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SUSTAINABLE AGRICULTURE AND TRADITIONAL IRRIGATION PRACTICES IN BIHAR

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Abstract

In terms of global agriculture and socioeconomic development, the Sustainable Development Goals (SDGs) mark key turning points over the course of time. At both the macro and the micro levels, several researchers have made extensive documentation of the impending threats to agricultural sustainability and the myriad of elements that it encompasses. In the empirical study of sustainable agriculture, there are a number of practical obstacles to be faced, and the amount of research on sustainability indicators and quantification is very limited. The purpose of this research is to assess the possibility of agricultural sustainability in regions that are related to the state of Bihar in India. A tool known as an indicator was also utilised in order to study the variation that exists across districts in terms of the accessibility of resources. In order to calculate the agricultural sustainability index, secondary data were employed on a total of 28 agroecological indicators that were measured at the district level. The indicators are divided down into six different dimensions in order to reflect the variance that is distinct to each location. These categories are as follows: information accessibility, physical resources, financial resources, human resources, social resources, and livelihood diversity. The information was given by the Census, the NSSO, the MoSPI, and NABARD. We came to the realisation that the agricultural sector in Bihar is only minimally sustainable, and that the socioeconomic and environmental circumstances in each district are deteriorating towards higher levels. As a consequence of this, it is essential to pay special attention to the efficient utilisation of both human and material resources, as well as to the enhancement of management strategies. There is a possibility that the framework that was provided might be utilised for the purpose of monitoring sustainability in various parts of the country.

keywords : *Sustainable development , agricultural development , traditional irrigation.*

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INTRODUCTION

Sustainable agriculture is defined by the World Commission on Environment and Development as the management and use of the agricultural ecosystem in a manner that protects other ecosystems while maintaining its biological diversity, productivity, ability to regenerate, vitality, and capacity to function in order to fulfil significant ecological, economic, and social roles at the local, national, and international levels . Sustainable agriculture may also be referred to as eco-friendly agriculture. There is a wide range of goals that may be achieved through sustainable agricultural approaches. Agricultural systems are necessary in order to supply society with sufficient energy from food, a variety of nutrients that are necessary for a healthy diet, and financial advantages for farmers, companies, and other stakeholders in the food system that are involved in the food system. The goal of sustainable agricultural systems is to simultaneously reduce emissions of greenhouse gases and the adverse effects of agrochemicals on the environment, enhance the utilisation of water and land, and adapt to the impacts of climate change and unpredictability.

In addition to being able to provide sufficient nourishment, a sustainable agricultural system must also be able to adapt to unpredictable and variable fluctuations in temperature, precipitation, and severe events that are brought about by both natural and man-made causes. Agricultural systems at low latitudes, particularly those in India, are predicted to incur increased yield losses as temperatures rise, according to models that analyse how future climate change may effect agricultural output. This is the case if appropriate adaptation measures are not applied. millions of low-income, small-scale farmers in low latitudes are especially susceptible to the effects of climate change and volatility since they have few options for adapting to the changing environment. Additionally, there is a need for efficiency in agricultural land use due to a number of variables, including the reduction in the size of fields owned by smallholder farmers, the limitations on agricultural labour caused by the migration of people to urban regions, and the increasing dependency ratios (the ratio of jobless to employed household members) in countryside areas.

One of the areas that receives the greatest attention is agricultural development. This is due to the fact that a sizeable portion of the population is still employed in the agricultural sector. The main characteristics of agricultural growth are the widespread modernization of agriculture, the creation of numerous contemporary techniques, and the increase in farm productivity. These three factors

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are essential to the expansion of agriculture. Because of this, the majority of development strategies, including those that focus on other sectors, typically emphasise the necessity of rapid agricultural expansion in general and modernization in particular. This is because of the reasons stated above. The primary objective of agricultural growth from an economic standpoint is to raise the average income per person. In addition, agricultural development helps to provide the perfect farming settings for increasing the efficiency of crop planting, harvesting, and processing, all of which have the potential to reduce poverty and save lives. The 180-degree approach to development among tribal and minority societies has, without a doubt, brought about a shift in the manner that agriculture is carried out in the modern industry. Improved agricultural methods have been observed all throughout the world, and India is not an exception to this trend. Over the years, the government of India has made efforts to promote the expansion of the agricultural sector. First and foremost, the Indian government has made a number of attempts to convince farmers to adopt modern agricultural farming techniques in order to boost output. These efforts have been made in an effort to raise overall productivity. On the other hand, the frequent obstacle that stood in the way was the difficulty of reaching these facilities. Due to the fact that the majority of farmers in our country still live in rural regions, they are not aware of how to implement modern agricultural techniques. In addition, they do not have a clear understanding of the modern methods that are used to prepare the soil and to make use of seed varieties that produce high yields. Their inability to communicate effectively and their low level of educational attainment have frequently resulted in a general lack of understanding regarding the most recent agricultural technology and research projects. As a consequence of this, in contrast to a great number of other places of the world, these features have not been a significant contributor to the success of agricultural improvement. Understanding the difficulties and conundrums that are associated with agricultural growth has, of course, been the subject of a significant amount of research.

Problems of Indian Agriculture:

Golait recognised the beneficial impact of the government's crop diversification strategy in a Reserve Bank of India study, which was released in reaction to allegations of farmer suicides. Golait continued, "Indian agriculture continues to be plagued by:

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1.Low level of output

2.declining water levels

3.hefty credit

4.A misaligned marketplace

5.Numerous middlemen and intermediates who raise prices without adding much value

6.regulations that hinder private investment

7.Regulated costs

8.inadequate facilities and

9.inappropriate study.

For this reason, concentrating just on credit without taking into account any of the other factors will not be beneficial to agriculture.

Many of the agricultural techniques that are now in use, such as the use of tractors and other machinery, are designed for nations that have larger landmasses than India. In India, more than eighty percent of farmers have fewer than five acres of land, which makes farming expensive. The use of harmful pesticides and insecticides is one factor that adds to the bad reputation that farming has in terms of health. One example of this is the Cancer train, which travels from Punjab to Rajasthan throughout the country. The rate of inflation is one of the most significant challenges that the country is now experiencing; in order to slow down the rate at which food is produced, it is necessary for a farmer, distributor, retailer, or any other link in the food supply chain to take the brunt of the impact. The policies of the government have been centralised up to this point, which means that a single policy applies to all of the farmers in the country. Every single farmer has a different collection of infrastructural problems, each of which needs to be addressed on an individual basis. In spite of the fact that it is admirable that the government places a high priority on irrigation, the lack of a drainage system results in an excessive amount of water flowing especially during the rainy season. Minimum support prices (MSPs), which have been issued by a number of state governments, have traditionally been the instrument that has been utilised to address falling prices. The usefulness of these methods on farms, on the other hand, has been called into doubt. In addition, the effects of climate change are one of the primary reasons why crops fail to provide the desired results.

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Bihar: as it is in the present:

On November 25, 2000, Bihar underwent a reorganisation that resulted in the formation of 38 districts that are dispersed throughout an area of 94163 square kilometres. The longitude of these districts ranges from 83"-19'-50" to 88"-17'-40" east, while the latitude ranges from 24"-210" to 27"-31'-15" north for these districts. In spite of the fact that Bihar is totally surrounded by land, it is possible to assert that the state's connection to the ocean is not too far away because of the Port of Kolkata. In the east, Bihar is impacted by the humid climate of West Bengal, while in the west, the climate of Uttar Pradesh, which is sub-humid, is also a factor. Nepal is located in the north, Jharkhand is located in the south, West Bengal is located in the east, and Uttar Pradesh is located in the west. These are the territories that border it respectively. The North Bihar Plains and the South Bihar Plains are physically distinct from one another, and each of these plains possesses its own set of geographical similarities and differences. There are a number of rivers and small tributaries that flow across the state, but the Ganga, Sone, Gandak, Kosi, Ghaghra, Bagmati, BudhiGandak, Poonpoon, and other rivers are the most prominent and are always flowing. In around forty percent of cases, the places that are farmed are prone to floods, and in another forty percent of cases, they are prone to drought.

After the partition of Bihar in November of 2000, the significant industrial hubs, wooded regions, and mineral belts that comprised the undivided Bihar were incorporated into the newly established state of Jharkhand. As a result, the only things that remained in Bihar were agricultural land and industries tied to agriculture. The agricultural sector is responsible for roughly 38 percent of Bihar's gross domestic product and employs over 75 percent of the state's labour force on average. Agriculture serves as the major engine that propels the economy of the state. Other crops, including as oilseeds, pulses, barely, gramme, maize, and others, are grown in the state as supplemental crops in addition to the many other coarse grains that are grown there. A variety of crops, including rice, wheat, sugarcane, lentils, and jute, are among the primary crops that are farmed in the state. Despite the fact that the state is recognised for producing a wide range of fruits and vegetables, it is particularly well-known for growing fruits such as litchi, bananas, and mangoes.

Agriculture has been the major engine of production in Bihar ever since the state was divided. However, despite the fact that it has the capacity to be updated, it is still considered to be out of date

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since there is a serious shortage of infrastructure, notably the cash that is required to invest in its modernization. A total area of approximately 56980 square kilometres is included of the North Gangetic plain, which is characterised by alluvial soil. The soil, in point of fact, does not contain any stone formations and is so abundant in nutrients that it is possible for crops to grow there anytime water can be pounded. In certain places, this soil may even be found at the foot of the Himalayan mountains. The most detrimental effect that this genetic design is subjected to is the annual damage that it brings about as a result of floods. Floods are a typical occurrence in the southern region of Bihar, notably in the Sonebasine and genetic plain regions. On the other hand, droughts are more prevalent in the hilly parts of the southern region. The climate of Bihar is perfect for growing a broad variety of crops, including cereals, coarse grains, fruits, vegetables, and several types of fibre crops. The total area of its agricultural lands is 92,358.40 square kilometres, while the total area of its urban regions is 1804.60 square kilometres. Clay, sandy, and loamy soil are the predominate types of soil found at an elevation of 173 feet above sea level. The average normal rainfall is 116.4 millimetres, and the temperature may fluctuate from a high of 44 degrees Celsius to a low of little more than 5 degrees Celsius. In terms of agricultural endeavours, each of these circumstances is quite beneficial.

According to the findings of the Tendulkar Committee research, which indicated that 54.5% of the population of Bihar lives below the poverty line, the degree of poverty in the state might be determined by using this information. The percentage of people living in rural areas is 55.7 percent, whereas the percentage of people living in urban areas is 43.7 percent.a. 1. Agriculture, which is a sector that is in a backward stage and has a terrible sluggish pace of growth, is the only source of income for ninety percent of the population, which still lives in villages and is dependent only on agriculture. Bihar continues to be the state with the lowest or bottom income, with a per capita income of Rs. 10,055, which is equivalent to 32.2% of India's average per capita income of Rs. 31,198. In past years, the government of Bihar has said that it has climbed and is currently at a total of 16,119 rupees. However, this increase accounts for less than one-third of the average per capita income in India, which is now 46,492 rupees for the whole country. This is in contrast to the current average of 46.492 rupees. When compared to the average per capita growth rate for all of India, this suggests that even now, despite the assertions of the Bihar administration that the state is performing at a high growth rate, the per capita income growth of the state is moving downward.2.

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There was a drop in the net sown area of the state, which now accounts for 60.5% of the total area of total geographical areas to 59.4 percent in recent years.

In comparison to the agricultural production of other states, such as Punjab, Haryana, and Andhra Pradesh, amongst others, it appears that Bihar's agricultural output was significantly lower. When compared to other agricultural states, Bihar falls substantially behind in terms of the amount of output produced per hectare. The average annual electricity consumption per person in the state is 122.11 kilowatt-hours, which is much lower than the national average of 778.71 kilowatt-hours. In addition to the brief examples that were presented earlier that illustrate how backward the economy of Bihar is, the state of the agro-allied industries, which include dairy, poultry, piggery, horticulture, and so on, is also quite precarious. This is because there is a lack of developed transportation infrastructure, processing facilities, research facilities, and other facilities that are necessary for the preservation of produced materials.

Important Difficulties:

The agricultural sector of the state is confronted with a wide range of complicated problems that originate from both inside and outside the administration. Historically, state agriculture has been typified by poor productivity across all sectors, including horticulture, crops, dairy, meat, eggs, and fisheries. This has been the case throughout the decades. Low levels of productivity have a direct influence on the high levels of poverty and low income that are prevalent in the community. The primary reasons for low productivity are discussed in the following paragraphs,

1. **Aspects related to technology:** In the state, there are one horticulture college, one agriculture engineering college, one dairy technology college, one veterinary college, two agricultural universities, and five agricultural colleges. There is a working Krishi Vigyan Kendra (KVK) at each of the 38 locations.The Eastern States Regional Headquarters of ICAR is located in Patna. In addition, the state has created the National Research Centre for Makhana and Litchi. However, because farmers are hesitant to accept new technology, state production is still poor. Cereal dominance in cropping patterns is a reflection of state agriculture's subsistence focus. Bringing the newest technology to farmers' fields is a problem for the institutional extension system.

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2. **Land Concerns:** Marginal holdings, or farms less than one hectare in size, account for significantly more than ninety-one percent of all holdings. Each and every one of these assets is divided into smaller pieces once more. Land-related records are out of date, which makes institutional investment almost impossible. Small-scale farming has several difficulties in the area of economies of scale.
3. **Rain fed farming:** There is still a significant degree of dependence on the monsoon on the agricultural sector of the state. It has been four years in a row that there has been a drought or a situation that is comparable to a drought. This has occurred during the course of the past five years. There is a limited chance to make investments in costly inputs, which makes the production of Kharif crops primarily a risky endeavour. The irrigation of canals is not very widespread. Irrigation is mostly dependent on tube wells that are driven by diesel, which accounts for seventy percent of the total. Due to the high cost of diesel-based irrigation, it is a very difficult input for even rabi crops to deal.
4. **Inadequate Facilities:** The state's efforts to enhance agricultural growth are hampered by a number of reasons, including inadequate road connections, storage capacity, and the availability of electricity for the agricultural industry.
5. **Absence of financing from institutions:** As a consequence of the slow speed at which the Kisan Credit Card is being implemented, a substantial number of farmers are left reliant on non-institutional credit sources that are prohibitively expensive. This presents a significant barrier to the utilisation of current agricultural inputs and the use of contemporary technology.
6. **Processing and marketing fail to meet expectations:** Both the marketing and processing facilities are inadequate, which has a negative impact on the revenue of farmers.
7. **Both Flooding and Drought:** There is a dependence on the monsoon on state agriculture. It is possible that a lack of rainfall might result in drought, while significant rainfall could cause flooding. Due to the fact that floods and droughts occur practically every year at the same time, agriculture is extremely susceptible to risk and instability.

In the state of Bihar, Irrigation and Water Management

The fact that the state of Bihar possesses both substantial surface water resources and ground water resources that are in equilibrium is a benefit for the state for which it is responsible. Private

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investments are being made in this sector largely for the purpose of obtaining ground water through shallow tubewells, cavity wells, bamboo wells, as well as through dugwells and irrigation ponds in a confined area. This is the primary reason for the investments. When referring to the state, the word "safe category" is used to refer to each and every block. The level of irrigation that covers around 49 percent of the total planted area in the states is significantly greater than the average of 40 percent that is seen across the nation. Approximately twenty-four percent of the net irrigated area in Zone-1 comes from tubewells, thirteen percent of the net irrigated area in Zone-2 comes from tubewells, and forty-eight percent of the net irrigated area in Zone-3 comes from tubewells. It is estimated that tubewells are responsible for about 76 percent of the net irrigated area in Zone-1, 85 percent of the net irrigated area in Zone-2, and 45 percent of the net irrigated area in Zone-3 for irrigation purposes. Tubewell irrigation accounts for sixty-two and a half percent of the net irrigated land in the state as a whole, while canal irrigation accounts for thirty percent of the total. Other sources account for seven and a half percent of the net irrigated land in the state.There will be 16.11 lakh hectares of ground water accessible for irrigation in the future, which has the ability to support roughly 8 lakh new tubewells in the state. This amount of ground water is expected to be available in the following years. It is estimated that roughly 3 lakh units have been placed, and there is still the chance that approximately 5 lakh units will be placed in the year to come.

OBJECTIVES

1. To study about the agriculture that is sustainable in the district of Bihar.
2. To study about Management of water and irrigation in the state of Bihar.
3. To study about Extension of agricultural production in the Bihar district.

RESEARCH METHODOLOGY

Bihar is a state in India that is located in the eastern region of the country and is known for having land that is of a high quality. Not only does Bihar have a border with the states of Uttar Pradesh, Jharkhand, and West Bengal, but it also has a border with Nepal, which serves as the state's international boundary. Each of the four main agro-climatic zones that make up the state of Bihar are as follows: the Alluvial Plain, the Northeast Alluvial Plain, the Southeast Alluvial Plain, and the Southwest Alluvial Plain. There are 38 districts that make up the state of Bihar, and these districts are further split into 534 Development Blocks and 45,103 revenue villages. This is according to the

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administrative division of the state. Within the state of Bihar, the whole geographical area is roughly 93.60 lakh hectares; however, only 56.03 lakh hectares are regarded to be the net cultivated area, while the gross cultivated area is approximately 79.46 lakh hectares. There are several sources of irrigation that are responsible for watering roughly 33.51 lakh hectares of net land and 43.86 lakh hectares of gross area. In terms of crops farmed for human use, the most important ones are paddy, wheat, maize, and pulses. According to estimates, the forest cover in Bihar includes a total area of 6, 764 square kilometres, which is comparable to 7.1% of the total land area in the state. Additionally, agriculture is a notable contributor to the current status of the economy in the state of Bihar. The results of the Census that was conducted in 2011 indicate that agricultural activities are carried out by 76% of the population. There is a connection between Ganga, which is the principal river that runs through the area, and the tributaries that start in the Himalayas. Because of its tropical monsoon setting, the state goes through three distinct seasons: winter, summer, and the rainy season. These seasons give the state its distinct characteristics. During the course of a year, the average amount of precipitation that falls is 1205 mm, and the average number of days that are wet is 52.5. The state has been experiencing water shortages and floods, which has had an effect on the agricultural and water resources industries. These issues have arisen as a consequence of the Southwest Monsoon, which is responsible for causing major fluctuations in the distribution of rainfall each year.

A methodology known as the indicator method was utilised in the current research project in order to ascertain whether or not agriculture is sustainable. Using the indication technique, it is possible to make use of any kind of data, regardless of its magnitude. The researcher is able to use proxy data for the development of the food security index at any size, including individual, family, village, district, state, and nation levels. This is one of the most attractive aspects of this approach. Having access to this capability is especially helpful in circumstances when reliable data is not readily available. Furthermore, the indicator method offers a number of qualities that have made it feasible for it to be utilised in a widespread manner in the planning process and in the transmission of policy during the course of the time period that has passed. one of these features is the capacity to condense a substantial amount of information into a format that is not only simple to handle but also simple to interpret. This enables the identification of the present level of performance for domains that are difficult to measure directly and are characterised by their complexity and an elusive nature.

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In addition, the indicator technique may be used to identify, prioritise, and rank the regions that are food insecure. This is done in order to outline the likely hurdles that are present in the process of a region's development. In conclusion, it may be employed to monitor and assess the development of an intervention, which will allow for enhanced decision-making when it comes to the intervention.

RESULT

The PRSI stands for Physical Resource Sustainability.

The information shown in Table 1 demonstrates the degree to which Bihar's physical resources are able to be preserved throughout duration. When compared to the other districts in Bihar, the Siwan district is regarded to have the most sustainable physical resources, whilst the Sitamarhi district is considered to have the least sustainable physical resources. Both districts are located in the state of Bihar. As an additional point of interest, the research on cross-indicators indicated that the Siwan district's superior physical resource sustainability was mostly attributed to relative advantages in farming intensity and irrigation, in addition to gains in transit coverage. Moreover, according to the statistics, the Siwan district is the one that has the greatest agricultural and irrigation intensities, with 292.88 and 228.75 respectively. This makes it the district with the highest agricultural intensity. Additionally, more than sixty percent of the population is afforded the opportunity to travel on such seasonal roadways. On the other side, the Sitamarhi district has irrigation and farming intensities of just 121.63 and 155.43 respectively, and only 34.87% of the population has access to all seasonal routes. This is a significant disparity..

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Table1. District-specific Sustainability Index for Physical Resources

Districts	AverageLandsize (Hac)	Areaundermarginal farmers (Hac)	IrrigationIntensity(%)	CroppingIntensity(%)	AccessofAllSeasonal Roads	PercentageofForestArea	PercentageofLivestock	PhysicalResourcesIndex	Rank
Siwan	0.012	0.336	0.070	0.074	0.078	0.000	0.043	0.613	1
Lakhisarai	0.061	0.329	0.023	0.031	0.072	0.000	0.074	0.589	2
Katihar	0.051	0.316	0.052	0.018	0.085	0.000	0.065	0.587	3
Gopalganj	0.016	0.333	0.040	0.030	0.021	0.046	0.091	0.576	4
Nawada	0.033	0.321	0.040	0.029	0.035	0.028	0.089	0.576	5
Jehanabad	0.043	0.317	0.030	0.015	0.044	0.050	0.073	0.571	6
Samastipur	0.020	0.335	0.025	0.048	0.064	0.000	0.079	0.571	7
Saran	0.029	0.336	0.019	0.028	0.064	0.000	0.091	0.567	8
Muzaffarpur	0.036	0.326	0.031	0.038	0.044	0.003	0.082	0.560	9
Nalanda	0.050	0.305	0.028	0.014	0.039	0.038	0.078	0.552	10
Banka	0.054	0.325	0.025	0.015	0.033	0.023	0.076	0.552	11
Bhojpur	0.044	0.315	0.027	0.013	0.061	0.000	0.087	0.547	12
Madhubani	0.029	0.318	0.029	0.014	0.051	0.031	0.074	0.545	13
Purnea	0.058	0.291	0.048	0.029	0.044	0.000	0.067	0.539	14
Munger	0.019	0.329	0.028	0.020	0.059	0.000	0.082	0.537	15
Gaya	0.041	0.312	0.021	0.029	0.038	0.000	0.091	0.531	16
Rohtas	0.037	0.316	0.015	0.019	0.045	0.000	0.099	0.530	17
Saharsa	0.045	0.300	0.007	0.018	0.051	0.026	0.082	0.529	18
Madhepura	0.031	0.321	0.026	0.016	0.047	0.000	0.087	0.528	19
Aurangabad	0.053	0.289	0.011	0.032	0.049	0.009	0.084	0.528	20
EastChamparan	0.027	0.324	0.022	0.005	0.036	0.024	0.087	0.525	21
Araria	0.050	0.298	0.007	0.032	0.056	0.000	0.079	0.522	22
Kishanganj	0.047	0.321	0.016	0.023	0.044	0.016	0.054	0.521	23
Begusarai	0.023	0.329	0.033	0.026	0.046	0.000	0.061	0.518	24
Sheikhpura	0.038	0.331	0.022	0.013	0.052	0.000	0.062	0.518	25
Darbhanga	0.020	0.328	0.008	0.002	0.069	0.000	0.089	0.516	26
Vaishali	0.039	0.314	0.021	0.018	0.040	0.000	0.084	0.515	27
Supaul	0.025	0.327	0.021	0.029	0.055	0.000	0.053	0.511	28
WestChamparan	0.000	0.338	0.006	0.028	0.046	0.000	0.091	0.508	29
Jamui	0.033	0.302	0.005	0.058	0.047	0.001	0.060	0.506	30
Patna	0.027	0.319	0.031	0.013	0.046	0.000	0.065	0.501	31

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Buxur	0.066	0.278	0.003	0.018	0.044	0.000	0.078	0.487	32
Bhagalpur	0.026	0.331	0.015	0.009	0.034	0.000	0.065	0.481	33
Kaimur	0.039	0.302	0.010	0.024	0.020	0.001	0.082	0.477	34
Arwal	0.038	0.318	0.007	0.000	0.049	0.000	0.060	0.473	35
Khagaria	0.033	0.306	0.027	0.022	0.023	0.000	0.059	0.471	36
Sitamarhi	0.025	0.323	0.005	0.030	0.041	0.000	0.039	0.463	37
Weight	10	35	11	8	11	15	10		

The Sustainability of Financial Resources Index (FRSI)

The state of the districts that are connected to Bihar in terms of their ability to maintain their financial resources is indicated in Table 2, which can be seen here. As a result of the results, it was found that the Katihar district, which had an index score of 0.090, possessed the highest level of financial resource sustainability. On the other hand, the West Champaran district, which had an index score of 0.028, possessed the lowest level of resources sustainability. According to the findings of the cross-indicator analysis, the key characteristics that lead to the highest degree of financial resource sustainability are the highest membership of agricultural credit groups and the biggest percentage of households that receive remittances through the international financial system. It is anticipated that around 56 percent of farmers who are located in the Katihar region have joined the agricultural credit society in order to address the financial constraints that they are now experiencing. It is estimated that around 38 percent of farmers have received remittances from metropolitan regions. This is an insult to injury. In contrast, just 19% of farmers who are members of the West Champaran area are members of the agricultural credit organisation, and only 3% of farmers have received remittances from urban regions within the region.

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Table2. Index of Financial Resource Sustainability, Broken Down by District

Districts	Agricultural**Credit** societies(%)	Proportion of farmers tookinsurance(C+D%)	Percentage of HHs receiving**Remittances**	PercentageofHHstaken loan from institutional sources	PercentageofHHsaccess to Tractors	FinancialResourcesIndex	Rank
Katihar	0.033	0.009	0.032	0.007	0.009	0.090	1
Purnea	0.030	0.000	0.005	0.036	0.009	0.080	2
Lakhisarai	0.019	0.013	0.021	0.018	0.008	0.079	3
Madhepura	0.017	0.039	0.004	0.009	0.009	0.077	4
Saran	0.020	0.000	0.012	0.020	0.021	0.073	5
Nawada	0.018	0.000	0.011	0.027	0.013	0.068	6
Khagaria	0.012	0.000	0.030	0.014	0.012	0.067	7
Jehanabad	0.004	0.004	0.028	0.015	0.014	0.066	8
Gaya	0.008	0.000	0.014	0.016	0.026	0.064	9
Patna	0.002	0.000	0.009	0.024	0.029	0.064	10
Araria	0.019	0.016	0.013	0.002	0.014	0.063	11
Rohtas	0.015	0.000	0.016	0.018	0.012	0.060	12
Siwan	0.028	0.014	0.004	0.003	0.011	0.059	13
Vaishali	0.013	0.000	0.009	0.013	0.022	0.057	14
Darbhanga	0.023	0.000	0.017	0.005	0.011	0.057	15
Bhagalpur	0.008	0.000	0.017	0.021	0.008	0.054	16
Madhubani	0.008	0.016	0.007	0.020	0.004	0.054	17
Aurangabad	0.005	0.000	0.009	0.006	0.027	0.047	18
Bhojpur	0.010	0.003	0.013	0.016	0.004	0.047	19
Saharsa	0.006	0.007	0.008	0.017	0.007	0.046	20
Jamui	0.006	0.006	0.011	0.009	0.013	0.046	21
Gopalganj	0.002	0.000	0.006	0.019	0.018	0.046	22
Samastipur	0.016	0.000	0.003	0.019	0.005	0.043	23
Muzaffarpur	0.020	0.000	0.008	0.006	0.009	0.042	24
Begusarai	0.017	0.005	0.004	0.011	0.006	0.042	25
Kaimur	0.011	0.000	0.017	0.003	0.010	0.041	26
Banka	0.005	0.000	0.008	0.007	0.019	0.040	27
East Champaran	0.006	0.000	0.011	0.011	0.012	0.039	28
Munger	0.010	0.000	0.005	0.023	0.000	0.038	29
Buxur	0.012	0.007	0.008	0.011	0.000	0.038	30

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Supaul	0.020	0.003	0.009	0.005	0.000	0.036	31
Kishanganj	0.010	0.003	0.006	0.014	0.002	0.036	32
Sitamarhi	0.015	0.000	0.004	0.012	0.005	0.035	33
Nalanda	0.012	0.000	0.006	0.008	0.009	0.035	34
Sheikhpura	0.010	0.004	0.000	0.018	0.000	0.033	35
Arwal	0.005	0.003	0.005	0.009	0.006	0.029	36
West Champaran	0.011	0.005	0.003	0.007	0.003	0.028	37
Weight	16	23	19	21	21		

(HRSI) stands for the Human Resource Sustainability Index.

The current state of the sustainability of human resources in Bihar is presented in Table 3. It was discovered via the findings that the Saharsa district, which has an index score of 0.127, possesses the highest level of sustainability, whilst the Supaul district, which has an index score of 0.108, possesses the lowest level of sustainability. There are four indicators that are used to create the human resource sustainability index. These indicators include the literacy rate, the mean age, the adult population, and the number of families that have had formal agricultural training. On the basis of the cross-indicator analysis, it has been determined that the farmers who belong to the Saharsa district are considerably younger and have a higher level of literacy than the farmers who belong to the Supaul district. The average age of residents of Saharsa was 29 years old, and the literacy rate was more than 70 percent.

Table3. Index of Human Resource Sustainability broken down by district

District	Percentageof HH taken formal Training in Agriculture	LiteracyRate(%)	MeanAge (Years)	Percentageofadult population in households	HumanResources Index	Rank
Saharsa	0.009	0.049	0.016	0.053	0.127	1
Begusarai	0.011	0.042	0.011	0.063	0.127	2
Banka	0.007	0.039	0.013	0.066	0.126	3
Bhojpur	0.010	0.047	0.003	0.066	0.125	4
Madhepura	0.016	0.040	0.011	0.058	0.125	5
Patna	0.015	0.042	0.000	0.066	0.124	6
Aurangabad	0.000	0.047	0.011	0.066	0.124	7
EastChamparan	0.011	0.042	0.008	0.063	0.123	8

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Kishanganj	0.007	0.041	0.013	0.061	0.122	9
Sheikhpura	0.006	0.044	0.013	0.058	0.121	10
Buxur	0.000	0.047	0.005	0.069	0.121	11
Khagaria	0.010	0.037	0.011	0.064	0.121	12
Muzaffarpur	0.008	0.043	0.011	0.059	0.121	13
Purnea	0.009	0.037	0.008	0.066	0.120	14
Vaishali	0.002	0.047	0.003	0.068	0.120	15
Nalanda	0.009	0.040	0.016	0.056	0.120	16
Samastipur	0.011	0.035	0.008	0.066	0.120	17
Gaya	0.006	0.044	0.000	0.070	0.119	18
Munger	0.007	0.042	0.008	0.062	0.119	19
Jehanabad	0.003	0.047	0.011	0.058	0.119	20
Jamui	0.004	0.045	0.016	0.054	0.118	21
Kaimur	0.013	0.034	0.013	0.058	0.118	22
Arwal	0.005	0.045	0.005	0.062	0.118	23
Siwan	0.009	0.036	0.011	0.061	0.117	24
Darbhanga	0.007	0.037	0.011	0.062	0.116	25
Katihar	0.002	0.039	0.018	0.057	0.116	26
Lakhisarai	0.007	0.035	0.013	0.060	0.114	27
Araria	0.009	0.036	0.005	0.064	0.114	28
Bhagalpur	0.007	0.041	0.008	0.059	0.114	29
Madhubani	0.000	0.045	0.011	0.057	0.113	30
WestChamparan	0.005	0.039	0.005	0.063	0.112	31
Saran	0.000	0.042	0.011	0.060	0.112	32
Gopalganj	0.000	0.040	0.008	0.063	0.111	33
Sitamarhi	0.000	0.042	0.013	0.055	0.111	34
Nawada	0.000	0.037	0.003	0.071	0.110	35
Rohtas	0.005	0.033	0.011	0.061	0.110	36
Supaul	0.007	0.035	0.008	0.059	0.108	37
Weight	40	26	21	13		

(SRSI) stands for the Social Resource Sustainability Index

Table 4 provides an overview of the current situation in the district that is situated in relation to Bihar with regard to the viability of its social resources. As a result of the research, it was discovered that the neighbourhood of Madhepura has the highest social resource sustainability index score , whereas the neighbourhood of Nalanda has the lowest sustainability index score . The findings of the cross-indicator study indicate that farmers from the Madhepura district, which has the highest index score, have gathered information from progressive farmers in order to increase their agricultural productivity and implement environmentally responsible practices in agriculture.

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This information was gathered in order to improve the quality of their agricultural products. More than sixty percent of farmers have adopted the suggestions of specialists in order to deal with both natural and man-made disasters, according to the statistical data found in the previous sentence. However, it has been said that none of the farmers who are a part of the Nalanda area have adopted the advice that have been made by progressive farmers. This is contrary to what was stated earlier.

Table4. Index of Social Resources Organized by District

District	PercentageofFemaleHead Household	PercentageofJointFamily	Percentage of Households taken information to Progressive farmers	Percentage of HH member stayedawayfromusualplaceof residencefor15dayormorefor employment purpose	SocialResourcesIndex	Rank
Madhepura	0.206	0.044	0.035	0.028	0.313	1
Kaimur	0.210	0.062	0.003	0.028	0.303	2
Samastipur	0.213	0.083	0.000	0.006	0.302	3
Aurangabad	0.183	0.053	0.018	0.048	0.302	4
Purnea	0.210	0.057	0.019	0.013	0.300	5
Supaul	0.215	0.059	0.017	0.004	0.294	6
Gopalganj	0.205	0.052	0.020	0.009	0.287	7
Saran	0.204	0.050	0.020	0.013	0.287	8
Darbhanga	0.211	0.042	0.011	0.022	0.286	9
Araria	0.213	0.056	0.000	0.016	0.285	10
Vaishali	0.205	0.062	0.013	0.004	0.284	11
Lakhisarai	0.193	0.044	0.033	0.013	0.283	12
Gaya	0.205	0.054	0.018	0.002	0.279	13
EastChamparan	0.185	0.050	0.034	0.009	0.278	14
Saharsa	0.190	0.062	0.016	0.009	0.277	15
Rohtas	0.206	0.062	0.006	0.003	0.277	16
Begusarai	0.202	0.047	0.017	0.008	0.275	17
Arwal	0.184	0.060	0.006	0.024	0.274	18
Bhojpur	0.193	0.063	0.008	0.009	0.274	19
Siwan	0.201	0.052	0.019	0.002	0.274	20
Banka	0.203	0.043	0.015	0.011	0.272	21
Jehanabad	0.192	0.056	0.010	0.013	0.271	22
Bhagalpur	0.210	0.033	0.022	0.005	0.270	23

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Sheikhpura	0.205	0.054	0.005	0.005	0.269	24
Katihar	0.201	0.061	0.005	0.000	0.266	25
WestChamparan	0.206	0.054	0.000	0.004	0.265	26
Buxur	0.183	0.065	0.008	0.008	0.264	27
Khagaria	0.183	0.066	0.014	0.001	0.263	28
Patna	0.196	0.056	0.000	0.009	0.262	29
Sitamarhi	0.189	0.050	0.022	0.000	0.260	30
Jamui	0.193	0.045	0.006	0.011	0.256	31
Muzaffarpur	0.205	0.042	0.002	0.005	0.254	32
Nawada	0.189	0.058	0.000	0.003	0.251	33
Madhubani	0.203	0.038	0.008	0.000	0.249	34
Munger	0.201	0.046	0.000	0.002	0.249	35
Kishanganj	0.190	0.038	0.012	0.005	0.246	36
Nalanda	0.185	0.044	0.000	0.000	0.229	37
Weight	45	10	15	30		

(ASI) stands for the Agriculture Sustainability Index

Table 5 provides a description of the agriculture sustainability index that was computed for the districts that are located within the state of Bihar. According to the results of the calculation of the agriculture sustainability index, the district of Saran has the greatest agriculture sustainability status , while the district of Kaimur's agriculture sustainability status is the lowest, with an index score of 0.273. The cross-indices analysis showed that the information accessibility index and human resource index with the highest scores are the primary drivers of higher agricultural sustainability in the Saran district, while the information accessibility index and human resource index with the lowest scores are the primary drivers of lower agricultural sustainability in the Kaimur district.

Table5. District-specific Index of Agricultural Sustainability

District	Physical ResourcesIndex	Financial ResourcesIndex	Human ResourcesIndex	Social ResourcesIndex	Livelihood DiversityIndex	Information AccessibilityIndex	Agricultural Sustainability Index	Rank
Saran	0.567	0.073	0.112	0.287	0.538	0.742	0.386	1
Siwan	0.613	0.059	0.117	0.274	0.436	0.589	0.348	2
Madhepura	0.528	0.077	0.125	0.313	0.469	0.521	0.339	3
Buxur	0.487	0.038	0.121	0.264	0.494	0.624	0.338	4
Lakhisarai	0.589	0.079	0.114	0.283	0.465	0.454	0.331	5

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Katihar	0.587	0.090	0.116	0.266	0.436	0.480	0.329	6
Bhojpur	0.547	0.047	0.125	0.274	0.510	0.457	0.327	7
Samastipur	0.571	0.043	0.120	0.302	0.523	0.390	0.325	8
Muzaffarpur	0.560	0.042	0.121	0.254	0.485	0.457	0.320	9
Nalanda	0.552	0.035	0.120	0.229	0.572	0.396	0.317	10
Jehanabad	0.571	0.066	0.119	0.271	0.489	0.384	0.317	11
Supaul	0.511	0.036	0.108	0.294	0.432	0.508	0.315	12
Purnea	0.539	0.080	0.120	0.300	0.511	0.330	0.313	13
Saharsa	0.529	0.046	0.127	0.277	0.539	0.360	0.313	14
Bhagalpur	0.481	0.054	0.114	0.270	0.405	0.548	0.312	15
Araria	0.522	0.063	0.114	0.285	0.485	0.396	0.311	16
Sheikhpura	0.518	0.033	0.121	0.269	0.499	0.419	0.310	17
Darbhanga	0.516	0.057	0.116	0.286	0.483	0.392	0.308	18
Rohtas	0.530	0.060	0.110	0.277	0.516	0.352	0.307	19
Gopalganj	0.576	0.046	0.111	0.287	0.440	0.373	0.306	20
Gaya	0.531	0.064	0.119	0.279	0.519	0.305	0.303	21
Aurangabad	0.528	0.047	0.124	0.302	0.496	0.320	0.303	22
EastChamparan	0.525	0.039	0.123	0.278	0.503	0.344	0.302	23
Nawada	0.576	0.068	0.110	0.251	0.555	0.238	0.300	24
Vaishali	0.515	0.057	0.120	0.284	0.460	0.343	0.297	25
Banka	0.552	0.040	0.126	0.272	0.464	0.324	0.296	26
Kishanganj	0.521	0.036	0.122	0.246	0.466	0.384	0.296	27
Khagaria	0.471	0.067	0.121	0.263	0.460	0.378	0.293	28
Begusarai	0.518	0.042	0.127	0.275	0.396	0.400	0.293	29
Patna	0.501	0.064	0.124	0.262	0.512	0.296	0.293	30
Arwal	0.473	0.029	0.118	0.274	0.479	0.376	0.291	31
Jamui	0.506	0.046	0.118	0.256	0.459	0.349	0.289	32
West Champaran	0.508	0.028	0.112	0.265	0.417	0.385	0.286	33
Munger	0.537	0.038	0.119	0.249	0.459	0.284	0.281	34
Sitamarhi	0.463	0.035	0.111	0.260	0.494	0.294	0.276	35
Madhubani	0.545	0.054	0.113	0.249	0.392	0.292	0.274	36
Kaimur	0.477	0.041	0.118	0.303	0.465	0.237	0.273	37

CONCLUSION

Several local issues that Bihari farmers encounter have been discussed in the previous discussion, leading to the emergence of a few major concerns. These issues are quite significant in terms of the state's farmers and the real expansion of the agricultural situation. Further proof that agricultural

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development policies still exist and are really implemented at the local level comes from the current study. The results of this study show that farmers in the state of Bihar cultivate crops that fall into three categories: pure profitable crops, crops that go hand in hand with food crops, and staple food crops. In one growing season, farmers frequently grow three different crops: rice, which is a staple diet; potatoes, which are eaten as a side dish; and a range of green vegetables. They also grow profitable pure crops including flower, betel-leaf, potato, groundnut, sesame, and guava. These crops are not only profitable, but there is a substantial market demand for them throughout the state. Because these crops are so profitable, farmers in the state choose to cultivate them. Conversely, they cultivate paddy only for their personal use. As a result, rice farming is declining over the whole state.

To improve their agricultural techniques, the farmers in the state of Bihar need a lot of help. Farmers submit applications for funding and extension initiatives. Every day, the cost of all agricultural inputs increases more and more. The vast majority of farmers who responded to the survey expressed discontent with the fact that farming is become less and less profitable. This is caused by more than simply the negative impacts of illness and the climate; it's also a result of rising production costs and declining commodity prices. Large amounts of gasoline are used by farmers to run equipment and irrigation pumps. Their profit margins will thus be greatly reduced by raising the price of fuel. According to research, farmers are more concerned about commodity crop low prices, poor profitability, and shifting markets than they are about climate change. The reason for this is that crops do better under irrigation than under rainfall. Because of this, the government's prompt intervention is crucial in addressing the aforementioned agricultural challenges. On the other hand, the state's agricultural system needs to expand, and it needs a diverse range of farmers to actively engage in system development.

REFERENCES

1. Antweiler, C. (1998). Local Knowledge and Local Knowing : An Anthropological Anlaysis of Contested Cultural Products' in the Context of Development. Anthropos.Vol. 93. pp. 469-494.
2. Berrigan, F. (1979). Community Communications: The Role of Community Media in Development. UNESCO, Paris.

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(An open access scholarly, peer-reviewed, interdisciplinary, monthly, and fully refereed journal.)

3. Bhalla, G.S. and D.S. Tyagi (1989). Patterns in Indian Agricultural Development : A District Level Study. Institute for Studies in Industrial Development, New Delhi.

4. Cleveland, D. A. (1994). Can Science and Advocacy Coexist? The Ethics of Sustainable Development.Anthropology Newsletter.Vol. 35. No. 3, pp. 9-10.

5. 189 CSSC. (1974). Green Revolution: The Unfinished Task. Minerva Associates, Calcutta.

6. Dewalt, B. R. (1994). Using Indigenous Knowledge to Improve Agriculture and Natural Resource Management.Human Organization.Vol. 53.pp. 123133.

7. Ellen, R.E. (Ed.) (2006). Ethnobiology and the Science of Humankind.Blackwell Publishing House, Oxford.

8. Engel, P.G.H. and M.L. Salomon (1997). Facilitating Innovation for Development.A Raaks Resource Box. Royal Tropical Institute, Amsterdam.

9. Hendy, David (2000). Radio in the Global Age. Polity Press, Cambridge.

10. Martin, G.J., A.L. Agama, J.H. Beaman and J. Nais (2002). ProjekEtnobotaniKinabalu : The Making of a Dusun Ethnoflora (Sabah, Malaysia), People and Plants Working Paper 9. UNESCO, Paris.

11. Mellor, J.W. (1966). The Economics of Agricultural Development. Cornell University Press, Ithaca.

12. Netting, R. McC. (1974). Agrarian Ecology.Annual Review of Anthropology.Vol. 3. pp. 21-56.

13. Netting, R. McC. (1993). Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture. Stanford University Press, Stanford, CA.

14. Purcell, T.W. (1998). Indigenous Knowledge and Applied Anthropology : Questions of Definition and Direction. Human Organization.Vol. 57. pp. 258-272.

15. Rhoades, R.E. (1984). Breaking New Ground: Agricultural Anthropology. International Potato Centre, Lima.