STATISTICAL EVALUATION OF AGRICULTURAL DEVELOPMENT IN ASIAN COUNTRIES

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1. Introduction

Agricultural development is not pre-determined but it is a continuous process of improvement of crop and livestock production. It implies the availability to the maximum number of people in adequate measures the existence of agricultural and technological infrastructural facilities for enhancing the agricultural produce. Development in the farm sector requires a balanced human resource development in most of the countries. The technology absorption in agriculture which is a principal sector of economy of most of the Asian countries could be considered as a primary objective of any developmental efforts. In most of the Asian countries, agricultural developmental programmes were initiated for enhancing the productivity of various crops and thus improving the social and economic positions of the people. In most of the Asian countries, rural development depends on progress and growth of agriculture.

There are fifty countries in Asia. About 39 countries in the continent are contributing towards most of the agricultural produce. All the 39 countries covering more than 99 per cent of population of the continent are included in the study. Agricultural sector plays very important role in enhancing the level of living of people in these countries. Structural transformation is taking place in some of the countries in Asia for diverting heavy dependency on agricultural sector. These countries are making concerted efforts for promoting industrial growth along with enhancement in farm sector. These efforts have played a key role in shaping a self-reliant rural economy through creation of massive gainful employment for the rural population.

2. Developmental Indicators

Development is a multi-dimensional process. Its impact can not be captured fully by any single indicator. Moreover, a number of indicators when analyzed individually do not provide an integrated and easily comprehensible picture of reality. Hence there is a need for building up of a composite index of development based on optimum combination of various indicators.

Agriculture is expected to provide a bulk of employment to the labour force. In the improved practices of cultivation, emphasis is laid on irrigation, multiple cropping system and adoption of high yielding production techniques with creation of greater employment avenues. In a country with agrarian economy, animal resource developmental activities play an important role. These activities have varied benefits prominently providing nutrition to the people and generation of employment opportunities to both educated and un-educated youths by rearing animals and birds.

The following indicators have been used for evaluating the level of agricultural development.

1. Yield Rate of Total Cereal
2. Yield Rate of Wheat
3. Yield Rate of Rice
4. Yield Rate of Coarse grain
5. Yield Rate of Barley
6. Yield Rate of Maize
7. Yield Rate of Millet
8. Yield Rate of Sorghum
9. Yield Rate of Roots & Tuber Crops
10. Yield Rate of Potato
11. Yield Rate of Total Pulses
12. Yield Rate of Beans Dry
13. Yield Rate of Soybeans
14. Yield Rate of Groundnut in Shell
15. Yield Rate of Cotton Seed
16. Yield Rate of Tomatoes
17. Yield Rate of Chilies
18. Yield Rate of Onion Dry
19. Yield Rate of Garlic
20. Yield Rate of Grapes
21. Yield Rate of Sugarcane
22. Yield Rate of Tobacco
23. Number of Cattle Per 100 Thousand Population
24. Number of Sheep Per 100 Thousand Population
25. Number of Goats Per 100 Thousand Population
26. Number of Chickens Per 100 Thousand Population

These indicators may not form an all inclusive list but these are major interacting components of agricultural development.

3. Method of Analysis

Variables in respect of different indicators are taken from various population distributions and these are recorded in different levels of measurement. Number of indicators utilized for estimation of level of development may be different for different countries because only those crops which are grown in the country have been included in the study. The values of the variables are not quite suitable for simple addition in combined analysis. The values of indicators are transformed as follows:

Let X_{ij} be the value of j^{th} indicator of i^{th} country. (i = 1, 2…. ,n and j = 1, 2…., k)

Transform X_{ij} to Z_{ij} as

(1) $$Z_{ij} = \frac{X_{ij} - \overline{X}_j}{S_j}$$ Where $\overline{X}_j$ & S_j are = Mean and Standard deviation of j^{th} indicator.

From $[Z_{ij}]$, identify the best value of each indicator . The best value of the transformed variable for each indicator (with maximum/minimum value depending upon the direction of the impact of indicator on development) is obtained.

Let the best value for the j^{th} indicator be Z_{oj}.

For obtaining the Pattern of Development, calculate Pij as follows.

(2) $P_{ij} = (Z_{ij} - Z_{oj})^2$

Pattern of development is further standardized and a new parameter C_i and is given as

(3) $$C_i = \left[\sum_{j=1}^{k} P_{ij} / (C.V.)_j \right]^{1/2}$$

Where $(C.V.)_j$ is the coefficient of variation of the j^{th} indicator in X_{ij} .

Composite Development Index D_i is given by

(4) $D_i = C_i / C$ for $i = 1, 2, \ldots n$

Where $C = \overline{C} + 3S_{D_i}$

$\overline{C}$ = Mean of C_i

and

S_{Di} = Standard Deviation of C_i

Smaller value of D_i will indicate high level of development and higher value of D_i will indicate low level of development.

Obtain the value of the Composite Development Index for each country by utilizing the information for all indicators used. Thereafter the statistical procedures developed by Narain *et. al.* (1991) may be applied to further analyze the composite index of development. The values of composite indices are non-negative and their smaller value indicates high level of development and higher values indicate low level of development.

4. Results and Discussions

4.1 Composite Indices of Agricultural Development

The composite index of agricultural development has been calculated for different countries. The countries have been ranked on the basis of composite indices. The composite index of agricultural development along with the rank is presented in table 1 for different countries.

Table 1: Composite Index of Agricultural Development and Rank of the Country

S.No.	Name of country	Composite Index of Agricultural Development	Rank
01.	Afghanistan	0.79	33
02.	Armenia	0.67	14
03.	Azerbaijan	0.70	16
04.	Bangladesh	0.74	27
05.	Bhutan	0.84	39
06.	Cambodia	0.83	38
07.	China	0.41	1
08.	Cyprus	0.59	7
09.	Georgia	0.72	18
10.	India	0.72	20
11.	Indonesia	0.68	15
12.	Iran	0.66	13
13.	Iraq	0.75	28
14.	Israel	0.58	6
15.	Japan	0.58	5
16.	Jordan	0.65	12
17.	Kazikistan	0.81	37
18.	Korea DP Republic	0.72	22
19.	Korea Republic	0.62	8
20.	Kuwait	0.48	3
21.	Kyrgyzstan	0.72	19
22.	Laos	0.79	34
23.	Lebanon	0.62	9
24.	Malaysia	0.72	21
25.	Myanmar	0.78	31
26.	Nepal	0.80	35
27.	Pakistan	0.73	25
28.	Philippines	0.77	30
29.	Saudi Arabia	0.56	4
30.	Sri Lanka	0.77	29
31.	Syria	0.65	11
32.	Tajikstan	0.74	26
33.	Thailand	0.73	24
34.	Turkey	0.62	10
35.	Turkemenistan	0.80	36
36.	United Arab Emirates	0.43	2
37.	Uzbekistan	0.72	23
38.	Vietnam	0.78	32
39.	Yemen	0.71	17

The composite indices varied from 0.41 to 0.84. China is found to be the best agricultural developed country in Asia whereas Bhutan is in the last place. China, Japan, Kuwait, Saudi Arabia and United Arab Emirates are observed to be the best five developed countries and Bhutan, Cambodia, Kazikistan, Turkemenistan and Nepal are the last five developed countries in the continent. Wide disparities in composite indices of agricultural development have been observed among different countries.

4.2 Different Stages of Development

For relative comparison of different countries with respect to agricultural development, it appears quite appropriate to assume that the countries having composite indices less than or equal to (Mean –SD) are highly developed and are classified in stage I of the development and the countries having composite indices greater than (Mean +SD) are low developed and are classified in stage IV of development. In the same way, countries having composite indices between (Mean) and (Mean – SD) are high middle level developed and countries having composite indices between (Mean) and (Mean +SD) are low middle level developed. High middle and low middle level developed countries are classified respectively as stage II and stage III of development. According to the above assumption, countries having the composite indices less than or equal to 0.59 are highly developed and put in stage I of development and countries having composite indices greater than 0.79 are low developed and these are classified in stage IV of development. Countries having composite indices between 0.60 to 0.69 are high middle level developed and these are classified in stage II of development and countries with composite indices between 0.70 to 0.79 are low middle level developed and these are classified in stage III of development. The following table presents the names of countries and percentage population lying in different stage of developments.

Table 2: Names of Countries and Percentage Population under Different Stages of Development

Developmental Stage	Name of Country	Percentage Population
High	China, Cyprus, Israel, Japan, Kuwait, Saudi Arabia, United Arab Emirates (7)	40
High Middle	Armenia, Indonesia, Iran, Jordon, Korea Rep., Lebanon, Syria, Turkey (8)	12
Low Middle	Afghanistan, Azarbaijan, Bangladesh, Georgia, India, Iraq, Korea DPR, Kyrgyzstan, Laos, Malaysia, Myanmar, Pakistan, Philippines, Sri Lanka, Tajikstan, Thailand, Uzbekistan, Vietnam, Yeman (19)	46
Low	Bhutan, Cambodia, Kazikistan, Nepal, Turkemenistan (5)	2

It may be seen from the above table that out of 39 countries included in the analysis, seven countries are found to be highly developed in agriculture. These countries are thickly populated and they cover about 40 per cent of population of Asian countries. Eight countries are found to be in high middle level developed group and about 12 per cent population of the continent come from these countries. Nineteen countries are found to be low middle level developed and these countries cover about 46 per cent population. Five countries are poorly developed and these are in low stage of development. These countries cover about 2 per cent population of the continent. Special steps are needed for enhancement of agricultural development in these countries.

4.3 Inter-relationship between Different Indicators and Agricultural Development

For proper and effective agricultural development, it is desirable that the crop productions and animal husbandry activities should prosper together in the country. The correlation coefficients between different important indicators and composite indices of agricultural development are given below.

Table 3: Correlation Coefficients

Factor	Wheat	Rice	Maize	Pulses	Cattle	Sheep	Goats	Composite Index (Di)
Wheat	1	0.87**	0.16	0.30	0.59*	-0.20	0.09	-0.68**
Rice		1	0.80**	0.38	0.48*	-0.27	-0.02	-0.91**
Maize			1	0.03	-0.27	-0.03	-0.11	-0.74**
Pulses				1	-0.07	0.03	-0.05	-0.44*
Cattle					1	0.26	-0.10	-0.47*
Sheep						1	0.03	0.19
Goats							1	-0.15
Composite Index (Di)								1

* Significant at 0.05 probability level.
** Significant at 0.01 probability level.

The correlation coefficient between yield rates of wheat and rice is highly significant which indicates that the productivity levels of these two crops are positively associated. The productivity of rice is also found to be highly associated with productivity of maize crops. The productivity levels of wheat and rice are observed to be moderately associated with cattle population in the countries. Yield rate of total pulses is not found to be associated with the yield rates of wheat, rice or maize crops. The correlation coefficients between the yield rate of wheat and composite index (Di), yield rate of rice and composite index (Di) are found to be negative and highly significant. Since higher values of composite index indicate low level of development and lower value of composite index indicates high level of development, the productivity levels of wheat, rice and maize are associated positively with the level of development. In the same way, the productivity of total pulses and cattle population are also moderately associated with agricultural development in the positive direction.

4.4 Improvements Needed in Developmental Indicators of Low Developed Countries

Five countries namely Bhutan, Cambodia, Kazikistan, Nepal and Turkemenistan are found to be low developed in agriculture. These countries are situated in different parts of the continent having different climatic conditions. Average performance over all countries and actual achievements of low developed countries are presented in table 4 for different developmental indicators.

Table 4 : Actual Achievements of Low Developed Countries and Average Performance over all countries for different indicators

S. No.	Developmental Indicators	Bhutan	Cambodia	Kazikistan	Nepal	Turkemenistan	Average performance of Asia
1.	Total cereal yield rate	1097	1730	699	1988	684	2609
2.	Wheat yield rate	714	--	692	1607	575	1960
3.	Rice yield rate	1667	1739	2556	2456	1125	3431
4.	Coarse grain yield rate	876	1333	683	1574	861	2242
5.	Maize yield rate	867	1333	1419	1705	1778	3295
6.	Root crops yield rate	10750	6432	9189	8102	7000	15450
7.	Pulses yield rate	800	784	735	688	--	1103
8.	Beans dry yield rate	--	784	700	671	--	1231
9.	Cotton yield rate	--	--	1692	--	738	1730
10.	Tomato yield rate	--	--	22000	--	15636	30320
11.	Onion dry yield rate	--	--	12500	--	11200	20046
12.	Grapes yield rate	--	--	2304	--	8657	9097
13.	Tobacco yield rate	--	909	1067	790	2000	1786
14.	No. of cattle per 100 thousand population	--	26.7	--	30.8	28.5	31.1*
15.	No. of sheep per 100 thousand population	3.5	--	140.9	4.0	142.4	146.4*
16.	No. of goats per 100 thousand population	2.5	--	5.0	25.7	10.1	277.5*
17.	No. of chickens per 100 thousand population	--	92.2	186.0	66.7	--	203.7*

* Maximum number.

It may be seen from the above table that the present achievements of low developed countries are extremely low. These are found to be much below to the level of average performance of Asian countries in almost all the developmental indicators. General suggestions for improving the level of development of low developed countries are given below. Special studies for estimating the level of development at micro level (district or sub-division level) are required to be conducted in these countries for providing specific location-wise suggestions of improving the status of development.

Bhutan

This is a very small country. It is mostly covered by mountains and forests. Yield rates of most of the crops are low and improvements are needed to enhance the productivities of wheat, rice and coarse grain etc. Steps should be taken to popularize the activities of animal husbandry. Most of the area of the country is covered by forest. Action is required to enhance the productivities of fruits, vegetables and forest products.

Cambodia

This is a small country situated in eastern part of the continent. Productivity of rice which is the main crop of the country is low. Productivities of maize and other coarse grains are very low. Improvements are needed to enhance the productivities of different crops in the country. Improved animal husbandry practices should be popularized in the country. Steps should also be taken to increase the fish production in the country.

Kazakistan

This is a very small country situated in central Asia. Yield rates of various crops are very low. Improvements in farm sector are needed for enhancing the productivity level of different crops. Steps are also required to be taken for cultivation of fruits and horticultural crops. Activities regarding animal husbandry should also be popularized in the country. High yielding crop varieties suitable for the area should be evolved and advocated for cultivation.

Nepal

This is a small country situated in north of India. The country is mostly covered with hills and forests. Productivity levels of different crops are found to be very low. Suitable steps are required to be taken for enhancing the yield rates of different crops. Action should be taken to popularize the cultivation of fruits and vegetables in the country. The country needs enhancement of forest products. Suitable action should be taken to enhance the activities in animal husbandry. These activities might be practiced along with cultivation of crops.

Turkemenistan

This country is situated in western part of Asia. Yield rates of various crops grown in the country are very poor. Suitable steps should be taken to enhance the productivity level of these crops. Action is also needed to explore the possibility of growing non-food crops in the country. People should be motivated to adopt animal husbandry practices along with growing crops. Crop protection measures along with creation of irrigation facilities and their proper use should be advocated among the people engaged in agriculture.

5. Conclusions

The broad conclusions emerging from the study are as follows:

- There are fifty countries in Asia out of which eleven countries namely Bahrain, Brunei Darsm, East Timor, Gaza Strip, Hong Kong, Macau, Maldives, Mangolia, Oman, Qatar and Singapore are not having sufficient data for evaluating the level of agricultural development. Hence these countries are not included in the present study.

- Out of 39 countries included in the study, China is found to be the highest developed country in agriculture. China and Japan come in the first five developed countries in agricultural sector in Asia. Bhutan was on the last place in the continent with respect to development in agriculture.

- Wide disparities among different countries were found in agricultural development.

- The level of development has been categorized in four stages as high level, high middle level, low middle level and low level. It was found that about 40 per cent population of the continent live in high developed countries whereas only two per cent population comes from the low developed countries. About 46 per cent population belongs to low middle level developed countries.

- General suggestions have been given for enhancing the level of agricultural development of low developed countries. It would be useful to examine and evaluate the level of development at micro level for giving location-wise specific recommendations for improving the level of development.

6. References

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7. Abstract

The status of agricultural development of different Asian countries has been estimated with the help of composite index based on optimum combination of twenty six developmental indicators. Out of fifty countries in the continent, thirty nine countries have been included in the study. China is found to be the best developed country in the farm sector whereas Bhutan is on the last position. Agricultural development is found to be highly associated with the productivity levels of wheat and rice. Wide disparities have been observed in the level of development of different countries. General suggestions for improving the level of agricultural development of low developed countries have been given.