

Impact of Irrigation Projects on Agricultural Development

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Abstract:

Since rice is a major food staple in Asia, several Asian governments have poured resources into irrigation projects. India has a long history of irrigation work, and the country's post-independence era saw the launch of many significant irrigation projects. Borrowings from outside sources made up the bulk of funding for these kinds of endeavors. Nevertheless, in India, the effect of irrigation on agricultural output is seldom studied. The few studies that have been conducted tend to concentrate on the differences in crop output across tanks. This study attempts to fill this knowledge gap by examining the relationship between irrigation and production from 2010 to 2022. This research focused on the effects of irrigation on two specific agricultural crops—Paddy and Maize—using a multiple regression methodology. Secondary sources released by the USDA provided the data used in the analysis. Our research shows that increasing the amount of water available to plants leads to higher yields. For instance, compared to rain-fed regions, agricultural yield in irrigated areas is typically 30-40% greater.

Keywords: Irrigation, Effect, Agriculture, Intensity of Irrigation

Introduction

The use of irrigation dates back thousands of years. Irrigation technology has historically led to the rise of civilisation. When irrigation is carried out in a thoughtful manner, most knowledgeable men are confident in its long-term viability. Some people believe that as water supplies dry up, so does a civilisation that relies on agriculture under irrigation. The rise and fall of civilizations coincide with the rise and fall of irrigation systems. Lack of governmental and communal stability, necessary to maintain agriculture, led to the downfall of most ancient

civilizations dependent upon irrigated agriculture. Permanently prosperous agriculture is one of several variables that contribute to a civilization's longevity. This study has examined some of the ideas and practices fundamental to sustainable, profitable agriculture under irrigation. In regions where annual precipitation is less than 15 cm, farming without irrigation is a futile enterprise. The rising need for water in agriculture might be satisfied by making more and greater use of the water supply. Hence, defining the regional pattern of their quality, quantity, and consumption is one of the primary goals of water resource inquiry. Surface water, ground water, and ocean water are the three types of water that humans may access. Hence, rivers, streams, and lakes are the primary sources of surface water utilized for irrigation. There are a number of factors that limit irrigation's potential use. The rising use of fertilizers and, to a lesser degree, better varieties of seed make timely demands of water a must, while low rain fall and its unpredictable nature need the creation of artificial methods of moisture delivery. Farm infrastructure and irrigation system upgrades are one solution to the issue of poor agricultural output. A great deal of the difference in agricultural productivity among areas may be traced back to differences in irrigation access. Transformation and development of agriculture are possible if a reliable water supply is guaranteed.

Without irrigation, mass cultivation would be mostly ineffective. Irrigated regions routinely provide greater crop yields than rainfed areas across the developing world. Around 40% of worldwide cereal crop output comes from irrigated land, which accounts for roughly 17% of global agricultural area.. There are both direct and indirect effects of irrigation on poverty alleviation. Increases in agricultural production due to increased crop yields and the ability to diversify cropping patterns and crop technology are two direct advantages of irrigation. The subsequent increases in personal income, spending, and employment may be attributed to these factors. Higher salaries are an indirect advantage of irrigation for the landless since it increases marketable surpluses and the number of available jobs. Lastly, irrigation has the potential to reduce food costs, which would be particularly helpful for the poor since that is where a major percentage of their money goes. Gains in production during the Green Revolution of the 1960s and 1970s in Asia are often attributed, at least in part, to improvements in access to irrigation water. Boosting agricultural output is crucial now more than ever due to rising food costs and competition from non-agricultural uses of land. Would increased agricultural yields be possible

if irrigation efficiency is increased? If that's the case, how can we make the most of irrigation, and to what degree can we? Agricultural output and agricultural GDP may only benefit somewhat from further investments in irrigation, according to several recent studies based on regional or state-level data. Nonetheless, there are many who argue that the potential economic advantages from more irrigation improvements are substantial. Many studies and publications have been published that assess irrigation's monetary value. Nevertheless, there are limitations in the issues being examined and the data and techniques being utilized, such as aggregation bias, small sample concerns, and an inability to prove the genuine causal link between irrigation and the effect of irrigation. This study provides a comprehensive overview of the many approaches that have been used to far in order to calculate the monetary benefits of irrigation water availability.

II. Literature Survey

Irrigated regions regularly have greater crop yields than rainfed areas across the developing world (Rosegrant et al., 1997; Hussain and Hanjra 2004; Lipton et al. 2003). Around 40% of worldwide cereal crop output is attributable to irrigated land, which accounts for roughly 17% of all agricultural area (WCD 2000). The importance of irrigation in reducing poverty and fostering economic progress has been reaffirmed by studies looking at World Bank-supported irrigation projects from 1994 to 2004 (IEG 2006) and International Water Management Institute-supported irrigation projects in Asia (ADB/IWMI 2005). The massive productivity increases seen in Asia during the Green Revolution of the 1960s and 1970s are often attributed, at least in part, to the region's improved access to irrigation water (Pingali et al. 1997).

Boosting agricultural output is crucial now more than ever due to rising food costs and competition from non-agricultural uses of land. Would better irrigation allow for even greater increases in agricultural yields? If that's the case, how can we make the most of irrigation, and to what degree can we? Recent research using regional or state-level data suggests that increased spending on irrigation will only marginally increase agricultural output and GDP (Fan et al. 2000; Fan and Chan-Kang 2004, Jin et al., 2012). Nonetheless, there are many who argue that the potential economic advantages from additional improvements to irrigation are substantial (Sombilla et al., 2002; Hussain and Hanjra 2004). Many studies and publications

have been written about irrigation's monetary effects. Nevertheless, there are limits to the issues being examined and the data and techniques being utilized, such as aggregation bias, small sample concerns, and an inability to demonstrate a clear causal link between irrigation and the effect of irrigation. In this study, we take a look at the many approaches that have been used to calculate the monetary benefits of irrigation water distribution. Following, we discuss some of the most common approaches used by these researchers, notably in more recent investigations. Studying how irrigation affects crop yields is the primary focus of this research. This analysis takes into account the effects of irrigation on two specific crops: rice and maize. The effects of irrigation on other field crops cannot be studied due to a lack of information.

Rice and wheat yields

The possibility of measurement mistakes impacting income per acre is a source of worry. A commodity's price is determined by dividing its market value by the total number of units exchanged. It was necessary to estimate prices from data of other families in the sample since many households did not sell any or just a portion of their crops, which might lead to measurement error. Nonetheless, crop yields are more reliable than area yields due to the fact that both may be calculated directly from survey data. In India, rice and wheat are the two most significant crops grown throughout the country's two harvest seasons.

The canal system in India provides evidence that labor movement is a critical avenue for agricultural development. This article demonstrates that centuries after canals are constructed, communities that have access to canal water continue to benefit from increased agricultural output and population density. Although though non-farm economic activity is similar in waterway and non-canal communities, canals spurred rapid urbanization in the surrounding areas. Migration to urban centers has been a major factor in the alteration of the structure.

Maybe the most ubiquitous feature of development is the structural change of an economy away from agriculture. The percentage of the population working in agriculture has decreased dramatically in every nation that has achieved significant economic expansion.

For decades, this pattern's mechanism has piqued the curiosity of development economists (see Schultz 1953, Lewis 1954, Johnston and Mellor 1961). The direction of causation and the geographic scale at which structural change and development occur are both still open problems in the subject. Understanding this connection better is also important for policymaking purposes; for example, should developing nations prioritize increasing agricultural output in the hopes that more sophisticated sectors will soon follow? Alternatively, does agricultural productivity shift in response to growth in other sectors, such as manufacturing and services? Irrigation plays a crucial function in the food production system in countries like India. India's irrigation projects may be broken down primarily into three categories:

Projects are classified as either "major" (those with a CCA of more than 10,000 ha) or "medium" (those with a CCA of between 5,000 and 9,999 ha) or "small" (those with a CCA of 2,000 ha or less) based on their cultivable command area (CCA). The ultimate irrigation potential of the nation was believed to be on the order of 113 million hectares in the 1960s after a thorough evaluation of several states was done for the irrigation area that can be eventually brought under irrigation, both by surface and as well as ground water. The evaluated potential of small ground water schemes and minor surface water schemes were revised higher to 64 million ha and 17 million ha, respectively (Manivanan, 2006), leading to the current state of nation being 139 million ha. The country's minor irrigation projects use both surface and ground water, whereas large and medium-sized projects rely mostly on surface water. While canals were formerly crucial to irrigation, their contribution has decreased from 40% in 1951 to 24% in 2012-13. Nevertheless, wells and tube wells went from accounting for 29% of the total irrigated area to 62% in 2012-13. (Fig. 1). That the amazing growth of tube wells over the last few decades has not been countered by "regardless of massive public investment on canals, our governments have not been able to minimize the groundwater depletion" is an accurate characterization of the situation. The main cause is the growing gap between available irrigation resources and their actual use.

Environmental impacts of irrigation

Irrigation systems may have positive or bad impacts on the local ecology depending on a number of factors including the kind of water source available, existing quality of irrigation water currently extant, and the way by which drip irrigation is delivered to agricultural land. As aquifers have gotten saltier and other types of ground-water contamination have increased, land has started to sink as a result of ground-water depletion. Yet, the hydrology of rivers and water streams, water temperature, and other natural environmental variables are all altered by the removal of surface water, which may have devastating effects on the aquatic ecosystems dependent on these bodies of water. When agricultural land was watered with high salty irrigation water or normally treated effluents, soil penetration was inhibited and salt buildup commenced. Excessive irrigation water consumption in canal command zones has developed as a serious environmental problem owing to waterlogging, erosion, and downstream degradation of water quality from salts, agrochemicals, and toxic leachates. Groundwater extraction raises the possibility of adding to the salinity issue due to its variable quality. Because of the high osmotic potential in the soil, plants have trouble taking in water and nutrients when there is a significant downward soil water flow that washes salts away from the root zone. Saline soils are particularly detrimental to plant development because they are rich in soluble salts. High RSC irrigation water had a comparable effect on barley's grain and straw production and nutrient content as saline water does on wheat's. Both have an impact on soil fertility. The infiltration rate and permeability dropped dramatically and, in some instances, permanently when the exchange complex was dominated by sodium and the infiltrating water had a low concentration of salts. Other causes of irrigation-induced salinity include insufficient water usage efficiency on farms, improperly constructed and maintained irrigation canals that lead to significant seepage losses from canals, and a lack of or inadequate drainage infrastructure. Overusing and/or poorly managing irrigation water often leads to waterlogging. In many irrigated locations, the danger of a rising water-table may be mitigated by lining and covering canals throughout the whole length of the system, from the storage dams to the point of delivery. Because to waterlogging, agricultural yields have dropped by nearly 20% on about 10% of the world's irrigated acreage (Mishra, 2008). Agricultural chemical runoff, which includes fertilizers, insecticides, and weed killers, is primarily an issue in areas where the usage of these inputs is very high. The typical farmer has raised their usage of urea and other fertilizers by 400% over the last 30 years, as reported in the National Fertilizer Recommended

Handbook 2005. Water from irrigated fields washes away topsoil, causing soil erosion and sediment transport along with the movement of fertilizers and other pollutants (and adsorbed chemicals). Decreased crop yields are a direct result of soil erosion, which is worsened by furrow irrigation (compared to sprinklers or drip irrigation). In addition to wreaking havoc on aquatic ecosystems, the sediments carried by irrigation flows may clog canals and other water conveyance structures, reduce the longevity and regularity of sprinkler and drip irrigation systems, and cause other serious difficulties. The physical and chemical characteristics of sediment contamination are crucial to the evaluation and management of pollutants released into the environment. Stop layer soil loss (surface soil) and land degradation by gully and sheet erosion are examples of the physical dimension; these processes cause high levels of turbidity in incoming water and have far-reaching environmental and physical repercussions due to deposition in river and lake bottoms. Chemically speaking, however, the silt and clay component of soil plays a crucial function as the major transporter of adsorbed chemicals, including phosphorus, chlorinated pesticides, and most metals, that cause toxicity and are eroded with sediments into the aquatic system and alter its ecosystem. The water will carry with it any dissolved substances in the soil, including nitrates, salts, and other pollutants. Nitrate poisoning of groundwater is a concern, especially when growing crops that need large amounts of water and nitrogen (Wick et al., 2012). Significant nitrate losses from the soil through leaching have been seen in areas with light-textured soils and where crops with shallow roots are produced intensively under irrigation. Many investigations conducted in India and Africa have shown that 20–50% of wells had nitrate concentrations of 50 mg/l or more, and in some instances, even several hundred mg/l (FAO, 1996). Increasing nitrogen levels in groundwater are a direct effect of intensive agricultural practices, especially on irrigated land. Although it has previously been documented that high nitrate levels in drinking water cause methemoglobinemia in infants, it now appears that nitrate may be one of a number of co-factors that play sometimes complex roles in causing the number of diseases. This was the conclusion of a recent investigation report published by the World Health Organization (Fewtrell, 2004). In various South American nations, Reiff (1987) discovered an increase in malaria cases shortly after the reservoirs were built. The parasitic illness Schistosomiasis, which affects over 200 million people in 70 tropical and subtropical nations, has been shown to have expanded dramatically in areas where reservoirs have been built for irrigation and hydroelectricity, as he

also observed. There is direct food contamination due to the use of untreated (or badly treated) human effluent for irrigation. A growing trend in many developing nations is the use of urban wastewater for irrigation despite the lack of treatment of this water source. Typhoid, cholera, ascariasis, giardiasis, enteroinvasive *Escherichia coli*, and amoebiasis are only some of the diseases that have been linked to the consumption of food grown in areas where irrigation water has been polluted. Plants like cabbage, lettuce, strawberries, and other leafy greens that are consumed fresh pose the greatest risk of contracting one of these illnesses. Soil erosion and nutrient leaking from farming along river banks are additional unintended consequences of irrigation. Malaria and schistosomiasis, both of which are linked to irrigation systems, may also add significant costs to the implementation of irrigation projects.

Irrigation and livelihood security of farmers in India:

Irrigated regions in the developing world have consistently better output and productivity than rainfed or dryland areas. Irrigation has been shown to be crucial to the alleviation of poverty and the expansion of the economy, according to studies conducted by the World Bank and the International Water Management Institute research of the effects of irrigation on rural poverty in India covers the 25 years from 1970 to 1994 and finds that irrigation, particularly from groundwater, is a key factor contributing to the reduction of poverty. The findings also imply that having access to irrigation is merely a required prerequisite, with additional elements like agricultural technology (fertilizer and HYV) and human skills guaranteeing suitable circumstances (education).. Irrigation unquestionably lessens the likelihood of output failure, production seasonality, and demand shortage in terms of food security.

Conclusion

People in the project command, who are often impacted by flooding, rely heavily on the current small irrigation services to improve their standard of life. Human, material, social, financial, and ecological resources that influence peoples' standard of living were all affected. There is little question that irrigation development has increased agricultural production and livelihood assets in the study area, despite the fact that the current state of irrigation development is far from ideal. Just 39.18 percent of the total operating land was able to be irrigated in the examined region.

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