Research Journal of Agricultural Sciences
An International Journal

Res. Jr. of Agril. Sci. **12**(2): 559–564

P- ISSN: 0976-1675 | **E**- ISSN: 2249-4538

www.rjas.org

Research Paper

Disparities at the Level of Agricultural Infrastructure Development in Jammu Province: A Geographical Analysis

Aayush Pandit*[1] and Inder Jeet Singh[2]

Received: 26 Jan 2021 | Revised accepted: 25 Mar 2021 | Published online: 26 Mar 2021

A B S T R A C T

The role of good quality infrastructure for agricultural development is widely recognized. Rural infrastructure is required extensively for improving the quality of farming and accelerating the process of agricultural development. It has the potential to transform the existing conventional agriculture or subsistence farming into advance, commercial and dynamic farming system in India. Regional disparities in agriculture development of Jammu and Kashmir union territory (UT) are the foremost factor related to inequality in the level of rural development of the UT, which needs to be overcome through proper planning. Hence, systematic identification of levels of agricultural infrastructure development is must. Present study has tried to comprehend the spatial variations in the level of agricultural infrastructure development in Jammu province. For this purpose, ten variables relating to pre-harvest and post-harvest infrastructure have been taken. To find out the composite picture of agricultural infrastructure development in Jammu province composite index has been prepared by using variable index. The study reveals that post-harvest infrastructure development was better in Jammu province as compare to pre-harvest infrastructure development. Spatially north-eastern part of the study area has lowest and southern part has highest level of agricultural infrastructure development which is mainly attributed to the physiographical conditions of the study area. Nevertheless, study identifies various indicators which are lacking behind in each administrative division.

***Key words*:** Agriculture infrastructure, Spatial variation, Development, Pre-harvest, Post-harvest

Infrastructure is vital for agricultural development and for taking the production dynamics to the next level. It is only through the development of infrastructure, especially at pre-harvest and post-harvest stage that the produce can be optimally utilized with a chance for value enhancement and reasonable deal for the cultivators. Development of such infrastructure shall also address the regional disparities, enhancement of human resource and understanding of full potential of our restricted land resource [1]. It is well stated by [2] that roads, electricity, telecommunication and other infrastructure services are inadequate in all rural areas, even though they are of key significance to stimulate agricultural investment and growth. Agricultural services are very vital in developing countries where subsistence farming is dominating [3]. It is widely accepted that for agriculture development we require good infrastructure as it is one of the most significant factors for agriculture development. By improving rural infrastructure, we can improve the quality of farming and increase farmer's earnings. It has the potential to transform the existing conventional agriculture or subsistence farming into advance, commercial and dynamic farming system in India as well as in the study area. India is expected to attain the goal of doubling farm income by 2022. The agriculture sector in India is likely to generate better growth in the next few years due to increased investment in agricultural infrastructure [4]. The study on infrastructure has been done by various scholars showing the significance of agriculture and rural infrastructure [5-7]. Impact of infrastructure on agricultural development [9]. A study showing Indian states with the highest and lowest rural infrastructure index by using indicators (rural electrification, roads, transport, health, irrigation, farm credit, fertilizer, agricultural marketing, research and extension) [10]. Agriculture infrastructure includes broad range of services that ease production, sourcing, processing, preservation, marketing and trade which can be grouped under following broad-based categories i.e., Pre-Harvest Infrastructure (like: Seed, Fertilizers and Pesticides, Nurseries, Irrigation, Testing Laboratory) and Post-Harvest Infrastructure (includes road, packaging and processing, logistics and storage, market facilities, Electricity) [11].

*Aayush Pandit
aayushpandit19@gmail.com

[1-2]Department of Geography, University of Jammu, Jammu Tawi - 180 006, Jammu and Kashmir

Study area

Jammu province is the part of Jammu and Kashmir union territory. It is an administrative division consisting of 10 districts Jammu, Kathua, Samba, Rajouri, Poonch, Reasi, Doda, Udhampur, Ramban and Kishtwar. It covers an area of 26,293 km^2 [12]. This region is bounded on the north by Kashmir province of Jammu and Kashmir, on the east by UT of Ladakh and on the south it is bordered by Punjab and Himachal Pradesh. On the west, line of control (L.O.C.)

separates it from Pakistan occupied region of Jammu and Kashmir (POK). Jammu Province is a wide area which has varied physiography and climatic conditions. The study area has been sub-divided into three physiographic regions i.e., Foot- hill plains (below 366 meters), The Shiwaliks hills (600 to 1220 meters) and The Lesser or Middle Himalayas (3600 to 4600 meters) [13].

The main objective of the study is to find out the spatial variations in agricultural infrastructure development in Jammu Province, with main focus on disparities at the level of development in various districts in the study area. To achieve this, the following objectives are set forth:

1. To comprehend the spatial variations in Agricultural Infrastructure and their associated factors in the study area.
2. To understand the role of available infrastructure in the development of agriculture in the study area.

MATERIALS AND METHODS

Present study is based on secondary data. The required data for the year 2015-16 has been attained from various sources mentioned in (Table 1). To understand the physiography of the study area ASTER DEM data of USGS was used.

Methodology for data analysis

To understand the level of agricultural infrastructure development in the study area, five-five indicators have been taken to analyze the pre-harvest and post-harvest infrastructure respectively. By using these selected indicators, a composite index was framed on the basis of variable index which was prepared by using following formula:

$$I = \frac{X_i - \min(X)}{\max(X) - \min(X)}$$

Where 'x_i' denotes value of variable for a general district at a given time. Furthermore, *min* (*x*) and *max* (*x*) are the minimum and the maximum value of 'x_i' across all districts at given time. The normalized indicators 'I' denotes variant of the Min-Max whose values lying between 0 and 1 [14].

For understanding the role of available infrastructure in the development of agriculture, correlation results give us a broad idea about the relationship between agriculture infrastructure and agricultural output in the province. For calculating the correlation, Pearson correlation method as mentioned below has been used [15]:

$$r = \frac{\Sigma(X - \bar{X})(Y - \bar{Y})}{\sqrt{\Sigma(X - \bar{X})^2}\sqrt{(Y - \bar{Y})^2}}$$

Where, $\bar{X}$= mean of X variable

$\bar{Y}$= mean of Y variable

The data has been processed and analyzed in MS Excel and SPSS software. To show the regional variations in agricultural infrastructure development and physiography of the study area maps were prepared using Arc GIS 10.5 software.

RESULTS AND DISCUSSION

The current study is an attempt to analyze the spatial variations in agricultural infrastructure development in Jammu Province by taking into consideration of ten indicators as mentioned in (Table 1). Agricultural infrastructure can be categorized as pre- harvest and post-harvest infrastructure.

Table 1 Indicators for agricultural infrastructure development

Indicators		Source of data collection
Pre-harvest infrastructure	Fertilizer and Insecticides Consumption in kg/hectare	Regional Digest of Statistics, Jammu Province, 2015
	Average area served by one nursery	Directorate of Horticulture Jammu
	Percentage of Irrigated Area	Financial Commissioner Revenue, J&K
	Testing Laboratories	Department of Agriculture & Cooperation and Farmers Welfare, GOI
	Primary Agricultural Credit Societies	Additional Registrar Co-operative Societies, Jammu
Post-harvest infrastructure	Rural Road Connectivity	Chief Engineer, PWD (R&B), Jammu
	Logistics and Storage Capacity	Additional Registrar Co-operative Societies, Jammu
	Market Infrastructure	Dy. Director Horticulture (P&M), Jammu
	Power and Electricity	J&K State Power Development Corporation, Jammu
	Cold Storage Capacity	Department of Agriculture & Cooperation and Farmers Welfare, GOI

Pre- harvest infrastructure

A pre-harvest system may be defined as a system of various technologies for agricultural unprocessed materials production. Therefore, the term describes the elementary technical and economic relations within agriculture [16].

The (Table 2) evidently shows the level of pre-harvest infrastructure in the study area. It shows the composite index values of various selected indicators and combined pre-harvest infrastructure development index. Jammu district which is also the winter capital of union territory of Jammu and Kashmir has highest index value of 0.70 followed by Kathua (0.47), Rajouri (0.39), Poonch (0.29), Doda (0.24), Samba (0.23), Udhampur (0.21), Kishtwar (0.20), Ramban (0.17) and Reasi (0.14). The study area has registered 0.30 average pre-harvest infrastructure index. Seventy percent of the total districts in the Jammu province have observed pre-harvest infrastructure development index below the average of province. This clearly shows that pre-harvest infrastructure development is not up to the mark in the study area. These districts have less fertile soil, undulating topography, therefore, it is very difficult to develop the irrigation, nurseries, or develop easy financial sources for the farmers. Consequently, agriculture is not properly developed in these parts of the region and it leads to low level of development of pre-harvest infrastructure. If we see the overall index value of the selected indicators in Jammu province, it has been found that level of irrigation (0.19) and credit facilities (0.23) have registered lowest index value. Hence, special attention must be given to bring more area under irrigation and easily accessible credit facilities must be provided to farmers so that they can get easy credit for buying seeds, fertilizers, tools and other agricultural needs. The districts like Jammu, Kathua and Rajouri have above average pre-harvest infrastructure development index value which is attributed to physiographic conditions and nearness to the main urban centre. Plain topography provides favourable conditions for the development of pre-harvest

infrastructure such as irrigation and urban centre provides accessibility to various agricultural inputs such as fertilizers, pesticides and insecticides. Apart from these factors better literacy of these districts also plays a significant role in agricultural infrastructure development. It is also evident from the (Table 2) that these districts have performed better in 60 percent of the selected indicators which contributed in better index value of pre-harvest agricultural infrastructure.

Table 2 Jammu province: Pre-harvest infrastructure development index, 2015

District	Average area served by one nursery	Fertilizer and insecticides consumption in kg/hectare	Percentage of irrigated area	Testing laboratories	Primary agricultural credit societies	Pre-harvest infrastructure index
Jammu	0.12	0.38	1.00	1.00	1.00	0.70
Samba	0.57	0.16	0.31	0.00	0.12	0.23
Kathua	0.49	1.00	0.38	0.29	0.17	0.47
Udhampur	0.20	0.13	0.00	0.43	0.28	0.21
Reasi	0.00	0.30	0.00	0.29	0.10	0.14
Ramban	0.46	0.09	0.00	0.29	0.04	0.17
Doda	0.47	0.13	0.03	0.43	0.16	0.24
Kishtwar	0.72	0.00	0.12	0.14	0.00	0.20
Rajouri	1.00	0.14	0.03	0.43	0.37	0.39
Poonch	0.65	0.33	0.07	0.29	0.10	0.29
Total	0.47	0.27	0.19	0.36	0.23	0.30

Source: As per the indicators mentioned in (Table 1)

Table 3 Jammu province: Post-harvest infrastructure development index, 2015

District	Logistics capacity	Rural road connectivity	Market infrastructure	Electricity	Cold storage capacity	Post-harvest infrastructure index
Jammu	1.00	0.92	1.00	1.00	1.00	0.98
Samba	0.31	0.90	0.33	1.00	0.04	0.52
Kathua	0.02	0.65	0.67	1.00	0.02	0.47
Udhampur	0.25	1.00	0.67	1.00	0.00	0.58
Reasi	0.01	0.66	0.33	0.85	0.00	0.37
Ramban	0.00	0.28	0.33	0.72	0.00	0.27
Doda	0.07	0.00	0.00	1.00	0.00	0.21
Kishtwar	0.00	0.32	0.00	0.00	0.00	0.06
Rajouri	0.15	0.63	0.33	1.00	0.00	0.42
Poonch	0.09	0.91	0.67	0.94	0.00	0.52
Total	0.19	0.63	0.43	0.85	0.11	0.44

Source: As per the indicators mentioned in (Table 1)

Post- harvest infrastructure

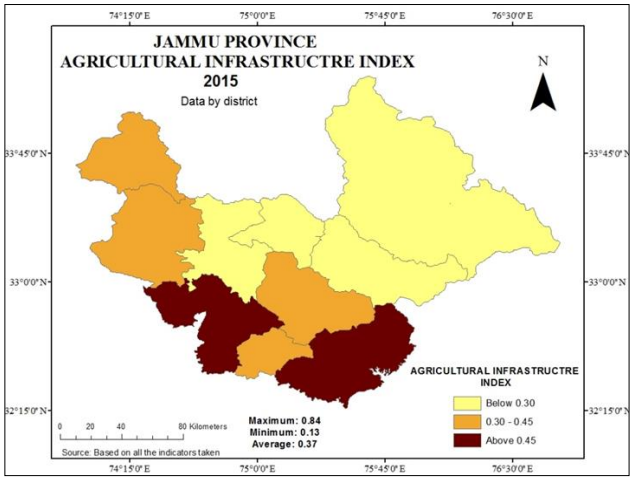
The post-harvest system, is mainly concerned with those activities which follows the pre-harvest activities and includes technologies of storage space, transportation, and dispensation of agricultural unprocessed materials into food products [16]. Most of the developing countries have inadequate post-harvest management facilities. The major issues are related to inefficient management as well as transportation, lacks in storage facilities; processing, packaging and poor infrastructure [17]. A significant amount of agricultural produce in India wasted or destroyed due to inadequate post-harvest facilities and the lack of processing. This results in a substantial gap between gross food production and net availability [18]. Hence, post-harvest infrastructure is highly significant to reduce post-harvest loses of agricultural produces particularly perishable crops such as fruits and vegetables. Jammu and Kashmir is well known for the cultivation of fruits and vegetables, therefore post-harvest infrastructure becomes very vital for agricultural development in this hilly region of the country.

Table 4 Identification of districts under different level of agricultural infrastructural development

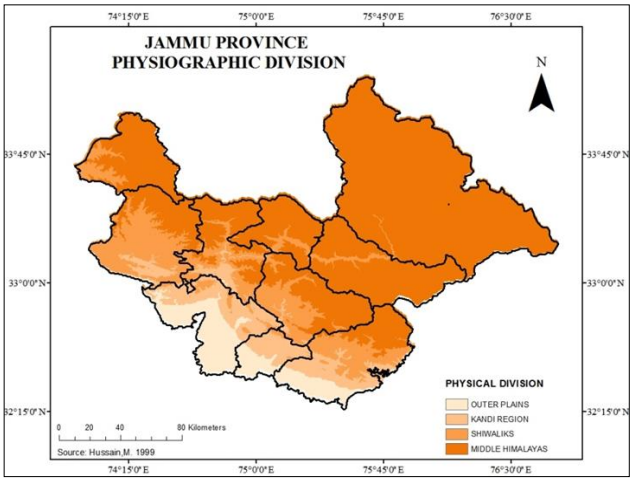
Categories of districts	Agriculture infrastructure development index	2005			
		Name of districts	Total No. of districts	Percentage of districts	Major area of concern
High infrastructural development	Above 0.45	Jammu, Kathua	2	20%	Lack in nurseries
Moderately infrastructural development	0.30-0.45	Samba, Udhampur, Rajouri, Poonch	4	40%	irrigation, market and storage facilities
Least infrastructural development	Below 0.30	Reasi, Doda, Ramban, Kishtwar	4	40%	Lack in all indicators

It is clearly discernable from (Table 3) that in Jammu province post-harvest infrastructure development is better as compare to pre-harvest infrastructure as post-harvest infrastructure index is higher (0.44) than pre-harvest infrastructure (0.30). Jammu district observed maximum post-harvest infrastructure development (0.98) followed by Udhampur (0.58), Samba (0.52), Poonch (0.52), Kathua (0.47), Rajouri (0.42), Reasi (0.37), Ramban (0.27), Doda (0.21) and Kishtwar (0.06). Moreover, 50 percent of the total districts of the study area registered index value higher than

the average index value of post-harvest infrastructure index. Jammu district has the highest level of post-harvest infrastructural development due to the fact that the major storage facilities in the study area are established in this region and it is also the winter capital of the Jammu and Kashmir. Thus, it performs well in all the indicators taken. Other four districts namely Udhampur, Samba, Kathua and Poonch with average index value performed better in almost 60 percent of the indicators, while remaining 50 percent of the total districts of the study area have insignificant development in 60 percent or more than 60 percent of the selected indicators. Due to physical constraints infrastructure development is an uphill task in these districts. It is imperative to mention that these districts have lot of potential in the cultivation of cash crops. Hence, to harness the hundred percent potential of the district's infrastructure development is needed.



Map 1 Jammu province: Agricultural infrastructure index



Map 2 Jammu province: Physiographic division

Spatial patterns of agricultural infrastructure development

A spatial pattern of agricultural infrastructure development shows the picture of unequal development at district level. It depicts the disparity among different districts of the study areas. Overall, the level of agricultural infrastructure development in the region is quite low. The study area has registered overall score of 0.37 which indicates toward low agricultural infrastructure development. Likewise, pre- and post-harvest infrastructure we can see a similar pattern in overall agricultural infrastructure development index. The analysis shows that the southern to western part of the study area has better agricultural infrastructure. If we can compare the pattern of agricultural infrastructure index with physiographic division (Map 2) of the study area, level of agricultural infrastructure development corresponds to the physiographic divisions, which is an indication of dominance of physical constraints in the development of agricultural infrastructure. It clearly establishes the relationship between agricultural infrastructure development and physiography in the study area. Higher the terrain lesser is the development. The southern part which is mainly located in plain region has better agricultural infrastructure whereas towards north terrain gets tougher and the level of development gets decreasing. (Table 4) depicts the various districts having disparity at the level of agricultural infrastructure development. (Map 1) shows the spatial patterns of agricultural infrastructure development in the study area. Maximum index value has been recorded in Jammu district (0.84) and minimum index value was registered in Kishtwar district (0.13). To study the spatial variations in agricultural infrastructure development, the entire region has been classified into three broad categories:

Area with high agricultural infrastructure development (above 0.45): The high degree of agricultural infrastructure development has been found in those areas which performed better in more than 50 percent of the indicators. The (Map 1, Table 4) clearly show that the southern region has the highest level of agricultural infrastructure development. It comprised of two districts i.e., Jammu (0.84) and Kathua (0.47). District Jammu being the winter capital has good road connectivity as 94 percent of the rural area connected with roads. The only terminal market of the region also located in this district. More than 90 percent of the cold storage facility has been concentrated in Jammu district. Nevertheless, being situated in plain region it has more than 80 percent of the cultivated area under irrigation (Digest of Statistics, Jammu province, 2015). So, having the highest index value Jammu district performed well in all the parameters and has high level of agricultural infrastructure development. Furthermore, it only lacks in the availability of nurseries (0.12 index value). The Kathua district with second highest index value had performed well in electricity connectivity, market facilities and rural road network connectivity but mainly lacks in primary agricultural credit societies and in storage facilities.

Area under moderate agricultural infrastructure development (0.30-0.45): The region stretched from north-west to south-eastern part of the study area has moderate level of agricultural infrastructure development (Map 1). The index value in this region ranges between 0.37 in Samba district and 0.41 in Rajouri district. The majority of the districts (40 percent) fall under moderate level of agricultural infrastructure development which comprised of Rajouri (0.41), Poonch (0.41), Udhampur (0.40) and Samba (0.37). If we superimpose this region on physiographic map (Map 1) we can see that it is located in Shiwalik Range and Middle Himalayas which has undulating topography. Consequently, the development of agricultural infrastructure development is very difficult. As a result, this region observed moderate agricultural infrastructure development. The region lacks behind in many selected indicators such as irrigation, market and storage development. Other major problem is of poor market facilities. So, there is a need to improve these indicators in this region. These districts have performed comparatively better in post-harvest infrastructure but had recorded average development

in pre-harvest infrastructure. Hence, they fall in the moderate agricultural infrastructure development zone.

Areas having least agricultural infrastructure development (below 0.30): (Map 1) clearly depicts that north and north-eastern parts of the study area have less agricultural infrastructure development. The region constitutes four districts named Kishtwar (0.13), Doda (0.23), Reasi (0.25) and Ramban (0.22) districts. These districts have performed below average in all the indicators which has been attributed to their remote location, less fertile soil and poor connectivity to rest of the region. This part of the study area has physical constraints and problem of landslide that hinders the movement of agricultural produce gets disturbed which leads to post-harvest loses. Moreover, these districts have potential to produce horticultural crops but because of all mentioned problems they are not able to harness the 100 percent potential. The region is in a developing stage of market facilities as many new *Mandies* are under construction [19] but the major concern is the poor connectivity of markets with production centers. Other facilities like godowns and cold storage are also not adequate. It is very shocking to note that two remote districts of the region i.e., Doda and Kishtwar do not have any market facility and also lacking in road connectivity particularly all-weather roads, even though three areas are famous for the cultivation of temperate fruits especially for dry fruits and apple. Thus, to promote commercial farming in this region as climatic conditions are hospitable for various temperate fruits, it is imperative to develop agricultural infrastructure.

Table 5 Jammu province: Correlation between infrastructure and agriculture productivity

Variables	Correlation Coefficient	Result
Pre-harvest infrastructure	0.79	Positively correlated
Post-harvest infrastructure	0.78	Positively correlated
Overall infrastructure	0.83	Positively correlated

**Correlation is significant at the 0.01 level

Source: Digest of Statistics of 2015-16, Directorate of Economics and Statistics

Relationship between infrastructure and agriculture output

The relationship among infrastructure development and agriculture output has been recognized by many pragmatic studies [20-24]. A strong and positive relationship between infrastructure development and agricultural productivity shown by [25] also a positive and significant correlation between roads development and total crop output [26]. Good infrastructure is must for the growth of all sectors of the economy. Rural infrastructure plays a significant role in improving agricultural productivity in developing economies [27]. There is a strong correlation between institutional agricultural infrastructure and volume of agriculture production [28]. Agriculture has a significant role in the economy of Jammu province. To identify the linear relationship between agricultural infrastructure and crop productivity Pearson correlation is used. (Table 5) is indicating the correlation of agricultural infrastructure with agriculture productivity. It is evident from the table that both pre-harvest and post-harvest as well as overall infrastructures showing positive correlation with agriculture productivity. Pre-harvest Infrastructure and post-harvest infrastructure have a correlation of 0.79 and 0.78 respectively with agricultural production which is positively correlated. Overall infrastructure has coefficient of 0.83 which clearly indicates that likewise other factors like climate, physiography etc. agricultural infrastructure is also an important determinant of agriculture production. Thus, this analysis shows that attention must be paid towards the agricultural infrastructure development in the study area as it is highly significant to enhance the agricultural productivity.

SUGGESTIONS

After above analysis it has been accomplished that there is unequal development of agricultural infrastructure. Therefore, it is necessary to suggest some measures to remove the disparities in terms of agricultural infrastructure development in various districts of the study area. Following are the suggestions in this regard:

- Attention must be paid for the development of nurseries, in Jammu district and agricultural credit societies and storage facilities in Kathua district.
- There is a need to open more fertilizers and insecticide distribution centers, testing laboratories, primary agricultural credit societies and cold storage facilities in Samba district to enhance the agricultural infrastructure development.
- Those districts which lies in the Shiwalik hill region mainly Udhampur and Rajouri require special attention towards the development of irrigation facilities. In addition to this they need to increase consumption of fertilizer and cold storage facilities.
- In north-western part of the study area required cold storage services as the region is totally separated from the rest of the study area. Due to the physical constraints this region requires modern irrigation practices instead of conventional irrigation method.
- Districts situated in the north and north-eastern part of the study area need attention on all the indicators taken. So that 100 percent potential of these districts in agriculture sector can be harnessed.

On the whole there is a need to focus towards market facilities, storage facilities and better transport connectivity in the highly remote regions so that they get motivated towards the advanced, commercial and dynamic farming system. This will encourage them to easily sell and store their surplus and generate remunerative income.

CONCLUSIONS

After above analysis, it has been found that because of physiographic constraints there is uneven distribution of agricultural infrastructure development in Jammu province. Level of infrastructure development is higher in southern region which comprised of Jammu and Kathua district. Comparatively leveled topography and fertile soil of these districts have provided suitable environment for infrastructure development. Whereas other districts due to highly undulating

topography, less fertile soil and remote location have achieved moderate and low level of infrastructure development in the region. As far as the role of infrastructure in agriculture development is concerned it is observed that agricultural infrastructure is positively co-related with the agriculture productivity. Pre-harvest infrastructure has shown the highest co-relation with agricultural productivity which clearly indicates that irrigation; nurseries and fertilizers are the most important determinants playing a significant role in the agricultural development in the study area. Overall correlation between infrastructure and agriculture productivity is positive and highly significant, at 99 percent significance level. The study area is backward in terms of pre-harvest infrastructure as it has recorded lowest index value in irrigation, primary agricultural credit societies and in fertilizers and insecticide consumption. The districts like Kishtwar, Reasi and Ramban had poor pre-harvest infrastructure which is attributed to the remote location and physical constraints of these areas.

LITERATURE CITED

1. National Agriculture Infra Financing Facility. 2020. Main Features. Retrieved from https://agriinfra.dac.gov.in/
2. Food and Agriculture Organization of the United Nations (2003). Anti-Hunger Programme: A Twin-track Approach to Hunger Reduction: Priorities for National and International Action. Retrieved from www.fao.org.
3. Singh J, Dhillon SS. 2004. *Agriculture Geography*. 3rd Edition. Tata McGraw Hill Education, New Delhi.
4. Anonymous. 2020. https://apeda.gov.in/apedawebsite/Comparative_Statement_sep.-2020-21.pdf
5. Binswanger HP, MC, Vang A, Bower, Mundlak Y. 1987. On determinants of cross-country aggregate agriculture supply. *Journal of Econometrics* 36(1): 111-113.
6. Jaffee and Morton J. 1995. Marketing Africa's high-value foods: Comparative experience of an emergent private sector. Washington, DC: World Bank, and Dubuque, Iowa: Kendall/Hunt Publishing Company.
7. World Bank Studies. 1994. World Development Report 1994. Infrastructure for Development. Published for the World Bank Oxford University Press.
8. Ahmed R, Hossain M. 1990. Developmental Impact of Rural Infrastructure in Bangladesh, IFPRI. Research Report 83. Washington, D.C. IFPRI.
9. Thorat SK, Sirohi S. 2002. Development of Rural Infrastructure in India: Trends and Emerging Issues, State of Indian Farmer: A Millennium Study. Ministry of Agriculture, Government of India, New Delhi.
10. Bhatia MS. 1999. Rural Infrastructure and Growth in Agriculture. *Economic and Political Weekly* 34(13): A43-A48.
11. Patel A. 2010. Infrastructure for agriculture and rural development in India need for a comprehensive program and adequate investment. Financial Inclusion for Development. Retrieved from https://www.findevgateway.org/sites/default/files/publications/files/mfg-en-paper-infrastructure-for-agriculture-rural-development-in-india-need-for-a-comprehensive-program-adequate-investment-sep-2010.pdf
12. Jammu and Kashmir ENVIS Centre. 2011-12. Profile of Jammu and Kashmir. Retrieved from http://jkenvis.nic.in/administrative_profile_data_2012.html
13. Husain M. 2000. *Systematic Geography of Jammu and Kashmir*. New Delhi, India: Rawat.
14. Organization for Economic Co-operation and Development. 2008. Handbook on constructing composite indicators, methodology and user guide. Retrieved from https://www.oced.org
15. Khullar DR. 2021. Essential of practical geography. Chaukhamba Auriyantaliya. Fortune publications, Punjab University.
16. Wos A. 2020. Interaction between pre-harvest and post-harvest systems and their implications for socio-economic development. United Nations University. Retrieved from https://archive.unu.edu/unupress/food/8F072e/8F072E02.htm
17. Rosa S, Rolle. 200). Postharvest Management of Fruits and Vegetables in the Asia-Pacific Region. Retrieved from http://www.fao.org
18. Choudhury ML. 2006. Recent Developments in Reducing Postharvest Losses in The Asia-Pacific Region. Postharvest Management of Fruits and Vegetables in the Asia-Pacific Region. Japan:Asian Productivity Organization and Italy: Food and Agriculture Organization of United Nations.
19. J&K Horticulture Planning and Marketing Department. 2020. About us. Retrieved from http://jkdhpm.in/index.aspx
20. Aschauer DA. 1989. Is public expenditure productive? *Journal of Monetary Economics* 23: 177-200.
21. Canning D. 1998. A database of world stocks of infrastructure, 1950-95. *World Bank Economic Review* 12(3): 529-547.
22. Calderon C, Chong A. 2004. Volume and quality of infrastructure and the distribution of income: An empirical Investigation. *Review of Income and Wealth* 50(1): 87-106.
23. Sawada Y. 2000. Dynamic poverty problem and the role of infrastructure. *JBIC Review* 3(1): 20-40.
24. Pinstrup-Andersen P, Shimokawa S. 2006. Rural infrastructure and agricultural development. Paper for presentation at the Annual Bank Conference on Development Economics, Tokyo, Japan, May 29-30.
25. Antle JM. 1983. Infrastructure and aggregate agricultural productivity: International evidence. *Economic Development and Cultural Change* 31(3): 609-619.
26. Binswanger HP, Vang MC, Bower A, Mundlak Y. 1987. On determinants of cross-country aggregate agriculture supply. *Journal of Econometrics* 36(1): 111-113.
27. Llanto GM. 2012. The impact of Infrastructural development on Agricultural productivity. ECONSTOR. Retrieved from http://hdl.handle.net/10419/126883
28. Singh P, Kaur J. 2014. Role of infrastructure in the growth of agriculture in Punjab. *IOSR Journal of Economics and Finance* 3(5): e-ISSN: 2321-5933, p-ISSN: 2321-5925.