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## "SPATIAL ANALYSIS OF AGRICULTURAL DEVELOPMENT IN NASHIK DISTRICT: A TAHSIL LEVEL STUDY"

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### Abstract:

Agriculture is not only an importance sector of an economy rather it feeds other sectors of economy. Agriculture plays an important role in economic development of the country. Agricultural development is an integral part of overall economic development in the country like India. For well agricultural development requires modernization and commercialization of agriculture. It is highly possible if good agricultural infrastructure is provided to agriculture activity dominated area. At national and local level, availability of such agricultural infrastructure is not well distributed, which is responsible to create regional disparity in agricultural development. In Nashik district also, such regional disparity in agricultural development is observed in large scale. Therefore it is important to highlight the less developed agricultural region and try to promote the agricultural development. Present work is an attempt in the same direction but at taluk level.

The aim of the present paper is to analyse the level of Agricultural development in Nashik District in 2014-15. For determining the level of Agricultural development, ten variables were selected. By using the data about all variables, the co-efficient index are calculated for each taluk. On the basis of co-efficient index, all taluks were categorized into three categories i.e. low, medium & high, according to their level of Agricultural development. The level of agricultural development is very low in the western part of the study region, where topography is rugged, agricultural infrastructure is not well developed and economic condition of farmer is not sound. Nashik taluk is highly developed due to well-developed agricultural infrastructure, good area under major cash crops and development of agro-based industries. Whereas the level of agricultural development in the rest part of the study region is medium.

**Key Words:** Irrigation, Co-efficient Index, Cropping Intensity, Cash crops, Horticulture and Agro-based industry.

### Introduction:

Agriculture is not only an importance sector of an economy rather it feeds other sectors of economy. Agriculture plays an important role in economic development of the country. Agricultural development enhances social and cultural development due to an increase in per capita income (Kazma Khan & Lubna Khaliq, 2013). Agricultural development is an integral part of overall economic development in the country like India. For well agricultural development requires modernization and commercialization of agriculture. It is highly possible if good agricultural infrastructure is provided to agriculture activity dominated area. At national and local level, availability of such agricultural infrastructure is not well distributed, which responsible to create regional disparity in agricultural development.

Nashik district is a major agriculturally dominant district in the Maharashtra. In Nashik district also, such regional disparity of agricultural development is observed in large scale. Therefore it is important to highlight the less developed agricultural region and try to promote agricultural development. Present work is an attempt in the same direction but at taluk level.

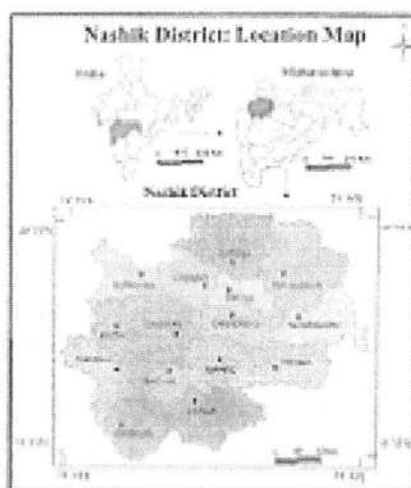
### Study Area:

Nashik District is situated partly in the Tapi basin and partly upper Godavari basin. It lies between 19° 33' to 20° 53' north latitude and 73° 15' to 75° 16' east Longitude (Nashik Gazetteer, 1983). Nashik is one of the agriculturally dominant district in the Maharashtra. Nashik

### S.D.Pagar

District has an area of 15,530 Sq.km. Nashik District had population 6,100,052 as per the 2011 census. Location of the study area is showed in Map No.1. The district is divided into 15 taluqa, which consisting of 1930 villages. The main system of hills is the Sahyadries, which run north-south in the western portion of the district. In the extreme north is salbort range, which approximately forms and boundary between Nashik and Dhule district. Next is the Sattmah range which runs right across district. Kalatbi range is located in the south part of the district. The district has two main rivers the Girna and the Godavari.

The district is surrounded by Dhule district in the north, Jalgaon and Amravati districts in the east, Ahmednager district in the south, and Thane district in the south-west and Gujarat state in the north-west. Rice, Sugarcane, Citrus, Grapes, Pomegranate and Vegetables are the dominant crops of this region. The climate of the district is generally dry except during the monsoon season. The average annual rainfall of the district as a whole is 1034.5mm. The rainfall in general decreases from west to east. The summer season is moderately hot and the temperature varies from 26° c to 43° c. The air is humid during the monsoon season and is generally dry during the rest of the year.



Map No.1

**Objectives:** The main objectives of the present paper are as follows.

- i) To analyze the agricultural development in Nashik District.
- ii) To analyze the availability of agricultural infrastructure for agricultural development in Nashik District.
- iii) To analyze the problems of agricultural development in Nashik District.

**Data and Methodology:**

The present study is based on the primary and secondary source of data. Primary data is collected from the field work (2014-15) and interviews of 719 farmers from 204 villages of the study region. Secondary data is obtained from the socio-economic abstract of the Nashik district (2013), District census handbook and District Gazetteers. All data were suitably converted into tables drawn

S. D. Pagar

for analysis the agricultural development of the study region. The basic unit for investigation is tahsil and district as a whole.

A Geographical Information System (GIS) technique is also used to prepare the maps. For that purpose, AutoDesk Map 2004 and Iliwis 3.8 software are used. Statistical tools like percentage and average have been used in the study. Data is processed and represented with the Choropleth map. The Kendall's ranking co-efficient index method (1939) is used to determine the level of agricultural development of Nashik District. For that purpose, co-efficient index is calculated for each tahsil of the study region. The levels of Agricultural development have been determined on the basis of 10 variables. They are as follow:

X1= Percentage of Gross Cropped Area

X2= Percentage of Irrigated Area

X3= Numbers of Tractors (Numbers converted into %)

X4= Numbers of Iron Plough (Numbers converted into %)

X5= Number of Electrical Pump used for Irrigation (Numbers converted into %)

X6= Cropping Intensity.

X7= Percentage of Major cash crops (Grapes, Sugarcane, Onion & Pomegranate) to Gross Cropped Area.

X8= Use of fertilizers in agriculture (MT)

X9= Use of electricity for agriculture (000 KW)

X10= Number of agricultural credit society

By using data about above 10 variables the Co-efficient Index is calculated for each tahsil of the Nashik District by using the Kendall's co-efficient Index methods. The Co-efficient Index is inversely related to development i.e. lower the index the more development and higher the index low the development. For the calculation of Co-efficient Index, following formula of Kendall's is used.

$$\text{Kendall's Co-efficient Index} = \frac{\sum R}{N}$$

Where  $\sum R$  = Sum of rank, N = Numbers of variables.

#### Results & Discussion:

The variables for Agricultural Development: Ten variables are selected to determine the level of Agricultural development in the study region. All these variables are shown in the Table No. 1.

##### i) Percentage of Gross Cropped Area (X1):

This is a vital variable to determine the levels of agricultural development in the region. This variable shows area under cultivation of the region. It is highest in Dindori tahsil (64.01%) & Nashik tahsil (61.22 %), whereas it is very low in Poch (23.63 %) & Trimbak (23.89 %) tahsil of the study region due to undulating topography of the region

##### ii) Percentage of Irrigated Area (X2):

Water is basic input in agriculture (Patel, 2013). For agriculture development supply of artificial water in the form of irrigation is important. Irrigation is necessary for almost any kind of agricultural development and prerequisite for the success of modern technology in agriculture (Gomate Singh and S. W. Ashraf, 2012). Irrigation makes possible the growth of more than one crops where one is grown, and one or more where nothing is possible. The Niphad tahsil having maximum irrigated area (86.53 %) followed by Nashik (78.93%) tahsil of the study region. It is very low in the western part as well as in rain shadow areas of the district. Percentage of the irrigated area in these areas is ranging from 15% to 40%.

**iii) Use of Tractors (X3):**

Tractors also helps to increase cropping intensity by enabling the farmer to save time and hence grow an extra new crop or to devote more area to existing crops. The maximum use of tractors is found in Niphad (86.67%), Dindori (62.26%) & Nashik (57.05%) taluhs. Whereas it is very less in Sagarani (00.00%) and Peth (01.54%) taluhs because low income of farmers and not in condition to buy tractor for agricultural operations.

**iv) Use of Iron plough numbers (X4):**

This is another important variable, which is used to determine the agricultural development. With the help of iron plough farmers enable to carry out farming operation more quickly for ploughing the agriculture land. In the use of iron plough Nandgaon (92.11%) is top in the list, while in Peth (15.38%) taluhs use of iron plough for agriculture is very less.

**v) Use of Electrical Pump for irrigation (X5):**

By using electrical pump irrigation water is possible to provide to crops within short time & according to their requirement. Therefore it is important variable in measuring agricultural development. The use of electrical pump is maximum in Niphad (98.15%) & Chandwad (97.87%), while it is very less in Peth (27.69%) & Trimbak (46.15%) taluhs due to rugged topography and availability of limited irrigation facilities.

**vi) Cropping Intensity (X6):**

Cropping intensity is refers to the use of a field several times during a cropping year. The highest cropping intensity is observed on Dindori taluhs due to horticulture development (146.04), whereas it is lowest in Peth (103.06) taluhs lack of irrigation facility of the study region.

**Table No.1: Nashik District: Spatial Distribution of Agricultural Development**

Sr. No.	Name of Taluhs	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
1	Sagarani	48.62	19.11	68.28	33.33	33.55	113.87	07.24	34.28	33.81	00
2	Kalasin	34.68	49.4	34.85	37.65	37.87	104.15	11.81	166.42	254.24	19
3	Dindori	53.25	70.85	38.63	38.45	83.77	110.57	49.14	123.89	289	60
4	Sitona	42.32	63.62	23.69	81.25	79.00	123.35	56.70	234.64	1812	92
5	Nandgaon	45.37	68.78	78.87	88.35	88.35	140.53	41.8	282.45	2074	128
6	Nandgaon	53.09	60.52	39.47	82.11	89.47	127.16	33.67	198.22	581	70
7	Chandwad	42.65	73.63	42.85	81.49	87.87	107.72	56.44	222.54	664	82
8	Dindori	64.01	64.55	87.36	68.15	85.35	186.04	48.32	222.20	564	34
9	Peth	21.83	23.87	32.54	13.58	27.69	335.06	04.32	3496	180	00
10	Trimbak	23.69	33.39	68.62	42.51	46.15	100.96	04.4	3417	1308	07
11	Nashik	61.22	78.85	457.3	62.3	80.00	128.29	38.68	144.60	1943	56
12	Ignatani	35.36	39.79	28.95	52.62	71.05	129.22	04.79	6603	1268	28
13	Sitona	29.05	65.42	74.62	81.54	80.58	134.83	24.48	180.82	1085.4	68
14	Niphad	57.61	85.55	66.67	68.53	88.15	155.5	67.51	499.68	2679	182
15	Yvela	41.28	72.76	28.33	78.42	86.08	129.07	25.1	235.46	1140	82

Source: Compiled by Author, based on Field Survey 2014-15.  
N.B.: Data of Use of fertilizer, Electricity & No of Agri. Credit Society (Year 2012-13), Nashik District Socio-Economic Abstract 2013.

Table No.2 Nashik District: Ranking Coefficient Index

Sl. No.	Name of Tahsil	X1	X2	X3	X4	X5	X6	X7	X8	X9	X	ΣR	Co-efficient Index
1	Surgana	07	13	13	14	13	09	12	14	15	15	129	12.9
2	Kalwan	12	07	11	11	10	14	11	10	12	12	112	11.2
3	Deola	05	05	06	05	08	11	04	11	10	09	72	7.2
4	Ashta	10	09	09	04	11	10	05	06	04	04	70	7.0
5	Malgajgaon	08	08	12	07	07	02	06	03	10	02	67	6.7
6	Nandgaon	06	11	05	01	06	04	04	08	11	07	71	7.1
7	Chandwad	09	03	06	02	10	12	02	07	09	06	70	7.0
8	Dindori	01	06	07	08	09	01	05	04	12	10	82	8.2
9	Peth	15	14	14	15	15	15	15	15	06	14	156	15.6
10	Trimbak	14	15	15	12	14	15	14	15	14	13	156	15.6
11	Nashik	02	02	05	09	09	07	09	02	01	04	52	5.2
12	Ignatpur	04	12	08	12	12	08	12	12	05	11	82	8.2
13	Sevur	12	10	07	10	05	06	10	09	04	03	76	7.6
14	Niphad	03	01	03	04	01	04	03	03	03	03	33	3.3
15	Vashi	11	04	10	05	04	05	07	10	07	03	64	6.4

Source: Compiled by Author, 2015.

## vii) Percentage of area under major cash crops to Gross Cropped Area (X7):

Cash crop is a highly specialized crop grown for the purpose of earning cash income. This is very useful parameter for measuring level of agricultural development. In Nashik district grapes, sugarcane, onion & pomegranate are the major cash crops, therefore combine area under all these cash crops is considered to determine the level of agricultural development of the region. The area under pomegranate is increasing rapidly during the last 15 years in the study area. It is very high in Niphad (67.51 %) & Chandwad (56.44 %) tahsil, while it is low in Peth (4.32 %) & Trimbak (4.40 %) due to unfavorable environment and lack of commercialization in agriculture.

## viii) Use of fertilizer in agriculture (X8):

Use of fertilizers play a vital role in agricultural production by replenishing fertility of the soil (Singh M.B. & Singh D.K., 2007). The use of fertilizer is more in Niphad and Nashik, where area under cash crops and vegetable is high. On other hand it is very less in Peth, Surgana and Trimbak tahsil where economic condition of farmer is not sound and awareness about use of fertilizer is also less. ix) Use of electricity for agriculture (X9):

The use of pumping set for irrigation require power to draw underground water for purpose of cultivation. The area of regular use of irrigation increased the use of electricity. In the study area use of electricity for agriculture is highest in Nashik whereas it is lowest in Surgana tahsil.

## x) Number of agricultural credit society (X10):

Agricultural credit is considered as an important infrastructure facility for agricultural development. For the purpose of agricultural development, the farmer need money (capital) it requires for digging a well, installing a tube well, for purchase of seeds, manure's, fertilizers and other agricultural implements (Patel, 2011). The major source of credit is agricultural co-operative society. Such societies provide loans for farmers for productive purpose. Therefore availability of such societies is very important in agricultural development. The availability of such societies are highest in Niphad (132) and it is totally absent in Peth and Surgana tahils of the study region.

## Level of Agricultural Development:

For the measuring the levels of agricultural development in the study region ten variables

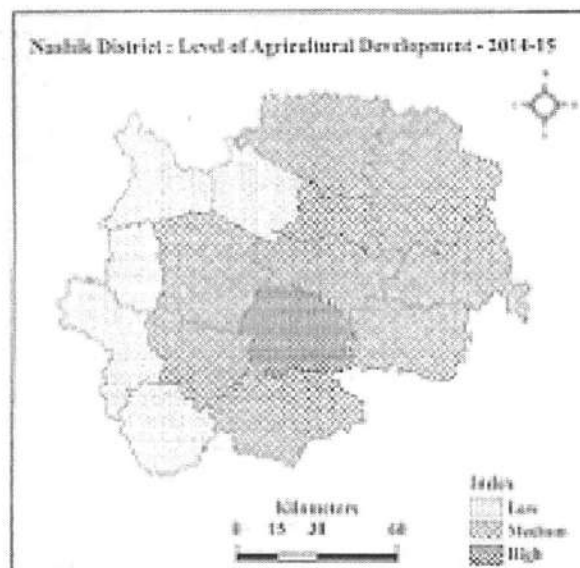
S.D. Pagat

have been taken into account collectively. By using data about above 10 indicators the Co-efficient Index is calculated for each tahsil, which are shown in the Table No.2. On the basis of Co-efficient Index, the agricultural development have been categorized into three categories i.e. Low, medium & high. The Table No.3 & Map No.2 indicates the classes about level of agricultural development in each tahsil of the study region.

Table No.3: Nashik District: Level of Agricultural Development-2014-15

Sr. No.	Co-efficient Index	Level of Agricultural Development	Names of Tahsils
1	6-4	High	Niphad
2	4-3	Medium	Nashik, Dindori, Chandwad, Malegaon, Yeola, Nandgaon, Satara, Deola and Singar
3	Above 3	Low	Peth, Sargota, Kalwan, Trimbak and Igatpuri

Source: Compiled by Author, 2015.



Map, No.2

**1) Low Agricultural Development:**

This category consists of five taluqs i.e. Peth, Sargana, Kalwan, Trimbak and Igatpuri taluqs of the study region. All these taluqs are located in the western parts of the study region. This entire belt has been characterized by adverse conditions like hilly, poor soils, less accessibility and low income of farmers. The farmers also not well aware about new farm technology and lack of commercial attitude about agriculture. Therefore this part of the study area is not too much developed.

**2) Medium Agricultural Development:**

The medium level categories comprises in nine taluqs i.e. Nashik, Dindori, Chandwad, Malgaon, Yeola, Nandgaon, Sonasa, Dindis and Sinar. These taluqs achieved medium agricultural development due to dominance of three to four variables of agricultural development. Main factors for medium agricultural development in these areas are increasing the area under cash crops and developing agricultural infrastructure. Mostly Dindis taluq developing rapidly due to horticulture and agro-based industrial development. In most villages of this taluq farmers used poly houses and green house for horticulture purpose.

**3) Highly Agricultural Development:**

Only one taluq come under this category i.e. Niphad. Many variables are dominated in this taluq. These taluq achieved high agricultural development due to well-developed agricultural infrastructure. It includes well irrigation facilities, developed agro-based industries, availability of credit (capital) & transportation network. One important factors which responsible for high agricultural development is area under cash crops is increased during last 15 years and notable gain includes sugarcane, grapes and cotton. These cash crops gives good return to farmers.

**Conclusion:**

The present study reveals that agricultural development is not well distributed in the study region. The majority of the taluqs come under medium agricultural development. It is lying in the central, eastern and south part of the study region. While the taluqs located in the western part are less developed as agricultural development is considered. Where physical environment is unfavorable & agricultural infrastructure is less developed. The study is highlight that Niphad is the highly developed taluq due to enjoying the many agricultural infrastructural facilities. It includes irrigation, road network, agro-based industries and good income of the farmers. It is clear that agriculture in western part cannot develop, unless irrigation is provided over such wider areas.

In all part of study region facing some agricultural problems, only the nature of such problems are different from place to place. Therefore, special attention should be given to agriculturally backward areas by the planners, so that regional disparities could be minimized. Irrigation facilities should be developed in western the study region; it will help to increase cropping intensity of the region. Seeing the adverse effects of use of chemical fertilizers in Niphad taluq, there is need to promote the use of natural and organic manures. It is also important for sustained agricultural production. Adequate attention is necessary for market incentives, especially in the medium developed region of the study area. During the rainy seasons in the western part of the study region, roads become muddy and thus very inconvenient for vehicles. Roads must be compliment and coordinate with railway station and other important market places. Western region has limitation for agricultural development, so some allied occupation of agriculture, like animal husbandry, agro-tourism etc. should be developed in this region. Post-harvest management and marketing linkages also important for overall development of agriculture in the study region. For this purpose creating awareness in the farmer is very important. Role of Government is very important in less developed region. Government should promote an irrigation facilities and other agricultural infrastructure for balanced development of agriculture of the region.

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**1) Low Agricultural Development:**

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**2) Medium Agricultural Development:**

The medium level categories comprises in nine taluqs i.e. Nashik, Dindori, Chandwad, Madgaon, Yeola, Nandgaon, Sonasa, Daula and Sutar. These taluqs achieved medium agricultural development due to dominance of three to four variables of agricultural development. Main factors for medium agricultural development in these areas are increasing the area under cash crops and developing agricultural infrastructure. Mostly Dindori taluq developing rapidly due to horticulture and agro-based industrial development. In most villages of this taluq farmers used poly houses and green house for horticulture purpose.

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Only one taluq come under this category i.e. Niphad. Many variables are dominated in this taluq. These taluq achieved high agricultural development due to well-developed agricultural infrastructure. It includes well irrigation facilities, developed agro-based industries, availability of credit (capital) & transportation network. One important factor which responsible for high agricultural development is area under cash crops is increased during last 25 years and notable gainers includes sugarcane, grapes and cotton. These cash crops gives good return to farmers.

**Conclusion:**

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