NEW COMMUNITY WATER AND SEWER SYSTEMS AND THE POPULATION OF SMALL TOWNS

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Recent years have seen a rapid expansion in expenditures for new small town water and sewer systems. Both federal and state governments have increased their aid programs significantly in this field. The primary source of federal funds for new water and sewer facilities in such towns has been the Farmers Home Administration (FmHA), whose loans and grants totaled approximately $1,425 million for water and $629 million for sewer facilities in such places during fiscal years 1966-1973.[1]

The recent activity by all levels of government in this area has raised questions concerning the benefits and costs of new systems for small towns. It is recognized that community systems typically have positive environmental aspects, but many questions remain as to whether there generally are any measurable economic benefits, such as increased business activity or population growth. New community water and sewer systems have been advocated for certain small towns on the basis of community survival. The logic in such instances is that, other things being equal, people would prefer to live in a town that has modern water and sewer facilities. In contrast, others have argued that since many small towns are declining anyway, society should not be investing in expensive new community systems – no matter the source of funds – because economic benefits are outweighed by costs.

Most previous research on the impact of water investments can be separated into two groups. (The impact of sewer investments scarcely has been investigated at all.) At one extreme are a few case studies which deal with the benefits of new water systems in a given town or water district [1, 2, 9, 13, 18]. Typically, they cite an impressive list of alleged benefits which sometimes are quite difficult to quantify. At the other extreme are a number of studies which have looked at public water resource investments – usually quite broadly defined, including such items as Corps of Engineers projects – using the county as the basic unit of observation [3, 7, 12]. The study area has been a state, a multistate region, or even the nation. Such studies typically have been as negative in their conclusions as the case studies have been positive. A few have shown some positive economic influence from water availability, but this has been limited more to microlocational rather than macrolocational (large regional) effects [5, 8].[2]

The net result is that there remains a

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[1] In 1961, P.L. 87-128 authorized a loan program for water systems in towns of up to 2,500 population. Some $109 million was loaned during the fiscal 1961-1965 period. Thus, the bulk of FmHA activity has followed the 1965 passage of the Poage-Aitken bill (P.L. 89-240), which added the authority to financial waste disposal systems, expanded the program to include both grants and loans, and authorized assistance to towns of up to 5,500 people.

[2] It may appear that the study by Landry, et al., [9] in Mississippi is an exception to the above dichotomy, but in fact it exhibits most of the characteristics of the case studies. Its focus is limited to the 580 FmHA-assisted rural water projects constructed in that state between late 1962 and February 1973. Questionnaires were sent to the 535 operating systems as of February 1973, and returns were received from 316 (60.2 percent). An attempt was made to look at changes in land values, housing, industry, number of water-using appliances, home improvements, population, water use, etc. The results suffer because the researchers were dependent on voluntary answers to questionnaires mailed to local officials. They therefore often were forced to rely on the subjective opinions of the respondents concerning such variables as population change. One does not know what would have occurred in the absence of these new systems nor was any attempt made to find out via the use of control groups. The study thus becomes largely a listing of difficult-to-quantify alleged benefits.

considerable lack of information concerning towns which have built new community water and sewer systems in recent years. Little is known about the number of towns building systems, their characteristics, or the timing of such investments with respect to population changes. This paper investigates some of these questions using population as the key variable. New water system investments were studied in five states – Colorado, Mississippi, North Carolina, North Dakota, and Oklahoma. New sewer systems were looked at for these same states plus Iowa.[3] All towns with a 1960 population of 75 to 10,000 which built new, first-time community water and sewer systems after 1950 were analyzed. Moreover, they were compared with towns with pre-1950 systems and those lacking systems. The towns were classified for detailed study on the basis of incorporation status, Standard Metropolitan Statistical Area (SMSA) status, FmHA assistance status, and size.[4] The primary objective was to determine if the construction of new, first-time community systems subsequently led to population growth, or possibly whether population increases ultimately led to the construction of community systems for the first time. This brings up certain aspects of economic theory regarding social overhead capital (SOC) which will be reviewed briefly.

THEORETICAL FRAMEWORK

According to Martin [11, p. 81], infrastructure or SOC "consists of the facilities and organizations used to produce public services for communities, including streets and roads, sanitary and water systems, parks and recreational facilities, libraries, police and fire protection, education, hospital and health services, museums, and other facilities for producing aesthetic services, recreation, and so on." Obviously, other economic factors being equal, differences in the quantity and quality of SOC can cause wide variations in the relative desirability of communities as places in which to live, work, and produce. Thus, economists and community leaders recognize the great importance of SOC.

Much more troublesome to economists than the importance issue has been the proper timing of SOC investments in the growth process. It is quite apparent that a lack of SOC can slow or prevent growth while a surplus is an extremely expensive luxury, given the cost of typical SOC investments. This has not been an easy question to resolve. Hirschman [6, p. 93] notes that two sequences of development of SOC are possible: (1) development via shortage, and (2) development via excess capacity:

> A basic difference between these two sequences is the type of inducement that is set up. Excess SOC capacity is essentially permissive; while it certainly serves to reinforce motivations that already exist, and may therefore mean the difference between a large flow of DPA (Directly Productive Activities) investment and a trickle, it invites rather than compels. The opposite holds with respect to the inducement via shortage. A shortage that is experienced as such is bound to lead to attempts to remedy it on the part of those who suffer from it or who stand to gain from its elimination.

In a similar vein, Maki [10, p. 87] states, "An adequate and not overburdensome infrastructure is, therefore, a necessary but not a sufficient condition for rural economic growth and development." Hirschman [6, p. 84] further observes, "As a result, SOC investment is largely a matter of faith in the development potential of a country or region."

PROCEDURE

A master list of all communities having a 1960 full-time, year-round population of 75 to 10,000 was compiled for the states from the Rand McNally *Commercial Atlas and Marketing Guide.* For a community to appear in the list, it had to be identifiable and possess a population in each of the years 1950, 1960, and 1970. The 1952, 1962, and 1972 editions of the atlas were used to allow a two-year lag after the census year and thus permit the Rand McNally people time to update their population estimates for unincorporated places based on the latest census. Every effort was made to account for annexations, changes in names, and places listed under two or more common names. For the five states, the final list contained 2,965 towns with a total 1970 population of 2.7 million. Comparable

[3] The intent was to include enough states so a variety of conditions could be observed. Originally, 10 states were selected for analysis based on such criteria as geographic and climatic differences, range of FmHA activity, and availability of field staff data collection assistance. In addition to the six states just mentioned, Idaho, Michigan, Missouri, and Oregon were included on the original list. However, despite the expenditure of considerable effort toward collection, it was found that accurate data concerning dates of first systems were available only for five of the states for water and six of the states for sewer. It was felt despite these difficulties that a wide range of conditions was included in the remaining states and the study proceeded on this basis.

[4] April 27, 1973, SMSA delineations of the Office of Management and Budget (OMB) were used throughout.

figures for the six states were 4,020 towns with a 1970 population of 3.7 million. These population totals were 48.0 and 53.2 percent of the respective five- and six-state rural population figures for 1970.

The most difficult task faced was identifying accurately the dates when the towns first obtained a community water or sewer system. Between late June 1972 and January 1973, every state health department or its relevant equivalent was visited in each of the states. Permit files and other pertinent published and unpublished data sources at the state level were collected and carefully perused. When possible, state engineers in these departments were personally contacted and asked for information and their reactions to the final lists. Every effort was made to cross-check data so as to identify the year in which the operation of the community systems actually began. Lag times were introduced into permit dates, upon consultation with the engineers, if actual first operation dates were unavailable. Both published federal data sources and the Environmental Protection Agency's computerized listing of municipal waste facilities were used as background references [14, 15, 16, 17].

The towns which received FmHA assistance were identified by a questionnaire. Lists of borrowers were compiled based on the FmHA computerized rural project tabulations of the St. Louis Finance Office. The lists included each borrower's name and the year and month of the first closing date. Each state office was asked to complete the questionnaire giving: (1) town(s) included, since borrowers and towns were not always synonymous; (2) estimated year of initial operation of the system, and (3) whether this was the first time the town had a water or sewer system. They were instructed to indicate "rural" if the system was entirely rural in nature and served no small towns. The lists were based on projects actually closed – not projects simply obligated, as these sometimes are never built.

The intent in both the water and sewer cases was to detect the date of the first adequate community system. For example, a few scattered pipes constructed during an early mining boom period would not suffice. A majority of the citizens had to be served by an adequate system. Whether the system was publicly or privately owned was not considered critical. The important thing was determining whether the town was served. No specific effort was made to include or exclude "company towns."

Exact dates were noted if the system was built during or after 1950. Towns whose systems were constructed before 1950 and towns without systems were lumped into separate categories and used as reference points. Throughout the tabulation process, respondents were asked to identify projects which were under construction and would be operational in 1972 or 1973. The result is probably the best existing information concerning the dates of initial small town water and sewer systems for these states with respect to towns obtaining new systems during and after 1950.

RESULTS

First, based on average 1970 community size, towns building new systems during 1950-1973 were compared with towns having systems built before 1950, lacking systems, and all towns. As Table 1 shows, in terms of 1970 population, towns building new water systems during the 1950-1973 period were only 57.7 percent as large as those building new sewer systems during the same span. Towns building water and sewer systems between 1950-1973 were, respectively, 22.5 and 29.3 percent of the size of those towns having old (pre-1950) systems, but were significantly larger than those places still lacking community systems. For both water and sewer systems, towns building were larger if they were incorporated, were inside an SMSA, or did not receive FmHA assistance.

Although towns building new water and sewer systems during 1950-1973 grew rapidly throughout 1950-1970, their overall growth rates were slightly less than those of towns having pre-1950 systems.[5] However, they were much greater than the increases shown by places lacking systems. Towns building during 1950-1973 which grew faster over 1950-1970 tended to be larger places, unincorporated, inside an SMSA, or did not receive FmHA assistance. Even though the unincorporated places were small, enough were located near large rapidly growing urban centers so as to greatly influence the growth rate of the entire group. The slower rates of growth for the FmHA-assisted places are much as expected since (1) these places were much smaller than average-sized towns, and (2) they were in need of outside financial assistance – assistance which, by the nature of things, tends to select the "problem" places.

Secondly, towns were analyzed to see if population growth tended to precede or follow after

[5] Total population of the five states increased 9.9 and 10.8 percent during the 1950-1960 and 1960-1970 periods, respectively. For the six states, comparable figures were 8.9 and 9.2 percent.

Table 1. **SELECTED CHARACTERISTICS OF COMMUNITIES INSTALLING A NEW COMMUNITY SYSTEM DURING 1950-1973 COMPARED WITH COMMUNITIES HAVING A PRE-1950 SYSTEM OR NO SYSTEM**

Item	Water (5 states)				Sewer (6 states)			
	Number of communities	Average 1970 population	Percent change in average community size: 1950-60	1960-70	Number of communities	Average 1970 population	Percent change in average community size: 1950-60	1960-70
	Number		Percent		Number		Percent	
Totals (1950-73):	560	395	9.6	15.2	684	654	9.8	12.4
Uninc. places	259	376	17.2	20.1	56	656	31.4	24.5
Inc. places	301	412	4.5	11.7	628	664	8.3	13.1
Inside SMSA's	74	905	61.0	45.3	107	1,067	40.8	37.5
Outside SMSA's	486	318	-0.7	6.0	577	589	3.8	7.7
Non-FmHA assisted	215	584	23.3	19.9	488	761	12.9	14.8
FmHA assisted	345	278	-3.4	9.9	196	420	-2.3	9.9
1960 comm. size:								
2,500 and over	4	5,565	322.6	65.0	16	4,606	33.7	10.8
1,000 - 2,499	16	1,651	20.2	24.5	56	1,679	18.8	19.8
500 - 999	84	704	26.4	10.5	199	777	8.0	15.1
200 - 499	251	318	-1.3	4.3	318	359	-1.5	8.8
75 - 199	205	164	-20.8	23.3	95	183	-12.4	22.8
Pre-1950 system	1,271	1,753	12.8	14.1	1,194	2,230	12.2	12.4
No system	1,134	236	5.2	-2.1	2,142	253	4.2	2.4
All towns	2,965	916	11.5	12.4	4,020	910	10.5	11.0

the date of new system construction. The 1950-1969 period was subdivided into four segments: 1950-1954, 1955-1959, 1960-1964, and 1965-1969 (Table 2). For each of these five-year periods, percent population changes were compared for the 1950's and 1960's. Such a technique yields eight cells – four time periods each for both water and sewer. Based on this technique, the data show more rapid rates of population growth during the decade of installation for each cell, with the exception of water systems built during 1960-1964 and sewer systems constructed during 1955-1959. In the former case, population growth was even more rapid prior to construction, while in the latter, a fast rate of growth during the decade of construction continued into the 1960's. Overall, the net result is that population growth was most rapid during or prior to construction in seven of the eight cells. Moreover, it is interesting to note that population growth increased significantly in the 1960's compared with declines in the 1950's for communities building new systems during the 1970-1973 span.[6]

Next, data for the 1950-1969 period for each of the states were analyzed in a similar manner. Each cell was examined for both water and sewer systems to determine if more rapid rates of population growth

[6] It is of interest to note the population changes experienced by towns building *both* water and sewer systems at about the same time, that is, within the same year groupings as defined in Table 2. Such data exist for five states (only sewer data were available for Iowa). The 113 towns in these states building both systems approximately simultaneously during the 1950-1973 period grew 10.0 and 12.4 percent during the 1950's and 1960's, respectively. The 802 places that had pre-1950 systems grew 14.0 percent both decades and the 1,086 towns lacking systems grew 6.0 percent during the 1950's but declined 3.5 percent during the 1960's.

Table 2. **PERCENT CHANGE IN AVERAGE COMMUNITY SIZE, 1950-1960 AND 1960-1970 BASED ON DATE OF FIRST COMMUNITY SYSTEM**

Item	Date of system						No system	Total
	Before 1950	1950-54	1955-59	1960-64	1965-69	1970-73		
	Percent							
Water (5 states):								
1950-60	12.7	21.3	46.3	16.2	-1.8	-8.0	5.2	11.6
1960-70	14.1	13.9	29.7	9.3	14.7	4.8	-2.5	12.4
Sewer (6 states):								
1950-60	12.2	8.9	12.2	15.2	8.7	-0.3	4.2	10.5
1960-70	12.3	8.6	13.5	21.0	10.3	16.3	2.8	11.1

(or smaller rates of population decline) occurred during the decade in which the new systems were installed. The results for state totals and by incorporation, SMSA, and FmHA assistance status subcategories are reported in Table 3. Results generally show that more rapid rates of population growth (or smaller rates of decline) occurred during the decade in which the new systems were built. Major exceptions were places, unincorporated or located inside an SMSA, building new sewer systems. These tended to be rapidly growing places located near large metropolitan centers, which, apparently as a result of their rapid growth rates, evidenced somewhat more unpredictable timing of their expensive new sewer system investments than did the other towns.

Lastly, research by Fuguitt [4, p. 452] has shown that approximately 500 new incorporations occurred nationwide during each of the respective decades 1950-1960 and 1960-1970. Thus, it is of interest to explore the possibility that new incorporations, which are influenced by population growth, may be related in some manner to the installation dates of new community water and sewer

Table 3. **TABULATION OF INSTANCES DURING WHICH THE MORE RAPID RATES OF POPULATION GROWTH OR SMALLER RATES OF POPULATION DECLINE OCCURRED DURING THE DECADE IN WHICH THE NEW SYSTEMS WERE INSTALLED**

Item	Water (5 states)			Sewer (6 states)		
	Date of system		Total	Date of system		Total
	1950's	1960's		1950's	1960's	
Totals:	6 of 10	6 of 10	12 of 20	5 of 10	7 of 12	12 of 22
Uninc. places	3 of 5	5 of 10	8 of 15	4 of 6	1 of 9	5 of 15
Inc. places	5 of 9	8 of 10	13 of 19	5 of 10	9 of 12	14 of 22
Inside SMSA's	4 of 7	6 of 7	10 of 14	1 of 7	4 of 10	5 of 17
Outside SMSA's	5 of 10	7 of 10	12 of 20	7 of 10	9 of 12	16 of 22
Non-FmHA assisted	6 of 10	6 of 10	12 of 20	5 of 10	6 of 12	11 of 22
FmHA assisted	a/	5 of 10	5 of 10	b/	4 of 6	4 of 6

[a]No FmHA water projects were found in the states studied for the 1950's since the vast majority of such projects were authorized by bills passed in 1961 (P.L. 87-128) and 1965 (P.L. 89-240).

[b]FmHA sewer projects were not authorized until the passage of P.L. 89-240 in 1965.

Table 4. PERCENT CHANGE IN THE NUMBER OF ACTIVE INCORPORATED PLACES, 1950-1960 and 1960-1970, BASED ON THE DATE OF THE FIRST COMMUNITY SYSTEM

Date of system	Water (5 states)			Sewer (6 states)		
	Number of incorporated places, 1950	Percent change in number of incorporated places		Number of incorporated places, 1950	Percent change in number of incorporated places	
		1950-60	1960-70		1950-60	1960-70
	Number	Percent		Number	Percent	
Before 1950	1,121	1.6	0.4	1,114	0.6	0.5
1950-54	47	2.1	2.1	65	1.5	0.0
1955-59	45	2.2	0.0	116	3.4	1.7
1960-64	37	2.7	2.6	143	5.6	0.0
1965-69	124	-8.1	4.4	172	4.7	2.8
1970-73	57	-3.5	16.4	109	1.8	8.1
No system	242	-22.7	3.7	828	-6.8	0.6
Total	1,673	-2.8	1.7	2,547	-1.0	1.1

systems. In order to find out, the percent change in the number of active incorporated places for the 1950's and 1960's was calculated for the states based on the date of the first community system (Table 4).[7]

The 1950-1969 data show the most incorporation activity occurring prior to or during the same decade as the systems were constructed, except for water systems built from 1950-1954 and 1965-1969. In the former case, the same exact percent rate of incorporation continued on into the 1960's, while in the latter instance, the number of active incorporations actually declined during the 1950's. However, in the latter case, systems were built late in the decade (1965-1969) and the data do not show if the increase in incorporations began to occur earlier in the decade prior to the new system construction or not. It is interesting to note that the rate of incorporation increased markedly during the 1960's over the 1950's for towns building new systems during the 1970-1973 period. The net result lends considerable support to the belief that new incorporations, which are influenced by population increases, tend to occur most frequently prior to or during the period of new system installation.

CONCLUSIONS

The majority of evidence, based on data from six selected states, suggests that the construction of new, first-time community water and sewer systems has been consistent with the model of development via shortage of social overhead capital – that is, population growth led to the need for these community facilities rather than vice versa. This may be because the towns involved felt that to invest in excess SOC typically is a very expensive luxury. It may also be related to the policies of federal agencies to put limited grant and loan funds where current needs are greatest. There were exceptions, of course, where declining places built costly systems. If federal or state grants were involved in such projects, one probably must view those efforts in a welfare context. However, even in those cases, there may not have been as much welfare involved as one might first think since rural areas have been exporting large amounts of capital for many years.

[7] Data on incorporation status of the towns were taken from the Rand McNally *Commercial Atlas and Marketing Guide.*

REFERENCES

[1] Blase, Melvin G., Arthur J. Matson, Parman R. Green, and Coy G. McNabb. *Public Water Supply Districts: Impacts in Two Areas.* University of Missouri Extension Division Bulletin MP 268, Feb. 1972.

[2] Blase, Melvin G., Parman R. Green, and Arthur Matson. "The Impact of Public Water Supply Districts on Household and Community Development." Paper given at the Southern Agricultural Economics Association meetings. Atlanta, Ga., Feb. 1973.

[3] Cox, P. Thomas, C. Wilford Grover, and Bernard Siskin. "Effect of Water Resource Investment on Economic Growth." *Water Resources Research,* Vol. 7, No. 1, pp. 32-38, Feb. 1971.

[4] Fuguitt, Glen V. "The Places Left Behind: Population Trends and Policy for Rural America." *Rural Sociology,* Vol. 36, No. 4, pp. 449-470, Dec. 1971.

[5] Garrison, Charles B., and Albert S. Paulson. *The Effect of Water Resources on Industrial Growth in the Tennessee Valley Region.* University of Tennessee, Center for Business and Economic Research, July 1972.

[6] Hirschman, Albert O., *The Strategy of Economic Development.* New Haven, Conn.: Yale University Press, 1958.

[7] Howe, Charles W. "Water Resources and Regional Economic Growth in the United States, 1950-1960." *Southern Economic Journal,* Vol. 34, pp. 477-489, 1968.

[8] James, L. Douglas. *A Perspective on Economic Impact.* University of Kentucky, Water Resources Institute Research Report No. 37, March 1972.

[9] Landry, Brenda M., Charles P. Cartee, and D. C. Williams, Jr. *Economic and Related Impacts of Rural Water Systems in Mississippi.* Mississippi State University, Water Resources Research Institute, July 1973.

[10] Maki, Wilbur R. "Infrastructure in Rural Areas." *Rural Poverty in the United States.* A report by the President's National Advisory Commission on Rural Poverty. Washington, D.C.: U.S. Govt. Printing Office, pp. 86-109, May 1968.

[11] Martin, Lee R. "Research Needed on the Contribution of Human, Social and Community Capital to Economic Growth." *Journal of Farm Economics,* Vol. 45, No. 1, pp. 73-94, Feb. 1963.

[12] Rivkin-Carson, Inc. *Population Growth in Communities in Relation to Water Resources Policy.* Prepared for the National Water Commission. Washington, D.C.: Rivkin-Carson, Inc., Oct. 1971.

[13] Smythe, Patrick E. *Economic Impact of a Rural Water District.* Kansas State University Cooperative Extension Service Bulletin C-409, Aug. 1969.

[14] U.S. Dept. of Health, Education, and Welfare. *1962 Inventory: Municipal Waste Facilities.* Public Health Service Publication No. 1065. Washington, D.C.: U.S. Govt. Printing Office, 1963.

[15] U.S. Dept. of Health, Education, and Welfare. *1963 Inventory: Municipal Water Facilities.* Public Health Service Publication No. 775 (revised). Washington, D.C.: U.S. Govt. Printing Office, 1964.

[16] U.S. Environmental Protection Agency. *1968 Inventory: Municipal Waste Facilities.* Environmental Protection Agency Publication No. OWP-1. Washington, D.C.: U.S. Govt. Printing Office, 1971.

[17] U.S. Environmental Protection Agency. *Project Register.* Dec. 31, 1971. Projects approved under Section 8 of the Federal Water Pollution Control Act (P.L. 84-660), as amended, and Section 3 of the Public Works Acceleration Act (P.L. 87-658).

[18] Wills, Walter J., and Donald D. Osburn. *Impact of Community Water Systems in Small Towns.* University of Illinois, Water Resources Center Research Report No. 20, June 1969.