

THESIS

PUBLIC INVESTMENT IN MEXICO'S NORTH PACIFIC

Submitted by

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ABSTRACT OF THESIS

PUBLIC INVESTMENT IN MEXICO'S NORTH PACIFIC

The purpose of this thesis is to examine the role of public investment to promote economic development. Mexico was chosen as a case study, with particular interest in the North Pacific region. The principal focus is on public investment in water delivery and removal systems. The thesis examines relevant institutional arrangements behind Mexican public investment in water delivery and removal systems; the role the resultant expanded agricultural system plays in overall economic growth and development; the structural effects of such investment; and the theoretical implications of investment strategies.

A theoretical framework for public investment is first established to provide a background for the remainder of the thesis. The next topic is the growth in Mexican agricultural output, and the role of the agricultural sector in an expanding economy. The relevant institutional arrangements and political forces which influenced the sectoral and regional distribution of public funds for water delivery and removal systems are examined next. Then the North Pacific region and the remainder of Mexico are compared with respect to investment in water delivery

and removal systems and with respect to differences in the structure of agriculture. Finally, the regional distribution of this investment is evaluated in terms of the theoretical framework established earlier.

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INTRODUCTION

The last twenty years represent a period when more than ever before the less developed countries of the world have set their sights on an improved state of economic development. Many of these less developed countries (LDC's) are located in arid or semi-arid regions of Asia, Africa, and Latin America. In the case of those countries which have large amounts of arid or semi-arid lands, water delivery and removal systems have become vital ingredients in the establishment of viable agricultural systems capable of meeting the needs of expanding populations.

It is the purpose of this thesis to examine aspects of public investment in water delivery and removal systems in arid and semi-arid regions. In particular I will examine relevant institutional arrangements behind the public investment; the role such an expanded agricultural system plays in overall economic growth and development; the structural effects of such investment; and the theoretical implications of investment strategies.

I have chosen Mexico as a case study for three reasons. First, Mexico is a good example of a country, having large arid and semi-arid regions, that has placed heavy reliance on water delivery and removal systems to increase agricultural output. Second, Mexico also happens to hold one of the better records of economic development among the LDC's. I am interested in the role an expanded agricultural system might have played in Mexico's growth and development. Third, Mexico

provides a good stage on which to study the allocation of public investment in water delivery and removal systems.

Chapter I of my thesis will establish a theoretical framework for an analysis of public investment. I will discuss such concepts as social overhead capital versus directly productive investments; balanced versus unbalanced growth; and various forms of benefit cost analysis. It is hoped that this theoretical framework will be useful in understanding and evaluating Mexican public investment strategies.

Chapter II will examine the growth in Mexican agricultural output, the economy in general, and the role of Mexican agriculture in an expanding economy. This chapter should not only give the reader a feel for the Mexican economy from 1940 to 1965, but should also indicate ways in which an expanding agricultural system can contribute to economic development.

Chapter III will cover the relevant institutional arrangements and political forces which have influenced the sectoral and regional distribution of public funds for water delivery and removal systems. In particular it is important to understand the Ministry of Hydraulic Resources and the powerful position held by the executive in Mexico's political system.

Chapter IV analyzes public investment in water delivery and removal systems in the North Pacific region of Mexico as compared to the rest of the country. I will show differences in investment priorities between the North Pacific as opposed to the rest of the country, and differences in the structure of agriculture.

In the conclusion I will draw on the theoretical framework presented in Chapter I in order to make a tentative evaluation of

Mexico's investment strategy in terms of water delivery and removal systems. At this point I will mention areas which I believe to hold promise for further research. Investment in water delivery and removal systems will hereafter be referred to as irrigation investment for the purpose of brevity.

CHAPTER I

THEORY CHAPTER

There is a large body of economic theory that deals with the problem of economic development. Economics can provide reasons for the heavy involvement of governments in economic development that we see in so many instances today. There are also economic hypotheses, some of them conflicting, concerning the strategies which the governments should use in promoting economic development. The purpose of this chapter is to discuss the contributions of economics in these areas, and in so doing to provide an essential background with which to evaluate the facts presented in this thesis. In Chapter Four I will return to this economic theory in order to evaluate economic development policies of the Mexican government. These economic hypotheses will provide some order to the analysis of government policies, and will aid in the discussion of past and present alternatives for policy.

In many of the less developed countries (LDC's) of the world today there is more and more pressure for the governments to take more direct and concerted action toward promoting economic development. For one reason or the other government has been given the role as the leading agent of change for the development process. I would like to begin this section by briefly reviewing a few of the factors which have helped to set the stage for the role of government in economic development.

It is important to point out that although governments of LDC's shoulder a very great responsibility for fulfillment of expectations

about economic development, the public share of total general expenditures in most of these countries is smaller than in the developed countries. This is not surprising when we consider both the greater taxable incomes beyond subsistence and also the superior tradition of administrative skills and government credibility with respect to the population found in the developed countries. But the issue becomes clearer when we see that in many cases, the public share in capital formation is greater in the less developed countries.¹ Where these governments can and do act it is often in response to the need for investment.

One of the most commonly cited reasons for the government role is that the LDC's have a shortage of entrepreneurial skills. Someone must be in a position to see investment opportunities, and then be able to mobilize the labor, capital equipment, raw materials, and financing needed. This type of a person may not be readily identifiable in a given culture, but most likely is the possibility that this character trait does exist but has not been drawn into action. For example, the institutional patterns of a country may be such that the mobilization of the above mentioned factors may be too great a feat for any individual or group of private individuals. It may seem as if the people in these countries are less production oriented and more exchange oriented. The driving force is not a desire for profits or to build empires, but rather a desire on the part of great numbers of people for a rapid rise in the standard of living.²

¹Paul Alpert, Economic Development (London: Collier-Macmillan, Ltd., 1963), pp. 60-69.

²H. Wallich, "Some Notes Towards a Theory of Derived Development," in The Economics of Underdevelopment ed. by A. N. Agarwala and S. P. Singh (New York: Oxford University Press, 1963), pp. 189-204.

Closely related to this problem of entrepreneurial skills is that of dualism. No country grows at an even rate in all sectors of the economy, nor in all regions. Certain parts of a country may not even be a part of the modern economy which is emerging. These areas can often be a major hindrance to further growth (little demand for products, political unrest, welfare needs) and at the same time most of the country's entrepreneurial skills will not be found here. Those areas which need the innovative skills worst, will have the least to go around.³

The actual presence of sufficient numbers of innovative persons will not help if the projects needed do not offer sufficient returns with respect to the relatively short time horizons shared by private individuals. This is the familiar case of social overhead capital which I will discuss in more detail later. I would only like to mention at this point that certain forms of social overhead capital may have to be present before the innovative individual can see possibilities for investment and thus be drawn into action. Due to the low rates of return of social overhead capital, high risks, the presence of social benefits, and the large initial investments, government may have to provide for it by default.

Equally important as a factor creating demand for government participation in development is the demonstration effect of the developed countries and the pressures that this places upon those holding political power in the LDC's. Improving communications allows the people to see the disparities in living standards and they understandably want rapid

³Wilfred Malenbaum, "Government, Entrepreneurship, and Economic Growth in Poor Lands," World Politics, XIX (October, 1966), 52-68.

redress for the inequalities. If a government wants to stay in power, it must convince the people that progress is being made. This implies a rate of economic development greater than that of almost all the initial rates of the presently developed countries. We see governments trying to minimize the mistakes and leisurely pace of haphazard development.

One way to increase investment and consequently economic growth is to restrict consumption, leaving more of a country's resources available for capital formation. This is particularly difficult when the importance of the desire for a higher standard of living is recalled. Restricting consumption requires strong governmental control, but can be effective as seen in the case of the U.S.S.R. This leads to the role of government as saver. Frequently, sufficient levels of private saving do not exist, or institutions don't exist that are capable of channelling private savings to those who wish to invest. Government can partially solve this problem by using taxation or monetary policy to force saving. Funds derived in this way would allow public investment in social overhead capital or directly productive investments.⁴

Finally, many countries have had bad experiences with private investment in certain areas. This is particularly the case with foreign investments in such areas as transportation, mining, and agriculture. But it has also been seen in the case of a country's own citizenry. This has illustrated only too clearly the possibility of conflicts between private interests and the public welfare of the country.

⁴Gerald M. Meier, Leading Issues in Economic Development: Studies in International Poverty (New York: Oxford University Press, 1970), pp. 186-209.

Balanced vs Unbalanced Growth

Government participation has been accepted as a very important factor in the process of development in today's LDC's. The next question that arises is that of the nature of this participation and how it fits into the overall process of economic development. One of the running controversies between economists has been between the ideas of balanced versus unbalanced growth. This conflict is worthy of notice because the way in which policymakers view critical factors of the growth process will have a controlling influence on the type of government action they attempt to initiate. I will try to show that both the balanced and the unbalanced growth views have something to add toward understanding the economic development and government's role in the process.

The theory of balanced growth starts from the proposition that the existing economic systems of most LDC's are initially deadlocked in a state of low-level equilibrium. The developmental goal is to superimpose a second modern economic system upon the first. This new system will be self-contained in that it provides its own additional markets: at the same time it produces an additional supply of goods and services. The manufacturing sector would be emphasized because its relative importance must increase as a consequence of the structural changes in economic development. The superimposed economic system would be created by a 'simultaneous' group of new industrial enterprises which would be able to take advantage of external economies in relation to supply, and of complementarities of markets in relation to demand.⁵

⁵H.W. Singer, International Development: Growth and Change (New York: McGraw-Hill, 1964), pp. 44-50.

Ragnar Nurkse is one of the leading proponents of the balanced growth doctrine.⁶ He describes the initial low level of equilibrium as a vicious circle. Individuals in less developed countries have a lower inducement to invest in productive activities. This stems from the small buying power found in the local market. The small buying power is of course the result of low real incomes to be found, the low real incomes being the consequence of low productivity in the economy. To complete the vicious circle, Nurkse contends that the low level of productivity is due to the small amount of capital used in the production of goods, and the amount of capital stays small because there is little inducement to invest and to save. Productivity becomes the most significant determinant of the size of the market. Monetary policy or the physical size of the market with its corresponding transport and trade aspects are not the primary problems.

The concern of the less developed countries over low inducements to invest resulting from low buying power might be compared to problems of recession and depression in the more developed nations and has its roots in Say's Law. The establishment of a few isolated firms would not be successful because there would be no market demand for their production nor other goods on which the workers may spend their increased incomes. There must be investment in a large number and range of industries so that the increased incomes of each would provide a market for the production of others. Further, this range of industries would provide a network of external economies of production that would benefit

⁶R. Nurkse, Problems of Capital Formation in Underdeveloped Countries (New York: Oxford University Press, 1953), pp. 4-31.

all present members and provide inducements for the establishment of new firms. Thus the initial vicious circle would be broken and the process of economic development begun. An important point is that the establishment of the initial group of industries to start the process would require a very substantial investment. The state would probably have to provide this initial investment rather than relying on a spontaneous group of private investments.⁷

J. Marcus Fleming agrees with the balanced growth doctrine but postulates that its success is dependent upon the condition that supplies of factors to be used in production are not fixed. Otherwise their prices will be bid up and the external diseconomies may outweigh the external economies. If the supplies are more or less fixed, the firm must use less factors than before. He adds a further refinement by stating that external economies are more likely to prevail in industries which are vertically related. The more industries which are vertically related, the greater their effect on other industries which are not vertically related. He warns against applying the idea of external economies in too wide or general a sense.⁸

Another major advocate of the balanced growth theory is Rosenstein-Rodan. He discusses the need for balanced growth in terms of a number of indivisibilities which he believes are in common existence. He illustrates first the indivisibility of the production function

⁷Ibid.

⁸J. Marcus Fleming, "External Economies and the Doctrine of Balanced Growth," Underdevelopment, ed. by Agarwala and Singh, pp. 272-294.

(lumpiness of capital) with particular reference to the need for social overhead capital (SOC). SOC must precede other investments, has long gestation periods, and has a high minimum durability. Other sectors than SOC would also enter the picture here. Second, there is an indivisibility of demand. Investment decisions aren't independent, but have high risks as a consequence of uncertainty over whether the products will find a market. International trade may help the problem some but there is still a certain minimum investment required. The third indivisibility is in the supply of savings. There must be mechanisms provided to assure that the marginal rate of saving remains greater than the average rate of saving once incomes are on the rise. Finally, there is a psychological indivisibility which militates against the emergence of entrepreneurial types of individuals. An atmosphere or feeling of development in a country may exist only when there is a certain minimum size and speed of overall investment.⁹

Harvey Leibenstein also sees a fluctuating condition of equilibrium at low levels of income. He developed the critical minimum effort thesis to show how a country might break out of this equilibrium state. For any stimulant to an economy there are corresponding income-depressing and also income-raising forces. If this critical minimum is surpassed, then the income-raising forces would predominate and the economy would be on the growth path. An example of an income-depressing force might be the increased population arising from a small increase in capital. If the capital increase was significant, benefits such as external economies

⁹P.N. Rosenstein-Rodan, "Notes on the Theory of the 'Big Push'," in Readings in Economic Development, ed. by T. Morgan, George Betz, and N.K. Choudhry (Belmont, California: Wadsworth Publishing Company, Inc., 1963), pp. 143-150.

and increased incomes would promote a rate of economic growth greater than the population growth rate. In conclusion, the initial investment must be large enough to overcome the income-depressing effects and to provide a surplus for economic growth. These income-depressing effects help to explain why isolated investments in a few industries will not do the trick.¹⁰

The theory of balanced growth has drawn many criticisms as well as praise for its usefulness in describing economic development. Hans Singer agrees that the doctrine is most useful when there are sufficient resources available; that carried out in the form of policy it would eliminate pessimism by providing an anticipation of expanding markets; and finally that its usefulness increases as a given country becomes more developed.¹¹

Singer also lists some important criticisms of the balanced growth doctrine. First, he contends that the theory fails to come to grips with the problem of resource shortages. Fleming's contention about expandable factor supplies is not likely to be met. Secondly, this increased demand for factors would be in direct competition with other investment projects also having the direct purpose of increasing the amount of available resources. Since agricultural investment to provide greater food supplies is a necessary part of the theory, taking the balanced growth path would almost appear to require an amount of resources found only in the already developed countries. As a result of these and

¹⁰Harvey Leibenstein, Economic Backwardness and Economic Growth (New York: John Wiley and Sons, Inc., 1957), pp. 94-110.

¹¹Singer, International Development, pp. 39-54.

other criticisms Singer concludes that "Guerilla tactics" may be more effective than a "direct frontal attack".¹²

There are alternatives to the balanced growth path and Singer mentions some of these. Agricultural and non-agricultural productivity could be increased, foreign trade could be expanded, import substitution could be promoted, the economic infrastructure could be strengthened, or the structural imbalance existing in the economy could be increased. Any one or a combination of steps like the above might be effective and would come closer to being within the ability of a given country.¹³

The list of criticisms and questions concerning balanced growth can be lengthened without looking very far. For example, will the owners of productive factors in older firms buy most of the output of newer firms at a profitable price? This has been a continuing assumption, but how do we know it is true? Second, a program calling for balanced investment in a large group of modern firms experiencing increasing returns to scale seems to have a built-in contradiction. With only limited resources a less developed country might be able to capitalize on returns from large scale production in only a few of the industries. Third, the balanced growth argument is criticized for assuming a closed economy. The fact that trade with the outside world is possible provides an alternative. Fourth, for an economy to internalize external economies would also require internalizing external diseconomies such as rising factor prices and dislocation of traditional enterprises. Fifth, the 'big push' idea of super-imposing a modern economy on the traditional

¹²Ibid.

¹³Ibid.

economy implies an extreme form of dualism. Sixth, it might be a wiser policy to concentrate on projects with a much lower initial investment but higher operating costs and lower outputs than the most modern firms. More projects of this type could be financed with limited resources. Finally, the question of who will organize this huge collection of complementary investments arises. Given the physical resources, how many governments would be capable of undertaking such a task effectively?¹⁴

Criticisms like those listed above seem to indicate that balanced growth is by no means the last word in development theory. Understanding certain faults of the balanced doctrine can provide an important clue about where to go next. Albert O. Hirschman has stated that his great opposition to the balanced growth idea had enabled him to discover that he had his own distinct ideas about the matter.¹⁵ He is of the opinion that balanced growth is actually derived from underemployment problems of the advanced countries, and is not applicable to the less developed countries because it requires the type of effort that these countries are just not capable of. In addition, he is not convinced that the external economies from balanced growth will automatically be greater than the external diseconomies. The theory thus fails as one of development because of its formidable requirements and uncertain outcome.¹⁶

Hirschman calls his a theory of unbalanced growth to illustrate the contrast to balanced growth. He contends that balanced growth is like a series of snap shots of the growth process which is really one of

¹⁴Stephen Enke, Economics for Development (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), pp. 298-316.

¹⁵Albert O. Hirschman, The Strategy of Economic Development (New Haven: Yale University Press, 1958), p. 50.

¹⁶Ibid., pp. 50-61.

unbalance. At a given time the system may be in balance, but this appearance has been brought about as a result of a continuing series of structural imbalances in the economy. The fact that investments are not made in a whole array of firms at once provides the motivational force for economic growth. A shortage of electric power or steel ingots will create pressures which will facilitate the establishment of the needed productive facilities. If the food processing industry cannot find enough suitable packages on the market, then this evident need will provide the incentive for some individual or individuals to invest in the packaging industry. Uncertainties about finding a market are reduced because the demand for packaging is evidently there. Unbalance serves to use scarce entrepreneurial skills in the wisest way possible. Further, the market is not the only method available for bringing about a reduction of shortages. If the market fails, pressures can always be applied in the political realm.¹⁷

The road to development involves continually maintaining stresses, and other imbalances, such as surpluses or shortages of SOC. The key to the process is induced investment, and external economies which have not yet been capitalized upon provide one of the main inducements for further investment. Proponents of balanced growth would argue that this process would never get off ground floor since there would be no market for the production of the relatively small number of existing industries. Not so, says Hirschman, no economy is ever at this rock bottom level of equilibrium. Either domestic or foreign markets exist, and are only

¹⁷Ibid., pp. 62-75.

waiting to be discovered. This, then is unbalanced growth. While the economy is constantly striving for balance, it never reaches that point as long as the growth process continues.¹⁸

Other theorists add support to Hirschman's idea of induced investment. An example is the idea of leading sectors in the take-off of economic growth as developed by Walt Rostow. Once the preconditions for take-off have been met, and some type of stimulus has launched the economy into economic growth, growth is maintained by the emergence of a continually changing group of leading sectors. Economic growth is characterized by differing growth rates in all sectors of the economy. There are first of all the primary growth sectors which maintain a high growth rate and induce expansion in other areas of the economy. Second, there are supplementary growth sectors whose expansion is the direct result of activities in the primary growth sectors. Finally, there are the derived-growth sectors which expand in some proportion to general indicators in the economy. The expansion of these primary growth sectors provides the external economies and other secondary effects needed to spur other parts of the economy.¹⁹

This discussion of the balanced and unbalanced growth theories is valuable because it adds understanding to the problem of economic development. Neither theory should be considered totally right or wrong, but both should be valued for the particular insight they provide. Some writers such as V. V. Bhatt believe that the two theories are not inconsistent at all. A certain amount of unbalance provides the otherwise

¹⁸Ibid.

¹⁹W.W. Rostow, The Stages of Economic Growth (New York: Cambridge University Press, 1960), pp. 52-58.

lacking motivation for an eventual growth of a balanced nature. Too much imbalance, on the other hand, could create a situation that would be potentially explosive. Further, balanced growth theory provides ideas about government participation that receive short shrift in writings about unbalanced growth.²⁰ Balanced growth may be desirable for an economy in more advanced stages of economic development, while a strategy utilizing the theory of imbalance may be necessary in earlier stages.

Since the idea has been developed that imbalance can provide an incentive to spur economic growth, it might be wise to investigate briefly some possible strategies toward this goal. Again, Hirschman has made some useful contributions to this field. Before going further, however, it will be useful to review the distinguishing characteristics of social overhead capital since this concept plays such an important role in Hirschman's analysis.

Social overhead capital (SOC) can be distinguished from other kinds of capital in the following ways: First, SOC cannot be imported in most cases. It often entails services rather than goods, and these services must be produced where they are used. Second, the benefits from SOC are often very widely spread among various classes of users who may at the same time be quite numerous. Third, services from SOC are often provided by the government at regulated or free prices due to the difficulty of charging those who are recipients of benefits from the projects. It is difficult both to exclude those from the benefits who do not wish to pay for them and to even determine a proper price in the first place.

²⁰V.V. Bhatt, "Some Notes on Balanced and Unbalanced Growth," Economic Journal, LXXV (March, 1965), 88-97.

Fourth, up to capacity use of the projects, marginal costs tend to be fairly constant and to represent a small percentage of total costs per unit of output. In other words it is of advantage to use the project to capacity since this will not add to costs that much, and social benefits will be maximized. Finally, the initial capital investments are often characterized by lumpiness, which implies that private investors may not have sufficient resources.²¹ To this list I would also add the fact that monetary benefits are often of a delayed nature, placing many projects outside of the time span that would be relevant for private investors.

Now I will return to the topic of strategies for promoting unbalanced growth and Hirschman's analysis. Hirschman sees that the policy makers have a choice between SOC and directly productive activities (DPA). A typical LDC will not have the ability to bring sufficient resources into action to allow for full investment in SOC and DPA at the same time. The choice becomes one of promoting an excess or a shortage of SOC. If the policy makers choose to promote an excess, then they will invest initially in SOC. This will provide such things as cheaper input prices and the necessary services in attracting potential private investors into the DPA area. The new SOC services might be all that are necessary to turn a dubious investment possibility into a profitable one in the eyes of the potential investor. Hirschman calls this type of inducement "permissive". An inflow of private investment in DPA would be expected to follow the new SOC.²²

²¹Enke, Economics for Development, pp. 321-22.

²²Hirschman, Strategy, pp. 83-97.

There may be potential problems with this type of strategy in that once the new SOC is in place, private investors still may not act. Also, there may already exist sufficient amounts of SOC due to its inherent attractiveness for policy makers. The difficulty in measuring costs and benefits for SOC investments can assure policy makers that past errors in project selection are hard to discover, and SOC projects make nice monuments for the government. The other policy alternative is to create a shortage in SOC by direct government investment, or government subsidy in DPA. Once the firms are in operation they will exert great political and economic inducements for provision of any needed SOC. This will assure efficiency in SOC project selection and at the same time provide the necessary incentives to get the projects completed. Investment in DPA may not be at all more risky to government than investments in SOC. This second strategy is more of a "compulsive" inducement. An important factor to remember when considering compulsive inducements is that a certain minimum of SOC must always be initially present as a prerequisite for any DPA.²³

Whichever strategy is chosen, the growth process proceeds by a series of steps: imbalance followed by rectification followed by new imbalance. In both cases it is the responsibility of government to create the imbalance which in turn should provide either the compulsive or permissive inducements for further investments. Eventually, as the economic structure of the country becomes more and more advanced, and decision makers become aware of future shortages from experience, both DPA and SOC investments will come more and more to be made in anticipation, before any shortages arise. Continuing investments will be made

²³ Ibid.

simultaneously in both areas, and the interrelationship between balanced and unbalanced growth will become apparent. Anticipated imbalance will have become the motivating force rather than imbalance itself. Economic development will then be assured.

Investment Criteria

No country will invest exclusively in DPA or SOC to the complete exclusion of the other. But a realization that these types of relationships may exist will be a useful part in the planning considerations concerning the general nature of investments for any LDC. Once the overall possible level of investment and the major strategy is determined, however, still more information is needed to further distinguish between different possible choices for individual projects. Investment criteria for project selection must be briefly discussed in order to provide a background in this area.

One possible alternative in order to establish a measure for the potential value of a proposed project is to use benefit-cost analysis. For each project the costs and benefits are calculated and used to form a ratio with which to compare projects. Benefits would include all net receipts from the sale of project outputs. The receipts for each year would be discounted according to their distance into the future and added together to obtain the present value of benefits. Included in this calculation would be the sale of any capital equipment at the end of the project life. If market transactions do not exist with respect to a particular project, then benefits would correspond to the amount of money which consumers would have been willing to pay if they had been able to make a market purchase. In certain other cases, benefits would be

counted as the cost of providing a particular output by the cheapest alternative means. Costs would consist of the value of all expenditures on goods and services needed to provide and maintain the project. This would include initial and replacement capital expenditures. The ratio of benefits to costs is the generally accepted criteria, rather than the difference between the two. Projects are then ranked starting with those having the highest benefit-cost ratios down to the lowest. A government body would then go down the list including all the projects which its sources of financing would allow it to complete. Usually, no project with a benefit-cost ratio less than unity would be undertaken. In cases where there are multiple objectives, the most important objective is usually maximized with the other objectives serving as constraints.²⁴

Two important qualifications concerning the above mentioned benefit-cost analysis should be made. First, the benefit-cost ratio as an investment criterion is truly useful for only certain types of investment decisions. Capital intensities of different projects must be within a certain limited range and the costs must be economically similar. The nature of the benefits and the levels of uncertainty associated with them should be similar. And of course different projects must have comparable life spans. These limitations would rule out a comparison of many SOC and DPA types of investments. Finally, the efficiency criterion, unless modified in certain ways, may not be the most useful way of comparing projects for some objectives.²⁵ The second qualification concerns the assumptions of a competitive market system which are behind the

²⁴Ian M. D. Little, "Project Analysis in Relation to Planning in a Mixed Economy," Development Problems, (OECD Development Centre), (Summary of Papers at the Columbo Seminar, Paris, 1967), pp. 47-65.

²⁵Otto Eckstein, Water-Resource Development: The Economics of Project Evaluation (Cambridge: Harvard University Press, 1958), pp. 47-70.

analysis. First, consumers are rational. They experience diminishing marginal rates of substitution between goods, and their preferences are independent of the purchases of others. Producers adhere to rational profit maximization. They experience decreasing returns in production, and there are no physical interdependencies among the production processes of different firms (e.g., pollution). The assumptions of a perfect market exist and the commodities produced must be of a marketable form. Additional assumptions would be an acceptable distribution of income, resources which are relatively mobile, and all resources and labor are employed. To the extent that these assumptions are not met, certain adjustments may or may not have to be made.²⁶

There are a number of other approaches to the problem which are related to benefit-cost analysis but have been developed out of the recognition that less developed countries have, to a greater extent, their own special problems which require unique solutions, and that the above assumptions are even less likely to be met in the case of LDC's. There are various types of benefits, depending upon such things as the frame of reference and the time period used. What things should be maximized: labor absorption, output per unit of a given scarce factor, future economic growth, or consumption for the present? In a similar manner, which should be minimized: initial investment or the gestation period?

Polak believes that the value of annual output divided by the value of capital used to produce the output is the key. He calls this the rate of turnover and specifies that the ratio should be maximized.

²⁶Ibid., pp. 19-46.

Polak was dealing with a capital shortage and a foreign exchange shortage situation which would follow WWII. The goal was to get the investment projects into operation as soon as possible and with the greatest rate of turnover. Either export producing or import substituting projects would receive priority.²⁷ This method represents a built-in bias against many types of social overhead projects which have low turnover ratios. In addition, it would not maximize growth in the long run since capital formation would be minimized.²⁸

Ragnar Nurkse calls for a type of forced saving by means of labor intensive capital formation. He assumes large quantities of surplus or underemployed labor in the agricultural sector which could be transferred to capital formation projects without reducing agricultural output. The key would be to keep both groups, those remaining on the farm and those transferred, from increasing their consumption by too great an amount (any increased consumption would have to be paid for by other domestic savings or foreign assistance). Nurkse favors social overhead investments as initially important to development, but points out that they should be built by the surplus supply of labor, even to the extreme where these workers would have to make their own simple tools.²⁹ While this may eliminate the need to support unemployed labor at subsistence levels, it is also criticized as not being compatible with maximum growth in the long run. It increases the propensity to consume,

²⁷J. J. Polak, "Balance of Payments Problems of Countries Reconstructing with the Help of Foreign Loans," Quarterly Journal of Economics, LVII (Feb. 1943), 208-40.

²⁸R. N. Tripathy, "Criteria for the Selection of Investment Projects," in Economic Development: Challenge and Promise, ed. by S. Spiegelglas and C. J. Welsh (Englewood Cliffs: Prentice-Hall, Inc., 1970), pp. 70-72.

²⁹Nurkse, Capital Formation, pp. 36-47.

leaving less investable surplus and does not utilize the most productive methods.³⁰ More importantly, the whole argument rests on the unproven assumption that underemployed labor can be removed from the farm without reducing farm production. And lastly, can untrained rural labor work at all effectively in constructing complex social overhead projects?

The social marginal productivity criterion has found many adherents, A. E. Kahn among them. The marginal benefit from a given project must be measured as it adds value to the total economy, not to the individual firm. This recognizes that the two may not always be in harmony. When benefits to the entire society are being considered, the need for shadow pricing often arises for instances when market prices do not reflect these benefits. The social marginal productivity (SMP) criterion is correlated to the capital turnover method when capital is relatively scarce and labor extremely plentiful, and investment is financed in part by borrowing from abroad. In the case of SOC, the SMP of capital may be very high up to a certain critical point and very low from then on.³¹ Once a surplus of SOC is reached, SMP will be very low.

H. H. Chenery has elaborated upon the SMP method in an attempt to further distinguish between private and social profitability. Let V/K represent the value added in the domestic economy per unit of investment, C/K the total operating costs per unit, and B the balance of payments effect where r represents the amount of increase in national income equal to a one unit improvement in the balance of payments. Chenery develops the following relation:

$$SMP = V/K - C/K + B \cdot r/K$$

³⁰Tripathy, "Investment Projects", pp. 70-71.

³¹A. E. Kahn, "Investment Criteria in Development Programs", Quarterly Journal of Economics, LXV (Feb. 1951), 38-61.

SMP depends upon more than the difference between value added and costs, but also on the balance of payments effect of a given investment. He explains that there are certain sectors which have a high balance of payments effect, and that labor-intensive methods are offset in other areas due to the same effect. Other useful tests could also be included: social costs, length of time for investment yields, and regional balance.³²

However, the SMP method can still make it difficult to choose between SOC and DPA since SOC doesn't contribute directly to output.³³

In a discussion of benefit-cost analysis, Arthur Maas tries to bring more than just economic efficiency into the picture. A major downfall in the past had to do with project ranking on the basis of efficiency alone. He ventures that income redistribution among classes and between regions could be an equally important goal. The objectives of efficiency and income redistribution can be conflicting, however, necessitating the development of a trade-off ratio between the two. The logical place to determine such a ratio would be in the political arena of a country.³⁴

In another attempt to integrate equity and efficiency, McGuire and Garn have developed an index of need which they call a welfare index. This index is a positive function of the ratios of the national employment rate to regional employment rate and national median family income to regional median family income. The larger the value the welfare index is allowed to take, the more prominently the equity criterion will come into play. Poorer people and communities are usually less efficient in

³²H. H. Chenery, "The Application of Investment Criteria," Quarterly Journal of Economics, LXVII (Feb. 1953), 76-96.

³³Tripathy, "Investment Projects," pp. 71-74.

³⁴Arthur Maas, "Benefit-Cost Analysis: Its Relevance to Public Investment Decisions," Quarterly Journal of Economics, LXXX (May, 1966), 208-26.

production than richer people and communities, but it is assumed that a given dollar's worth of benefits accruing to the poor person or region benefits society more than if it accrues to the wealthy person or region.³⁵ The question of regional imbalance will be returned to shortly.

I have mentioned that maximizing efficiency and a more equal distribution of income may be conflicting objectives. This is because an effort to maximize growth will always discriminate against large numbers of the present generation in favor of some nebulous future generation. Redistribution never seems to occur as long as growth maximization is the only goal. Harvey Leibenstein contends that maximizing the future level of output should be the objective of investment policy. Those areas must be invested in which will ultimately give each person a greater average productive power than any other alternatives. This large level of productive power depends upon, for one thing, maximizing the amount of capital per worker which is accomplished by paying attention to the amount of net "general reinvestment" generated each year by the initial investment. In general, the effects of any investment on the following four areas should be considered: the expansion of growth factors, future savings habits, future consumption patterns, and the rate of population growth.³⁶

Sooner or later choices must be made concerning various of the conflicting objectives and competing criteria for investment. In reality the trade-off between objectives will be on the basis of

³⁵M. C. McGuire and H. A. Garn, "Integration of Equity and Efficiency Criteria in Public Project Selection," Economic Journal, LXXIX (Dec. 1969), 882-93.

³⁶Leibenstein, Economic Backwardness, pp. 264-68.

politics, just as the investment criteria used will probably be more political than economic. This cannot be avoided, but the policy makers should be aware of the various economic tools available to aid them in their decisions.

I would like to end this chapter with a note on why investment policies are so often concerned with problems of regional balance. There are several possible reasons, and these should be mentioned, since regional objectives come into play so often. To begin, humanitarian reasons for regional concern can never be ruled out. A government may be genuinely concerned with living conditions experienced by various segments of the population. If humanitarian reasons are not behind this concern, however, it may still be there as a result of intense political pressures in that direction. A good economic reason would be a desire to reduce congestion in certain regions by developing other regions as alternatives for future investments. Diseconomies of scale in a region may take the form of pollution, congestion, high costs of services, and rising ranks of unemployed attracted by the great activity in an area. Certain regions may also have supplies of natural resources which could be exploited if a certain level of investment could provide the minimum set of conditions needed to start, these conditions including the provision of certain amounts of SOC. Investing in these regions might lead to maximizing overall growth itself. There are also unexpected rewards which come from the development of any region. These may include the development of previously unrecognized natural resources or the drawing forth of innovative individuals from within or without the region. Finally, all the normal national objectives of development would also be operative. These would include increasing national income, price

stability, diversification of the economy, and strengthening the balance of payments.³⁷ Any government which ignores regional needs as an objective of investment may be asking for trouble or ignoring possibilities to develop its country.

The reader should keep these hypotheses and their implications in mind while reading the rest of this thesis. Do they help explain why the Mexican government chose to invest directly in irrigation facilities? More importantly, will they be of help in evaluating the Mexican irrigation investment policies?

³⁷ David Barkin and Timothy King, Regional Economic Development: the River Basin Approach in Mexico (New York: Cambridge U. Press, 1970), pp. 1-5.

CHAPTER II

AGRICULTURE AND MEXICAN ECONOMIC DEVELOPMENT

The underlying reason behind the Mexican decision to invest in irrigation facilities is the great importance agriculture has played, and will continue to play in the economy of the Mexican nation. Arable lands are not common and controlling the amount of water available is very often a problem. This chapter will examine the Mexican economy and the contributions which the agricultural sector has made to economic growth and development.

It is important to remember these agricultural contributions, because a different policy of irrigation investment, such as changing the regional locations and project scale, would have resulted in a different agricultural sector than the one which actually evolved. A qualitatively different agricultural sector might have effected the overall economy in various possible ways. For example, agricultural export earnings might not have been so large; however, the domestic market might have been strengthened by a more equitable distribution of investment between regions.

General Observations Concerning the Mexican Economy

Something which can be called economic growth as opposed to economic development did take place in Mexico before the Revolution of 1910 but it did not represent an increase in the general level of

well-being for the masses nor the type of structural change which is normally associated with economic development. Manufacturing, mining, and some types of commercial agriculture were growing, but they were often controlled by foreign and wealthy domestic interests and directed toward the export rather than the domestic market.

The period from 1910 to 1940 did not exhibit impressive statistical indicators on growth, but it was a period of important institutional changes which likely laid the foundations for future growth and development. First came important changes in political control, followed by other institutional changes in such things as the ownership of the petroleum industry and railroads, development of credit and banking institutions, and changes in the holdings of agricultural lands. From 1940 on, the Mexican economy began to grow at truly impressive rates accompanied by continuing increases in per capita income.¹

Table 2-1 will help to illustrate the record of growth rates in the Mexican economy from 1900 to 1965. Table 2-1 shows that after 1940, the average annual growth rates did not fall below six percent. Comparing this figure to the rate of population growth indicates that the per capita product grew at 3.9 percent and 3.0 percent during the 1940's and 1950's respectively. From 1960 to 1965 the rate was not far under three percent, but it was lower than in previous periods. While the growth in GDP was no less than the previous period, the rate of population growth sky-rocketed to 3.4 percent during the 1960-65 period, explaining the decline in the growth rate of per capita product.

¹Clark W. Reynolds, The Mexican Economy: Twentieth-Century Structure and Growth (New Haven and London: Yale University Press, 1970), pp. 15-43.

Population growth will be a vital factor in future Mexican economic development, in that it could cancel out gains in total output.

TABLE 2-1
GROWTH RATES OF THE MEXICAN ECONOMY, 1900-65
(Compound Annual Rates of Growth--In Percentages)

	1900-10	1910-25	1925-40	1940-50
1. GDP	3.3	2.5	1.6	6.7
2. Population	1.1	0.1	1.6	2.8
3. Per capita Product	2.2	2.4	0.0	3.9
4. Agricultural Production	1.0	0.1	2.7	5.8
5. Manufacturing Production	3.6	1.7	4.3	8.1
6. Mining and Petroleum Production	7.2	5.6	-1.9	2.5

	1950-60	1960-65	1925-65
1. GDP	6.1	6.1	4.5
2. Population	3.1	3.4	2.6
3. Per capita Product	3.0	2.7	1.9
4. Agricultural Production	4.3	4.3	4.2
5. Manufacturing Production	7.3	8.1	6.4
6. Mining and Petroleum Production	5.3	4.2	1.7

Source: Clark W. Reynolds, The Mexican Economy: Twentieth Century Structure and Growth (New Haven and London: Yale University Press, 1970), p. 22.

Until 1925, mining and petroleum production grew faster than either manufacturing or agricultural production, but subsequent government policies, expropriation being the most important, eliminated this vitality in the primary sector. After 1940, manufacturing led the field, growing at rates well above seven percent. This reflected also government policies that were specifically designed to support manufacturing. Mining and petroleum finally reached rates of 5.3 and 4.2 percent during the 1950-60 and 1960-65 periods. While lower than manufacturing, the

agricultural sector continually increased its output at a respectable level of 4.2 percent from 1925 to 1965.

TABLE 2-2
SECTORAL DISTRIBUTION OF GDP, 1900-65
(Percentages)

	1900	1910	1930	1940	1950	1960	1965
Gross Domestic Product	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Crop Production	14.3	11.4	13.1	12.6	14.6	12.3	- ^a
Manufacturing	13.2	13.7	16.7	18.0	20.5	23.0	25.3
Mining	6.4	8.8	9.8	5.6	3.0	2.2	1.7
Electric Energy	-	-	-	1.0	0.9	1.2	1.4
Petroleum	-	0.3	3.7	2.9	2.7	3.2	3.2
Construction	-	-	-	3.6	3.1	3.5	3.5
Transportation	3.1	2.8	5.3	4.5	4.8	4.9	4.3
Commerce	-	-	15.8	24.0	26.2	25.7	-
Government	-	-	3.6	3.1	3.2	2.7	2.7

^aData not available.

Note: Columns will not total 100.0 due to the omission of certain sectors such as livestock, forestry, and fishing.

Source: Reynolds, The Mexican Economy, p. 61

Table 2-2 will help to briefly explain the changes in the relative importance of the various sectors in the Mexican economy. One can conclude that manufacturing's high rate of growth would increase its relative importance. From 1940 to 1965 manufacturing production increased from 18.0 to 25.3 percent of GDP. Electric energy and petroleum also showed increases during this period. While most of the other sectors did not show continuing trends in either direction, it should be noted that crop production has shown a tendency to decline in importance somewhat. From 1940 to 1965 mining decreased from 5.6 to 1.7 percent of GDP.

In conclusion, Mexico has produced a noteworthy level of economic growth and activity over a twenty-five year period, 1940-1965, that has allowed per capita product to grow at significant rates. Manufacturing has increased in relative importance while crop production has declined somewhat. This pattern is typical of that followed by many developing countries.

In the following parts of this chapter I will discuss this growth and development in slightly more detail, considering it from the framework of agriculture and that sector's contributions to growth in the other sectors, and to economic growth in general.

The Agricultural Sector

The record of Mexican growth has indeed been impressive as I have tried to show in the preceding section. While the Mexicans are a long way from solving their problems, they are sustaining a respectable growth rate. Perhaps continued high levels of performance in the future to match that of the past would give Mexico the means to solve such problems as inter- and intra-regional income inequalities and agricultural dualism. Like the over-all economy, the agricultural sector has had a notable record of growth in total output; however, certain problems such as regional dualism and poor income distribution continue to exist. I will first outline some of the main features characterizing the growth of the agricultural sector, and then discuss some of the contributions made by this sector to Mexico's over-all economic development.

The Mexican agricultural sector entered the twentieth century as mainly a subsistence agriculture, existing alongside growing areas of commercial agriculture and livestock raising on large haciendas. This

was during the rule of Porfirio Diaz (1876-1911), when government policy favored consolidation of the land and easy entrance of foreign interests into Mexican agriculture. The important thing to keep in mind is that during this period, increasing numbers of Mexicans were becoming landless as a result of land consolidation. At the same time agricultural exports were growing at the expense of food production for home consumption. The share of exports in the agricultural production were four percent in 1877, but rose to fifteen percent in 1907, and as high as nineteen percent in 1910. Because of these changes in the composition of agricultural production, the price of food rose by greater than twenty percent between 1900 and 1910.² This compounded problems already experienced by the masses. The agricultural sector was contributing neither to the welfare of the people nor very significantly to the economic development of the country, since the increased foreign reserves were not being used to help the masses.

During the revolutionary years from 1910 to 1920, the effects of the fighting had an adverse effect on the agricultural sector. Certain areas of the country such as the North Pacific³ did not feel the effects as much, but the small farmers in most parts of the country were particularly harmed. By 1920 production had fallen below the level of 1900⁴. Contributory problems included such factors as caution on the part of the large owners, seizures of lands, and increased on-farm consumption

² Reynolds, The Mexican Economy, p. 96.

³ For an explanation of the regional areas used see footnotes to Table 4-6 on p. 99.

⁴ Eduardo L. Venezian and William H. Gamble, The Agricultural Development of Mexico: Its Structure and Growth Since 1950 (New York: Praeger, 1969), p. 54.

of output. After 1920, production began to recover toward previous levels, but the agricultural sector had the same backward characteristics as before the Revolution. Official land reform had not as yet begun, and the commercial properties were still confident enough to increase their production for export. From 1907 to 1929 per capita agricultural product fell by eighteen percent, having important implications for the well being of the agricultural population and general per capita food consumption.⁵ This may overstate the problem, however, because 1929 was an unusually bad crop year. In fact, in the fifteen years after 1924 (from 1925 to 1940), there was apparently an increase in well being. Total crop production increased by one-third during this period while food crop production increased by one-half, and owner consumption of farm output also increased significantly.⁶

An examination of data compiled by Richard W. Parks in Table 2-3 will be helpful in developing a general understanding of changes in agricultural output from 1925 to 1960. This table is composed of a set of indices of agricultural production based on 25 different crops.

With the exception of the 1930-34 period, there has been a steady upward climb in production from 1925 to 1960. The 1930-34 period shows the effects of the world depression on the Mexican economy, particularly in the decreased foreign demand for Mexican exports. At this time, just before President Cardenas began his massive land reform program, there was great uncertainty on the part of many producers, resulting in the neglect of many of the farm lands. These two factors may

⁵Reynolds, The Mexican Economy, p. 102

⁶Ibid., p. 97.

TABLE 2-3
INDICES OF AGRICULTURAL OUTPUT

Period	Total	Foodstuffs	Industrial Crops
1925-29	100.0	100.0	100.0
1930-34	93.3	97.9	82.9
1935-39	105.9	102.1	114.8
1940-44	129.5	120.1	151.7
1945-49	160.7	147.3	192.3
1950-54	247.3	202.1	352.0
1955-59	362.9	286.7	541.1
1960	385.3	322.6	532.8

Source: Richard W. Parks, "The Role of Agriculture in Mexican Economic Development," *Inter-American Economic Affairs*, XVIII (Summer, 1964), 6.

be largely responsible for the fact that the industrial crop index fell fifteen points further than the foodstuff index. All the remaining periods show continuing increases in agricultural production, both for industrial crops and foodstuffs.⁷ The Second World War plays a very important part by providing an increased demand for agricultural exports of which the Mexican producers were able to take advantage. An upward bias probably exists in the above data due to improved collection of statistics, and the increasing proportion of output marketed.

Over the entire period from 1925 to 1960, the average annual rate of growth in agricultural production was 4.4 percent. From 1925-29 to 1940-44 the growth rate was 1.75 percent, but in the period 1940-44 to 1955-59 the rate increased to 7.05 percent. The overall rate of 5.75 percent per year growth for industrial crops was greater than the 3.55 percent yearly growth of foodstuffs. This illustrates the changing structure of Mexican agriculture as internal food requirements were

⁷Livestock production has not been included because of scarcity of data.

increasingly met and the government placed more emphasis on the provision of agricultural raw materials for the growing domestic industries and for export. With roughly thirty percent of the total agricultural production in 1925-29, industrial crop production had its share increased to forty-five percent by 1955-59.⁸

During the decades of the 'forties and 'fifties there was a shift in government policy from agriculture to industry, although agriculture continued to receive great emphasis. This shift came after recognition during the 1930's that land reform alone would not solve Mexico's agricultural and development problems. In the first place, there were too many people who wanted land, and property sizes were often too small for anything other than subsistence agriculture. Advances in farming methods could take place only to a limited extent on these minifundios.⁹

After 1940, then, land reform was de-emphasized and did not become important again until 1960. Emphasis was placed upon commercial agriculture to meet foreign and internal demand for raw materials and food. As it will be shown in later sections, areas with larger commercial farms received high priority in government programs of agricultural investment and credit. The year 1940 has often been called the turning point for Mexican agriculture as well as for the general economy. Investment in rural infrastructure was greatest after this time and output

⁸Richard W. Parks, "The Role of Agriculture in Mexican Economic Development," Inter-American Economic Affairs, XVIII (Summer, 1964), 6-8.

⁹Venezian and Gamble, The Agricultural Development of Mexico, pp. 51-65.

continued to grow at rates greater than any previous time, though these rates were decreasing after 1950, and particularly after 1960. Continued effort will be required in the future to keep agricultural production high enough to meet the needs of Mexico's expanding population.¹⁰

Before concluding this subsection and entering into a discussion of some of agriculture's contributions to the Mexican economy, I will briefly mention changes in the amount of land harvested, productivity, and the agricultural labor force.

Using the same twenty-six crops, Richard Parks has also compiled data on area harvested, calculated indices of area harvested, and productivity in terms of yield. These are shown in Table 2-4.

TABLE 2-4
AREA HARVESTED, INDEX OF AREA HARVESTED,
AND PRODUCTIVITY INDEX

Period	Area (1000 hectares)	Area Index	Productivity Index ^a
1925-29	5,514	100.0	100.0
1930-34	5,250	95.2	98.0
1935-39	5,258	95.4	111.0
1940-44	6,115	110.9	116.8
1945-49	6,565	119.1	134.9
1950-54	8,754	158.7	155.8
1955-59	10,667	193.4	187.6
1960	10,753	195.0	197.6

^aRepresents yield (ratio of a production index to area index).

Source: Parks, "The Role of Agriculture", p. 9.

The data illustrates a continual increase in the area harvested after 1940. Keeping in mind the decline in area harvested during the

¹⁰
Ibid.

1930's, the area harvested in Mexico grew at an average annual rate of 2.2 percent from 1925-29 to 1955-59. The rate of growth was slower from 1925-29 to 1940-44 at 0.68 percent, but increased to 3.72 percent annually from 1940-44 to 1955-59. Rates of growth since 1945 are indeed significant for the Mexican agricultural sector, and are partially a function of irrigation investment, to be discussed in a subsequent section.

Productivity increases in Mexico have not been nearly as impressive as output increases. In fact, many developing countries have surpassed Mexico in this aspect of development. From 1925 to 1959 the productivity index for Mexican agriculture increased at the average annual rate of 2.2 percent. The data illustrate that the largest increases in productivity took place during the decade of the 1950's. This can be partially explained by the spread of new wheat and corn varieties and the expanded use of irrigated lands. Perhaps truly significant increases in the productivity of Mexico's agriculture will come in the future as more intensive use is made of such inputs as mechanization, fertilization, credit, and education.

Shifts in Mexico's population between rural and urban areas have been typical of the pattern found in most countries as they proceed along the path of economic development. In 1910 there were 10,812,000 people classified as residing in rural areas, or 71.2 percent of the population. By 1960, the absolute number of people in the rural sector had increased to 17,218,000, but this was only 49.3 percent of the total population. Changes in the rural economically active population as a percent of the total active population were similar, but not quite so marked. From 1910 to 1960 the rural active population declined from

67.1 to 54.1 percent of the total active population. This information is shown in Table 2-5.

TABLE 2-5
RURAL POPULATION AND LABOR FORCE AS A SHARE OF TOTAL

	1900	1910	1921	1930	1940	1950	1960
Rural							
Population as percent of Total Population	71.7	71.2	68.8	66.5	64.9	57.4	49.3
Rural Active							
Population as percent of Total Active Population	61.9	67.1	71.4	70.2	65.4	58.3	54.1

Source: Reynolds, The Mexican Economy, pp. 9, 388.

An accurate view of the Mexican agricultural sector is not possible without considering the great dualism which exists. Using data from the 1960 Mexican Agricultural Census,¹¹ the total number of farm holdings, including private and ejidal, is a little over 2,100,000. There were 68,234 private holdings that were responsible for over one-half of all the crop sales. Adding the 231,000 largest ejidal holdings to the 68,234 largest private holdings, the result is that less than fifteen percent of the total holdings produce seventy-five percent of the total agricultural sales. The remaining eighty-five percent of the producers, who total around twenty million people with their families, have not participated to a very large extent in improved welfare and agricultural

¹¹ Mexico, Secretaria de Industria y Comercio, Direccion General De Estadistica, 40 Censo Agricola Ganadero y Ejidal De Los E.U.M. Mexico D.F.: Secretaria de Industria y Comercio, 1960.)

progress.¹² This shows that the potential stimulus to total domestic demand may be many times greater, if the remainder of the agricultural sector can receive more benefits from the developments in the agricultural field.

The Manufacturing Sector

The growth in Mexican manufacturing has been even more impressive than agriculture with the per capita output performance surpassing all other sectors between 1925 and 1965. The rate of industrial growth is third in Latin America behind Brazil and Venezuela, but this growth has been accompanied by an agricultural sector with a dynamism not present in these other countries. This is what makes Mexico's high rate of industrial growth even more remarkable.¹³ Table 2-6 will illustrate the preceding contentions.

TABLE 2-6

GROWTH OF MANUFACTURING PRODUCTION DURING MAJOR
PERIODS OF MEXICAN ECONOMIC DEVELOPMENT

(Percentages)

	1877-1910	1910-1940	1940-1960
Total Manufacturing	3.1	3.0	7.7
Total Population	1.4	0.9	2.9
Per capita Manufacturing Production	-0.8	2.1	4.8

Source: Reynolds, The Mexican Economy, p. 161.

¹²Donald K. Freebairn, "The Dichotomy of Prosperity and Poverty in Mexican Agriculture," Land Economics, XLV (February, 1969), 31-42.

¹³Reynolds, The Mexican Economy, pp. 161-75.

In the periods shown, the growth of manufacturing has never been lower than 3.0 percent annually and rose to 7.7 percent during the 1940-1960 period. Total population growth has always been slower than that of manufacturing. This has allowed per capita manufacturing production to increase at the rate of 4.8 percent per year in the 1940-1960 period.

I will now discuss some of the contributions made by the agricultural sector to the growth of the manufacturing sector. At this point it is important to keep in mind the fact that the relationships between all the sectors of a given economy are interconnected in a complementary manner, and not a simple cause and effect kind of relationship. Considering this qualification, agriculture's part in this complicated relationship can now be examined.¹⁴

First, the agricultural sector has provided food supplies necessary to meet the growing domestic demand for food. This growing demand is a function of both the increasing population and the growing per capita income level. Richard Parks has combined data from several sources to verify this contention. These data appear in Table 2-7.

Only in the 1940-44 period did the growth in food demand exceed the growth in food production. During the 1950's the growth in food production significantly exceeded the growth in food demand. By the mid 1950's Mexico was almost entirely self-sufficient in food production as evidenced by the decline in food imports discussed in the next subsection. Johnston and Mellor point out the importance of this kind of trend to developing countries.¹⁵ If the food supply is not sufficient to meet

¹⁴Most of the points I will discuss are covered in Parks, "The Role of Agriculture," pp. 3-26.

¹⁵B. F. Johnston and J. W. Mellor, "Agriculture in Economic Development," American Economic Review, LI (September, 1961), 571 ff.

TABLE 2-7

COMPARISON BETWEEN RATES OF INCREASE OF FOOD
PRODUCTION AND RATES OF INCREASE OF FOOD DEMAND

(Percentages)

Period	Population	Per Capita Income ^a	Demand	Food Production ^b
1940-44	2.64	2.63	5.27	3.25
1945-49	2.74	1.05	3.79	4.22
1950-54	2.82	0.89	3.71	6.50
1955-59	3.31	1.36	4.67	7.21

^aParks used an income elasticity of 0.5 which he obtained from E. N. Keller, Projections of Mexican Food Demand (unpublished), Giannini Foundation.

^bIncrease in food production represents income over previous period.

Source: Parks, "The Role of Agriculture", p. 22

growing food demands, prices and wages will increase, thus decreasing profits and investments for the industrial sector. Of course, the importation of food drains scarce foreign exchange reserves. It is necessary to conclude by pointing out that the above discussion does not consider income distribution. The existence of sufficient aggregate food supplies does not imply that the majority of the population will have an income sufficient to provide for an adequate diet.

A second contribution of agriculture has been the great increase in the production of agricultural raw materials for the industrial sector. As mentioned previously, it has been government policy since 1940 to increase the production of industrial crops in order to supply the manufacturing sector. Consider the following important industrial crops: sesame, cotton, sugar cane, and tobacco. From 1940 to 1962 sesame production has increased from 27,000 to 146,000 tons, cotton

production from 66,000 to 458,000 tons (with a peak of 1,038,000 tons in 1959), sugar cane production from 4,973,000 to 19,880,000 tons, and tobacco production from 24,000 to 75,000 tons.¹⁶

A third contribution which agriculture has made to the industrial sector involves the provision of an expanding supply of labor for manufacturing. The change in the percentage of the labor force engaged in agriculture results in labor being freed from agriculture. Low or declining levels of real wages in the industrial sector indicate that the supply of labor has probably been too large if anything.¹⁷ However, a continued low level of real wages would tend to spur profits and investment incentives.

Fourth, the agricultural sector, particularly after the Second World War, has supplied private savings which were available to finance industrial development. Reynolds estimates that from 1942 to 1961 the net flow of public revenues into the agricultural sector was less than one percent of the agricultural value added, and over the same period private capital stock in agriculture grew at less than two percent of cumulated value added. He concludes that private net savings in the sector almost certainly exceeded three percent of value added, implying a net outflow of savings.¹⁸

Finally, the increased demand for domestic production coming from the agricultural sector should receive some speculation. Although some

¹⁶Mexico, Secretaria de Industria y Comercio. Direccion General de Estadistica. 20., 3er., 40. Censo Agricola, Ganadero y Ejidal de Los E.U.M., (Mexico, D. F.: Secretaria de Industria y Comercio, 1940, 1950, 1960.

¹⁷Adolph Strumthal, "Economic Development, Income Distribution, and Capital Formation in Mexico," Journal of Political Economy, LXIII (June, 1955), 308.

¹⁸Reynolds, The Mexican Economy, pp. 177-78.

agricultural inputs must still be imported,¹⁹ the increased use of manufactured inputs would be expected to stimulate domestic production. For example, the use of nitrogen, phosphate, and potassium for fertilizers has increased from 1948-52 to 1966 by 2410.5, 1065.1, and 545.4 percent respectively.²⁰ The potential for further increases is very great, and at present Mexico produces around one-half of its fertilizers domestically.²¹ Also, increasing incomes in the agricultural sector would be expected to translate into increased demands for manufactured consumer goods. Again, large income disparities would distort the demand effect for certain consumer goods resulting from a given increase in per capita incomes for the sector.

The Foreign Trade Picture

The advent of the world depression marks the beginning of a true awareness on the part of Mexican policymakers concerning the dangers of too heavy a reliance on the foreign trade sector. It was concluded that the world market for Mexico's exports was too unstable a foundation upon which to base the economy of the country. The Mexican economy would have to industrialize in order to produce domestically the range of goods now imported and those that would be needed in the future. In order to build the domestic economy, however, it would be necessary to increase imports

¹⁹ According to the United Nations, Economic Commission for Latin America, Statistical Bulletin for Latin America, imports of agricultural machinery and equipment amounted to 2.4 percent of total imports in 1963.

²⁰ Sources include: for 1948-52, U.N., Food and Agriculture Organization, Production Yearbook (Rome, Italy, 1960); for 1966, Mexico, Secretaria de Agricultura y Ganaderia, Programa Nacional de Fertilizantes (Mexico D.F.: Secretaria de Agricultura y Ganaderia, 1966).

²¹ U. S. Embassy, Mexico, Special Report on Mexico's Fertilizer Industry (mimeo.), April 21, 1966.

of raw materials and capital equipment, requiring a continued reliance on export earnings.²² Insufficient export earnings could thus easily create a large trade deficit. New domestic industries were encouraged, beginning particularly with the Second World War, by a policy of protectionism using import controls as a major tool.²³

When a developing country embarks upon the road of import substitution, the import mix should gradually change from one of predominantly finished consumer goods to intermediate products and finally capital equipment. Earlier stages of this substitution process should come easier than later stages. During earlier stages of the process, domestic industries produce relatively uncomplicated products, in terms of the production requirements. Later stages of import substitution will require the production of technologically sophisticated products, a slow and painful evolution initially involving only the final assembly of the product. The Mexican auto industry is a case in point. The point is that a certain level of imported goods will be essential throughout the different stages of development.

William O. Freithaler points out that Mexico has earned an unusually high proportion of its foreign exchange needs, leaving a small amount to be financed by international capital transfers. The processes of import substitution and tourism have helped reduce unnecessary imports, keeping the 'trade gap' down to a manageable level. In fact, during the 1940's Mexico essentially financed its economic development through internal means.²⁴

²²Reynolds, The Mexican Economy, pp. 207-209.

²³For a discussion of Mexican protectionism, the reader should refer to: Rafael Izquierdo, "Protectionism in Mexico," in Public Policy and Private Enterprise in Mexico, edited by Raymond Vernon (Cambridge: Harvard University Press, 1964), pp. 243-289.

²⁴William O. Freithaler, Mexico's Foreign Trade and Economic Development (New York: Praeger, 1968), pp. 122-25.

A review of the data in Table 2-8 illustrates the extent to which Mexico has been able to keep down the import requirement. The import coefficient is merely the ratio of total import outlays to GNP.

TABLE 2-8
MEXICAN IMPORT COEFFICIENTS

	1940	1945	1950	1955	1960	1961	1962	1963	1964
Import Coefficient	13.0	10.5	14.1	16.8	13.4	12.5	11.8	11.7	13.3

Source: William O. Freithaler, Mexico's Foreign Trade and Economic Development (New York: Praeger, 1968), p. 147.

The higher coefficients in 1950 and 1955 represent deferred demand from the two World Wars.

Mexico's terms-of-trade have not shown the secular decline that is so often debated. In fact, the terms-of-trade may have improved since 1940. At times when the import coefficient has increased to unusually high levels, the terms of trade have also improved, notably in 1950 and 1955.²⁵

The reason for the preceding discussion on Mexican imports has been to develop a feeling for the trade sector, but more importantly to lead into agriculture's part in the trade picture. The changing nature of Mexican imports has been mentioned. Such things as autos and auto parts and components, industrial machinery installations, and trucks and their components are now preeminent imports. At the same time Mexico no longer needs to import large amounts of food to feed the population. An

²⁵Freithaler, Mexico's Foreign Trade, pp. 49-50.

examination of Table 2-9 shows the extent to which Mexico has been able to produce important food products domestically. From 1954 through 1961, Mexico was able to produce domestically the vast majority of its wheat and rye, rice, other cereals, and potatoes.

TABLE 2-9
DOMESTICALLY PRODUCED FOOD IN MEXICO, 1954-61

Year	Wheat and Rye		Rice (milled)		Other Cereals		Potatoes, etc.	
	A ^a	B ^b	A	B	A	B	A	B
1954-56	1029	95	137	100	4772	98	340	100
1957-59	1365	100	150	104	5955	90	310	100
1961	1408	100	222	99	6753	99	701	100

^aA = total supply in thousands of metric tons.

^bB = domestic production as a percent of total supply.

Source: U.N., Statistical Office, Statistical Yearbook, 1965, p.366.

Changes in the structure of Mexico's exports have also taken place since 1940. Of course, the contribution of the tourist industry to Mexico's export earnings has been extremely important and growing each year. An examination of commodity exports in Table 2-10 shows that mineral exports no longer have the same significance as before the Revolution. The absolute value of manufactured goods exports is not yet large enough to be a major part of total commodity goods exports. From 1940 to 1964 the greatest change has been the large increase in the export of agricultural products.²⁶ Without this increase Mexico's foreign exchange

²⁶Ibid., pp. 64-65.

TABLE 2-10
 THE STRUCTURE OF MEXICAN COMMODITY EXPORTS, 1940-60
 (Percentages)

	1940	1945	1950	1955	1960
Agricultural and forest products	20	35	52	57	55
Livestock and fisheries	4	6	5	5	12
Fuels and lubricants	11	3	5	6	3
Minerals	62	26	31	24	23
Manufactured and other products	3	30	7	7	8
Total	100	100	100	100	100

Source: Reynolds, The Mexican Economy, p. 205.

picture would not have been so favorable. Table 2-11 will look at the growth in exports of cotton, coffee, and sugar to illustrate. These three products constitute the majority of Mexico's agricultural exports in dollar terms. From a practically insignificant level in 1940, the value sum of these three crops has risen to forty percent of commodity exports or greater in 1955, 1956, and 1958, and in all the years shown after 1950, to at least thirty percent of the total commodity exports.

To summarize, the agricultural sector has contributed to Mexico's foreign trade position in three major ways. First, the country no longer needs to import large quantities of food. Second, as explained in the preceding section, industry has been able to draw from an increasing supply of agricultural raw materials rather than importing them. Third, exports of agricultural products are an important segment of total earnings from commodity exports.

TABLE 2-11

THE VALUE AND RELATIVE IMPORTANCE OF
COTTON, COFFEE, AND SUGAR EXPORTS, 1940-64

(Millions of U.S. Dollars)

Year	Cotton ^a		Coffee		Sugar ^b	
	\$	% ^c	\$	% ^c	\$	% ^c
1940	---	---	4	3	---	---
1950	139	26	45	8	---	---
1955	252	32	104	13	---	---
1956	263	31	105	12	---	---
1957	173	23	106	14	8	1
1958	190	27	79	11	11	2
1959	198	26	63	8	15	2
1960	157	20	71	9	53	7
1961	160	19	72	9	69	8
1962	218	23	70	7	43	5
1963	196	20	49	5	60	6
1964	169	16	87	8	77	7

^aRaw cotton only.

^bRaw and refined sugar.

^cPercent of total commodity exports.

Source: Freithaler, Mexico's Foreign Trade, p. 143.

Interregional and Intraregional Income Disparities

Prior to concluding this chapter it would be helpful to mention the problem of income disparities in Mexico. The reason for including this topic is because it has been suggested that federal expenditures and policy have in the past served to reinforce the inequalities. Such

actions can be supported by arguing that in an under-developed country there is not enough economic production to significantly improve the standard of living for all the population and at the same time to increase the capital base. The priority must be placed on increasing the capital base, and therefore inequalities may have to be ignored at the outset. The other side of the argument would state that present generations should not be sacrificed in misery for the possibility of future growth. Rather, all the existing resources of a nation should be put to work to provide the highest quality of life possible for all the people now living. Growth would be a goal, but only if it did not result in unacceptable income inequalities. It comes down to the question of what time horizon is acceptable.

A country as large and diverse as Mexico would not be expected to have all its different regions develop at the same rate. This has not even happened in the economically more advanced U.S. However, national policies have served to intensify the process in Mexico.

The wealthiest regions in Mexico are the Federal District and the northern states. Most of the industry is concentrated in and around Mexico City and in Monterrey. The northern states have modern commercialized agriculture. The border areas with the U.S. do a lucrative tourist business. In contrast to this, much of the Mesa Central is over-crowded with low income families and saddled with an unproductive agriculture. The South Pacific region is relatively underdeveloped with many people having little contact with the federal government or the national economy. Contact with the Yucatan Peninsula in terms of transportation has been quite recent. Regional industrial value-added per head of population varies from fifty-six to 650 pesos. The regional

contribution to total agricultural production varies from 4.4 to 17.9 percent of the total national production. Baja California Norte is the state with the highest GNP per capita at three times the national average, while the GNP per capita for Oaxaca is just over one-fourth the national average.²⁷

Even within states and regions there is a large range of income distribution. In Baja California Norte 11.7 percent of the urban and 31.8 percent of the rural families have monthly incomes below the grand mean income (families within the national mean income bracket apportioned by interpolation). The only difference is that the poorer states have a larger percentage of family incomes below the grand mean. But the actual disparities are just as great. For example, Aguascalientes has 83.1 and 95.2 percent below in urban and rural areas respectively.²⁸

In general, past regional differences have developed around the existence of strategic economic activities which have been often allied to external demand. These regional differences have involved the growth of urban centers in the more fortunate regions.

Recently, new infrastructural works, irrigation, highways, electric power, petroleum, etc., have helped regional growth, but mainly in areas already experiencing greater development.²⁹ These inequalities may well be limiting Mexico's growth since the market base is not as

²⁷David Barkin and Timothy King, Regional Economic Development: The River Basin Approach in Mexico (New York: Cambridge University Press, 1970), pp. 58-63.

²⁸Mexico: Secretaria de Industria y Comercio, Direccion General de Estadistica, Ingresos y Egresos de la Poblacion de Mexico (Mexico, D.F.: Secretaria de Industria y Comercio, 1960), pp. 23-404.

²⁹E. Mondoze-Berrueto, "Regional Implications of Mexico's Economic Growth," Weltwirtschaftliches Archiv, CI (September, 1968), 87-124.

large as it could be. Public investment can either increase or decrease regional differences. Policymakers should be aware of this fact and plan accordingly.

Conclusion

I have discussed Mexican economic growth and development with particular reference to the agricultural sector. The cause and effect relationships in a growing economy are very complicated and interconnected, but I have tried to mention several of the contributions made by agriculture. The performance of the agricultural sector may have prevented the formation of certain bottlenecks which could have hindered the performance of the entire economy. For example, export earnings might not have been as large, import requirements for foodstuffs and agricultural raw materials might have been greater, and the growth of the domestic market might have been slowed without the growing agricultural incomes. On the other hand, the strategy for promoting agricultural development may have created an unnecessary agricultural dualism. This dualism could be responsible for inter and intra regional income disparities which might have greatly hindered the growth of the Mexican domestic market.

As mentioned in the introduction, it is the intent of this thesis to examine the role of government in promoting economic development using public investment in agriculture as a tool. This will be accomplished by focusing upon public investment in irrigation, and the governmental apparatus which has evolved to serve the function of supervising irrigation investment and maintenance. In the final chapter I will examine one region, the North Pacific, that has received heavier irrigation investments than the remainder of the country. I will examine structural

differences between agriculture in this region and agriculture in the remainder of the country. This should throw more light on the nature of Mexican investment policies in irrigation.

In relation to this goal it is important to first examine the nature and evolution of Mexican public expenditures, and particularly the development of such a heavy commitment to irrigation investment. This, along with the principal vehicle for irrigation investment, the Ministry of Hydraulic Resources (Secretaría de Recursos Hidraulicos, in Spanish) will be discussed in the next chapter.

CHAPTER III

FEDERAL EXPENDITURES IN THE MEXICAN ECONOMY

The purpose of this chapter will be first to examine the evolution of Mexican Federal expenditures, with particular interest in the period after 1940. Second, federal investment in irrigation to promote economic development will receive special emphasis. This will provide the necessary background for the discussion of irrigation in the Pacific North, which will follow in the next chapter. This should be seen as a continuance of the central purpose of this thesis which is to examine the nature of government participation in the economic development process, using irrigation investments in the Mexican North Pacific as a case study.

The Mexican Political System

In order to understand Mexican Federal expenditures it will be helpful to discuss the political system because it is the political context in which investment decisions are made. How are decisions made? What groups and individuals have the most influence in these decisions? Do the decisions reflect upon the true needs of the Mexican people? Is continuity in federal expenditures provided for?

The Mexican political system is continually evolving and changing. Two forces are at work. First, the Constitution delineates the legal form of the government. As a continuing process, necessary laws are made which alter and clarify the legal foundations of the government. Second,

the actual workings of the government are continually evolving to meet the changing needs of the Mexican nation. This evolution results in practices which are at variance with the prescriptions of the Constitution. One example is the legislative branch which does not have nearly the power envisioned in its constitutional role.¹ It is therefore important to realize that significant changes are continually taking place within the political system.

The Mexican Constitution of 1857 was concerned with the political ideals of individual rights and laissez-faire government. It drew upon the French revolutionary constitutions, the Spanish Constitution of 1812, various constitutions from the European revolutions of 1848, and, of course, the influence of the United States Constitution was very great. The Mexican Revolution resulted in the drawing up of the Constitution of 1917. This, the most recent constitution, was a reaction to the injustices occurring under the old laissez-faire government. It attempted to strengthen the active, positive role of the Mexican state in the promotion of social and economic affairs. As we shall see, this resulted in a very strong executive branch. While disagreement existed over some areas in the drafting of the Constitution, there was unanimous agreement over the need for vast programs to benefit the agricultural sector. Articles 27 and 123 on this subject have been particularly important contributions after which other countries have patterned their constitutions. Article 27 was concerned with agricultural protections such as defining and limiting property, who may hold property, and principles and procedures for solving the agrarian problem. Article 123

¹Robert W. Scott, Mexican Government in Transition (Urbana: University of Illinois Press, 1964), pp. 4-33.

was concerned with protections for agricultural labor. It specified a minimum wage, payments for labor in legal tender, an eight hour day, the right to unionize, and protections for accidents and illness.²

In general, the Constitution calls more for Centralism than Federalism. There is no question over whether the individual states are supreme, as existed in United States history. The government is to be democratic, and the separation of powers is called for. The three branches are the legislative, judicial, and executive.³

The legislative branch consists of two houses, the Chamber of Deputies, regarded as representing the people, and the Senate, which is supposed to represent the states. The power of the legislature is eclipsed by the strong executive. This power relationship was provided for in the Constitution and has become even more marked with the continuing evolution of the Mexican society. Legislators can hold office for only one term, preventing the formation of a power base there. Deputies serve a three-year term, and senators serve a six-year term. The function of the legislative branch is to make laws, but bills initiated by the executive branch take priority. The legislature does not itself originate many bills of importance.⁴

A judicial branch is important in terms of federal expenditure policy if it has interpretative control over legislation. Mexico follows the civil law tradition rather than common law as in the United States.

²Howard Francis Cline, Mexico: Revolution to Evolution, 1940-1960 (London, New York: Oxford University Press, 1962), pp. 135-40.

³Cline, Mexico: Revolution to Evolution, pp. 135-48.

⁴William P. Tucker, The Mexican Government Today (Minneapolis: University of Minnesota Press, 1957), pp. 91-101.

This implies that the court cannot shape the law by its interpretation of court cases. The laws provide the necessary prescriptions to follow, and the court only decides how this is to be done.⁵ Therefore, the judicial branch is not legislatively as important as in the United States.

The executive branch, centered around the president, is by far the most important of the three branches. This was envisioned as necessary in order that the government could play a more active role in the development of the country. In addition, the importance of the position has evolved outside the legal framework. Besides being head of the official government, the president is the leader of the Institutional Revolutionary Party (PRI), the only effective political party. The president holds office for only one term (six years), but is the key man in deciding who the PRI's candidate for his successor will be. The president has extremely wide powers granted to his office. He has very extensive appointment powers for positions in the executive branch. His ability to remove appointees from their positions is almost unrestricted. As head of the PRI, he has control over the party's candidates for office. The executive control over legislation has already been mentioned in that its bills have priority in the legislature. Only the president can make a law official by having it published, and he can veto a law entirely or in part. The president's budget making powers have evolved as equally great. Congress approves the presidential budget, but only very rarely does it make changes which are not to the president's liking.⁶

⁵Cline, Mexico: Revolution to Evolution, pp. 145-48.

⁶Ibid., 141-148.

The executive branch of the government consists of ministries, departments, and decentralized agencies. The difference in roles between ministries and departments is often clouded in practice and not important for the purposes of this thesis. For most purposes they are equal. The ministers and department heads have great centralized control over their agencies, and are themselves directly under the control of the president. The ministers, department heads, and the federal attorney general in effect make up the presidential cabinet which the president can consult for advice. In practice he does not do so very often, preferring to meet individually with the various ministers and department heads. With the aid of these individual meetings, the ministries will draw up proposed legislation which fits into the president's program goals.⁷

A large number of decentralized agencies have developed in the framework of Mexico's government. They are usually for the purpose of credit and developmental work. The amount of autonomy and power varies. They are more easily freed from hindering routines and vested interests which can be found in the older departments. These agencies are independent of the regular budgetary process in the legislature, allowing more attractive salaries to be offered. The decentralized agencies are under the direct control of the president who usually appoints the chief positions, but some would like to see him have even more control, particularly because these agencies can make the direction of public expenditures harder to control. Those who head these agencies have sometimes been very powerful individuals, whose political backing the president must take into account. Several of these agencies which have been developed are TVA type valley or river basin authorities.⁸

⁷Tucker, Mexican Government, pp. 121-48.

⁸Scott, Mexican Government, pp. 142, 146-47.

Mexico's single political party system is an important factor in the power of the president and must also be discussed when considering federal expenditure decisions. The PRI has evolved to meet the special needs arising from the Mexican society. In particular it was needed in order to provide a continuity of control for those who gained power in the Revolution so that their revolutionary programs would have the time needed to produce results in economic and social development. The PRI has thus succeeded in removing almost all the old forms of political power and control. It is the only party with enough of a popular base to provide candidates for all the local and national elections, and virtually dominates all public offices. Its membership is many times greater than the combined membership of all the other legally recognized parties in the country.⁹

Because of its position of power, nomination for office as a PRI candidate usually assures election, often with no opposing candidate at all. To maintain its position of power, however, the PRI has to continually consider the interests of the many groups in the pluralistic Mexican society. This is one reason for the complicated organization of the party. For the purposes of this chapter it is important to recognize that the PRI tries to assimilate as many opposing interests as possible, and to do so its programs must be such that each member group finds something in the policy of great enough value to its special interests. The PRI has been quite successful in maintaining this balance of interests and allowing political stability to develop in Mexico, but as the society becomes more complicated, the task becomes more difficult.

⁹Ibid., pp. 115-47.

Reflecting the diverse support, the general membership of the PRI consists of the Labor Sector, the Farm Sector, and the Popular Sector, the latter consisting of a number of different groups including government workers. While this balancing process has resulted in less revolutionary programs, the PRI has provided a certain degree of continuity in development programs which is so important for economic and social development.¹⁰

In conclusion, government decisions concerning which investment programs should be funded are made in the context of a democratically elected government headed by a president with extremely extensive powers which include the leadership of the PRI, the only significant party on the Mexican political scene. All investment programs will be directly formulated by the executive branch, but must be tempered by the ever present need to maintain the unity of the diverse interests in the PRI.

Review of Past and Present Priorities

Given the almost complete control over government policy in the hands of the president, it will be helpful to review some of the past policies on government expenditures since the Revolution. This will provide a background for a more detailed discussion of federal expenditures since 1940.

James W. Wilkie has divided post-revolutionary Mexico into four ideological periods concerning government expenditures.¹¹ In reviewing these periods, relative expenditures within the budget, rather than absolute expenditures, are used as a guide or indicator because not all governments had access to comparable revenue sources. Relative emphasis

¹⁰Ibid., pp. 145-96.

¹¹James W. Wilkie, The Mexican Revolution: Federal Expenditure and Social Change Since 1910 (Berkeley: University of California Press, 1970), pp. 35-39.

on the administrative, social, and economic areas are more accurate indicators as to where were the interests of the different administrations. These three expenditure groups are based upon functional expenditure groups as devised by the Mexican government. The economic category consists of expenditures in communication and transportation; agriculture, livestock, conservation, and forestry; industry and commerce. The social category consists of education and culture; health, assistance, and hospital programs; welfare and social security. Administrative expenditures consist of the military, administration, and public debt areas. In addition, actual and projected expenditures will be found to differ, since sources of revenue change from the projected levels at the time of budget formulation. Since revenues are often greater than projected, the president has some freedom to make later changes. In these cases actual expenditures tell the real story, although projected expenditures may indicate original intentions. This information is given in Table 3-1.

The first ideological period, from 1910 to 1930, was one of political revolution. This involved changes in political control and government ideologies. Significant adjustments were indeed being made, but the percentages of actual and projected expenditures devoted to the economic, social, and administrative areas did not differ to any significant extent from those of the pre-revolutionary governments. The Mexican state still played a passive role in economic and social affairs, with administrative expenditures composing the great majority of the total budget. Francisco J. Madero, the first president after Diaz, wanted only a return to democratic procedures, and did not envision the great and immediate changes which needed to be made in Mexico. Even President

TABLE 3-1
 PERCENT OF FEDERAL BUDGETARY EXPENDITURES BY
 TYPE OF EMPHASIS, 1929-1963

Years	Economic		Social		Administrative	
	Projected	Actual	Projected	Actual	Projected	Actual
1929- 1934 ^a	25.4	25.2	15.2	15.2	59.4	59.6
1935- 1940 ^a	30.5	37.6	23.0	18.3	46.4	44.2
1941- 1946 ^a	30.7	39.2	23.4	16.4	45.8	44.3
1947- 1952 ^a	39.2	51.9	18.6	13.3	42.2	34.8
1953- 1958 ^a	43.8	52.7	20.4	14.4	35.8	32.8
1959- 1963 ^a	38.8	39.0	30.8	19.2	30.4	41.8

^aPresidential terms: 1929-34, Emilio Portes Gil, Pascual Ortiz Rubio, and Abelardo Rodriguez; 1935-40, Lazaro Cardenas; 1941-46, Manuel Avila Comacho; 1953-58, Ruiz Cortines; 1959-63, Lopez Mateos (data not available for 1964).

Source: Clark W. Reynolds, The Mexican Economy: Twentieth-Century Structure and Growth, (New Haven and London: Yale University Press, 1970), pp. 69-92.

Venustiano Carranza, who called the Constitutional Convention in 1916-1917, planned only for minor changes, and did not expect the more radical nature of the document which was developed. The plans for a more active state developed by the constitutionalists were still not put into practice until conditions changed in the 1930's. Even at the start of the next period to be discussed, the strong man and former president, General Plutarco Calles, tried to slow the changes.¹²

¹² Ibid., pp. 70-81.

The decade of the 1930's can be called a period of social revolution.¹³ This period witnessed important increases in the relative percentages of expenditures for social and economic ends. The world depression changed many minds in Mexico and the previous faith in international capitalism was greatly shaken. Mexico's dependence upon this world market and the conditions under which most Mexican citizens lived were seriously questioned. During the short terms of Emilio Portes Gil, Pascual Ortiz Rubio, and Abelardo Rodriquez, from 1929 through 1934, changes were talked about and attempted. For example, the percentage of expenditures for administration began to fall, and the need to help the masses in some way was recognized. But for economic and internal and external political reasons, the transition was not completed until Lazaro Cardenas took office in 1934.

Cardenas was chosen as the official party candidate largely because of his social policy record as the governor of the state of Michoacan from 1928 to 1932. He was a president who gained firm control of the presidency and was actually able to develop decisive programs in the social and economic spheres. In fact, his term represented the beginning of a new era when each president would be independently in control of his office, and not greatly influenced by some previous president. Cardenas's policy was based upon the need for social revolution to help the masses of Mexican people. He expropriated land and foreign oil interests, and transferred funds from administration to education and social welfare in attempts to make Mexico more economically independent and to improve individual well-being. For the first time in Mexico's republican history, actual administrative expenditures fell below fifty

¹³Ibid., pp. 70-81.

percent of the total budget. In addition, a number of important institutions for the promotion of economic development were created. During his term the role of the active state was established in practice, and particularly the role of the state in the social realm.

During the presidential term from 1940 to 1946, a period which coincided with the Second World War, Manuel Avila Comacho launched the third ideological period, one of economic revolution. The percentage levels of projected expenditures for Comacho's term were nearly the same as those of President Cardenas, but actual expenditures told the difference. There was a small increase in the percentage of social expenditures, but the large increase in emphasis came in the economic expenditure area. During the presidential term of Miguel Aleman from 1946 to 1952, economic expenditures reached a new high and social expenditures a low since 1930. The next president, Ruiz Cortines, did not really change the trend but was forced to provide some relative increase in the neglected social and administrative areas. The emphasis had been changed from one of socialist revolution and collectivism to economic revolution and the promotion of individualism. This involved fostering the conditions for private enterprise such as eliminating uncertainty and the provision of economic infrastructure. As a consequence of these changes, land redistribution hit a new low.¹⁴ It has already been shown that this was the period of Mexico's greatest economic growth. Mexico's resources were limited, and all the expenditure needs could not be provided at one time, but we shall see that the next president tried to do a better job of meeting economic, social, and administrative needs in a more equitable manner.

¹⁴Ibid., pp. 82-89.

The president was Lopez Mateos who served from 1958 to 1964, and Wilke has termed this the period of "balanced revolution".¹⁵ In effect, Mateos wanted to combine the positive aspects of the eras of social and economic emphasis. This idea of a balanced revolution had been called for in the Constitution, but never achieved in practice. While the expenditures projected by Mateos very nearly approximated balance, increases in actual revenue resulted in social expenditures again falling somewhat short. But absolute expenditures in the social area were greater than in the past, and events such as increased land redistribution and subsidized food for the masses showed that governmental proclamations had been sincere to a degree. The reader should refer to Table 3-1.

The realization that important areas of expenditures could no longer be slighted at the expense of pet policies had finally arrived. Indeed, such thinking had become politically expedient due to increasing tensions in Mexico.

Stepping back and taking a look at the Mexican situation from a longer run perspective, including a comparison with other developing countries, does not present such a rosy picture with regard to social expenditures. In a recent work, Roger D. Hansen addresses himself to the social impact of the government policies.¹⁶ While a relative shift toward more balanced expenditures did take place in 1958, when compared to other developing countries, Mexico does very poorly in such things as educational expenditures, income redistribution, and social security coverage. The government has done comparatively little to help the

¹⁵Ibid., pp. 89-96.

¹⁶Roger D. Hansen, Mexican Economic Development: The Roots of Rapid Growth (Washington, D.C.: National Planning Association, 1971), pp. 70-84.

bottom quarter of society. In fact, wages, prices, and occupational opportunities have changed in such a way as to leave this segment equal to or worse off than it was in 1940. In addition, the Mexican tax effort is very low compared to most developing countries. Land redistribution has, of course, been a bright spot in this picture, but if the government wished to do so, it could legally redistribute much more at a greater pace. This again comes back to the major theme of Mexican development which stresses maximum growth and the development of a growing industrial and commercial agricultural class. Implicitly or explicitly, government policies hold that the country's total output must be increased before income redistribution receives major priority. Continued emphasis on investment in economic infrastructure has left less for investments in other social areas.

It is important to consider how vital land redistribution has been to development policies in Mexico. It has been an important complementary part of the government policy of maximizing total output. A major reason for its importance is that it has allowed the continuance of political stability with a relatively minimal outlay. The large land holdings which have so long been a source of trouble in the heavily populated areas have been eliminated. Political stability has enabled the government to continue its concentration on heavy investment in economic infrastructure and other priorities for industrialization. At the same time it has provided conducive conditions for private enterprise to respond to the government initiatives.¹⁷

¹⁷Ibid., pp. 60-2.

Recent Government Expenditures

It will now be of use to take a closer look at government expenditures during the last several decades. The reader should keep several factors in mind during this discussion. First, the participation by the Mexican government in money expenditures is actually quite low when contrasted with other developing countries. Table 3-2 compares Mexican government expenditures as a percentage of Gross National Product to a number of its Latin American counterparts. The data show that Colombia,

TABLE 3-2

GOVERNMENT EXPENDITURES AS A PERCENTAGE
OF GROSS NATIONAL PRODUCT, 1950, 1960, 1966

	1950	1960	1966
Mexico	9.1	9.0	7.2
Argentina	12.9	13.2	12.8
Bolivia	--- ^a	39.8	43.0 ^b
Brazil	9.4	11.0	14.0
Chile	15.5 ^c	22.1	22.8
Colombia	6.7	8.4	8.0 ^d
Ecuador	6.0	13.1	15.8
Peru	12.3	15.1	16.7 ^d
Venezuela	20.1	25.9	21.4

^aData not available

^b1963

^c1953

^d1965

Source: Reynolds, The Mexican Economy, p. 269.

and Ecuador in 1950 are the only countries with a comparably low percentage to Mexico's. And compared to Mexico's 1960 percentage of 9.0, Bolivia spent 39.8 percent, Venezuela accounted for 25.9 percent, and Chile for 22.1 percent. While in many countries the trend in expenditures as a percentage of GNP has been upward, the Mexican trend has

clearly been in the downward direction. It will be shown later that one principal reason for this fact is Mexico's low taxing effort. Tax receipts have not kept up with the GNP growth. I shall also show that the one area of expenditures which was growing at least up until 1955 is the one most crucial to economic development, public investment. Finally, to say that Mexico has a relatively low government expenditure percentage of GNP is not to imply that the control of the government over the economy is insignificant, or that those areas to which expenditures were directed have not been crucial to the impressive Mexican record of economic development. It should be pointed out that Mexico has made use of a number of non-fiscal measures such as monetary measures and import controls to a very significant extent.

Table 3-3 shows the distribution of actual (as opposed to projected) federal expenditures from 1940 to 1963. It indicates the extent to which the budget was used for direct physical investment to increase the country's stock of capital. The figures show that administrative expenses have generally fallen as a percentage of the budget. In 1940 they consumed sixty-two percent of the total budget. By the 1951-55 period they had fallen to a low of thirty-four percent. The figure for 1961-63 had risen slightly to thirty-nine percent. The figures show a continuing rise in government transfers to consumption and investment which involves pensions to workers, transfers to states and households, and loans. This reflects a slowly growing awareness on the part of policy makers that the standard of living for many of the people needs to be vastly improved. Finally, it can be seen that direct physical investment rose to a high of twenty-eight percent in the 1951-55 period and then fell to twenty percent in the 1961-63 period. Relative levels

TABLE 3-3
 LEVEL AND DISTRIBUTION OF ACTUAL FEDERAL
 EXPENDITURES, 1940-63

(Average Percentages)

	1940	1941-45	1946-50	1951-55	1956-60	1961-63
<u>Total Federal Expenditures</u> (million current pesos)	522	942	2147	5176	9548	8992
Percent Total	100	100	100	100	100	100
<u>Current Expenditures</u> Sum	75	68	64	54	62	73
Administrative Expenses	62	54	45	34	37	39
Transfers to Consumption & Investment	7	5	11	14	20	28
Interest on the Debt	1	3	3	4	4	5
Unclassified	4	6	4	2	1	1
<u>Capital Expenditures</u> Sum	25	32	36	46	38	27
Direct Physical Investment	19	25	27	28	24	20
Acquisition of Real Estate	--- ^a	---	---	1	---	---
Finance of Other Sectors	6	6	9	17	13	7
Other Expenses	1	1	---	1	1	1

^aLess than one percent.

Source: Reynolds, The Mexican Economy, p. 278.

of physical investment compared to private again point out the active role of the Mexican government in the promotion of economic development. The share of direct government investment as a percent of total gross fixed investment has declined with many fluctuations from 36.9 percent in 1939 to 10.8 percent in 1962.¹⁸ When the investments of wholly or partially owned government enterprises are added to direct government investment, the share out of gross investment again falls from 61.7 percent in 1939, and 47.9 percent in 1940, to a low of 22.1 percent in 1956. By 1962, however, the proportion had risen again to 32.7 percent.¹⁹ In other words, the importance of wholly or partially owned government enterprises has increased in later years. It can be concluded that the influence of the public sector in the Mexican investment picture has been very great, particularly in the earlier years. Most sources seem to indicate that there is now a large excess demand for private investment and that the private sector can continue to play a greater role in this area. Reynolds predicts that the private sector might indeed handle this greater share without too much trouble. He goes further to state that the private sector may have to do so unless the share of government revenues in GDP rises by a significant amount. Otherwise the growing demand for social expenditures will require such an increase on the part of government. His most interesting prediction is that the stage of major public investment in economic infrastructure may be passing.²⁰

¹⁸Clark W. Reynolds, The Mexican Economy: Twentieth Century Structure and Growth (New Haven: Yale University Press, 1970), p. 284.

¹⁹Ibid. For information giving contrary results see Raymond Vernon, The Dilemma of Mexico's Development: The Roles of the Private and Public Sectors (Cambridge: Harvard University Press, 1963), p. 199; or, William O. Freithaler, Mexico's Foreign Trade and Economic Development (New York: Praeger, 1968), p. 140. These tables are based primarily on information from the Nacional Financiera which understates the rate of private investment after 1950, according to Reynolds. This results in higher figures for the proportion of public investment out of the total.

²⁰Reynolds, The Mexican Economy, p. 280.

Regardless of the future amount of direct government investment, this investment has probably played an irreplaceable role during the period of major interest in this thesis: from 1940 to 1960 or shortly beyond.

Table 3-4 further breaks down public sector investments into agricultural, industrial, communication and transportation, and social investments. With the exception of the very important sector of communication and transportation, agricultural investments received a larger outlay than any other area until after 1952. It can be seen that investments in irrigation works comprise the preponderate majority of agricultural investments. Except for the 1959-63 period, irrigation investments had already been well over ten percent of total investments. Communication and transportation investments began the time span under survey with more than half of all public investments and declined to a level still around thirty percent in the 1959-63 period. The decreases in the two previously mentioned sectors were compensated for by increases in industrial and social investments as a percentage of total public investments. Industrial investments sky-rocketed from 18.9 percent of total public investments in 1947-52, to 30.3 percent and 35.3 percent in 1953-58 and 1959-63, respectively. This great increase in industrial priorities occurred during the administrations of Adolfo Ruiz Cortines and Adolfo Lopez Mateos. Social investments have increased at an equally great rate from 8.3 percent in 1935-40 to 21.3 percent in 1959-63. This data underlines the increasing importance placed on industrialization and maximum economic growth. But the significant size of investment in agriculture also underlines the recognition on the part of policymakers that agriculture plays an integral part in the process of economic development as they view it. Further, as it will soon be seen even more clearly, the provision of irrigated land is the central pillar of Mexican agricultural policy.

TABLE 3-4
 INVESTMENTS OF THE PUBLIC SECTOR IN MEXICO, 1935-63
 (Percentage Distribution)

	1935-40	1941-46	1947-52	1953-58	1959-63
<u>Total Outlays</u> (million pesos)	947	4309	14091	29674	50729
<u>Agricultural Investments</u>	<u>17.8</u>	<u>15.7</u>	<u>22.0</u>	<u>13.0</u>	<u>8.9</u>
Irrigation Works	16.8	15.0	16.2	12.2	8.5
Other	1.0	0.7	5.8	0.8	0.4
<u>Industrial Investments</u>	<u>9.3</u>	<u>10.2</u>	<u>18.9</u>	<u>30.3</u>	<u>35.3</u>
Electricity	0.7	2.2	6.8	6.7	17.3
Gas and Oil	8.6	8.0	12.0	19.8	13.7
Other	--- ^a	---	0.1	3.7	4.3
<u>Communication & Transportation Investments</u>	<u>51.4</u>	<u>51.6</u>	<u>40.2</u>	<u>36.3</u>	<u>30.2</u>
Roads	18.9	23.3	16.0	14.7	11.9
Railroads	29.4	26.0	21.3	16.0	11.4
Other	3.1	2.3	2.9	5.7	6.8
<u>Social Investments</u>	<u>8.3</u>	<u>12.9</u>	<u>13.3</u>	<u>14.3</u>	<u>21.3</u>
Public Housing	---	---	1.5	1.5	4.9
Hospitals	0.7	1.5	1.5	1.5	4.8
School and Research Facilities	2.4	1.2	3.0	2.5	2.5
Other	5.2	10.2	7.3	8.7	9.1
<u>Miscellaneous</u>	<u>13.3</u>	<u>9.5</u>	<u>5.6</u>	<u>6.1</u>	<u>4.2</u>

^aInsignificant quantities.

Source: William O. Freithaler, Mexico's Foreign Trade and Economic Development (New York: Praeger, 1968), pp. 12-13.

Financing Federal Expenditures

The Mexican tax system has followed an evolution similar to that in many developing countries. Earlier dependence on revenues from taxes on foreign trade was great, but this has declined in importance over recent years. A glance at Table 3-5 which shows the sources of federal revenue since 1940, reflects that both imports and exports have declined in importance as sources of tax revenue. The major decline in export revenues did not come about until the mid 1950's. Commerce and trade

TABLE 3-5

SOURCES OF FEDERAL REVENUE IN PERCENTAGE TERMS
FOR SELECTED YEARS, 1940-63

	1940	1943	1946	1952	1958	1960	1963
Total Revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Major Tax Sources							
Import	18.1	9.0	11.9	12.0	12.0	10.1	10.7
Export	11.4	19.8	12.3	13.1	8.5	5.8	5.9
Commerce and Trade	1.7	1.4	1.3	7.5	5.9	5.7	7.9
Industry	21.5	13.5	17.7	13.1	11.3	8.8	11.9
Stamps	9.7	7.3	10.3	0.8	1.1	1.1	1.3
Income Tax	9.8	20.0	18.5	24.2	21.3	18.8	27.8
Public Service	7.1	5.4	4.4	2.8	2.7	2.2	2.9
Loans and Financing	--- ^a	---	---	---	10.3	33.2	19.9
Other Sources	20.7	23.6	23.6	26.5	26.9	14.3	11.7

^aIndicates insignificance.

Source: James W. Wilkie, The Mexican Revolution, Federal Expenditure and Social Change since 1910 (Berkeley: University of California Press, 1970), p. 294.

has increased in importance. At the same time income taxes have become one of the major sources of revenue. It is interesting to note that while industry has been growing at truly impressive rates, its importance as a source of revenue has declined relatively from 21.5 percent in 1940 to 11.9 percent in 1963.

While the Mexican income tax system is progressive in theory, it actually becomes quite regressive above the urban middle class, who are themselves taxed quite heavily due to the ease of making deductions from their payrolls. Tax rates on industrial profits have been kept low and the government has not been strict in auditing corporate accounts. The sum total of all these changes amounts to the fact that total revenue as a share of GDP has not risen in more than twenty years.²¹ The fact that Mexican public expenditures have been much lower than in other developing countries is largely explained by the fact that there have not been large revenue increases. Again looking at Table 3-5, the growing reliance on loans and financing as a source of revenue illustrates that the government would rather add to its revenues in this manner than increase taxes and risk hurting investment incentives in the private sector.

The Context of Irrigation Expenditures

I will now discuss irrigation expenditures in the context of the Mexican experience. The nature of the Mexican landscape has created several problems in the development of agriculture to feed the growing population. First, much of the landscape is mountainous, making agriculture in these areas difficult. The total amount of surface area amounts to two hundred million hectares, but sixty-four percent of this is mountainous. Therefore, only thirty-six percent of the surface area is potentially or actually arable in terms of topography. Second, the country has a wide variety of climates, but unreliable rainfall is a common factor which must be contended with.

Much of the northern region of the country is characterized by a desert-like climate. Here, agriculture is not possible without some form of irrigation. Some of the southern regions receive more than sufficient

²¹Ibid., pp. 271-272.

rainfall, but often these areas are swampy lowlands or forested mountain regions which present a number of difficult problems for farmers, drainage being a major one. Therefore, of the thirty-six percent of the land that is not mountainous, much does not have the reliable rainfall needed for agricultural production.²² By one account eighty-three percent of the land surface is either arid or semi-arid. Irrigation is indispensable for production on sixty-three percent of the cropland cultivated.²³

Throughout the history of the area which now consists of the nation of Mexico, water has been a factor with which all the inhabitants have had to contend.²⁴ The earliest irrigation works were developed by various pre-Columbian Indian groups. Much later, the dictator Diaz showed some interest in irrigation, but any works which were constructed by him or by private citizens during his regime were not great in number, nor did they benefit any but the large landholder. In fact we have seen that this tendency to ignore the needs of the Mexican peasant gave fuel to the Revolution. The increasing numbers of people and declining food production at this time in history only emphasized the potential for agricultural problems if new policies were not forthcoming.

As soon after the Revolution as the term of President Alvaro Obregon (1921-24), a hydraulic policy was initiated. This involved the creation of the Irrigation Bureau which was part of the Agriculture

²²Martin H. Greenberg, Bureaucracy and Development: A Mexican Case Study (Lexington, Massachusetts: D.C. Heath and Company, 1970), p. 10.

²³U. S. Department of Agriculture, Economic Research Service, Sources of Change in Mexican Agricultural Production, 1940-65, by Reed Hertford, Foreign Agricultural Economic Report No. 73 (Washington, D.C.: Government Printing Office, 1971), p. 33.

²⁴The following discussion of the beginnings of Mexican irrigation policy is largely derived from Greenberg, Bureaucracy and Development, pp. 10-41.

Ministry. Funds were seriously restricted at this time and even the function of data gathering was very incomplete. The work of the Irrigation Bureau was restricted to data gathering and maintaining some of the already existing irrigation works, particularly around the city of Mexico.

President Plutarco Elias Calles (1925-28) was the major driving force behind Mexican involvement in irrigation. He believed that the development of irrigation was an unavoidable prerequisite to the improvement of Mexican agriculture. He was responsible for the passage of the Irrigation Law of 1926 which established the National Irrigation Commission (CNI). This law would provide the guidelines for irrigation policy until 1947 when the present Ministry of Hydraulic Resources was established. Key factors of the 1926 law were the nationalization of existing private works and the establishment of the CNI, a dependency of the Ministry of Agriculture, to plan potential works on the basis of financial considerations and to undertake the actual construction of the works. This law complemented the new constitution which recognized water resources as the property of the Mexican nation.

During this period the goals of the early irrigation program were worked out. The stated goals were to colonize unpopulated areas in conjunction with the agrarian reform, to increase agricultural production, and to develop a rural middle class by raising living standards which in turn would increase the size of the domestic market. These goals imply more of an integrated idea of economic development than just the construction of irrigation works, but the CNI was denied other than the construction functions by existing agencies.

Political, and not economic or social considerations dominated the early irrigation policy. While many of the older engineers insisted that large works should not be undertaken until more complete data were available, the desires of younger engineers to begin construction immediately prevailed. The reason was that Calles was anxious to get the projects started in areas of actual or potential political and social unrest in order to demonstrate the effectiveness of the government. Another example of the political considerations that reigned was the establishment of works along the border rivers between Mexico and the United States. These works were to serve as bargaining instruments for Mexico in the advent of negotiations which would inevitably take place with the U.S. over water rights.²⁵

An examination of Table 3-6 illustrates that by the term of President Avila Comacho (1941-46) a yearly average of 91,521 hectares of land were being benefited by irrigation works. Irrigation as an objective of public investment had been firmly entrenched and a large fund of technical capability and experience was being built up. Adolfo Orive Alba, the head vocal executive of the CNI initiated an important change in the construction policy by starting the practice of contracting out the construction to private firms, an important stimulus for the private sector. Adolfo Orive Alba has become the principal name associated with Mexican irrigation. He was to become so vital to the irrigation program that he would be able to withstand all types of political changes in the government for many years. One other point that should be added regarding this period is that the policy of establishing large as opposed to small

²⁵Greenberg, Bureaucracy, pp. 13-14.

TABLE 3-6
 AREA BENEFITED BY HYDRAULIC WORKS DURING
 PRESIDENTIAL PERIODS
 (Hectares)

Period	Total	Yearly Average
1926-28	2,000	666
1929-34	146,000	24,433
1935-40	118,495	19,749
1941-46	549,129	91,521
1947-52	625,512	104,252
1953-58	747,791	124,662
1959-64	<u>250,767</u>	<u>41,794</u>
Total or Average	2,440,294	101,678

Source: Greenberg, Bureaucracy, p. 38

irrigation works generally prevailed. Larger works were not only more challenging to design, and created greater and more impressive evidence of government activity, but were technically necessary for such areas as the dry northern region.

The first works constructed were located in the northern part of the country. Resources were limited and the completion of any significant works would require that efforts be concentrated. Further, the northern areas were among those that were most torn by the Revolution.

The Law of 1926 had called for the users to make repayments for the land and works, but it soon became evident that this would not be possible. Those working the land just did not have the means to do so and this function would have to be left to the government.²⁶

²⁶ Donald Anthony Walker, "The Role of Government in the Development of Mexico's Water Resources for Agricultural and Health Purposes" (unpublished Masters Thesis, University of Texas, Austin, 1956), pp. 18-33.

A number of quite serious problems and difficulties arose as a result of the nature of the CNI, the functions it performed and those it did not. The CNI had charge only of the design and construction of the irrigation works. There was a reluctance to begin multiple use projects and much duplication of effort resulted because other related aspects of water development were under the control of various agencies not connected to the CNI. The Federal Electricity Commission took care of hydro-electric generation, the Ministry of Health and Social Welfare was in charge of drinking water, and flood protection was provided by the Ministry of Communications and Public Works.

Orive Alba and other important persons in the CNI took advantage of this situation and were instrumental in persuading the executive to give the Commission full ministry status. On December 7, 1946, a law was passed which created the Ministry of Hydraulic Resources (SRH). The true importance of irrigation was approaching full recognition in terms of governmental structure.²⁷ The only task yet remaining in the evolution of the agency was for the operation, as well as the construction of the works, to be permanently placed under the authority of the Ministry, a development which was not long in coming after the impracticability of having the Ministry of Agriculture operate the projects was demonstrated.

The purpose of the irrigation law of 1947 as outlined in the second article, was to promote the following:

1. The construction of hydraulic works for impounding, storing, diverting, conducting, and distributing water; for the discovery of underground waters; for the elimination of waters and brines that are prejudicial to agriculture and for the protection of uncultivated lands.

²⁷Greenberg, Bureaucracy, p. 20.

2. The development of hydraulic power through the use of irrigation works.
3. The acquisition of the lands necessary for building and operating such works.
4. The construction of the necessary lines of communication for the development of the irrigation works.
5. The utilization of irrigation works for quarries, deposits and layers of construction materials.
6. Field work and studies of the soil and of the subsoil, soundings, studies, drawing up of projects and establishment of observation and experimental stations to meet any of the requirements of this Law.
7. The formation of agricultural-urban centers and the establishment of their public services.
8. The colonization of lands improved by irrigation works, as well as the acquisition of the lands necessary for regulating the property distribution in irrigation districts.
9. The operation of irrigation districts established or acquired by the Federal Government.
10. In general, the carrying out of works and activities that are complementary or auxiliary to those mentioned above.²⁸

This should make it clear that the SRH was not envisioned to be merely a design and construction agency for irrigation projects. The law has important implications about the intended function of irrigation investment in Mexican economic development. Public investment in irrigation works is not for the sole purpose of increasing irrigated farm land. Rather, this investment is intended to be surrounded and complemented by a whole range of other activities including drinking water, sanitation, communications, and a variety of social investments such as education and health facilities. Irrigation investment is indeed a vehicle for economic development, and requires complementary investments and programs.

²⁸ As translated in Walker, "The Role of Government," pp. 135-136.

When reading in the next chapter about irrigation investments in the Pacific North and changes which have taken place in that region as compared to the rest of the country during the same time period, the reader should keep this fact in mind. Economic and social changes have resulted from the inclusion of these other activities in addition to irrigation.

In order to further clarify the diverse functions of the SRH, the technical activities of the Ministry are also outlined at this point.

Donald Anthony Walker has broken them down into eleven groups:

1. The development of an inventory of rains, river waters, lakes, and all other hydraulic resources.
2. The compilation of an inventory of all the soils of Mexico.
3. The construction of irrigation works following studies of the water and the soil.
4. The development of drinking water for the villages and towns.
5. The generation of electrical energy through the projects.
6. Draining lands and towns in order to reclaim lands for cultivation and to reduce the threat of disease.
7. The provision of flood control.
8. The development and the improvement of navigable inland waterways.
9. The determination of water rights.
10. The provision of the socio-economic development of the irrigation districts.
11. The integrated development of all renewable and non-renewable²⁹ natural resources of several large river basin areas.

The integrated development mentioned in the last point has required the formation of river basin commissions. These are decentralized

²⁹Ibid., pp. 136-44.

agencies, which were mentioned earlier, and are autonomous to varying degrees depending upon political factors at a given time or place. The river basin commission idea was somewhat inspired by the TVA in the United States. They are direct attempts at regional development in certain areas which could benefit from integrated development as might be provided by a special agency. Besides the large array of investments which may be channeled through the basin commissions themselves, these commissions also serve the function of coordinating projects in their areas which are carried out by other Federal agencies such as housing. Again, the amount of power, and the success of these river basin commissions is dependent upon and has often been compromised by political factors such as resentment by other government units. This may have prevented them from demonstrating their true usefulness. The four major river basin projects are the Papaloapan project, the Grijalva project, the Balsas (formerly the Tepalcatepec) project, and the Fuerte project of which part is located in the Pacific North region.³⁰

The many diverse functions as envisioned for the SRH were reflected in the organization of the ministry. The ministry was headed by the Minister of Hydraulic Resources, a Sub-Minister, and an Official Mayor who was supposed to be in charge of administrative matters but who in reality didn't wield much power. There were two major branches, the irrigation and the sanitary branch. Irrigation was the larger and more important branch, headed by a Chief Engineer and a Sub-Chief. There were four departments in the irrigation branch: a Department of

³⁰David Barkin and Timothy King, Regional Economic Development: The River Basin Approach in Mexico (New York: Cambridge University Press, 1970), pp. 93-119.

Hydrology, a Department of Studies and Projects, a Construction Department, and a Department of Small Irrigation. There were five administrative departments which took care of such things as auditing, purchasing, accounting, and budgeting. There were also four departments which served both the irrigation and sanitary engineering branches. These included Geology, Cost Control, Soil Quality, and Legal. The Technical Consultant office was organized to provide advice to the technical branches on difficult problems.³¹

The irrigation districts are the administrative units for the areas served by the irrigation works. A given district may encompass areas which are not yet receiving water. These districts also serve as statistical units for data collection. At various times the operation of the districts has been under other agencies than that of irrigation, but experience has shown that the best solution toward effective operation is to leave design, construction, administration, and maintenance under the same ministry.

Table 3-4 shows the changes which have occurred over the years in irrigation investments as a percentage of total investments, with the greatest relative emphasis coming before the mid 1950's. Further clarification is possible when the levels of absolute investments are examined. This is shown in Table 3-7. While relative irrigation expenditures have declined in recent years, Table 3-7 shows that the trend for absolute expenditures on irrigation has been continually upward. Table 3-6, which shows the total amount of area benefited by hydraulic works during presidential periods, should be interpreted with care. Investments initiated in one period are often not completed until the next

³¹ Greenberg, Bureaucracy, pp. 20-21.

TABLE 3-7
 FEDERAL INVESTMENT IN IRRIGATION, CNI AND SRH
 (Millions of Pesos; Current Prices)

Year	Amount	Cumulative
1926	2.6	2.6
1936	18.1	112.1
1940	26.2	223.6
1941	54.5	278.1
1942	60.7	338.8
1943	80.4	419.2
1944	117.1	536.3
1945	138.5	674.8
1946	174.4	849.2
1947	214.7	1,063.9
1948	218.9	1,282.8
1949	218.1	1,500.9
1950	326.4	1,827.3
1951	387.4	2,214.7
1952	611.0	2,825.7
1953	573.7	3,399.4
1954	619.4	4,018.8
1955	643.2	4,662.0
1956	601.7	5,263.7
1957	641.5	5,905.2
1958	657.3	6,562.5
1959	662.7	7,225.2
1960	768.8	7,994.0
1961	829.5	8,823.5
1962	1,080.3	9,903.8
1963	1,395.5	11,299.3
1964	2,249.0	13,548.3

Source: Roberto Juarez Ramirez, "La Obras de Riego y su Efecto en la Economia Nacional" (unpublished thesis, Universidad Nacional Autonoma de Mexico, 1967), p. 237.

presidential term. This may make a given president seem more irrigation oriented than he is in actuality. He may only be finishing works which were already committed before he had control of policy. This is particularly true in the case of regional commissions.

Avila Camacho (1946-52) was the president who actually furthered irrigation the most. His administration added more than 549,000 hectares by projects designed for that purpose only. The Aleman and Ruiz Cortines totals were partly composed of figures counting areas which were already watered by tributaries of the Papaloapan River and thus appear greater than in actuality.³²

Conclusion

In concluding this chapter I will make a few comments and then raise some important questions. In this chapter I have described the directions which have been taken by Mexico's public sector in playing an active role in economic development with respect to government expenditure, particularly economic investments. The description of the political structure was to delineate the framework in which expenditure decisions are made. The SIIH is the government ministry which has evolved to administer one particular aspect of investment, irrigation, and all the complementary activities.

In regard to federal expenditures in Mexico in general, I have often come across the criticism that tax revenues as a share of GDP should be expanded by increasing the tax intake and that fiscal policy should play a larger role in the maintenance of aggregate demand. The extent to which loans can continue to provide for increasing needs for revenues is surely limited by the burden of servicing these debts.

With respect to irrigation investments in particular, perhaps the river basin approach should have been given a greater chance to prove its potential for the integrated development of regions. Second, many of the

³²Greenberg, Bureaucracy, pp. 30-41

opportunities for the construction of the large irrigation works have passed, but the costs of maintaining these finished works will continue to make demands upon the budget. Now may be the time to shift investment priorities over to smaller projects in more populated areas. This bears directly upon the final questions that need to be raised.

Have irrigation investments in the past unnecessarily served to perpetuate and increase the agricultural dualism that was mentioned in Chapter Two? A more complete consideration of this question will have to be postponed until the next chapter, but several points can be suggested now. First, as will be shown in the final chapter, irrigation investments have been largest in the peripheral zones of the country. These areas do contain a large amount of water resources to be tapped, but also a low population density when compared to other parts of the country. No more than fifteen percent of all Mexican farmers have access to the water in the irrigation districts. But these same farmers find it easiest to obtain agricultural credit, to avail themselves of the results from agricultural research, and to benefit from other agricultural investments and developments. These trends have served to create a commercial agricultural class as shown by the statistics in the second chapter. A significant portion of the output from these farms is directed toward export markets.³³

The second and related question concerns the future needs of Mexican agriculture and thus agricultural investment. Projections of future needs show that the demand for food production for domestic consumption will grow much faster than demand for export production. It

³³ Donald K. Freebairn, "The Dichotomy of Prosperity and Poverty in Mexican Agriculture," Land Economics, XLV (February, 1969), 31-42.

can also be shown that increasing certain inputs to the traditional part of the sector can result in proportionately greater returns to the small farmer.³⁴ Might not the two needs of meeting this food demand and increasing the size of the domestic market, best met by shifting future investments of the SRH to the more densely populated central agricultural areas?

The next chapter will examine the Pacific North in terms of irrigation investments, and changes in the structure of the agricultural sector there as compared to the nation as a whole. This will further demonstrate the nature and particularly the effects of public investment policy.

³⁴Ibid.

CHAPTER IV
PUBLIC INVESTMENT IN IRRIGATION AND THE
NORTH PACIFIC

In Chapter One I reviewed the economic literature concerned with public investment for economic development. I showed that the balanced and the unbalanced growth theories were opposed to each other, yet that each provides valuable insights which should be considered when evaluating public investment policy. Benefit-cost analysis provides some conceptual contributions, particularly when projects under consideration are similar and other important goals such as regional equality of income are included in the analysis. I mentioned that an almost inevitable outcome of economic development would be regional inequalities. I planned to use this theoretical framework to provide a basis for the analysis of Mexican irrigation investments.

The purpose of Chapter Two was to illustrate the ways in which the Mexican agricultural sector has been successful in changing, and in meeting the needs of the growing Mexican economy. I have shown that agriculture provided foreign exchange earnings, met the expanding needs for a domestic food supply, stimulated the domestic market, and provided a source of loanable funds to other sectors. The Mexican government was wise not to ignore this sector, although the Mexican Revolution and subsequent land reform may have assured against agricultural neglect. I shall

soon propose, however, that a very large portion of Mexican agriculture was in a sense neglected when compared to a few areas which received the bulk of public attention.

Chapter Three examined the nature of the Mexican political system, the history of government expenditures for economic development, sources of revenue, and the governmental context of irrigation expenditures. The purpose was to provide a background for irrigation investment, and to explain the actual procedures and institutions which have evolved to promote irrigation investment.

The purpose of Chapter Four is to complete this picture of one aspect of public investment to promote economic development in Mexico. Specifically, it will examine one region, the North Pacific, which has received a disproportionately large share of public irrigation investment. I will examine the structure of agriculture in the North Pacific on a comparative basis, using the agricultural sector of the remainder of Mexico as a reference point in most cases. This analysis should complete the picture of public irrigation investment by serving as an example of the Mexican political priorities which determined that this region would be so favored. In describing the agricultural sector of the North Pacific in a comparative manner, I will emphasize that heavy irrigation investments have been a necessary but not a sufficient condition for the evolution of agriculture as it exists in this region. I will venture my own tentative evaluation, but it will be up to the reader to personally evaluate the advantages and disadvantages of this investment strategy. Such a judgment will have to be based upon whether the gains involved warranted the costs associated with them, against the value background of desired goals and ends. Regional data is always sketchy and incomplete in detail, and the

nature of the question assures that no "right" answer will be found as a result of any number of studies. I have only tried to raise the questions, and illustrate differences, with the hope that others will choose to carry the work further.

I should mention at the outset that the North Pacific as a region is certainly not homogeneous in terms of resources or agricultural structure. A large percentage of the farm lands in this region are not irrigated, and the extreme diversity of farm size and scale found in all of Mexico are present here as well. I have chosen the North Pacific first because it is an official region designated by the Mexican government. Past analysis and data collection have been based upon this official designation. Second, and more important, despite a lack of complete homogeneity, the area is characterized by many internal similarities. Most of it is a part of that large and arid region known as the Sonoran Desert. Throughout the region there are a number of rivers and streams flowing from the central plateau through the mountains to the coast. Any significant expansion of agriculture in this region has required extensive development of irrigation, and these rivers have represented the potential for this irrigation. There is also the significant fact that the region in general has traditionally been sparsely populated when compared to other parts of Mexico such as the Central Plateau. This factor has, among other things, saved the North Pacific from as extensive a minifundio problem as exists elsewhere. Finally, I will show in this chapter that the North Pacific is characterized by a large expanse of modern agriculture, distinguishing it from most other regions in the country.

The North Pacific region consists of four states: Nayarit, Sinaloa, Sonora, Baja California; and a territory: Baja California Sur.

Within the region there are seventeen irrigation districts and one river basin commission, the Commission del Rio Fuerte, parts of which are located in Sonora and Sinaloa.¹ Table 4-1 indicates that the North Pacific region contained 22,635,199 hectares of agricultural land in 1960. This represented 13.4 percent of the total agricultural area in Mexico. The region, due to its dry nature, is composed of a large amount of pasture land, at 62.5 percent of the total area in the North Pacific as compared to 44.3 percent for the remainder of Mexico. Grazing is a well suited extensive, as opposed to intensive, use of the dry landscape. Cultivated agricultural land and forested areas represent a smaller proportion of the land area in the North Pacific at 11.0 and 18.5 percent of the total North Pacific land respectively. This can be compared to proportions of 14.6 and 27.0 percent for the remainder of Mexico. Finally, a smaller proportion of the productive land remains uncultivated in the North Pacific.

The North Pacific contains 13.4 percent of Mexico's land area and 10.4 percent of the nation's cultivated area. In terms of the total number of people employed in agriculture, the region contains less than six percent of the nation's agricultural work force. This is shown in Table 4-2. This relatively small percentage is a function first of the smaller portion of the land devoted to cultivation. Secondly, I shall show in a later section of this chapter that a greater percentage of the farms in this region are larger in scale and more modern, using less labor per unit of cultivated land. The data also show that the agricultural work force has grown faster in the North Pacific in the last twenty years than in the remainder of Mexico.

¹Mexico, Secretaria de Recursos Hidraulicos, Direccion General de Distritos de Regio, Dpto. de Censo de Estadistica y Estudios Economicos, Informe Estadistico (Mexico, D. F.: Secretaria de Recursos Hidraulicos, 1968).

TABLE 4-1
LAND CLASSIFICATION

	1940	1950	1960
<u>Total Area (hectares)</u>			
North Pacific	13,743,740	18,668,410	22,635,199
Remainder of Mexico	115,005,485	126,848,533	146,149,009
North Pacific/Mexico (percent)	10.7%	12.8%	13.4%
<u>Cultivated Land (hectares)</u>			
North Pacific (A)	1,147,175	2,076,115	2,489,414
Remainder of Mexico (B)	13,723,903	17,852,146	21,327,498
A / Total in Mexico (%)	7.7%	10.4%	10.4%
A / Tot. North Pacific (%)	8.3%	11.1%	11.0%
B / Tot. for Remainder (%)	11.9%	14.1%	14.6%
<u>Pasture Land (hectares)</u>			
North Pacific (A)	7,874,030	11,310,784	14,145,693
Remainder of Mexico (B)	48,298,241	56,068,258	64,946,535
A / Tot. North Pacific (%)	57.3%	60.6%	62.5%
B / Tot. Remainder (%)	42.0%	44.2%	44.3%
<u>Forest Land (hectares)</u>			
North Pacific (A)	3,005,550	3,356,858	4,176,240
Remainder of Mexico (B)	35,109,625	35,478,923	39,502,401
A / Tot. North Pacific (%)	21.9%	18.0%	18.5%
B / Tot. for Remainder (%)	30.5%	28.0%	27.0%
<u>Uncultivated Productive Land (hectares)</u>			
North Pacific (A)	144,736	352,898	531,571
Remainder of Mexico (B)	8,635,781	7,424,155	10,661,143
A / Tot. North Pacific (%)	1.1%	1.9%	2.3%
B / Tot. for Remainder (%)	7.5%	5.9%	7.3%
<u>Land Unproductive for Agriculture (hectares)</u>			
North Pacific (A)	1,572,249	1,571,755	1,292,281
Remainder of Mexico (B)	9,237,935	10,025,051	10,011,433
A / Tot. North Pacific (%)	11.4%	8.4%	5.7%
B / Tot. for Remainder (%)	8.0%	7.9%	6.8%

Source: Mexico, Secretaria de Industria y Comercio, Direccion General de Estadistica, 2o., 3er., 4o. Censo Agricola, Ganadero y Ejidal de los E.U.M., (Mexico, D. F.: Secretaria de Industria y Comercio, 1940, 1950, 1960).

The North Pacific has experienced the highest rate of overall population growth among all other regions in the country. The regional rate of 50.4 percent over the 1950-1960 period is composed of a 126.5

TABLE 4-2
TOTAL NUMBER OF PEOPLE EMPLOYED ON THE FARMS

	1940	1950	1960
<u>North Pacific</u>	178,977	277,180	366,543
non ejidal works	75,114	161,316	223,308
ejidal works	103,863	115,864	143,235
<u>Remainder of Mexico</u>	3,352,685	4,383,489	5,050,572
non ejidal works	1,855,169	2,408,195	2,637,712
ejidal works	1,497,516	1,975,294	2,412,860

Source: Same as Table 4-1.

percent rate for Baja California, 31.8 percent for Baja California Sur, 33.8 percent for Nayarit, 31.7 percent for Sinaloa, and 53.3 percent for Sonora. This high rate of population growth is caused by the highest difference between births and deaths among the regions, and the highest regional rate of in-migration.² Much of the flow of in-migration can be attributed to the greater economic opportunities in the region. Table 4-3 indicates the 1960 population figures for the region.

TABLE 4-3
POPULATION FIGURES

	1940	1950	1960
Mexico	19,653,552	25,791,017	34,923,129
North Pacific	1,204,073	1,724,241	2,613,470
North Pacific as a percent of Mexico	6	6	7

Source: James W. Wilke, The Mexican Revolution: Federal Expenditure and Social Change Since 1910. (Berkeley: University of California Press, 1970), p. 298.

²U.S. Department of Agriculture, Economic Research Service, Sources of Change in Mexican Agricultural Production, 1940-65, by Reed Hertford, Foreign Agricultural Economic Report No. 73 (Washington, D.C.: Government Printing Office, 1971), p. 25.

The farm and non-farm wages in the North Pacific were 140 percent and 125 percent of the national average respectively, and also higher than the rates of the other regions in 1960. In 1950 the farm and non-farm wages were 137 percent and 128 percent of the national average. This represents an incentive for in-migration. It is in addition a partial indicator of regional economic well being, although no conclusions should be made without an examination of regional cost-of-living differences which are not available. Farm and non-farm wage rates per month are found in Table 4-4.

TABLE 4-4
FARM AND NON-FARM WAGE RATES PER MONTH, MEXICO
(pesos)

Region	1950		1960	
	Farm Wage	Non-Farm Wage	Farm Wage	Non-farm Wage
North	151	265	398	786
Gulf	147	248	291	709
Pacific North	198	331	496	999
Pacific South	132	193	296	572
Central	135	255	346	814
Mexico	145	258	354	800

Source: U.S. Department of Agriculture, Economic Research Service, *Sources of Change in Mexican Agricultural Production, 1940-65*, by Reed Hertford, Foreign Agricultural Economic Report No. 73, (Washington, D.C.: Government Printing Office, 1971).

The North Pacific is the recipient of a relatively high level of irrigation development as compared to other regions in the country. Irrigation development can be measured by the amount of money invested and the number of hectares irrigated. Table 4-5 shows this information. From 1926 to 1958, the North Pacific received 37.6 percent of all Federal investment in irrigation. This represents an investment of over 2400

million pesos if we combine this figure with the information in Table 3-7. This high percentage of the total irrigation investment becomes more meaningful when we remember that the North Pacific contains only 10.4 percent of Mexico's cultivated land and less than six percent of the work force employed on the farms out of the total for Mexico.

TABLE 4-5
CULTIVATED AREA, IRRIGATED AREA, AND IRRIGATION
INVESTMENTS BY PERCENT

	1940	1950	1960
Total cultivated area			
(hectares)	14,871,078	19,928,261	23,816,912
North Pacific	1,147,175	2,076,115	2,489,414
% of Mexico	7.7%	10.4%	10.4%
Remainder	13,723,903	17,852,146	21,327,498
% of Mexico	92.3%	89.6%	89.6%
Irrigated area			
North Pacific (A)	406,279	672,852	1,098,756
A / total cultivated area in North Pacific	35.4%	32.4%	44.1%
Remainder of Mexico (B)	1,493,161	1,830,867	2,416,554
B / total cultivated area in remainder	10.9%	10.2%	11.3%
North Pacific / total irrigated area for Mexico	21.4%	26.9%	31.3%
Increase in Total Cultivated Area (%)			
North Pacific	117.0%	170.4%	37.6%
Remainder of Mexico	55.4%	61.8%	62.4%
Increase in Irrigated Area (1940-60)			
North Pacific	117.0%	170.4%	37.6%
Remainder of Mexico	55.4%	61.8%	62.4%
Percentage of Total Irrigation Investments From 1926 through 1958			
North Pacific	117.0%	170.4%	37.6%
Remainder of Mexico	55.4%	61.8%	62.4%

Source: Cultivated and Irrigated area from Mexico, 20., 30., 40. Conso Agricola Ganadero y Ejidal.

Source: Percentages for irrigation investments from Wilke, The Mexican Revolution.

The area of land irrigated also shows this regional bias very clearly. In 1960, irrigated land represented 44.1 percent of the cultivated land in the North Pacific. The corresponding figure for the remainder of Mexico was only 11.3 percent. These 1,098,756 irrigated hectares represented 31.3 percent of all the irrigated land in Mexico. From 1940 to 1960, irrigated land area in the region increased by 170.4 percent. Irrigated land area in the remainder of the country increased by 61.8 percent by comparison. The Mexican government did not ignore irrigation needs in other parts of the country during this period, but the figures reveal an undeniable bias toward the North Pacific. It is one of the goals of this thesis to suggest the existence of this preferential investment policy, to note some of its indirect or related effects in terms of the structure of agriculture, and to pose the unavoidable question concerning the merit of this policy. This goal is a significant one whether we consider the investment policy to be deliberate in *ex-ante* terms, or simply unplanned in an *ex-post* manner.

I will now conclude this section by examining levels of social welfare in the North Pacific compared to other regions of the country. I will use an index for poverty levels which was developed by James W. Wilkie.³ The index developed by Wilkie contains indicators such as illiteracy, population speaking only an Indian language, persons living in communities with a population under 2500, barefoot population, population wearing sandals, deficient dietary complex, and population without sewage disposal. His index is of a collective nature, designed to show trends in social poverty, and not individual poverty levels. Wilkie

³James W. Wilkie, The Mexican Revolution: Federal Expenditure and Social Change Since 1910 (Berkeley: University of California Press, 1970), pp. 204-215.

developed his own geo-social regions which displayed less variance in poverty levels within regions. He also developed an alternative index which used the accepted geo-economic regions as I have done. It is this alternative index which I will use in order to be consistent.

Table 4-6 (A) shows an index of change in poverty from 1910 to 1960. This shows relative rates of change of levels between regions only. This enables us to see which areas are reducing poverty at the greatest rates, but does not compare actual poverty levels. Table 4-6 (B) shows an index of relative levels of poverty for each year. It shows the relative poverty level of each region in regard to the other regions. These tables use the indicators mentioned in the preceding paragraph. With the exception of the Federal District, the North Pacific has consistently had the lowest level of poverty at each of the ten year intervals from 1910 to 1960. From 1910 to 1940, the North Pacific was second only to the Federal District in terms of rate of reduction of poverty. The North Pacific was first among regions in reducing poverty from 1940 to 1960.

These results imply that if reduction of social poverty levels for the entire country were a principal criteria for irrigation investment, then the North Pacific would have received a proportionately smaller, rather than larger, share of investment. It is also reasonable to assume that the rate of poverty reduction, particularly after 1940, was influenced to some extent by the heavy irrigation investment, and other complementary investments which may have been included.

Regional Comparisons of the Agricultural Sector Nature and Size of the Works

Several of the differences between the North Pacific and other areas of Mexico have been established. The actual structure of this region's agriculture, the size of the works, and the combinations of

TABLE 4-6 (A)

RELATIVE POVERTY BETWEEN REGIONS
INDEX OF CHANGE (1940 = 100)

	1910	1921	1930	1940	1950	1960
Mexico	123.7	115.4	108.7	100.0	85.7	72.0
North Pacific ^a	137.3	121.0	107.2	100.0	87.2	74.1
North ^b	130.6	121.6	111.6	100.0	87.9	75.5
Center ^c	120.0	114.0	107.7	100.0	89.8	77.0
Gulf ^d	129.0	121.6	109.8	100.0	86.7	76.3
South Pacific ^e	111.2	107.6	102.8	100.0	89.8	81.6
(Center without Federal District)	120.0	114.6	108.4	100.0	90.9	77.6
(Federal District)	178.6	145.0	126.1	100.0	78.6	78.6

TABLE 4-6 (B)

COMPARATIVE POVERTY LEVEL
(Percentages)

	1910	1921	1930	1940	1950	1960
Mexico	56.9	53.1	50.0	46.0	39.4	33.1
North Pacific ^a	51.2	45.1	40.0	37.3	32.5	27.6
North ^b	52.4	48.8	44.8	40.0	35.2	30.2
Center ^c	56.4	53.6	50.6	47.0	41.8	36.2
Gulf ^d	59.2	55.8	50.4	45.9	39.8	35.0
South Pacific ^e	63.0	61.0	58.1	56.5	50.7	46.1
(Center without Federal District)	60.1	57.4	54.3	50.1	45.1	38.9
(Federal District)	20.0	16.2	14.1	11.2	8.8	8.8

^aBaja California, Baja California Territory, Nayarit, Sinaloa, Sonora.

^bChihuahua, Gahuila, Durango, Nuevo Leon, San Luis Potosi, Tamaulipas, Zacatecas

^cAguascalientes, Federal District, Guanajuato, Hidalgo, Jalisco, Mexico, Michoacan, Morelos, Puebla, Queretaro, Tlaxcala.

^dCampecho, Quintana Roo, Tabasco, Veracruz, Yucatan.

^eColema, Chiapas, Guerrero, Oaxaca.

Source: Wilkie, The Mexican Revolution, p. 297.

factors used will now be examined. First, I will focus on what might be called operational works: those farming units which are autonomous in terms of decision making regarding unit operation. There may still be governmental, legal, or community restrictions on a given unit in terms of decision making. These units are used in order to eliminate hired labor and additional members of families.

The North Pacific of Mexico has three different kinds of land-holdings. First are ejido lands. Ejidos are unique institutions which represent a government grant for the use of a parcel of land to an entire community. They may be operated collectively or broken down into more or less separate holdings for operational purposes. Individual ejiditarios may not sell the lands of the ejido; their individual property rights involve only use of the land. In the following discussion of operating farm units, I will consider each ejiditario who works a plot to be a farm unit. The second type of land-holding is the colony, which is an association of private farmers. These colony lands may or may not be operated in a collective manner, but once colonists obtain titles to their land, they may dispose of it in any manner they desire in most cases. Finally, those who own private lands, but do not belong to colonies, are called particulares. In the tables which follow, particulares and colonists will be included under the classification of non-ejidal or private works. Ejiditarios who work their own plots will be in a separate subdivision.

Ejiditarios are normally allowed by law to hold as many as ten hectares of non-irrigated land with the limit for private holdings at 100 hectares of non-irrigated land. Cotton and sugar holdings may exceed this limit to the extent of 150 and 300 hectares respectively. There are several ways in which these legal restrictions are avoided. Larger than

legal holdings have evolved in the North Pacific in many cases to meet the capital and operating costs of irrigated agriculture. In certain instances a private farmer will get around the legal limit by registering segments of his land under the names of other members of his family, or he may lease land to increase the size of his operation. Ejiditario plots may be increased as more of their land is brought under irrigation. Ejiditarios may sometimes rent out their individual parcels to others.⁴

More farming units in the North Pacific tend to be larger in size than in other parts of Mexico. Table 4-7 indicates the amount of cultivated area per operating farm unit. Average non-ejidal farm units in the North Pacific have larger amounts of cultivated land than the remainder of Mexico in all three census years, and the gap has been growing. Cultivated land per non-ejidal holding has grown by 152 percent over the twenty years shown, while cultivated land per holding has grown only by 70.5 percent in the remainder of Mexico. The cultivated area in North Pacific ejiditario plots is also greater than in the remainder of Mexico, and has increased by a greater amount over the twenty year period.

Table 4-7 does not indicate the very large skew in land holdings. The North Pacific has a relatively large number of very small holdings, co-existing with a smaller number of very large holdings. Table 4-8 gives a good comparison of the distribution of private farms by size in the two areas. If very small plots (minifundios) of less than five hectares are considered, the North Pacific has fewer plots in number and less area devoted to the small plots than the remainder of Mexico. Even in the North Pacific farms of five hectares or less account for 26.8 percent of the total private farms and occupy only 0.1 percent of the total

⁴D. A. Henderson, "Arid Lands under Agrarian Reform in Northwest Mexico," *Economic Geography*, XLI (October, 1965), 301-308.

TABLE 4-7
EXTENT OF CULTIVATED AREA PER FARM UNIT

	1940	1950	1960
<u>Cultivated area per unit</u> (hectares) ^a			
Non-ejidal works			
North Pacific	15.8	33.6	39.8
Remainder of Mexico	6.1	7.4	10.4
Ejiditario plots ^b			
North Pacific	8.3	10.1	12.1
Remainder of Mexico	5.6	6.2	6.4
<u>Percent change from 1940 to 1960</u>			
Non-ejidal works			
North Pacific		152.0	
Remainder of Mexico		70.5	
Ejiditario plots			
North Pacific		44.2	
Remainder of Mexico		13.4	

^aWorks without cultivated area counted.

^bOnly those ejiditarios who possess land.

Source: Same as Table 4-1.

private farm area. The North Pacific has more of the quite large plots above five hundred hectares, occupying more of the private farm area than the remainder of Mexico. In the North Pacific we find 11.7 percent of the private farms occupying 88.1 percent of the private area. These farms are all above five hundred hectares in size. This implies a greater incidence in the North Pacific of medium to large farms, with the very largest farms found in the rest of the country.

The large size of land holdings allows farmers to meet the high cost of capital and farm operations which tend to be associated with

TABLE 4-8

DISTRIBUTION OF PRIVATE FARMS BY SIZE, 1960

Farm Size in Hectares	North Pacific				Remainder of Mexico			
	Number	Percent	Area (has.)	Percent	Number	Percent	Area (has.)	Percent
5 or less	11,878	26.8	30,636	0.1	887,230	68.1	1,297,471	1.2
5.1-10	3,626	8.2	26,279	0.1	90,684	6.9	652,570	0.6
10.1-25	7,416	16.7	130,041	0.7	124,876	9.5	1,974,043	1.8
25.1-50	4,450	10.0	169,277	0.9	65,653	5.0	2,314,759	2.1
50.1-100	4,615	10.4	342,052	1.8	54,064	4.1	3,794,880	3.5
100.1-200	4,065	9.1	526,932	2.9	37,131	2.8	5,152,467	4.8
200.1-500	2,909	6.5	921,690	5.0	23,893	1.8	7,263,806	6.8
500.1-1000	2,248	5.0	1,441,782	7.9	8,441	0.6	5,899,079	5.5
1000.1-5000	2,367	5.3	5,386,268	29.6	7,042	0.5	16,636,898	15.6
greater than 5000	634	1.4	9,195,090	50.6	3,220	0.2	61,431,106	57.7
Total	44,208	*	18,170,048	*	1,302,234	*	106,417,085	*

*May not total 100 percent due to rounding.

Source: Mexico, 40. Censo Agricola Ganadero y Ejidal.

irrigated lands. These costs can be distributed over larger units of production. The increasing North Pacific orientation toward the commercial market, which I will return to later in the chapter, also favors larger farm units. Larger farm units can operate more efficiently and therefore compete more easily on the commercial market. There is thus an impetus for the legal and extra-legal formation of farm units larger than the legally designated size. I have already mentioned the large family combines, and the ways in which ejiditario plots have become larger than the legal size or have become concentrated in the hands of renter-operators. This change in size of farm units is contrary to the land reform philosophy.

The extent of mechanization in North Pacific agriculture will be treated also in the next section, but at this time I will illustrate the principal forms of power used. This is shown in Table 4-9. In the North Pacific 35.3 percent of the cultivated area censused used primarily animal power, compared to 75.6 percent for the remainder of Mexico. Cultivated area using primarily mechanical power for farming represented 25.3 percent of the cultivated area in the North Pacific, contrasted to only 6.0 percent for the remainder of Mexico. This information begins to indicate that agriculture in the North Pacific is more highly mechanized than in the remainder of Mexico, and this fact will become more evident when value of the machinery per person employed on the works is examined.⁵

Another way to look at the question of mechanization is to compare the value of machinery per average operating farm unit. This is shown in Table 4-10. This information indicates that the value of machinery per farm unit in the North Pacific as compared to the remainder

⁵See p. 115, Table 4-15.

TABLE 4-9
 FARM UNITS ACCORDING TO TYPE OF TRACTION EMPLOYED, 1960
 (Area in Hectares)

	Area	Percent of Total
Total Area		
North Pacific	2,162,047	
Remainder of Mexico	17,544,487	
Area using Animal Power		
North Pacific	763,817	35.3
Remainder of Mexico	13,264,879	75.6
Area using Mechanical Power		
North Pacific	547,267	25.3
Remainder of Mexico	1,060,199	6.0
Area using Mixed Power		
North Pacific	850,958	39.4
Remainder of Mexico	3,219,400	18.4

Source: Same as Table 4-1.

of Mexico has been consistently eight to twelve times greater for private farms and three to four times greater for ejidatarios who farm their own plots. From 1940 to 1960, the average value of farm machinery on private farms in the North Pacific increased at an average rate of approximately fifty-eight percent per year. The rate of increase on private farms for the rest of the country was thirty-nine percent per year. The value of farm machinery on the average ejidatario plot increased slightly faster in the rest of Mexico than in the North Pacific. The values are nine percent per year for the North Pacific and fifteen percent per year for the rest of the country. Again, many smaller farms in the North Pacific region are not mechanized, but the existence of a large number of highly mechanized commercial farms causes such a large difference in average value.

TABLE 4-10

VALUE OF FIXED CAPITAL, IRRIGATION FACILITIES,
AND MACHINERY PER FARM UNIT
(Pesos, 1954 as Base)^a

	1940	1950	1960
Value of fixed capital			
<u>per unit</u>			
Non-ajidal works			
North Pacific	24,594	45,629	122,579
Remainder of Mexico	6,109	13,374	24,299
Ejiditario plots			
North Pacific	7,313	13,361	18,589
Remainder of Mexico	3,803	7,320	10,111
Value of irrigation			
<u>facilities per unit</u>			
Non-ajidal works			
North Pacific	1,071	3,041	8,584
Remainder of Mexico	138	280	764
Ejiditario plots			
North Pacific	410	575	259
Remainder of Mexico	167	145	127
Value of machinery			
<u>per unit</u>			
Non-ajidal works			
North Pacific	1,326	6,262	16,711
Remainder of Mexico	155	617	1,360
Ejiditario plots			
North Pacific	573	902	1,068
Remainder of Mexico	142	259	550

^aIn this and all tables to follow, an index of major prices in Mexico City was used to adjust values to 1954 pesos.

Source: Same as Table 4-1.

Table 4-10 also indicates differences in fixed capital and irrigation facilities. The average value of fixed capital per farm, which includes such things as buildings, irrigation facilities, and roads, is significantly greater in the North Pacific for 1940, 1950, and 1960,

particularly for private farm units. Compare 122,579 pesos per private unit to 24,299 pesos in 1960, for a value five times as large in the North Pacific. Irrigation facilities, which are a component of fixed capital, represent an equally great bias in favor of the North Pacific where private farms had facilities valued at ten times the remainder of Mexico in 1960, and ejidos had facilities valued two times greater for an average plot. Some farms are also well irrigated and mechanized in other parts of Mexico, but in the North Pacific these types of farm units are much more common, making the average values per unit greater. Over the twenty year period from 1940 to 1960, the average value of private irrigation facilities increased thirty-five percent per year in the North Pacific and twenty-three percent per year in the rest of the country. Irrigation valuation on ejidal plots decreased at rates of 2.9 percent and 1.6 percent per year respectively. This seems to indicate more emphasis on private irrigation than ejidal in both areas. This distinguishes the entire North Pacific region as one of more highly mechanized and irrigated farms.

I have not yet shown anything specific about the manner in which inputs are combined, but certain conclusions can be made at this point. The "average" farm unit in the North Pacific tends to be larger in cultivated area, to contain more modern machinery, to consist of a greater amount of fixed capital, and to have a greater extent of irrigated area and a greater value of irrigation facilities than the average for the remainder of Mexico. The greater number of relatively more modern farm units would appear to be related to the establishment of a greater concentration of large scale commercialized agriculture in the North Pacific. Smaller, less mechanized plots would not have such a quantity of surplus beyond subsistence needs.

I will now examine the values of fixed capital, irrigation facilities, and machinery per cultivated hectare in the two regions. This information is shown in Table 4-11. Cultivated land on private farms in the North Pacific is associated with a greater value of fixed capital per hectare than in the rest of Mexico. The values were 3,080 and 2,336 pesos per hectare, respectively, in 1960. Interestingly enough, the value of fixed capital per hectare on ejidal lands was slightly less in the North Pacific at 1,536 pesos in 1960 compared to 1,580 pesos for the

TABLE 4-11
VALUE OF FIXED CAPITAL, IRRIGATION FACILITIES,
AND MACHINERY PER CULTIVATED HECTARE
(1954 Pesos)

	1940	1950	1960
<u>Value of fixed capital</u> <u>per hectare</u>			
Non-ejidal works			
North Pacific	1,556	1,358	3,080
Remainder of Mexico	1,001	1,807	2,336
Ejiditario plots			
North Pacific	881	1,323	1,536
Remainder of Mexico	679	1,181	1,580
<u>Value of irrigation</u> <u>facilities per hectare</u>			
Non-ejidal works			
North Pacific	60	90	216
Remainder of Mexico	23	38	73
Ejiditario plots			
North Pacific	49	57	21
Remainder of Mexico	30	23	20
<u>Value of machinery</u> <u>per unit</u>			
Non-ejidal works			
North Pacific	84	186	420
Remainder of Mexico	25	83	131
Ejiditario plots			
North Pacific	69	97	154
Remainder of Mexico	25	42	87

Source: Tables 4-7 and 4-10. Values per farm unit divided by average number of cultivated hectares per farm unit.

rest of the country. If the growth in fixed capital per hectare from 1940 to 1960 in the two areas is compared, it is apparent that the growth has been greater for both private and ejidal lands in the rest of Mexico. In the North Pacific the rates were ninety-eight percent for non-ejidal lands and seventy-four percent for ejidal lands. The values for the remainder of Mexico grew at a rate of 133 percent on both non-ejidal lands and ejidal lands.

The value of irrigation facilities per hectare for the North Pacific and the remainder of Mexico were 216 pesos and 73 pesos respectively for private lands, and twenty-one pesos and twenty pesos respectively for ejidal lands in 1960. The value on private farms grew at a rate of 218 percent in the North Pacific and 217 percent in the rest of the country from 1940 to 1960. On ejidal lands the values per hectare decreased by fifty-seven percent in the North Pacific and decreased by thirty-three percent in the rest of Mexico. These decreases might be the result of bringing previously non-farm lands around already existing projects under irrigation. It might also reflect a greater emphasis on irrigating private lands as opposed to ejidal lands. While the value of irrigation facilities per hectare is about the same in the two regions for ejidal lands, the value is three times greater for private lands.

A look at the value of machinery per hectare reveals that it is greater in the North Pacific for both private and ejidal lands. On private lands in 1960 the North Pacific had machinery valued at 420 pesos per hectare compared to 131 pesos per hectare for the rest of the country. On ejidal lands the figures were 154 pesos and 87 pesos per hectare respectively. This represents three times as much valuation on private lands and almost two times as much valuation on ejidal lands. A posi'dve

aspect for the remainder of Mexico is that machinery valuation per hectare again grew faster over the period from 1940 to 1960. In the North Pacific values increased by four hundred percent on private lands and 123 percent on ejidal lands. In the remainder of Mexico values increased by 424 percent on private lands and 248 percent on ejidal lands.

These results might indicate several things. First, the rest of the country started with less in terms of fixed capital, which includes irrigation facilities, and in terms of machinery than did the North Pacific. Growth may indeed be faster when a region starts with less. It is still apparent, on private lands at least, that the disparities in values per hectare were great enough in 1960 to raise questions about how long it would take the rest of the country to catch up. Second, on the basis of the disparities in machinery valuation on both private and ejidal lands, it seems reasonable to speculate that modern machinery plays at least as important a part on large commercial farms as does irrigation. Third, the disparities between regions are much greater for private lands than for ejidal lands. Fourth, within regions the values are always significantly greater for private farm lands than for ejidal farm lands.

Table 4-12 reflects the fact that the average farm unit in the North Pacific produces more agricultural production in value terms. In 1960, the average private farm unit in the North Pacific produced 8.34 times as much production and the average ejiditario produced 3.10 times as much production valued in pesos as their counterparts in the remainder of the country. Part of the reason for this difference is that there are more large farms in the North Pacific. In other words, this should not be confused with value of production per hectare, which I shall discuss next.

TABLE 4-12
 AGRICULTURAL PRODUCTION PER FARM UNIT
 (1954 Pesos)

	1940	1950	1960
<u>Total value of</u>			
<u>production^a (x 1000)</u>			
Non-ejidal works			
North Pacific	43,525	427,314	1,622,119
Remainder of Mexico	375,784	2,799,550	6,903,550
Ejiditario plots			
North Pacific	46,820	322,294	958,911
Remainder of Mexico	361,604	1,591,512	4,910,957
<u>Value of production</u>			
<u>per farm unit</u>			
Non-ejidal works			
North Pacific	6,443	22,327	42,489
Remainder of Mexico	1,435	3,559	5,095
Ejiditario plots			
North Pacific	2,736	5,639	7,734
Remainder of Mexico	1,314	1,690	2,492

^aNot in 1954 pesos--unadjusted.

Source: Same as Table 4-1.

In 1960 the value of agricultural production per hectare on private land in the North Pacific was over twice that of the remainder of Mexico. Table 4-13 shows this information. From 1940 to 1960, this figure increased 162 percent in the North Pacific. This can be compared to an increase of 108 percent in the rest of the country. There is also a disparity on land found in ejiditario plots with 639.2 pesos per hectare for the remainder of the country. Growth rates in the case of ejidos were ninety-four percent in the North Pacific and sixty-six percent in the rest of Mexico. Farm land in the North Pacific produces a greater yield than its counterpart in the rest of Mexico, and the difference in yield between the two regions has continued to widen. Despite the decreasing differential

TABLE 4-13
 AGRICULTURAL PRODUCTION PER CULTIVATED HECTARE
 (1954 Pesos)

	1940	1950	1960
<u>Value of production</u> <u>per hectare</u>			
Non-ejidal works			
North Pacific	407.8	664.5	1,067.6
Remainder of Mexico	235.2	480.9	489.9
Ejiditario plots			
North Pacific	329.6	558.3	639.2
Remainder of Mexico	234.6	272.6	389.4

Source: Tables 4-7 and 4-12.

in machinery and fixed capital between the two regions, the farms in the North Pacific seem to have greater access to yield increasing technology such as new seeds, culture practices, fertilizers, etc., provided by extension agents and foreign companies operating in that region.

The need for exercising great care in interpreting this data cannot be emphasized too strongly. The use of averages hides the fact that there are a great many subsistence farms in all of Mexico. This type of computation might tempt the reader into believing that the "average" farm unit really exists and is a common occurrence. The use I have been making of averages is a crude method for showing that a given region contains more farm units with certain characteristics than some other region. Table 4-8 indicates the presence of a great inequity in land distribution for both regions. But notice that a larger percentage of the total units are less than five hectares in the remainder of Mexico than in the North Pacific.

Differences in the Use of Factors

It is useful to have a feeling for differences in the size and value of farm units in the two regions. It is also helpful to know how capital and machinery are combined with the land. A more complete understanding of differences in the structure of agriculture, however, requires an understanding of the way in which man, the farmer, is combined with the other factors of land and capital. It is the purpose of this section to investigate this aspect.

Table 4-14 shows the cultivated area per person employed on the farms. The labor figure involves all persons of both sexes over fifteen years of age employed on private and ejido farms, excluding day workers and peons on ejidos. The number of private and ejidal farm units were counted for works less than or equal to five hectares. In 1960, the average private laborer worked on 6.24 hectares of cultivated land in the North Pacific and 4.58 hectares in the rest of the country. The average worker on ejido lands was combined with 7.65 hectares in the North Pacific and 3.83 hectares elsewhere. The large land area per worker on ejidos in the North Pacific probably stems from the fact that ejidos are not characterized by minifundias to as great an extent. If the data could be broken down further the nature of modern agriculture leads me to believe that it would show an even greater amount of cultivated area per worker on the larger, more modern farms in both regions. But this and the remaining data to follow in this section are sufficient to show that significant differences in the use of factors do exist between the regions.

The average farm worker works on a larger unit of cultivated land in the North Pacific. He is also combined with a greater amount of agricultural machinery and fixed capital which includes irrigation facilities.

TABLE 4-14
 NUMBER OF CULTIVATED HECTARES PER PERSON
 EMPLOYED ON THE WORKS

	1940	1950	1960
<u>Non-ejidal</u>			
North Pacific	7.34	7.92	6.24
Remainder of Mexico	3.92	4.09	4.58
<u>Ejidos</u>			
North Pacific	5.74	6.90	7.65
Remainder of Mexico	4.31	4.05	3.83

Source: Number of persons employed from Table 4-2; cultivated land from Mexico, 2o., 3er., 4o. Censo Agrícola Ganadero y Ejidal.

This is shown in Tables 4-15 and 4-16. Since 1950, the value of machinery per worker on private farms has been from four to six times the value in the rest of the country. The difference on ejidos was less (around three times) although still significant.

An examination of the trends of this labor-machinery mix over time produces some interesting results. On private farms the value of machinery per worker in the North Pacific has increased at an average rate of approximately sixteen percent per year, while it has increased at a rate of twenty-five percent per year in the rest of the country over the twenty year period. The fact that the differential between the two is declining might be attributed to population growth and in-migration, both of which took place in the North Pacific during the twenty year time period. On ejido farms the differential in the labor-machinery mix remained about the same with the value of machinery per worker increasing at an average rate of about ten percent per year for both areas. In 1960 the value of fixed capital per non-ejidal worker was 19,216 pesos in the

TABLE 4-15
 VALUE OF FARM MACHINERY PER WORKER
 (1954 Pesos)

	1940	1950	1960
<u>Non-ejidal workers</u>			
North Pacific	615	1,476	2,620
Remainder of Mexico	100	339	601
<u>Ejidal workers</u>			
North Pacific	393	668	1,176
Remainder of Mexico	113	171	332

Source: Number of persons employed from Table 4-2, value of farm machinery from Mexico, 2o., 3er., 4o. Censo Agricola Ganadero y Ejidal.

TABLE 4-16
 VALUE OF FIXED CAPITAL PER WORKER
 (1954 Pesos)

	1940	1950	1960
<u>Value of fixed capital per worker</u>			
<u>Non-ejidal workers</u>			
North Pacific	11,397	10,754	19,216
Remainder of Mexico	3,900	7,372	10,750
<u>Ejidal workers</u>			
North Pacific	5,038	9,091	11,703
Remainder of Mexico	2,925	4,815	6,008
<u>Value of irrigation facilities per worker^a</u>			
<u>Non-ejidal workers</u>			
North Pacific	498	716	1,345
Remainder of Mexico	88	153	338
<u>Ejidal workers</u>			
North Pacific	280	392	163
Remainder of Mexico	130	95	76

^aValue of irrigation facilities is a component of value of fixed capital.

Source: Number of persons employed from Table 4-2, value of fixed capital from Mexico, 2o., 3er., 4o. Censo Agricola Ganadero y Ejido de Los E.U.M.

North Pacific and 10,750 pesos in the rest of the country. For ejido workers the values were 11,703 pesos and 6,008 pesos respectively.

If these figures are examined over time, it again appears that the private farm differential between the North Pacific and the rest of the country is decreasing. The value of fixed capital per worker increased at an approximate rate of 3.4 percent per year from 1940 to 1960 in the North Pacific. The rate of increase for private farms in the rest of the country was 8.8 percent per year, over twice as fast. As before; this might be explained by population growth, in-migration, and the fact that there are more opportunities for increasing fixed capital in capital poor areas of Mexico than in the North Pacific. If these rates remained constant it would still take generations for the rest of the country to catch up with the North Pacific. Fixed capital per worker on ejidal farms grew at an average rate of 6.6 percent per year in the North Pacific and at 5.3 percent per year in the remainder of the country.

In terms of machinery and capital this information seems to indicate that modern agriculture is significantly more common in the North Pacific region than in the remainder of Mexico. Modern agriculture usually implies a greater land to labor ratio and capital to labor ratio, because it takes advantage of modern machinery and newer agricultural techniques such as large, efficient irrigation systems. As the capital to labor ratio increases, so will the land to labor ratio through substitution.

Table 4-17 reflects the existence of larger irrigated farm units in the North Pacific. The area irrigated per user is 16.9 hectares in the North Pacific, almost four times more than the 4.3 hectares irrigated per user in the remainder of the country.

TABLE 4-17
 WATER DISTRIBUTED PER USER AND
 AREA IRRIGATED PER USER, 1960

	North Pacific	Remainder of Mexico
Number of users	41,046	216,902
Area irrigated (Has.)	693,483	923,116
Volume distributed (M ³)	7,985,038	10,613,273
Area irrigated per user	16.9	4.3
Volume distributed per user	194.5	48.9

Source: Same as Table 4-1.

In summary, more farm units are apt to be larger, to have more capital, and to be extensively irrigated in the North Pacific. Within these farm units we are also apt to find the use of modern techniques. These techniques include large proportions of the factors of land and capital, and smaller proportions of labor in combination. Reasoning one step further would lead us to expect greater productivity on the part of this worker, since he appears to be combined more favorably with the other factors.

The determination of whether this implication is correct will rely upon the information given in Table 4-18. This table measures the average net agricultural value product per producer (the owner or manager) and per person employed. The net agricultural value product figure includes the total value of agricultural, livestock, and forest production minus all cash outlays, excluding day-wages and the administrative

TABLE 4-18
DISTRIBUTION OF NET AGRICULTURAL VALUE PRODUCT
(1954 Pesos)

	1940	1950	1960
<u>Net Agricultural</u> <u>value product (x 1000)^a</u>			
North Pacific	864,808 ^b	1,165,484	1,883,697
Remainder of Mexico	7,237,121	8,016,802	11,404,458
<u>Average net value</u> <u>product per producer</u>			
North Pacific	8,130	9,974	14,017
Remainder of Mexico	3,100	3,051	4,168
<u>Average net value product</u> <u>per person employed</u>			
North Pacific	4,833	4,204	5,139
Remainder of Mexico	2,159	1,828	2,257

^aIncludes value of agricultural, livestock, and forest production minus all cash outlays, excluding day-wages and administrative costs.

^bForest production for 1939.

Source: Same as Table 4-1.

costs. In 1960, the average net value product per person employed was 5,139 pesos in the North Pacific and 2,257 pesos in the rest of Mexico. The average net value product per producer in this year was 14,017 pesos in the North Pacific and 4,168 pesos in the other areas. This table also illustrates that the average net value product per person employed and per producer in constant terms has increased by a greater amount in the North Pacific in both census years since 1940. Perhaps this is due to greater levels of investment in this region.

Table 4-19 combines the information concerning the irrigated area per person employed, the value of irrigation facilities per person employed,

TABLE 4-19

IRRIGATED AREA PER PERSON EMPLOYED, VALUE OF IRRIGATION
FACILITIES PER PERSON EMPLOYED AND AVERAGE NET VALUE
PRODUCT PER PERSON EMPLOYED
(1954 Pesos)

	1940	1950	1960
<u>Irrigated area per person employed (has.)</u>			
North Pacific	2.3	2.4	3.0
Remainder of Mexico	0.4	0.4	0.5
<u>Value of irrigation facilities per person employed (posos)</u>			
North Pacific	372	581	884
Remainder of Mexico	109	127	212
<u>Average net value product per person employed</u>			
North Pacific	4,833	4,204	5,139
Remainder of Mexico	2,159	1,828	2,257

Source: Same as Table 4-1.

and the average net value product per person employed. It shows that these figures are increasing together, but does not imply any direct relationships, even though they are certainly related indirectly in ways that have already been discussed. Over the twenty year period from 1940 to 1960, irrigated area per person employed increased thirty percent in the North Pacific and twenty-five percent in the rest of Mexico. Value of irrigation facilities per person employed increased 138 percent in the North Pacific and about 4.5 percent for the rest of the country. The average net value product per person employed did not increase to a significant extent in either area. Nor was there any clear cut unexplained residual increase on the basis of increase in value or irrigation

facilities per person, or irrigated area per person employed. These results make it hard to evaluate the magnitude of irrigation investment on the basis of this data. In summary, I have shown that the average net value product per producer and worker is significantly larger in the North Pacific than in the remainder of Mexico.

Cotton, wheat, tomatoes, and maize are four important North Pacific crops which are also produced in other parts of the country. Table 4-20 compared yields of these crops between regions and gives an indication of what proportion of the area harvested in the crops was on irrigated land. Cotton and wheat were raised on a high percentage of irrigated land in both regions. With the exception of cotton in 1950, the yields were always greater in the North Pacific. Tomatoes were harvested almost entirely on irrigated lands in the North Pacific in 1960, and only on about forty percent irrigated lands in the rest of Mexico. Here again there is a significant difference in yield. The proportion of the area in maize harvested on irrigated land was seventeen percent in the North Pacific and eight percent in the remainder of Mexico. In this case also, yields were higher in the North Pacific. These and the other results illustrate that irrigation has not been the sole factor of importance, but rather a very necessary part of an agricultural system that is more extensive, mechanized, highly irrigated, and productive in the North Pacific.

Government investment in irrigation has been a crucial part of the growth process of the commercial agricultural sector in the North Pacific. It has allowed modernization to proceed by overcoming the water restraint. Indeed, I have mentioned that some of the modernization has been induced by irrigation, in order that the farmers might be able to

TABLE 4-20
 YIELDS OF COTTON, WHEAT, TOMATOES, AND MAIZE
 (kg. per Ha.)

	1940	1950	1960
<u>Cotton</u>			
<u>Percent of area harvested</u>			
<u>on irrigated land</u>			
North Pacific	----	----	84
Remainder of Mexico	----	----	80
<u>Yields</u>			
North Pacific	924	930	1,549
Remainder of Mexico	775	966	1,267
<u>Wheat</u>			
<u>Percent of area harvested</u>			
<u>on irrigated land</u>			
North Pacific	----	85	84
Remainder of Mexico	----	74	58
<u>Yields</u>			
North Pacific	1,121	1,210	1,618
Remainder of Mexico	688	857	1,168
<u>Tomatoes</u>			
<u>Percent of area harvested</u>			
<u>on irrigated land</u>			
North Pacific	----	----	92
Remainder of Mexico	----	----	41
<u>Yields</u>			
North Pacific	2,174	6,775	6,779
Remainder of Mexico	3,606	4,677	4,688
<u>Maize (comun Solo)</u>			
<u>Percent of area harvested</u>			
<u>on irrigated land</u>			
North Pacific	----	----	17
Remainder of Mexico	----	----	8
<u>Yields</u>			
North Pacific	----	1,041	1,209
Remainder of Mexico	----	780	823

Source: Same as Table 4-1.

fully utilize the irrigated lands and to afford the costs of irrigating. This brings me back to the discussion in Chapter One about social overhead capital versus directly productive activities as alternative investment strategies. It appears that in the case of the North Pacific, SOC in the form of irrigation investment has indeed acted to induce further private investments toward the end of modernizing agriculture.

Differences in Productivity Residuals

The growth of productivity can be described as that growth in output which is unexplained by the growth of land, labor and capital inputs. Strictly economic criteria would dictate that public investment should be channeled into those areas where the growth in productivity is likely to be the greatest. Table 4-21 shows that from 1929 to 1959 in the North Pacific the amount of growth unexplained by inputs was the smallest of all the other regions, at 0.2 percent. In the years 1929 to 1949, the North Pacific experienced a negative productivity residual, particularly from 1939 to 1949, when the residual ranged from -3.2 to -3.5 percent depending upon whether the labor shares of value added were estimated to be sixty, fifty, or forty percent respectively. However, from 1949 to 1959, the productivity residual in the North Pacific ranged from 5.8 to 6.1 percent, by far the highest of any region in the nation.⁶ This was a period of heavy irrigation investment. It is still necessary to raise the question concerning the justification of such heavy irrigation investment in the North Pacific. The growth of output unexplained by inputs is the highest in the labor-intensive South Pacific region at 2.8 percent from 1929 to 1959. Would equally heavy irrigation investments

⁶Clark W. Reynolds, The Mexican Economy: Twentieth-Century Structure and Growth (New Haven and London: Yale University Press, 1970), pp. 122-123.

TABLE 4-21

THE GROWTH OF MEXICAN CROP PRODUCTION, INPUTS,
AND PRODUCTIVITY, 1929-59
(Compound annual growth rates)

	Growth of Output	Growth of Inputs	Growth "Unexplained" by Inputs of Labor, Land, and Capital (1 minus 2)
North	5.0	4.2	0.8
Gulf	4.5	2.7	1.8
North Pacific	5.8	5.6	0.2
South Pacific	5.7	2.9	2.8
Center	3.5	1.8	1.7
Mexico	4.5	3.2	1.3

Source: Clark W. Reynolds, The Mexican Economy: Twentieth-Century Structure and Growth (New Haven and London: Yale University Press, 1970), p.124.

in the South Pacific or some other region have produced even larger unexplained productivity residuals?

Donald K. Freebairn states that there is no reason to assume that the historical distribution of resources was an optimal one. He is very specific in stating that irrigation investments have been concentrated in the peripheral regions of the country. In addition, credit is channeled to a small proportion of farms and heavily into those regions which have most of the irrigation works. Agricultural research activities have been concentrated on a limited number of crops, and particularly for production on irrigated acreages. Fertilizer application has been mainly for cotton, wheat, and sugar cane. These crops are grown on commercial farms. Use of fertilizers has been further concentrated in irrigation districts. He concludes that public policy has served to develop a new and commercial agricultural sector in unsettled regions. Attempts to modernize and reform traditional agriculture have been very few.⁷

⁷Donald K. Freebairn, "The Dichotomy of Prosperity and Poverty in Mexican Agriculture", Land Economics, XLV (February, 1969), 31-42.

The great increase in productivity from 1949 to 1949 may represent the fact that the returns on irrigation investment are delayed, but are considerable once they start being realized. This statement would have to be judged by weighing alternative investments with shorter gestation periods against the longer gestation periods of large scale irrigation investments and other advantages of these investments such as higher propensities to save and invest in the North Pacific, longer growing seasons, and greater productivity increases for fertilizer and new seed varieties on irrigated lands. Some good alternative investments to irrigation might be roads, communications, and education. These seem to have played a large part in the greater agricultural productivity increases experienced in other, more labor-intensive regions in Mexico.⁸

In conclusion, if potential increases in productivity and short gestation periods were to be the primary criterion for public investment in agriculture, the level of investment in irrigation in the North Pacific was probably too high. This once again suggests the operation of other possible goals or criteria, and these will be mentioned in the "Conclusion".

⁸Reynolds, The Mexican Economy, pp. 126-128.

CONCLUSION

The central theme of this thesis has been to examine public investment policies in the context of the Mexican experience. In Chapter Two I pointed out the fact that Mexico's record of economic development has been impressive enough to gain world wide attention. In this second chapter I explained some of the ways in which the expanding agricultural sector has contributed to the overall development of the Mexican economy. The success of the agricultural sector has depended heavily upon the fact that it received much governmental attention. The first very important step was, of course, the land reform which began after the Revolution. Government participation did not stop here, but also involved the provision of credit, price supports, investments in transportation, and finally, irrigation investments which accounted for the majority of public funds invested in agriculture. Having established the importance of agriculture, I investigated several aspects of the government's role in irrigation, since direct public investment in irrigation was so important.

The nature of the Mexican political system is such as to give each president very comprehensive control over the policies of his administration. But he is also restricted by the past policies and commitments of other presidents. Since the Revolution, presidential policy has evolved from greater administrative emphasis to social emphasis, economic emphasis, and finally to an attempt at greater balance between the three which was

not entirely successful. The SRH has evolved with the tasks of planning and promoting the construction and maintaining the works.

Chapter Four has suggested that public investment policies concerning irrigated agriculture in the North Pacific have helped spur the formation of a capital intensive, commercial agricultural sector in that region. These commercial farms are large by present Mexican standards, in many cases exceeding the legal size limits. So far the Mexican government has accepted these conditions. In order to make this form of irrigated agriculture profitable, it may indeed be necessary to allow for mechanization and large farm unit size in order to spread the costs as mentioned earlier.

I will now examine the Mexican irrigation investment policy in the North Pacific using some of the investment criteria discussed in Chapter One. The purpose will be to see what help the established body of theory can provide in evaluating the Mexican irrigation investment policy.

First, the balanced growth theory implies the superimposition of a modern economy upon a traditional one in the sense that a large, interconnected series of investments need to be made. In Mexico, investment in irrigation has helped create a modern commercial agricultural sector alongside a traditional, non-mechanized agriculture characterized by minifundios. But the rest of the series of investments called for by the balanced growth theory were not made. Irrigation development in the North Pacific seems to better fit the criteria for unbalanced growth theory. Irrigation investment helped the agricultural sector to take advantage of unexploited markets such as the export market. These unexploited markets would not exist according to the balanced growth thesis, which assumes that market demand must be created as part of the investment policy.

Improving the vitality of the agricultural sector created the demand for a whole range of inputs from fertilizers and insecticides to agricultural machinery. Thus a relatively modern agricultural sector such as that in the North Pacific might be classified as having served as one of Rostow's primary growth sectors, providing the external economies and other secondary effects to carry forward other segments of the economy.

Irrigation expenditures represent investment in social overhead capital (SOC) which serves to create inducements for private investment in directly productive activities (DPA).. This "permissive" investment would necessarily be expected to spur directly productive activities in agriculture and other related support industries such as the machinery and fertilizer. In the case of irrigation in the North Pacific, the SOC must first be present as a prerequisite for the development of large scale efficient agriculture.

There can be little doubt but that irrigation investments have provided economic incentives for increasing the activities in other related sectors. But what about making choices between potential irrigation projects in different regions, and between other alternatives for public funds than irrigation? I do not believe that any method resembling a benefit-cost analysis was used. The earlier discussion in Chapter One suggested that benefit-cost analysis might be useful in choosing between alternative irrigation projects, but not between irrigation and other forms of investment with widely different capital intensities, gestation periods, and life spans. In addition, assumptions such as full employment are not met. If benefit-cost analysis had been used to choose between potential irrigation projects throughout the entire country, patterns of irrigation development may well have been different from those which developed in practice.

Another more sophisticated method of choosing between projects would be similar to Chenery's proposal to consider the difference between value added and costs, but also including in the equation some other desirable goal such as the balance of payments, regional balances of income, or length of time for investment yields. The problem is that such economic criteria often take second seat to political factors even in economically developed countries such as the United States. It is not surprising that a country like Mexico would have problems trying to implement such an economic method for making choices.

Polak's idea of maximizing the rate of return, the output to capital ratio, would have dictated the need to invest in those projects with the shortest gestation periods or the highest potential for increasing productivity, or both. This type of criteria would not automatically maximize growth over a longer time span, but would have allowed the effects to be felt earlier, and possibly on a more equitable basis in the case of Mexico. It would also have minimized the short run use of those capital goods which are usually in shortest supply in less developed countries. At any rate, the capital-intensive irrigation projects found in areas like the North Pacific would likely have not passed the test in many cases.

In line with the goal of minimizing the use of capital, Ragnar Nurkse's plan for using surplus labor for capital formation looks useful at first glance. The complex requirements for building the large irrigation projects which have received the greatest emphasis makes the plan unfeasible, however. These projects require the use of heavy machinery in many instances, and surplus, untrained labor would not meet the skill requirements very effectively. Smaller scale irrigation projects in more populated areas of the country might have presented greater opportunity

for the implementation of this plan, but there would be much disagreement for the same reasons even in this case. It is possible to conclude that the technical requirements and sheer engineering feats required for larger projects would not have been so great in most instances of smaller projects. They would, as a result, have economized upon scarce human talent as well as scarce capital, and would have provided an opportunity to try out Nurkse's plan.

Finally, I mentioned the conflict between maximizing efficiency criteria such as present and future rates of growth and improving inter-regional and intraregional income distribution. In terms of irrigation investments in the North Pacific, it has not been established whether the amount of net "general reinvestment" was likely to have been maximized by the capital-intensive projects. This might be an interesting avenue for further study. The social poverty index shows that if reducing regional inequalities in income had been a major goal in determining where to invest in irrigation, other areas of the country would have received most of the available funds, since the North Pacific has traditionally been relatively high in terms of welfare.

Reducing regional income disparities or maximizing future rates of growth were probably not the criteria used in choosing the North Pacific as a site for major public investment. Rather, the desire to increase available agricultural lands in an area that would not be plagued by the minifundio problem is a more reasonable suggestion, along with the desire to establish a modern agricultural sector with its advantages. A modern commercial agricultural sector would represent great potential for export earnings. For example, at the end of the Second World War, Mexico was indeed in a favorable position to capture a much larger than previous

portion of the world market for cotton. Foreign exchange earnings from agricultural imports were credited earlier in this thesis for having helped meet Mexico's irreducible import needs. Another possible reason behind the historical pattern of investment could have been the technical challenge for ambitious engineers of large, grandiose projects. The political need for highly visual monuments to governmental development efforts may also have operated. In addition, political pressures from the northern regions may have been felt strongly at various times. Finally, Mexico may still experience a remnant of that old wish to develop the sparsely settled areas which are adjacent to the United States.

There were other alternatives in the past to the pattern of irrigation investment which developed over the years. But these alternatives were not large in number given the government's goal of developing a viable agricultural sector. Agricultural lands constitute a small percentage of Mexico's total land area. Where the land is suitable for agriculture, water is a major constraint. There is in many cases either too little, too irregular, or too large a supply of water. Thus the control and wise use of Mexico's water resources was essential in order to meet the agricultural needs of an expanding population. Within this very important constraint the government could have chosen to alter either the geographical location of the projects, their physical scale, or both. Altering the geographical location to poorer, more highly populated regions would most likely have also necessitated the alteration of their physical scale. A whole host of new problems such as distribution of the water may have arisen in addition. Attempting to improve agriculture in the highly populated regions might also have required reallocating some funds from the actual irrigation projects into other areas such as exten-

Evidence presented in this thesis indicates that increases in productivity per dollar invested might have been greater in this alternative agricultural investment plan. A capital-intensive modern agricultural sector superimposed upon a neglected traditional sector which harbors most of the rural population, may not have been the best answer. It is reasonable to assume that export earnings from agricultural products would not have been of such an impressive magnitude. But this loss would have been offset by increased economic well being for larger numbers of Mexican people in the long run. There might also have been, as a result of a more equal distribution of income, an expanded domestic market for manufactured products. Chances for long term political stability may also have been improved, as social unrest in rural areas is in evidence. Regardless of past policies, the future in Mexico may call for an end to large scale irrigation projects in favor of more investments in smaller scale projects in the highly populated areas, with additional investments in other aspects of agriculture such as extension and research.

I will close by suggesting several additional possibilities for research that have occurred to me. First, a much more detailed comparison between large and small scale irrigation projects should be made. This would examine productivity, factor ratios, and social welfare. In addition, an investigation into the actual political factors of the choices made would be helpful. Such an investigation might reveal that certain groups had a disproportionate influence in the decision making process, to the detriment of the entire country. Third, what is an optimal size farm under various geographical, social, and demographic conditions in Mexico? Just how much can be done to increase productivity

on the very small plots? Finally, using economic criteria such as those which I have discussed, what would the best investment policies be in the future?

BIBLIOGRAPHY

BOOKS

- Agarwala, A. N. and S. R. Singh, eds. The Economics of Underdevelopment. New York: Oxford University Press, 1963.
- Alpert, Paul. Economic Development. London: Collier-Macmillan Ltd., 1963.
- Barkin, David and Timothy King. Regional Economic Development: The River Basin Approach in Mexico. New York: Cambridge U. Press, 1970.
- Eckstein, Otto. Water-Resource Development: The Economics of Project Evaluation. Cambridge: Harvard University Press, 1958.
- Enke, Stephen. Economics for Development. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963.
- Freithaler, William O. Mexico's Foreign Trade and Economic Development. New York: Praeger, 1968.
- Greenberg, Martin Harry. Bureaucracy and Development: A Mexican Case Study. Lexington, Mass.: D. C. Heath and Co., 1970.
- Hirschman, Albert O. The Strategy of Economic Development. New Haven: Yale University Press, 1958.
- Leibenstein, Harvey. Economic Backwardness and Economic Growth. New York: John Wiley and Sons, Inc., 1957.
- Meier, Gerald M. Leading Issues in Economic Development: Studies in International Poverty. New York: Oxford University Press, 1970.
- Morgan, Theodore, George W. Betz, and N. K. Choudhry. Readings in Economic Development. Belmont, California: Wadsworth Publishing Company, Inc., 1963.
- Nurkse, Ragnar. Problems of Capital Formation in Underdeveloped Countries. New York: Oxford University Press, 1953.
- Reynolds, Clark W. The Mexican Economy: Twentieth-Century Structure and Growth. New Haven and London: Yale University Press, 1970.

- Rostow, W. W. The Stages of Economic Growth. New York: Cambridge University Press, 1960.
- Scott, Robert E. Mexican Government in Transition. Urbana: University of Illinois Press, 1964.
- Singer, H. W. International Development: Growth and Change. New York: McGraw-Hill, 1964.
- Spiegelglas, Stephen and Charles I. Welsh, eds. Economic Development: Challenge and Promise. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1970.
- Tucker, William P. The Mexican Government Today. Minneapolis: University of Minnesota Press, 1957.
- Venezian, Edwardo L. and William H. Gamble. The Agricultural Development of Mexico: Its Structure and Growth Since 1950. New York: Praeger, 1969.
- Vernon, Raymond. The Dilemma of Mexico's Development: The Roles of the Private and Public Sectors. Cambridge: Harvard University Press, 1963.
- _____, ed. Public Policy and Private Enterprise in Mexico. Cambridge: Harvard University Press, 1964.
- Wilke, James W. The Mexican Revolution: Federal Expenditure and Social Change Since 1910. Berkeley: University of California Press, 1970.

ARTICLES

- Bhatt, V. V. "Some Notes on Balanced and Unbalanced Growth." Economic Journal, LXXV (March, 1965), 88-97.
- Chenery, H. H. "The Application of Investment Criteria." Quarterly Journal of Economics, LXVII (February, 1953), 76-96.
- Freebairn, Donald K. "The Dichotomy of Prosperity and Poverty in Mexican Agriculture." Land Economics, XLV (February, 1969), 31-42.
- Henderson, D. A. "Arid Lands under Agrarian Reform in Northwest Mexico." Economic Geography, XLI (October, 1965), 300-12.
- Kahn, A. E. "Investment Criteria in Development Programs." Quarterly Journal of Economics, LXV (February, 1951), 38-61.
- Maass, Arthur. "Benefit-Cost Analysis: Its Relevance to Public Investment Decisions." Quarterly Journal of Economics, LXXX (May, 1966), 208-26.

- McGuire, Martin G. and Harvey A. Garn. "Integration of Equity and Efficiency Criteria in Public Project Selection." Economic Journal, LXXIX (December, 1969), 882-93.
- Malenbaum, Wilfred. "Government, Entrepreneurship, and Economic Growth in Poor Lands." World Politics, XIX (October, 1966), 52-68.
- Mendoza-Berrueto, E. "Regional Implications of Mexico's Economic Growth." Weltwirtschaftliches Archives, CI (September, 1968), 87-124.
- Parks, Richard W. "The Role of Agriculture in Mexican Economic Development." Inter-American Economic Affairs, XVIII (Summer, 1964), 3-26.
- Polak, J. J. "Balance of Payments Problems of Countries Reconstructing with the Help of Foreign Loans." Quarterly Journal of Economics, LVII (February, 1943), 208-40.
- Strumthal, Adolph. "Economic Development, Income Distribution, and Capital Formation in Mexico." Journal of Political Economy, LXIII (June, 1955), 308.

PUBLIC DOCUMENTS

- Mexico. Secretaria de Agricultura y Ganaderia. Direccion General de Estadistica. Programa Nacional de Fertilizantes, Mexico, D.F.: Secretaria de Agricultura y Ganaderia, 1966.
- _____. Secretaria de Industria y Comercio. Direccion General de Estadistica. Ingresos y Egresos de la Poblacion de Mexico, Mexico, D.F.: Secretaria de Industria y Comercio, 1960.
- _____. Secretaria de Industria y Comercio. Direccion General de Estadistica. 2o., 3er., 4o. Censo Agricola, Ganadero y Ejidal de Los E.U.M., Mexico, D.F.: Secretaria de Industria y Comercio, 1940, 1950, 1960.
- _____. Secretaria de Recursos Hidraulicos. Direccion General de Distritos de Regio. Departamento de Estadistica y Estudios Economicos. Informe Estadistica, Mexico, D.F.: Secretaria de Recursos Hidraulicos, several issues.
- United Nations. Economic Commission for Latin America. Statistical Bulletin for Latin America, 1963.
- _____. Food and Agriculture Organization. Production Yearbook, Rome: Societa Grafica Romana, 1960.
- _____. Statistical Office. Statistical Yearbook, 1965.

U. S. Department of Agriculture. Economic Research Service. Sources of Change in Mexican Agricultural Production, 1940-1965, by Reed Hertford. Foreign Agricultural Economic Report No. 73. Washington, D.C.: Government Printing Office, 1971.

_____. Embassy to Mexico. Special Report on Mexico's Fertilizer Industry (mimeo.), April 21, 1966.

_____. OECD Development Centre. Development Problems, by Ian M. D. Little, Summary of papers at the Colombo Seminar, Paris, 1967.

UNPUBLISHED MATERIALS

Ramirez, Roberto Juarez. "La Obras de Riego y su Efecto en la Economia Nacional." Unpublished thesis, Universidad Nacional Autonoma de Mexico, 1967.

Venezian, Eduardo. "Income Distrubition and Agricultural Development in Mexico." Paper presented at the Ford Foundation Agricultural Program Seminar, Bogota, Columbia, November 6-9, 1968.

Walker, Donald Anthony. "The Role of Government in the Development of Mexico's Water Resources for Agricultural and Health Purposes." Unpublished Masters Thesis, University of Texas, 1956.