the composite index (CI) the level of development in terms of socio-economic development in Uzbekistan has been evaluated. The relation between the value of composite score and the level of development is direct for instance regional administrative divisions. with the greater value of composite score have the advanced level of development and the state having lesser value recognize the lower level of improvement.

Table 4. Composite index value matrix of socio-economic indicators

Composite Level of development	Name of Index	regional administrative divisions
0.33 -0.40 Low	Surkhandarya(0.33), Kashkadarya(0.36), Rep.of Karakalpakstan(0.38), Syrdarya(0.38), Jizzakh(0.38), Namangan(0.40).	
0.40-0.52 Moderate	Fergana(0.42), Khorezm(0.43),Samarkand(0.45), Bukhara(0.50),Andijan(0.52).	
0.52-0.64 High	Tashkent(0.60), Navoi(0.64).	
0.64-0.96Very high	Tashkent city (0.96).	

Source: Author's calculations.

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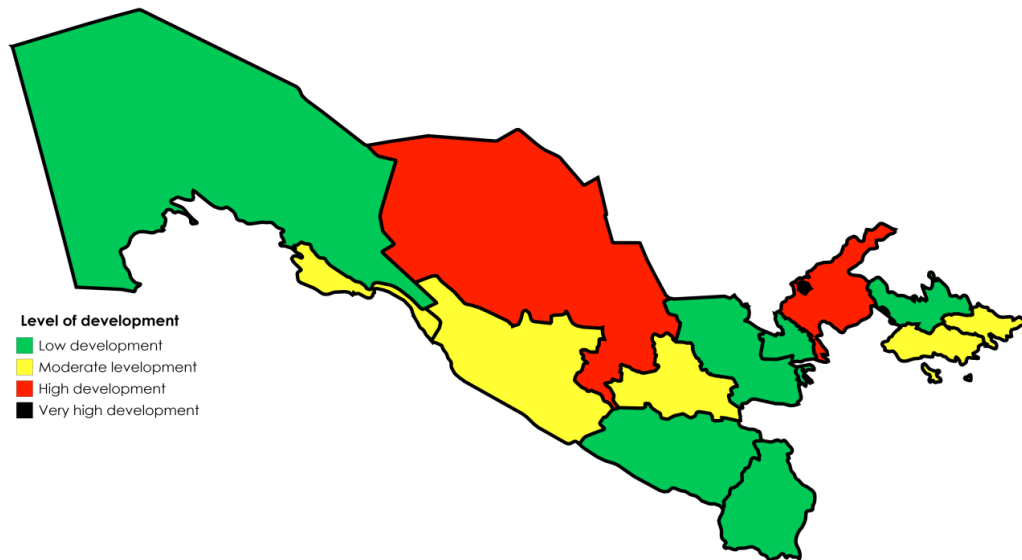


Figure 1. Level of Socio-economic Development in Uzbekistan

Very high developed Region:

Tashkent city, since the capital of the country presents very high characteristics of socio economic development compared to other administrative-territorial units. Tashkent explains mostly the main characteristics of this county, basically urban. Poverty rate, total per capita income, export per capita, industrial products per capita, services per capita, the number of enterprises per 1,000 population, percentage of household by availability of gas, percentage of household having vehicles, unemployment rate and so on is experienced very high level of development in this area. Tashkent has the highest number and the most important medical and educational centers.

High developed Region:

The region having the composite index between 0.52 and 0.64 have been included in this category. They are Tashkent and Navoi regions. An important role must play the neighboring of the Tashkent region, as it is near the capital city- Tashkent. But this influence is not as much as strong and it explains the lower socio economic development rate than Navoi region and lower rate of some socio economic indicators than other regions. With the superior circumstance in terms of industrial products per capita, high level of Export per capita, total per capita income, Services per capita, percentage of household by availability of gas, lower level of unemployment rate, number of students per teacher with higher education in secondary school, Navoi measured as developed region. However in terms of certain socio-economical factors like poverty rate, the morbidity of

the population by main classes of diseases Navoi has justified as a moderate region.

Moderate developed Region:

The underlying region of this zone is Fergana(0,42), Khorezm(0,43), Samarkand(0,45), Andijan(0,53), Bukhara(0,53). Samarkand and Fergana have a lower rate of poverty, but with low level of industrial products per capita and high level of unemployment rate have restraint the development. Khorezmis based on agricultural productivity where percentage of population employed in agriculture, hunting and fisheries is higher and total per capita income is higher even though there is low level of industrial products per capita, export per capita and the number of enterprises per 1,000 population. Other socio economic indicators like poverty rate, unemployment rate, services per capita, percentage of household by availability of gas, percentage of household having vehicle is moderate. At the same time, Andijan and Bukhara also practiced high level of total per capita income, services per capita and lower level of poverty rate. On the other hand Andijan is based on industrial and as well as agricultural activities where the number of enterprises per 1,000 population and persons employed in agriculture, hunting and fisheries as percentage of total, is very high that help in the economic development of the region. But high level of unemployment rate, morbidity of the population by main classes of diseases, number of students per teacher with higher education in secondary school are the reason behind to this moderate development.

Low developed region:

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Republic of Karakalpakstan, Surkhandarya, Kashkadarya, Namangan, Jizzakhand Syrdaryabelong to this low developed region. All the selected socio economic indicators experienced lower development in Republic of Karakalpakstan, Surkhandarya, Kashkadarya, Namanganlike percapita income, poverty rate, services per capita, unemployment rate, number of enterprises per 1,000 population etc. But Republic of Karakalpakstanhas a high percentage of household by availability of gas and lower number of students per teacher with higher education in secondary school. Syrdarya has higher level of poverty and unemployment rate, and lower level of persons employed in trade, transportation and storage, housing and food services as percentage of total employment even though there are a large number of enterprises per 1,000 population. On the other hand in Jizzakhgood indicators of socio economic development is prevailed like lower level of unemployment rate, large number of enterprises per 1,000 population, high percentage of household by availability of gas, less number of Students per Teacher with higher education in secondary school, the lowest level of morbidity of the population by main classes of diseases. But higher level of poverty rate, less industrial products per capita and export per capita are the reason behind to this low development.

CONCLUSION

In the study, we have measured the development levels of different regional administrative division of

Uzbekistan applying the composite index based upon optimum combination of selected socio-economic development indicators. The association between developments of different sectors of the economy is assessed and the regional administrative divisions are ranked precisely according to their levels of socio-economic development. The level of development is assessed overall socio-economic fields. All 14regional administrative divisions have been included in the study and classified into four development categories according to the values of the composite indices.

The results show that wide disparities in the level of socio-economic development exist among different regions of Uzbekistan. The level of development in trade and services is found to be positively and statistically significantly associated with the overall socio-economic development indicating that the growth and progress of these sectors have been going hand in hand in the country. The results show that t in low development regions of Uzbekistan the level of industrial development does not significantly influence the agricultural and overall socio-economic development while agricultural development influences overall socio-economic development. It is noticed that both industrial and agricultural development have a significant bearing on overall socio-economic development in the region. Low developed regions are poorly developed in agriculture and service as well.

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