

POTENTIAL ECONOMIC IMPACT OF IRRIGATION DEVELOPMENT
IN NORTH CENTRAL KANSAS COMMUNITIES

by

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CHAPTER I

INTRODUCTION

This report attempts to assess the potential economic impact of the development of irrigation projects in neighboring North Central Kansas towns and cities. It will do this by reviewing effects of similar development activities on local communities where results have been measured.

It has long been recognized that farmers are not the only beneficiaries of irrigation developments. From even the most casual observation of urban growth and other evidence of economic activity in irrigated areas, it is obvious that important benefits accrue indirectly to non-farm groups.

Long established irrigation projects have shown significant effects on the economic and social characteristics of adjacent communities. Project beginnings in Kansas are a feature of the past ten years and are still in developmental stages. Preliminary studies have shown a remarkable similarity between this infant development and the typical irrigation-based agricultural economy in arid regions of the Western United States.

Development of irrigation in North Central Kansas has been unlike conditions generally found in many newly irrigated areas of the western United States. In more arid regions, crop farming and settlement must wait for irrigation. North Central Kansas had an established farming

pattern before irrigation development. Agricultural production of counties in the area often exceed \$10,000,000 per year.

Objectives of Study

Long established irrigation projects have shown significant effects on the economic and social characteristics of adjacent communities. Today's growth of commerce and industry is tightly knit with agriculture, and especially so in rural communities.

The purpose of this analysis is to identify, trace out and measure some of the impacts of irrigation in well-established irrigation communities. These changes will be interpreted as they could apply to projects in North Central Kansas.

The potential effects of irrigation on area trade centers will be considered. What adjustments will need to be made? Will irrigation lend stability to business in a local trade center? What are the problems associated with introduction of irrigation into a community?

Impact of irrigation development will also be studied as it effects the individual farm. Changes will be noted in cropping and livestock programs, farm incomes and the effect of intensified irrigation agriculture in the community.

An additional objective of the study is to determine what areas of economic research are needed to aid development. Progress on the farms and in adjacent communities can be best served through adequate knowledge of needs and uses of resources.

Development of Irrigation Systems

There are four federally constructed irrigation systems in the Kansas River Basin in Kansas. Since 1953 about 414 miles of canals and laterals have been completed, providing irrigation service to 64,078 acres of irrigable, fertile valley and tablelands.¹

Crop reports disclose that 41,741 acres produced irrigated crops in 1964 having a value of some \$4,435,877, slightly more than \$106 per acre (see Table 1). This value is probably from two to three times the value of the crops these same lands might have produced without irrigation. This increase in value was largely the result of increased yields but, to some extent, it was also the result of introduction of higher value crops such as potatoes, sugar beets, popcorn, and castor beans.

TABLE 1

ACREAGE IRRIGATED AND THE VALUE OF THE CROPS PRODUCED IN 1964
IN NORTH CENTRAL KANSAS IRRIGATION PROJECTS

Irrigation District	Acreage	Gross Crop Value
Kansas-Bostwick	22,892	\$2,733,667
Kirwin	8,630	851,811
Webster	6,202	588,389
Cedar Bluff	4,017	262,010
	41,741	\$4,435,877

Source: Water Control Operations in the State of Kansas, Corps of Engineers and Bureau of Reclamation, Topeka, Kansas, April 8, 1965.

¹A report presented by the Water Control Operations in the State of Kansas, Corps of Engineers and Bureau of Reclamation, Topeka, Kansas, April 8, 1965, p. 2.

Irrigation is provided for 86,240 acres of land in the Bostwick district, 24,240 acres in Nebraska and 62,000 in Kansas. The irrigated area follows the course of the Republican River Valley, extending 105 miles downstream from the Harlan County Reservoir. Near the diversion dams, the area is confined to the narrow valley lands; it widens to as much as 12 miles where it includes higher terrace lands.

Harlan County Reservoir, near Alma, Nebraska, is the key storage basin for water. Lovewell Reservoir, on White Rock Creek in Jewell County, Kansas, provides water storage, flood control and a method of water delivery to the south part of the Division. Diversion dams, supply canals, distribution laterals, pumping plants and drainage structures complete the delivery of water to farms.

The reservoir formed by the Harlan County Dam has a storage capacity of 850,000 acre feet including the space for storage of 500,000 acre feet of flood water. A total of 350,000 acre feet has been provided for irrigation storage and sedimentation. There will be occasions when the flood water storage can be utilized for irrigation.

Lovewell Reservoir has total storage of 94,200 acre feet, 44,100 acre feet in the irrigation pool, and an additional 50,100 acre feet is provided for flood water.

The first water was delivered to the Kansas-Bostwick Irrigation District in the spring of 1955. Eight thousand seven hundred and seven acres were irrigated that year. The area was experiencing another drouth

almost as severe as the dry thirties.¹

Kirwin Reservoir provides storage for 11,500 acres of land served by the Kirwin Main, North and South Systems. The irrigated lands are in the north fork of the Solomon River between Kirwin and Portis, Kansas. All of the major construction on water delivery systems is complete.

Kirwin Reservoir was completed in 1955. Total storage is 315,000 acre feet. Long range annual yield of irrigable water from Kirwin is expected to be 28,500 acre feet. Water was first delivered to the system in 1958.²

Webster Reservoir provides storage for the 8,500 acres served by the Osborne Canal. These lands are on the north side of the South Fork of the Solomon River Valley from Woodston to approximately five miles east of Osborne, Kansas. Webster delivery began in 1961 through the Osborne Canal. Kirwin and Webster Irrigation Districts are operated under joint management.³

Cedar Bluff Reservoir provides storage for irrigation of 6,600 acres of District lands on the north side of the Smoky Hill River Valley. Cedar Bluff Reservoir was completed in 1951 with a total storage of 377,000 acre feet. It is expected to deliver 26,500 acre feet of irrigation water annually.

¹Frank B. Clayton, "Public Policy and a Community," (unpublished Master's thesis, Kansas State University, Manhattan, Kansas, 1959), pp. 6-16.

²United States Department of the Interior Bureau of Reclamation, Kansas River Projects, 1964 Operations, 1965 Outlook, Denver, Colorado, February 1965, p. 15.

³Ibid., pp. 4-18.

Cedar Bluff Canal was operated by the Bureau of Reclamation in 1963 and 1965. All of the major construction has been completed and the system was transferred to the District for care, operation, and maintenance on January 1, 1965.¹

Potential Irrigation Development

Norton Reservoir will provide storage for the irrigation of 5,350 acres of land in the Almena Irrigation District. Construction of the Norton Dam was completed in 1964 and storage began October 6, 1964. The specifications for the Almena Diversion Dam, canals and laterals are essentially completed and a portion of the right-of-way has been purchased. Federal funds have not been made available for fiscal year 1966 and issuance of specifications for construction of facilities have been deferred.²

Formation of a possible 16,500 acre irrigation project on the Smoky Hill River near Lindsborg is pending at this time. Water is available from Kanopolis Reservoir, completed in 1948.

Wilson Reservoir was completed in 1964. A 25,000 acre potential irrigation development in Lincoln, Ottawa, and Saline Counties is possible from water stored at Wilson. Water from the Saline River will contain a high soluble sodium content, which has slowed development in the proposed Wilson unit.

¹Ibid., pp. 4-28.

²Ibid., p. 4.

Glen Elder Reservoir on the Solomon River will be completed in 1969. Sixty-eight thousand five hundred acre feet of water will be available annually to irrigate a potential 21,000 acres in Mitchell, Cloud and Ottawa Counties. Farmers in the Solomon Valley are taking steps to organize an irrigation District prior to completion of the reservoir.¹

¹Kansas Water News, State Water Resources Board, October 1964, Vol. 7, No. 6, Topeka, Kansas, p. 4.

CHAPTER II

MEASUREMENT OF LOCAL BENEFITS

Irrigation Benefits

The socially and economically desirable results of irrigation -- or of any resource development, for that matter -- are generally termed, in resource economics, "benefits." In the broad view, such benefits represent increases in the opportunities to earn livelihoods or increases in the levels of living of persons affected by the development. The direct benefits, in the case of irrigation, accrue at the farm level of the local economy. The indirect benefits radiate outward through the economy--beyond the farm.

Literature pertaining to concepts and techniques for estimating local benefits is not plentiful or well defined. Various Federal policy statements present general guidelines but they fail to develop fully the concepts as they relate to a local economy. The Bureau of Reclamation uses local secondary information in project justification and, therefore, has been especially interested in developing procedures for measuring such benefits.

A 1947 study of Marts was designed "to measure the relationship between the direct and indirect benefits within a local trade area dependent on irrigation agriculture." In this study, direct benefits were comprised of (1) net income to farm operators, (2) government payments

to farmers, and (3) farm wages. The indirect benefits included all net nonfarm income, including (1) net entrepreneurial income, (2) labor income, and (3) property income. Then, assuming all income derived within the area was attributable to irrigation, a simple percentage ratio of direct to indirect income was computed. The result indicated that indirect income was 1.27 times the direct income, or a local economic multiplier of 2.27.¹

A study of Holje, and others, also attempted to measure the indirect benefits of irrigation development within a local area. The ratio technique as used by Marts was retained, but the emphasis was shifted from the income approach to the relationship between the number of farm to nonfarm workers. The report concludes that a ratio of 1.00 farm worker to every 1.3 to 1.4 nonfarm workers would be a "satisfactory benchmark." The increase in agricultural employment resulting from development is then used as a basis for computing non-farm (indirect) employment.²

¹ M. E. Marts, An Experiment in the Measurement of the Indirect Benefits of Irrigation, Payette, Idaho. Boise, Idaho: A Report Prepared for Bureau of Reclamation, June 1950. Marts' study was accepted by the Department of Geography, Northwestern University, Evanston, Illinois, as his Doctoral dissertation. The above report is a condensation of his dissertation.

² H. Holje, et al., "Indirect Benefits of Irrigation Development," Montana Agricultural Experiment Station Technical Bulletin No. 517 (Bozeman, 1956).

Community Sectors

A Bureau of Reclamation Economist, Robert Struthers, has suggested a study of sectors of the community economic base.¹ The economic structure of the area studied was divided into three sectors: basic, linked and derivative. The basic sector is composed of those industries which utilize the natural resources of the area, together with non-resource industries which serve those markets outside the trade area. The linked sector industries and activities are those which are closely associated with the basic sector industries and which would not be present in the absence of the basic industry. Derivative industries rest entirely on the demands for goods and services generated by the entire local populations, the basic and linked sectors and even the derivative sector's self-generated demands.²

Irrigation's effects are studied in each of the three sectors. Observation and statistical information provide the share for basic and linked industries, and a commensurate share is assigned to the derivative sector.

Water Resource Benefits

The importance of some of the broader secondary benefits of reclamation projects, in addition to those customarily mentioned, has

¹ Robert E. Struthers, The Role of Irrigation Development in Community Economic Structure, Grand Valley Trade Area, Colorado. Washington, D. C., United States Department of the Interior. 1963.

²Ibid.

been pointed out by the Federal Reserve Bank of Kansas City in a recent study on economic analysis of water resource development projects.

In addition, a benefit attributable to the project may arise out of the fact that an expansion of the market in a sparsely populated or low income area may contribute generally to efficiency of production by making possible a more extensive division of labor.¹

Another source of secondary benefits due to external economies can arise in the field of social overhead capital. Facilities such as schools, roads, utilities, and other urban social capital may have excess capacity and thus be subject to decreasing costs as their use expands. The fuller use of social overhead capital is a legitimate secondary benefit attributable to a project. These types of secondary benefits may be of great importance in specific projects. Although their effects are invariably difficult to trace, they are nevertheless quite tangible.

The third and final variety of secondary benefits is much more difficult to conceptualize and no adequate means of measuring these benefits exists as yet, although in many cases they may well be the most important of the three. This variety of benefit may be termed "dynamic" or "developmental." Such benefits do not depend upon adjustments leading to more efficient allocation of a given stock of resources, but rather arise from the dynamic social engineering aspect of skilled labor and the introduction of advanced techniques and capital, which

¹Monthly Review, Federal Reserve Bank of Kansas City, October, 1958, pp. 15-18.

will convert the underutilized resources of the area to optimal employment. The type of reasoning which stresses this type of dynamic benefit has been basic to much of the recent literature on underdeveloped countries, but it has also long impelled many proponents of resource development programs in the less highly developed areas of our own country. The benefits which such social and economic engineering might yield are potentially tremendous, but unfortunately economic science has not developed to the point where accurate measurement is possible.

Two other sources of secondary benefits falling loosely into this category of dynamic effects of resources development projects may be mentioned. The first is sociological as well as economic. The migration of population within the country in the last decade or so reveals an area preference which is gradually moving the center of population westward. If such a movement continues, the productivity of human resources in the areas experiencing large population increases will fall unless the population movement is accompanied by a transfer of capital and the careful development and husbanding of resources, including water. The portion of the population which has gone west has demonstrated its mobility and the provision of employment opportunities in areas which offer the amenities of living which attract people to them increases satisfaction just as surely as any policy which enhances the gross national product as ordinarily measured. Needless to say, this effect of development projects is highly speculative and currently no means of measuring it exist.

Secondly, resource development has long been supported by conservationist ideas. Conservation policies are ordinarily designed to make a greater provision for the future than the market mechanism (or any procedure based upon the imputation of market values) would demand. Resources development projects present the opportunity of providing very durable, in some cases almost perpetual, additions to the Nation's capital stocks. It may be presumed that this capital usually will grow in value as population and the economy expands.

CHAPTER III

THE LOCAL ECONOMY IN RECENTLY ORGANIZED IRRIGATION PROJECTS

Farms and business enterprises do not experience immediate progress from their beginning to maturity, but they pass through slow and frequently difficult phases of development. Irrigated farms in a newly developed irrigation area and associated businesses also seem to demonstrate this phenomena. Most of the irrigation development in Kansas and all of the recently initiated Bureau of Reclamation Projects would be considered in the immature stages.

Commercial enterprises serving irrigation farmers slowly make changes too. As crop and livestock programs change, demands for new products are met and needs of the developed area are considered. New projects and related commercial enterprises may take as long as twenty years to reach a stage of maturity.¹

Economic effects of the development of an irrigation district are apparent although the project is still in a growing phase. Even though the project will not reach full development for several years, it makes an impact on the economy of the area often before the first water is distributed.

¹ Willis C. Boegli. Economic Effects of the Tucumcari Irrigation Project, New Mexico. Division of Irrigation Bureau of Reclamation, Region 5, Amarillo, Texas, 1958.

Land development is one of the first changes that must be made. On most fields, this will require land grading or land leveling. Grading or leveling may be a major capital expense item which costs to one hundred dollars (\$100) per acre.

Availability of an adequate supply of irrigation water permits the producer to plan his crop production program more precisely than he could when he was dependent solely upon average rainfall conditions to supply one of the essential elements in crop production. This change in the status of water from a variable to a more or less fixed factor in crop production places stronger emphasis upon the other physical factors of crop production over which the producer has nearly absolute control. These factors may be grouped under large general headings as those related to:

- (1) Engineering - Land preparation techniques, methods and techniques of controlling and utilizing irrigation water, planting, tillage, harvesting and storage of crops.
- (2) Agronomic - Soil fertility, crop species and varieties, plant populations, methods and techniques of controlling injurious disease and insects.
- (3) Economic - Methods and techniques of farm management and production programs which permit the irrigator to secure maximum economic benefit from each resource and from combining of all resources - Land, Water, Capital and Human Resources.

Adapting to these changes with irrigation farming takes time and new knowledge and techniques. More than one growing season is required to adequately test a new crop with weather variations, machinery adaptations, and market development. Many of the tests are unsuccessful and new methods must be tried.

Development of business enterprises usually must wait on advancement of the irrigation program. Farm capital may be tied up with land development costs, slowing machinery purchases.¹ Certain businesses and markets must wait for volume.

Oklahoma Water Resource Studies

A research program on economic evaluation of upstream watershed development is being conducted in Oklahoma. Cooperative arrangements between the Economic Research Service of the United States Department of Agriculture and the Department of Agricultural Economics, Oklahoma State University have enabled several researchers to study effects of watershed development. Two recent studies by Arnold² and Jansma³ report results of phases of the program.

Arnold prepared irrigation budgets for typical farms in the flood plain area. Returns were greatest from reduction of flood damage, but net income increases were also shown from water use through irrigation and more intensive use of flood plain land.⁴

¹Clayton, op. cit., p. 44.

²Adlai F. Arnold, "Potential Economic Effects of Upstream Flood Control and Irrigation Development: Boggy Creek Watershed, Oklahoma," Unpublished Ph.D. Thesis, Oklahoma State University, Stillwater, Oklahoma, 1962.

³John Dean Jansma, "Secondary Effects of Upstream Watershed Development: Roger Mills County, Oklahoma," Unpublished Ph.D. Thesis, Oklahoma State University, Stillwater, Oklahoma, May 1964.

⁴Arnold, op. cit., pp. 102-104.

Labor and non-capital land requirements, and gross and net returns increased significantly on all farms with a change from dryland farming to irrigation. Average resource requirements and income figures included: an increase from 1502 hours annual labor to 2510 for the crop requirements alone on the farm. Non-land capital requirements increased from \$14,120, with no irrigation on the farm to \$22,446, when irrigable bottomland received adequate water. Gross farm incomes increased from \$21,887 to \$33,352 and net incomes increased from \$9,350 to \$11,366.¹

Jansma studied the relations of primary and secondary income to the local area from projects with agricultural and recreational development purposes. One county was selected for the study with the major selection criteria being:

1. Availability of primary and secondary data.
2. An agriculturally oriented county with a relatively simple economic structure, and
3. A substantial amount of public investment in water resource development.²

The selection principles, evaluation concepts and methods of study make Jansma's report especially useful in evaluating secondary benefits from resource developments such as irrigation.

Jansma used interindustry economic analysis to study intersectorial flows in the local economy. Multiplier effects of an initial increase in income were used as a general framework for conducting the investigation. A local multiplier was derived from empirical analysis in the community. Secondary effects, or net benefits were increases in

¹Ibid., pp. 80-83.

²Jansma, op. cit., p. 7.

net income to all other individuals or sectors in the local area as a result of existing local net primary benefits.

For each one dollar increase in direct gross receipts for agriculture, \$2.07 was measured in gross receipts in the local economy. This was the estimated local gross receipts multiplier associated with an increase in farm income.¹

Net incomes were determined from consumption components for the different sectors of the local economy. There was an increase in local net income to agriculture of 27¢ for each dollar increase in gross receipts to agriculture. When the net incomes to other sectors were included, this figure increased to 43¢ per dollar in agriculture's gross income.

For each one dollar of direct net income for agriculture, there was an estimated \$1.88 in net income to the local economy. This was the estimated local net income multiplier.²

A major part of the secondary income accrued to the agri-businesses of the county such as elevators, farm machinery dealers, and farm supply services including gas, oil and repairs. These results indicated a high degree of interdependency between agriculture and the general agri-business complex in the county.³

¹Ibid., p. 66.

²Ibid., p. 67.

³Ibid., p. 66.

The Tucumcari, New Mexico Project

The Tucumcari, New Mexico irrigation project was ten years old when the Boegli study was made. This is similar to the age of the older projects in Kansas and presents an outlook for the newer projects. The New Mexico project had 35,500 acres under irrigation in one county. Tucumcari, the county seat town, had a population near 8,000.

New business enterprises have sprung up to service the needs of irrigation agriculture. In the first few years, these businesses have been started: cotton gin, grain elevator, feed mill, vegetable packing shed, large cattle feeding yard, irrigation district, two land development contractors, three lumber dealers, and five farm machinery dealers.¹

Existing businesses felt the impact of 330 new farms from a semi-arid area where only a few livestock ranches existed before. Business activities which have made appreciable improvements or additions include meat packing plant, three additional lumber yards, two grain and feed mills, two machinery dealers, feed and seed store, and two machine shops.

Retail trade in these and other local stores reflected the favorable influences of the improved agricultural economy in a growth rate in retail sales volume. The growth rate was compared with comparable adjacent areas without irrigation development and was found to exceed those areas by 43 per cent.

All of the Tucumcari project is in Quay County, New Mexico. A seven county area, exhibiting about the same characteristics as the

¹Boegli, op. cit., p. 10.

subject area would now have, had the Tucumcari project not been built, was used for comparison. It is possible to estimate the effect of the irrigation project in Quay County in increasing and stabilizing the population and creating business activities.

Although the Tucumcari project is still in a growing phase, it is evident that it already has made an impact on the economy of the area. The local businessmen feel the new and enlarged businesses are just the first of the many that will develop in the next few years.¹

Boegli also found the local economy received a boost from irrigation development in addition to retail trade. Non-farm employment was created, the unemployment and relief load was reduced, living standards were enhanced, and public services were improved.²

Construction started on the Tucumcari Project in 1940. An estimated 631 permanent non-farm jobs were created between 1940 and 1956 by the construction and operation of the project. These jobs are in the stores, the mills, the utility and service companies, the schools, government, and other businesses which serve the increased family activity. Total population growth arising out of new jobs has been about 3800.

The Tucumcari project caused the Quay County population to gain slightly, while all other counties in the comparison area were losing heavily due to the general trend toward larger farms and drouth conditions. Other county seat towns did gain 23 per cent in population,

¹Ibid., p. 10.

²Ibid., pp. 10-13.

however, the 53 per cent gain in Tucumcari was more than double that of the average of the other county seats.

Total numbers of employed persons fell off 16 per cent in adjacent counties during the 1940-1956 period, while in Quay County employment gained 19 per cent. Loss of labor force in adjacent counties was largely due to the decline in employment opportunities.

Better farming and better businesses have improved per capita income in Quay County beyond the level of adjacent counties by 41 per cent. Per capita income for Quay and adjacent counties in 1955 were \$1,433 and \$1,017, respectively.

The effect of the Tucumcari project in increasing the number of farms with telephone and electric service is shown by a comparison of the 1945 and 1954 conditions. Farms with telephones increased 214 per cent in Quay County and 36 per cent in the seven adjacent counties. Farms with electricity increased at twice the rate of growth in Quay County as in the other counties.

Bostwick Irrigation Division

Two studies have been completed in the Bostwick Irrigation Division that offer a background for analysis of immature irrigation economies in this area. Studies by Clayton in the Kansas Bostwick and by Vogel in the Nebraska Bostwick viewed development to about 1959.

Clayton's study examined the development of an irrigation district as a public program with controversial implications. Economic impact on the Republic County, Kansas area is treated as one of the justifications

for expenditure of public funds. The cost-benefit ratio of construction is considered an important consideration, but it can not compare with intangible effects on the individual farmer or local community.¹

Although Clayton fails to list the public policy considerations he considers controversial in the Bostwick area, policy considerations must enter into proposals for establishment of irrigation development undertaken by the Federal Government. Increasing agricultural production in periods of surpluses, repayment provisions of the Bureau of Reclamation, and acreage limitations are debatable features of national reclamation policies. Public acceptance of irrigation development will depend on tangible and intangible benefits, whether to the local economy or on a national scale, that offset controversial practices in a convincing manner.

The study does depict evidence of changes in the economy of Republic County even before all planned acreage was under irrigation. The first water was delivered in the district in 1955, and at the time of the 1959 study, about one-half of the present irrigated acreage was receiving ditch water. Growth of the district is shown in the Bureau of Reclamation's annual crop production reports (see Table 2).²

Clayton compared 1954 agricultural activity in the county with 1959 figures using 1959 prices. The most discernible change was in net

¹Frank B. Clayton, "Public Policy and a Community," (unpublished Master's thesis, Kansas State University, Manhattan, Kansas, 1959).

²Bureau of Reclamation. Crop Production Reports, 1956-1963, Kansas Bostwick Irrigation District, Missouri River Basin, Bureau of Reclamation, McCook, Nebraska.

TABLE 2
ACREAGE IRRIGATED IN THE KANSAS BOSTWICK
IRRIGATION DISTRICT

Year	Acres Irrigated
1956	5,347
1957	7,272
1958	8,707
1959	16,240
1960	19,955
1961	21,962
1962	22,395
1963	25,117

Source: Bureau of Reclamation. Crop Production Reports, 1956-1963, Kansas Bostwick Irrigation District, Missouri River Basin, Bureau of Reclamation, McCook, Nebraska.

income, increasing from an estimated \$729,010 in 1954 to \$2,896,639 in 1959. He also notes that weather was more favorable to farming in 1959 than in 1954. However, during the same period, the county sustained a 10,120 acre reduction in cropland. Much of the reduction is due to land in the Conservation Reserve program.

Relationships resulting from the transition from dryland to irrigation farming are described without an attempt to appraise their effects. The town of Courtland, most centrally located in the District, had sixteen new homes completed in the five year period with more under construction. Population gained from 370 in 1954 to 408 in 1959, an

unusual trend for towns under 500 population in Kansas. Two new businesses, a ready mix concrete plant and an implement agency were inaugurated after introduction of irrigation. An elevator in Courtland added a new feed mill.¹

Implement dealers interviewed in the area reported no large increases in demand for machinery in the young irrigation economy. Financial strain from development costs was listed by the dealers as a deterrent to machinery sales. Auto dealers, on the other hand, reported an increase in business which they contributed to the stability of expected farm income.

Commercial grain storage facilities in the county increased by over five million bushels while the three neighboring Kansas counties increased their storage an average of just over one million bushels. A commercial feed yard has been built near Scandia. Railroad carloadings in shipments and outshipments had increased at area towns in the irrigation district from 1954 to 1959.²

Nebraska Bostwick Division

Vogel's analysis of the impact of irrigation in the Nebraska Bostwick concerns an economy influenced more by irrigation than the Kansas Bostwick area at the time of Clayton's report. Development in Nebraska started in 1951 and had progressed further by 1959. It is

¹Ibid., p. 40.

²Ibid., pp. 39-42.

possible that the farmers in the Nebraska area had more irrigation background than their Kansas neighbors, and adopted recommended irrigation practices sooner.

The Nebraska Bostwick study does offer an excellent background for consideration of irrigation impact in North Central Kansas for several reasons.

1. The area is adjacent to Kansas.
2. Crops and soils, methods of crop production, and climate are similar.
3. Towns in both areas have many similarities in size, dependence on agricultural income and culture.
4. Irrigation development has been accepted in an area that had a successful, productive agricultural background. Good crop yields were possible without irrigation, although production yields may have been erratic over a period of years.
5. Irrigation development was nearly complete in the Nebraska Bostwick by 1956. The Nebraska farmers have the experience of producing and developing irrigation during the drouth of the mid -50's.¹

Vogel measured effects of irrigation development on farms in the District and on towns serving the area. A comparison area was selected to examine changes that were caused by irrigation. The comparison area land was classed as irrigable and was similar in many respects to the Republican Valley area before irrigation. Towns were also studied in the comparison area.

Among items considered on irrigation farms were crop production, livestock production, farm machinery inventory, farm size, tenancy, land values, costs of irrigation and age of farm operators. In adjacent towns

¹ Philip E. Vogel, "A Geographic Study of Some of the Effects of Irrigation in the Nebraska Bostwick Irrigation Project," (unpublished Ph.D. Thesis, Department of Geography, University of Nebraska, Lincoln, Nebraska, 1960). p. 151.

size and functions of retail establishments, assessed valuations of businesses, volume of business and bank deposits and loans were reported.

In an area that had developed irrigation less than ten years, Vogel concluded that the irrigation farmer who applies good managerial techniques and observes sound farming procedures will, year in and year out, realize a higher net return on his investment than will his dry farming counterpart.¹

The chief risk which the Bostwick Division irrigator still faces in his crop and livestock production is the erratic nature of prices, not of production. One feature inherent in irrigation agriculture is the measured fixed operational expense, but it appears this is overcome by the crop yield increase. The irrigator realizes a higher degree of security than formerly under dryland farming operations.

Vogel found crop yields not only increased under irrigation, but there was less variation from average in the yields, both absolute and percentage, than is normal under dry farming techniques. Corn was the major crop in the District but there was some shifting to other crops.

Studies of several of the more mature irrigation-economies show a strong emphasis on livestock programs on irrigators farms. In contrast with these studies, Vogel found a slight reduction in total livestock emphasis on irrigators farms in the district.² Other reports show this may be typical, at least in newer irrigated areas as farmers emphasize

¹Ibid., p. 152.

²Ibid., p. 158.

crop production. Other irrigated areas have experienced a reduction in farms classed as cash-grain after irrigation has gained a foothold, so there is reason to believe the same pattern will be followed in the Bostwick.

An appreciable increase was noted in the purchasing power of the irrigation farmer. Larger gross incomes, larger machinery investments and increased crop costs result in more money per acre in a community trade area. The irrigation area also contributes increased tax revenues to local sources. Higher land valuations, 29 per cent more machinery on irrigators farms, and almost twice the value of household goods add money for support of schools and better roads in the area.¹

The Bostwick area towns showed some of the characteristics of midwest small towns with decreasing numbers of retail establishments. However, decreases were only 60 per cent of those in comparison area towns. The size of retail and wholesale establishments increased at a considerably faster pace than comparison area counterparts, a 40.3 per cent increase in Bostwick District towns from 1951 to 1958 while the comparison area showed a 34.8 per cent increase. The farm supply and service dealers such as implement firms, grain, feed and fertilizer centers and bulk fuel suppliers exhibited more stability in the irrigation district.²

¹Ibid., pp. 170-171.

²Ibid., p. 194.

CHAPTER IV

THE ECONOMY IN ADVANCED IRRIGATION DEVELOPMENTS

Irrigation farming in long-established districts and areas has become so basic to the economy of the community it would be difficult to conceive the total influence of irrigation in the entire development of the community economic structure. A small city serving as a trade center for an irrigation farming area may acquire service facilities for agriculture, and later become a center for processing products from the irrigated farms. Businesses may survive during drouth periods because of a more stable agriculture and a broader-based manufacturing payroll. Eventually the city becomes the major trade and industrial center for the region. The evolvment may unfold over a 50 to 75 year period, and the economic structure may become so complex that agricultural income is only a minor part of the total revenue accruing to the area. This is the pattern condition, especially in many of the arid areas of the western United States.

California Studies

An indication of the magnitude of possibilities from irrigation is seen in the Imperial and Coachella Valleys in California where normal rainfall is less than three inches. Agricultural production in the valleys in 1954 was \$155 million. In the Imperial Valley, retail sales-tax-collections

were \$2.3 million in 1954 and property tax levies produced nearly \$5 million. Fruit and vegetables equivalent to over 42,000 carloads were produced in the valleys.

The 1954 evaluation by the Bureau of Reclamation of the Valleys' economy measured various economic indicators to study growth of the area through facilities of their canal system. Population increase, postal receipts, utility connections, building permits and bank resources revealed significant changes reflecting the beneficial effect of an assured water supply.¹

North Platte Project

One of the first irrigation projects authorized for construction under the Reclamation act of 1903 was the North Platte area in eastern Wyoming and western Nebraska. This immense project, which took 25 years to construct, provides service to more than 350,000 acres.²

Agriculture is the only basic income-producing activity in the valley. Irrigation accounted for some \$21 million worth of crops in a recent census year. Upon this foundation of irrigation farming rests an associated economy which in 1950 turned out a \$91 million income for valley residents. Ninety-one per cent of the area's income results from

¹Bureau of Reclamation. Contribution of the All American Canal System Boulder Canyon Project, to the Economic Development of the Imperial and Coachella Valleys, California, and to the Nation. (Washington. United States Government Printing Office, 1956.)

²Bureau of Reclamation. Accomplishments of Irrigation North Platte Project Wyoming - Nebraska. (Washington, United States Government Printing Office. 1956), pp. 4-11.

irrigation of but ten per cent of the land area, illustrating the importance of irrigation.

The city of Scottsbluff was established after the turn of the century with a population of 450 people. As irrigation developed in the valley around Scottsbluff, it has grown to be a major service center. In 1910 the first beet sugar factory was built in Scottsbluff. The year 1923 saw the start of the dry bean industry - now an \$11,500,000 annual business in valley plants. Local meat packing plants employ over 200 persons. Special sugar beet and potato equipment is manufactured in Scottsbluff. The city's population has grown to over 13,000.¹

Each thousand acres of the irrigated portion of the North Platte Valley supports 134 persons on farms and in the towns. In contrast, only five persons reside in the adjacent dryland area per thousand acres in dryland uses. Agriculture, as the basic industry, creates investment and employment opportunities in proportion to its productivity. For every irrigated farm in the valley, four families living in the local towns and villages perform personal services, manufacturing, transportation, and trade activities.

Stability of population is an important characteristic of irrigated communities. During the unstable decade from 1930 to 1940 most midwestern states lost population. During this period, the natural population increase in the United States was about 10 per cent but Nebraska was losing 4.5 per cent of its population. Dryland counties adjacent to Scottsbluff

¹Ibid., pp. 7-8.

county lost 12 per cent of their population. Scottsbluff county experienced a population gain of 18.4 per cent.¹

Lower Yellowstone Project

Benefits to a main trading center for an irrigation development are shown in a report of the Lower Yellowstone Project in Montana and North Dakota. The project had been in operation for a half-century when the report was made in 1958. Its irrigated area is approximately 49,000 acres.²

The Lower Yellowstone Project has become widely noted for its production of sugar beets and its large and expanding livestock feeding operations. The project and the sugar factory operations are a solid base for success and prosperity of the community. Development of the project has built the city of Sidney, Montana, into a hub of commerce for a multicounty area. Sidney is located in the central part of the project and is also the county seat of Richland County. About two-thirds of the project lies in Richland County in northeastern Montana and one-third in North Dakota, immediately above the confluence of the Yellowstone and Missouri Rivers.

Personal income, trade, and employment in Richland County was compared with an equivalent area of non-irrigated farm and ranch land.

¹Ibid., p. 9.

²Edwin E. Wilson, A Half Century of Irrigation Lower Yellowstone Project, Montana-North Dakota. (Billings, Montana: Report by Division of Irrigation, Bureau of Reclamation, 1958), p. 1.

The 1950 census figures show Richland county's personal income was \$15,632,000; in an equivalent area of the comparison county, it was \$5,308,000.¹

The 1954 Census of Business showed the volume of trade in Richland County was more than four times that in the comparison area.

Retail sales in Richland County in 1954 were \$12,909,000; but only \$3,078,000 in the comparison area. Payrolls of the retail establishments amount to \$1,287,000 or 6.6 times those in the comparison area.²

Employment in the project area, both farm and town would be less than five per cent of its present magnitude if there were no Lower Yellowstone Project. The net farm employment gain includes about 490 farmers, and 75 year-round hired farm workers plus the seasonal workers. The increase in farms and farmers is due to the larger gross and net incomes per acre possible with irrigation agriculture.

Employment indirectly attributable to irrigation farming covers operators and employees of stores, banks, agricultural processing plants (most notably the sugar factory), hotels, restaurants, and various other service industries. To illustrate: Service workers in Richland County numbered 243 in 1950; in the comparison area only 42. Richland County had 8 physicians, and the comparison area had only one.³

For all purposes, Richland County levied in 1954 taxes of \$1,251,529; the comparison county levied \$569,996, or less than half as much. On a

¹Ibid., p. 7.

²Ibid., p. 10.

³Ibid., p. 10.

per capita basis, these taxes were \$121 per person in Richland County and \$176 in the comparison county. Even with taxes proportionately almost 50 per cent higher, the comparison area received less in public services. This resulted from the difference in density of population. Richland County, with a denser population, could and did provide its residents with more public services with less burden on the taxpayer. This all resulted from more intensive use of land resources through irrigation.¹

The project provides a ready market for tens of thousands of feeder lambs and feeder cattle grown on range land extending from western North Dakota westward nearly to the Continental Divide in Montana, and south into northern Wyoming. Thus, there occurs much complementary use of irrigated land with dry-farmed land and range land. This is true even though some of that range land is 300 miles away from the irrigated farms on the Lower Yellowstone Project.

Livestock feeding on the project is linked very closely with the growing of sugar beets, barley, oats, and alfalfa on the project and almost as closely with the growing of barley and oats, mainly on dryland farms within easy trucking distance of the feed lots.

Cattle, lambs, and ewes are fed for the market on the project in very large numbers. The total numbers of livestock fed for the market in the last five seasons were 41,088 cattle and 539,005 sheep. The trend in volume of feeding is upward.

¹Ibid., p. 8.

Another measure of the size of the livestock feeding operations on the project is the value added to livestock fattened on the Lower Yellowstone Project. In four recent seasons, these values added to cattle totaled \$2,380,000; and to sheep, \$3,682,000.

The sugar beet crop contributes tremendously to the economy of the area. In 1956, production of sugar beets on the project was 135,511 tons on 9,779 acres. The sugar beets in that year provided enough sugar for 440,000 persons (average consumption of 100 pounds).¹

Population Growth

Irrigation was a part of the early history of Finney County, Kansas. White settlers were using irrigation in 1879 and by 1890, 17,285 acres were irrigated.² Larson compared population growth in Finney County as contrasted to Hodgeman County for the period 1890-1958. By 1958, there were more than 95,000 acres irrigated in Finney County, while Hodgeman County had less than 5,000 acres irrigated at that time. Irrigation had been unimportant in the development of Hodgeman County agriculture.

Finney and Hodgeman are adjacent counties in southwest Kansas. Finney County has grown from a population of 3,350 in 1890 to 14,270 in

¹ Ibid., pp. 2-5.

² Sara C. Larson, Population Changes in Finney County, Kansas 1880-1958, Department of Geology and Geography, Kansas State University, Manhattan, Kansas, 1962. p. 111.

in 1958. Its county seat, Garden City grew from a population of 1,544 in 1900 to 10,623 in 1958. Hodgeman County's population moved from 2,554 in 1890 to only 3,057 in 1958. Jetmore, the county seat, moved from 349 to 975 during the same period.

Garden City had in 1958, 192 retail establishments, 89 service establishments, 20 wholesale establishments, 30 small manufacturing firms as well as other means of employment. On the other hand, Jetmore had a mere handful of grocery stores, filling stations, and one bank in addition to some activities connected with its function as the county seat of Hodgeman County.¹

The rural community in Kansas and the Great Plains may have major problems unless there are new economic opportunities. Few of the smaller towns are holding their own in population figures. Many businesses have passed into oblivion, others are still actively competing for the farmers's business, their main hope for survival. Irrigation development may offer the course to bring new life into selected communities.

Buzenberg found population and the number of retail stores decreasing in Kansas towns under 1,000 population.²

Increase in population did not prevent loss of stores. The number of retail stores declined more than ten per cent between 1957 and 1962, whether population of the town was increasing constantly or

¹Ibid., pp. 64-69.

²Mildred E. Buzenberg, The Inter-relationships of Region, Population Change and Change in the Number of Retail Firms in Non-Metropolitan Kansas, Kansas Agricultural Experiment Station, Kansas State University, Manhattan, Kansas, 1962, pp. 21-22.

decreasing. Declining rural population and change in shopping habits are expected to continue. Therefore, the number of retail outlets in these towns will decline further, perhaps intensify, as present owners retire.

In towns with 1,000 to 2,500 population farm machinery stores, food stores and drug stores declined in number between 1957 and 1962. The conclusion reached is that larger towns with increasing population are locations where opportunities are adequate for retail stores.

CHAPTER V

TERTIARY BENEFITS

As the economic effects of reclamation projects on the local economy are explored for particular projects, it must be kept in mind that some benefits are not susceptible to monetary evaluation. These include such intangibles as effect on community welfare, stabilization of the regional economy, psychological effect on project irrigators and the contribution to national security of increased productive capacity.

Increased farm prosperity and trade activities are not the only benefits of irrigation. Adequate income is provided by the production from irrigated lands and from commerce in the towns to maintain good schools, roads, medical services and the churches and civic improvements.

Recreation

Many people in Kansas, as elsewhere, know Reclamation and Corps of Engineer Reservoirs best because of the opportunities the project reservoirs and streams offer for a variety of outdoor recreation activities. The demand for all types of recreation has soared in recent years and none more than the demand for fishing, boating, swimming, water skiing, and camping. Reclamation project reservoirs generally offer facilities for several or all of these activities and are therefore

subjected to a recreation usage that no one would have anticipated a few years ago. Sales of sporting and camping supplies, boats, trailers, etc., have soared even in places which are many miles from water impoundments. Hundreds of people in Kansas and thousands in the Nation make their livelihood from manufacturing and selling the sporting and camping goods, supplies, etc., which are in demand because project reservoirs make their use possible.

Edgar Z. Falmer of the University of Nebraska, studied the recreational aspects of three lakes in Southwest Nebraska in 1960. These lakes, Enders, Swanson, and Strunk, attract two-thirds of their visitors from 19 counties in Nebraska, Kansas and Colorado.

The author concludes that:

Almost \$1.4 million is spent annually in the area in connection with recreation at the lakes, plus about \$1.2 million spent elsewhere. The \$1.4 million generates additional derivative businesses of up to \$2 million in the lakes area. The \$1.4 million spent locally probably provides work for about 50 persons directly plus another 70 indirectly, based on the derivative benefit. This means that about 300 persons, including families of workers, are supported by the recreation business generated by the lakes.¹

The author states that recreation is not the only possible economic benefit from the lakes. The prospects of establishment of industry, schools, other institutions, wholesale distribution offices and warehouses, and governmental branch offices are enhanced by the location of the lakes. These facilities bring in money from outside

¹Edgar Z. Falmer, Recreational Aspects of Three Nebraska Lakes, Nebraska University Bureau of Business Research Community Study No. 3, p. 2.

sources and add to the economic welfare.

Municipal Water Supplies

Municipal water is available to cities from reservoirs constructed for irrigation water storage. City governments may contract with the Bureau of Reclamation or Corps of Engineer's for water supplies. Adequate water supplies often play an important role in the growth and industrial development of towns and cities.

The cities of Norton, Beloit and Russell, Kansas, have contracts with the Bureau of Reclamation for municipal water supplies. Norton Reservoir provides storage for Norton, Kansas. A contract has been completed with the city to furnish a maximum of 1,600 acre-feet annually. The Bureau will furnish Beloit with 2,000 acre-feet from Waconda Reservoir when completed. Cedar Bluff Reservoir supplements the municipal water supply of Russell, Kansas, up to 2,000 acre-feet per year.¹

Wildlife

A United States Bureau of Sport Fisheries and Wildlife warm-water fish hatchery is in operation below Cedar Bluff Reservoir. A maximum of 4,000 acre-feet of reservoir storage per year is allocated for fish hatchery use.

¹Annual Operating Plan, Kansas River Projects, 1964 Operations, 1965 Outlook. p. 5.

CHAPTER VI

NEED FOR ADDITIONAL RESEARCH

Reports and research reviewed in this study demonstrate the dependence of local secondary benefits upon (1) the primary benefits by project purposes, and (2) the characteristics of the local economy.

Additional research will be needed in Kansas communities to permit more accurate estimates of the local primary benefits. These benefits can provide a benchmark for determining secondary impacts.

Also additional research is needed to determine the relation of economic characteristics in local economies and local secondary benefits and changes in these characteristics. Research is also needed on how local economies differ and how these differences affect the amount and distribution of the local secondary benefits resulting from project-wide irrigation development. The results from such research would be important in estimating the local primary as well as the local secondary benefits of resource development.

Large amounts of time and data are required for use of the current methods in regional analysis used in benefit studies. This suggests a need for developing less timely and lower cost methods of estimating local secondary benefits.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Irrigation farming in large scale projects began in North Central Kansas only in the last ten years. Crop acreage irrigated in the districts exceeded 40,000 acres in 1964. A potential total of 187,000 acres in irrigation districts in the area is planned by the Bureau of Reclamation.

This study was undertaken for the general purpose of analyzing the potential economic impact of these concentrated developments on adjacent towns and cities. Accomplishments of similar projects in neighboring states and other midwestern areas are reviewed and the results are interpreted as they may apply to North Central Kansas communities.

The unit of analysis applied to the studies was the local area. Secondary benefits that apply to a regional area or nationwide were not considered.

The results of the study show that irrigation economies pass through phases of development over more than a ten year period. Increasing crop yields for the first several years are a phenomena of newly irrigated areas. New crops are introduced. Later livestock feeding is increased. Commercial enterprises expand to meet the needs of production and marketing of products from the irrigation districts.

It is apparent that irrigation produces benefits which tend to permeate the entire community. Several studies have dealt with this general theme and they generally have reached about the same conclusions. They have produced data to suggest that on the average the indirect-direct benefit ratio appears to be about 1.25 to 1.00. In other words for each \$1.00 of benefit realized by the producer, the indirect benefits amount to about \$1.25. The values range from a low of \$1.12 to a high of \$1.88 with the average being about \$1.25.

A major part of the secondary income accrues to the agri-businesses in the community. Feed mills, machinery dealers, processing plants, and specialized equipment industries present opportunities for expansion in trade centers.

As an irrigation economy matures, its effects are frequently obscured by the development of other resources and unrelated economic activities. Many of these activities may be indirect results of the irrigation economy followed by more stable agriculture, water supply, or manufacturing or processing payroll. After a 50 year period, irrigation revenues may be only a small part of the total revenue accruing to an area.

Irrigation economies may continue to lose population in the mid-west, but losses may not be as severe as in non-irrigated areas. The stabilizing effects of project-wide irrigation on population and the labor force may be most pronounced during periods of drouth or agricultural depression.

Increased farm prosperity and trade activities are not the only benefits of irrigation. Development in projects tends to concentrate population and wealth in the project area. More efficiency in supplying schools, roads, services and civic improvements may result in an improved standard of living for the communities.

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POTENTIAL ECONOMIC IMPACT OF IRRIGATION DEVELOPMENT
IN NORTH CENTRAL KANSAS COMMUNITIES

by

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Development of irrigation in project-wide proportions affects the local community. The purpose of this study is to identify and measure some of the impacts of irrigation in well-established irrigation communities. These changes are then interpreted as they could apply to recently-developed project areas in North Central Kansas. Irrigation development is also studied as it affects the individual farm.

Irrigation farming is becoming an increasingly important segment of the economy of North Central Kansas. In 1964, 41,741 acres were irrigated in project areas. Value of the irrigated crops was over 4 million dollars. The U. S. Bureau of Reclamation has project plans for a total of 187,000 acres of irrigation districts in the same area.

There is abundant literature describing contributions of irrigation development, analyzing secondary benefits and appraising impact in communities. The majority of literature reviewed presented water resource development as a valuable asset for the project farmer, the community or the country as a whole. Literature was reviewed to study impacts that may be a feature of development in Kansas.

Effects that may be expected in an area with rainfall that will support a cropland agriculture are reported in the study.

Young irrigation economies pass through several stages of development before showing evidence of maturity. Commercial enterprises may need to expand to meet the needs of production and marketing of products from the irrigated acreage. Cropping patterns change as new crops are introduced.

The results of several studies indicate that irrigation produces benefits to the entire community. Data from these studies suggest that

on the average, the indirect-direct benefits ratio is about 1.25 to 1.00 or for each \$1.00 increase in income realized by the irrigator, about \$1.25 accrues in indirect benefit to the community.

The agri-businesses in the community receive the major part of the secondary income. Processing plants, feed mills, farm suppliers and equipment industries have an opportunity for expansion in newly irrigated areas.

The impact of irrigation in mature irrigation economies may be more difficult to measure. Irrigation is often the basis for the prosperity, the stability and security for the farms, cities and industries in the area. Agricultural income may be only a minor part of total revenue now accruing to the area, although many of the other activities are indirect results of the irrigation economy.

Results of the study indicate that adjustments will be needed in businesses serving agriculture in the irrigated areas. The Kansas setting is similar to recently developed projects in Nebraska and Oklahoma. Studies in these areas demonstrate apparent economic effects although the projects are still in a growing phase.

Additional research will be needed to more accurately determine benefits in Kansas Communities. There may be variation in economic characteristics of local communities that will result in differences in the amount and distribution of local secondary benefits. This report could provide a point of departure for that study.