AN ECONOMIC EVALUATION OF KOREAN LAND USE POLICIES WITH SPECIFIC REFERENCE TO AGRICULTURE, 1965-1985

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USE POLICIES WITH SPECIFIC
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ABSTRACT

AN ECONOMIC EVALUATION OF KOREAN LAND
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1965-1985

By

Martin Edward Hanratty

Since 1962 the Korean economy has been expanding rapidly, drawing many thousands of rural residents into the nation's bustling cities. To keep pace both with the expanding urban population and to provide the infrastructure required by industry, the nation has been forced to convert substantial areas of prime agricultural land to nonagricultural uses.

In response to these conversionary pressures, a number of public policies have been adopted to control the speed, type, and direction of both agricultural and nonagricultural development. In many instances, due to the lack of adequate information, authorities have been forced to adopt specific policies without a careful consideration of alternatives.

To partially relieve this situation, the study examines the process of urban growth, reviews the various types of land use policies which have been adopted in countries around the world to control agricultural land conversion and examines and evaluates Korean land use policies adopted since 1948. In addition, the study develops a

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simple technique, using existing land use data, to project the quantity of agricultural land which might be required under various land use policy options in and around Korea's ten major cities during the 1975 to 1985 period. The options examined are exclusive agricultural zoning, a mixed paddy and upland zoning approach, and development in the absence of zoning. The costs of conversion, under each policy assumption, are assessed using estimates of land rent, reclamation costs, and site preparation costs.

In the examination of past land use policies, it was discovered that Korea has depended extensively on the exercise of police powers, especially zoning, to control conversion. In some instances, such as the exclusive paddy land zoning ordinance administered by the Ministry of Agriculture and Fisheries, the use of land is so restricted that the enforcement of the law verges on confiscation without the payment of just compensation.

With the strong emphasis being placed on zoning little use has been made of alternative land use policies, such as government ownership, spending, and taxation. Examining land taxation, the data suggests that urban property is generally undertaxed while rather substantial evasion is occurring in the payment of agricultural property taxes and in the registration of land converted from agricultural to urban uses. This latter problem has resulted in questionable and inaccurate land use data.

Due to rapidly rising real incomes and rather stable urban land prices, per capita land demand, in and around Korea's major urban areas, has been expanding since 1970. This horizontal growth is estimated to consume 75 thousand hectares of additional agricultural

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land, 45 thousand hectares of paddy and 30 thousand hectares of upland during the 1975-85 period. These losses would result in a minor decline in rice production of 19.4 thousand metric tons per year, 15 percent of the average annual increase, and the displacement of 80 thousand agricultural jobs and 10 billion won in agricultural income. The maximum cost of this conversion would reach 67.6 billion 1974 won, 12.3 billion in land rent, and 55.6 billion in reclamation costs. If only the converted paddy land lost were replaced, this latter cost would decline to 44.2 billion.

Examining the effects of conversion within a 20 kilometer radius of Busan, the research suggests that the limited land area available for development will preclude the effective enforcement of the exclusive paddy land zoning ordinance. While agriculture would be better off under this policy, losing 30 to 40 million per year, the nonagricultural sector, especially those groups concerned with urban development, would be much worse off. The research indicates that the most viable approach to zoning in this area would be a mixed zoning approach, which allows for the conversion of poorer quality paddy and upland.

The study concludes with a set of recommendations covering the formation of a central office of land use planning, suggested changes in the land use data retrieval and analysis system and the formulation of a new system of agricultural land use zones in and around urban centers.

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CHAPTER I

INTRODUCTION

The Problem

After a long period of economic stagnation, Korea has since the Korean War (1950-53), and above all since the adoption of the First Five-Year Economic Development Plan in 1962, been engaged in a rapid modernization process. A major portion of its public investment funds, both foreign and domestic, have been committed to the construction and development of basic infrastructure required for the expansion of light and heavy industry. Growth in the export-oriented manufacturing sector has been impressive. During the period from 1962 to 1974 the nation's Gross National Product has risen, on the average, 10 percent per annum. Industry's share of this productivity has increased from 12 percent in 1960 to 30 percent in 1974.

Rapid growth in industrial production has helped move Korea from a largely agricultural society to a semi-industrial country. New jobs, in industry and a wide array of supportive services, have lured thousands of persons from rural areas into the cities. This influx of rural immigrants, has resulted in the expansion of urban areas at an alarming rate. In the last five years alone, Seoul, the nation's capital has grown over 19 percent.

To provide land for the rapidly expanding industrial and urban services sectors, thousands of hectares of agricultural land have been converted to nonagricultural uses. During the period from 1968 to 1974 it was estimated that over 80,000 hectares were lost to agricultural production. This decrease in agricultural land base has occurred at a time when the demand for cereal grains,[1] precipitated by increases in per capita income, has been on the upswing. As a result food grain imports have risen from .547 million metric tons in 1962 to 2.821 million metric tons in 1974.

The substantial drain these imports have placed on foreign exchange in conjunction with a wildly fluctuating world grain market and repeated hostile overtures from North Korea have forced the Ministry of Agriculture and Fisheries to place greater and greater emphasis on the adoption and enforcement of policies which will limit agricultural land conversion. Over the last two years, several pieces of legislation dealing with agricultural land-use controls have been enacted with strong Ministry support. At first glance it appears that this legislation will not, by itself, be adequate to effectively meet the full range of problems which must be confronted. One major shortcoming is the lack of provisions in the existing legislation to meet changing conditions as they evolve over the long term. For example, the Ministry is beginning to enforce an exclusive agricultural zoning policy provided for in the most recent bill. This policy has been designed to stop any further conversion of rice acreage to urban uses. If properly executed it may exclude a substantial portion of the 480 thousand hectares of relatively flat paddyland from urban conversion, in and around the nation's 32 major urban

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[1]Cereal grains include rice, barley, wheat, and corn.

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areas. Such land is highly sought after by developers and speculators for urban uses, since the absence of slope minimizes construction costs for such items as grading and site preparation.

Few would argue that such a measure will not benefit the Ministry's efforts to decrease agricultural land conversion. How much of a positive benefit after enforcement and administrative costs are netted out is not known. Estimates of these costs need to be determined to allow the Ministry to proceed in classifying urban agricultural land-use plans. In addition, the Ministry must take into consideration the negative side-effects which may result from the implementation of alternative land-use policies. For example, the exclusion of a portion of the potentially useful land from the urban land supply via agricultural zoning is likely to generate substantial inflationary pressure on the already elevated price of urban land. These price effects in turn are likely to give rise to a number of adverse consequences. The occurrence of land speculation on unzoned acreage and the incidence of illegal transfer of zoned parcels is likely to increase. As the differential between the use-value of zoned agricultural land and its potential market-value increases, resentment of the urban and semi-urban farm population will grow. This lack of local grass-roots support and the substantial monetary gain which can be secured by evading the law will require the commitment of substantial resources to the administrative and enforcement functions of the legislation. Also, the Ministry is likely to come under increasing pressure to modify or abandon the zoning policy both from other ministries that require urban land to provide services and from private entrepreneurs who see expected higher development and operating costs necessitated by building on slopeland rather than paddyland as a threat to their profits. Estimates of the time and costs which will be required to confront these pressures are again unknown.

It is unfortunate that the Ministry of Agriculture and Fisheries has been forced to adopt such short term land-use policies. However, without basic information to explain the effects of alternative policies on production and prices and the costs of such policies their options are severely limited. Only when this information is available can the Ministry proceed in formulating a comprehensive national agricultural land-use program and take its rightful place as a leader in the development of a national land-use plan.

Study Objectives

In light of the inadequate supply of information available to land-use planners in the Ministry, the following study will attempt to:

1. Improve the understanding of Korean policymakers of the process of urban growth, how this process effects the spatial configuration of land conversion and what types of land-use policies have been adopted in other countries.
2. Develop a relative simple technique for determining the cost of land-use conversion.
3. Estimate the future loss of farmland to non-farm uses in selected urban areas.
4. Evaluate the impact of this loss on agriculture.
5. Evaluate alternative zoning policies to determine their impact on the physical and economic costs associated with this loss.

General Procedures Used in the Study

This wide range of objectives requires the use of a number of distinct but complementary research techniques. To fulfill the objectives of the study, this report:

1. Draws together the various theories, case studies and research findings that have had a significant impact on explaining the agricultural land conversion process. These include excerpts from areas such as developmental economics, regional science, land economics and land-use policy.

2. Presents a general description of the key components and interrelationships which make up the Korean real estate market. This description includes the physical characteristics of Korea's land base, a discussion of past conversion trends, and an analysis of the institutional arrangements which have been formulated to control the land market.

3. Estimates the amount of land that will be needed for nonagricultural uses in and around Korea's ten major urban centers from now to 1985. Using various assumptions concerning the location and form of these developments, estimates are constructed of the quantity and quality of land that is likely to be converted. Using this information in conjunction with yield estimates for various paddy and upland crops and crop mixes the study determines the effect that this conversion will have on agricultural production and how the estimates would be effected by alternative agricultural zoning policies. The zoning policies examined are: exclusive paddy-land zoning, a mixed upland and paddy-land zoning approach, and development in the absence of zoning.

4. Converts these physical impacts into costs to examine the overall costs of conversion and the cost savings associated with the various policies. Because of the complexities and sometimes the non-quantifiability of the costs associated with urban land conversion, the research does not attempt to measure the precise changes in national income which are likely to occur during conversion. It does, however, measure the differential site preparation costs which are required to convert paddy and upland to nonagricultural uses and the opportunity cost of the land in agricultural use.

5. Draws together the information on the institutional structure of the market and the various costs associated with conversion to form recommendations on future land-use policy.

The analysis conducted in the study examined future land conversion pressures during the ten year period from 1975 to 1985. Secondary data collected and tabulated by various Korean ministries, quasi-independent research units and international organizations is used in the analysis whenever possible.

Study Organization

In carrying out these objectives the remainder of the report is divided into six sections. The first, which corresponds to Chapter II, outlines various topics in the literature which have a bearing on the conversion process. Chapter III describes the evolution of the Korean economy over the past decade and attempts to examine what effects this growth has had on national and urban land-use patterns. Chapter IV presents a discussion of the major land-use policies which have been adopted by Korea since 1965 and attempts to determine their effect on land-use patterns. Chapter V sets down the methodology used in estimating future land demands and the procedures used in converting these demands into cost estimates. Chaper VI examines the effects that these demands are likely to have on agricultural production and the cost of providing urban services. Included in this section is an analysis of the effects that alternative policies would have on the estimated land demand and the cost associated with conversion. Chapter VII, reviews the findings, presents recommendations on the administrative structuring required for adequate land-use planning, and recommends future courses of investigation which will be required in designing such a system.

CHAPTER II

LAND USE CONVERSION AND CONTROL WITHIN THE CONTEXT OF GROWTH

Introduction

The problem of allocating scarce resources in land among many competing uses has generated more than ample public interest and problems for governments throughout the world. This is and has been especially true in developing countries where large populations are supported by a relatively small productive land base. As economic development occurs and per capita income rises, the flow of people from rural areas to towns and cities commences. This process intensifies the competition for land between urban and rural uses. At some point in time government intervention is required to control changes in land use so that the actions of individuals will not prejudice the employment or living conditions of other individuals or the community at large. The initiation, adoption and implementation of these controls always generate a considerable amount of controversy, both within and outside government.

To understand the nature of this competition, how it arises and the various types of controls which can be brought to bear on the problem, it is necessary to draw on a wide range of academic and practical disciplines for guidance. This chapter attempts to draw together these separate threads into a comprehensive examination of the conversion process. As with any complex problem of this nature, a rather arbitrary subdivision of the relevant subject matter is required. As such, the chapter is divided into three interconnected but distinct sections. The first, presents a brief review of selected dual and multiple sector simulation models which have been developed to examine the various resource flows which occur between the urban and agricultural sectors during growth. Section two, goes on to examine the role which land plays in this growth process placing special attention on the physical area where land use conflicts are likely to occur, the rural-urban fringe. This is followed in section three by a general discussion of government's involvement in land use planning and the various types of land use controls presently employed to control urban growth by governments in selected countries throughout the world.

Interactions Which Occur Between Agriculture and Urban Sectors During Economic Growth

Few would argue that cities have not been an important part of man's cultural landscape, almost since the dawn of civilization. Their beginnings can be traced to a variety of factors. Many began as religious centers, some as political capitals or homes of royal courts and others as fortified sites which afforded defense and military advantage in war. Over the years some have grown and expanded to become modern metropolises while others have stagnated and declined.

Many economists, too numerous to mention here, have viewed the city as the focal point of economic development. They explain the rise of cities in terms of man's desire to associate and congre

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congregate with others, to produce goods, and to live at sites that offer opportunities for income and access to consumer products. Cities have grown to serve rural hinterlands. Their rise has often been tied to production, transportation, and institutional factors and is often explained in terms of agglomeration economies and the principles of comparative advantage.[1]

Dual-Sector Models of Economic Growth

While the question of why cities grow is an important issue, of more concern to this study is the interactions which occur between the urban center and its agricultural hinterland during the process of growth. A large portion of the studies which have addressed this issue have attempted to examine and/or define the intersectoral resource transfers which occur during growth. For example, Schultz and Nichols, in their work on agricultural development, focus their efforts on identifying the beneficial effects that urban growth has on agricultural factor markets. The basic linkage between agriculture and urban growth is presented by Schultz in the form of two hypotheses. In the first he states that:

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[1]A variety of theories and hypotheses have been formulated to explain the location and growth of urban centers. For a basic discussion on the growth of cities, the reader is referred to Eric E. Lampard, "The History of Cities in Economically Advanced Areas," in Regional Development and Planning, ed. by John Friedman and William Alonso (Cambridge: Massachusetts Institute of Technology Press, 1964), pp. 318-44. A more detailed discussion of a wide variety of theories concerning urban location, urban growth and regional development can be found in Harry Richardson, Regional Economics (New York: Praeger, 1969), Edgard M. Hover, The Location of Economic Activity (New York: McGraw-Hill, 1949), and Hugh O. Norse, Regional Economics (New York: McGraw-Hill, 1968).

> Economic development occurs in a specific location matrix. . . . These location matrices are primarily industrial-urban in composition. . . . The existing economic organization works best at or near the center of a particular matrix of economic development, and it also works best in those parts of agriculture which are situated favorably in relation to such a center.[2]

In his second he posited that those parts of agriculture situated favorably related to an urban industrial center enjoy more efficient factor and product markets than those situated at the periphery. Nichols, in a summary of his and Tang's work in the Tennessee Valley, substantiates this idea in the following manner:

> . . . those counties that experienced differentially higher rates of industrial-urban development also enjoyed increasingly superior capital-labor ratios and labor productivity within their agriculture, while neighboring counties that lacked industrial-urban development also lagged behind on the agricultural side. These findings thus strongly support the view that local industrial-urban development makes an important positive contribution to the efficiency of the local factor and product markets, thereby greatly facilitating the transfer of excess labor from, and of needed capital to, agriculture, within the immediate environs of the growing industrial center.[3]

The in-sectoral flows of labor and capital which occur during development as outlined by Schultz and Nichols form the basis of a number of mathematical models which have been developed to monitor and explain the change which occurs in agriculture as a result of urban growth.

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[2]T. W. Schultz, The Economic Organization of Agriculture (New York: McGraw-Hill, 1953), p. 147.

[3]William H. Nichols, "Industrialization, Factor Markets and Agricultural Development," The Journal of Political Economy 59 (1961), 340.

One of the most notable formulations of this so-called "dual sector approach" has been formulated by W. Arthur Lewis.[4] He presents a basic two-sector, neoclassical economic model composed of a subsistence sector (not necessarily agriculture) characterized by the absence of capital investment and an advanced or capitalist sector where productivity is a function of capital and labor. Drawing on Marx's concept of an army of unemployed, he postulated an unlimited supply of labor residing in the subsistence sector. He assumed that the opportunity cost of alternative employment in this sector to be zero. This led to the very controversial point that the marginal productivity of labor (MP_L) in the subsistence sector was zero. He believed that the movement of labor from the subsistence to the capitalist sector was accomplished by the payment of an institutionally defined wage rate ($\overline{W}$) equal to the average productivity of labor (the subsistence wage rate) plus an additional increment sufficient to induce emigration. The driving force behind growth, as is the case with all classical formulations, was capital accumulation.

Lewis envisaged the development process as a series of interactions between the subsistence and capitalist sectors, with excess capital being reinvested in the capitalist sector. This results in the growth of the sector, increases in the demand for subsistence labor (employed at the fixed institutional wage rate) and a further growth in capital surplus. This process of expansion continues until the labor surplus disappears.

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[4] W. Arthur Lewis, "Economic Development with Unlimited Supplies of Labor," <u>The Manchester School</u> (May 1954), 139-91.

Fei and Ranis,[5] while accepting Lewis's assumption of surplus labor and a fixed institutional wage rate ($\overline{W}$), criticize his effort on the grounds that he failed to consider or articulate the changes which occur in the agricultural sector due to growth. They hypothesize that these changes are embodied in three phases of growth. In the first labor is induced into migrating to the industrialized sector by the institutionalized wage rate ($\overline{W}$) with no effect on agricultural output. This phase is substantially the same as that postulated by Lewis. The second phase, however, differs substantially from Lewis's formulation. As more and more labor is removed from the agricultural sector, the MP_L increases, causing a decrease in total output. As long as the MP_L remains below $\overline{W}$, migration will continue. Throughout this phase there is a constant decline in the terms of trade between the two sectors; i.e., the decline in agricultural output causes an increase in the value of agricultural output relative to industrial output. At the point where the MP_L equals $\overline{W}$, the terms of trade turn against industry, causing a gradual rise in the wage rate which must be offered to labor to entice it to migrate. In this phase wages are equal to the MP_L in either sector.

Both the Lewis and the Fei-Ranis formulations have been attacked on a number of fronts. Jorgenson is highly critical of the assumption of a zero MP_L. He reasserts the neoclassical tenet that wages are not institutionally defined but are equal to the marginal productivity of labor both in the agricultural or subsistence

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[5] John C. H. Fei and Gustav Ranis, "Development and Employment in an Open Dualistic Economy," Discussion Paper 110 (New Haven: Yale University, Economic Growth Center, 1971).

sector[6] and the industrialized or capitalist sector. His hypothesis has been substantiated by a number of empirical studies. For example, Paglin in his work with small farms in India, found a correlation between increased labor inputs and output. Such would not be the case if the marginal product of labor were zero.[7]

Todaro in his two-sector model which was designed to examine the forces behind labor migration, seems to attempt to form a compromise between Jorgenson and Lewis.[8] While he does not accept the marginal product of labor in agriculture to be zero, he does assume a politically determined minimum urban wage rate which is substantially greater than the agricultural wage. Their wage, however, like the neoclassical approach, is determined by competitive market forces.[9]

In an effort to address the problems at hand in developing nations, two-sector models have undergone some recent changes. Earlier models, such as those described above, have generally focused on the industrial sector and its ability to provide employment and attract surplus labor from the agricultural sector. Mellor breaks with this traditional approach and places emphasis on the process of

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[6]Dale W. Jorgenson, "Development of a Dual Economy," Economic Journal 71 (1970), 309-34.

[7]M. Paglin, "Surplus Agricultural Labor and Development: Facts and Theories," American Economic Review 55, 515-34.

[8]An excellent survey of off-farm migration models, including economic, econometric, and cohort mobility models, has been compiled by John Sloboda and Tom Carroll entitled, "Approaches to Modelling Off-farm Migration," December 1974.

[9]M. P. Todaro, "A Model of Labor Migration and Urban Employment in Less Developed Countries," American Economic Review 59 (1970), 138-48.

transformation within the agricultural sector. In his work he highlights the role which technology plays in increasing agricultural output and its subsequent effects on rural income and employment.[10]

Multiple Sector Simulation Models

This shift in emphasis has been accompanied by a growing awareness of the complexity of the structural linkages which exist between the rural and urban sector. To incorporate these complexities into model design, a number of multiple sector simulation models have been developed. As Thorbecke believes:

> The purpose of the model should be to capture the most important structural and behavioral relationships within agriculture and between agriculture and the rest of the economy, on the one hand, and to be potentially useful to the policymaker as a planning tool to help select and formulate a sector program, on the other hand.[11]

The intimate relationship between the model builder, the policy maker, and the indigenous structural features of a developing economy has resulted in a variety of location-specific simulation models. The need for precision with respect to local conditions and policy options, as reflected in model formulations, has made comparisons between specific models extremely difficult and generalized. Thorbecke has formalized a rather broad typology of such models.[12]

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[10] John W. Mellor, "Toward a Theory of Agricultural Development," in Agricultural Development and Economic Growth, eds. Herman M. Southworth and Bruce F. Johnson (Ithaca: Cornell University Press, 1967), pp. 21-61.

[11] Erik Thorbecke, "Sector Analysis and Models of Agriculture in Developing Countries" (paper presented at the Conference on Strategies for Agricultural Development in the 1970, Food Research Institute, Stanford University, Dec. 13-16, 1971), pp. 1-2.

[12] Ibid.

He subdivides them into four general classes: (1) multilevel planning models, (2) microeconomic-dynamic models, (3) simulation-systems models, and (4) general equilibrium-consistency models. Examples of the first subclassification can be found in the International Bank of Reconstruction and Development's work in Mexico and the Ivory Coast.[13] Both approaches, basically programming models, break down the national economy into regions and subregional components, each with its own set of linkages, resources, and policy constraints.

Microeconomic-dynamic models, which differ substantially from the aggregate formulations of multilevel planning models, have been constructed by Day, Mudahar, and Singh.[14] Their model, which has been partially operationalized in the Punjab, builds upon the basic production and consumption units, the farm and the household. Dynamic elements enter into the modelling through the use of recursive programming, which allows farmer's decisions in time period t to be influenced by output prices and decisions made in a previous time period t-1.

The systems-simulation approach is exemplified by models designed by an interdisciplinary group at Michigan State University.

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[13]International Bank for Reconstruction and Development, Multilevel Planning: Case Studies in Mexico (Washington: Development Research Center, International Bank for Reconstruction and Development, 1972) and Rene Vaurs, Apostolos Condos and Louis Goreux, "A Programming Model of the Ivory Coast," Washington, International Bank for Reconstruction and Development, 1971 (Mimeographed).

[14]R. H. Day, Inderjit Singh, and M. S. Mudahar, "A Dynamic Microeconomic Model of Agricultural Development" (paper presented at Iowa State University, Ames, Iowa, 1971).

Under the direction of Johnson, the team has simulated the workings of the Nigerian and Korean agricultural economy, essentially by breaking the economic structure down into a number of separate but interconnected subcomponents. The models are designed to track changes in exogenous variables, such as policy instruments, technology, and public investment through the economic system. In so doing, they provide indigenous policymakers with a number of alternative development plans, one for each set of exogenous variables.[15]

The last class of models presented by Thorbecke falls under the general heading of general-equilibrium-consistency frameworks. They include a number of models such as those developed by Fletcher and the Food and Agricultural Organization.[16] Models within this class attempt to describe and analyze the agricultural sector within a consistency setting, emphasizing the role of agriculture in the overall process of economic development. This approach attempts to determine what levels of economic activities within the sector are required to meet specific macroeconomic targets, such as a rise in GDP or per capita income. Thorbecke uses this methodology to bridge

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[15]Glenn L. Johnson et al., A Generalized Simulation Approach to Agricultural Sector Analysis with Special Reference to Nigeria (East Lansing: Department of Agricultural Economics, Michigan State University, 1971), and George E. Rossmiller et al., Korean Agricultural Sector Analysis and Recommended Development Strategies, 1971-1985 (East Lansing: Korean Agricultural Sector Study Team, Michigan State University, 1972).

[16]L. B. Fletcher et al., Guatemala's Economic Development: The Role of Agriculture (Ames: Iowa State University Press, 1970), and The Food and Agriculture Organization of the United Nations, "Alternative Output and Employment Projections for Columbian Agriculture" (internal working paper, Food and Agricultural Organization, Rome, 1971).

the gap between macroeconomic objectives and investment criteria in his study of the Peruvian irrigation projects.[17]

The development of the above models has added immensely to the planner's ability to articulate and define the contributions which agriculture and the urban sector provide during the development process. Both the dual sector and multiple-sector simulation approaches, however, tend to be aspatial in nature. The former models in the classical tradition tend to assume the physical land area available as fixed. Changes in production are attributed to the more efficient application of labor, capital, or technology to this fixed land base rather than increases or decreases in tillable area. The latter formulations, especially the system-simulation approach developed by Michigan State University, does attempt to incorporate changes in the land area available to agriculture. Both increases and decreases in this land base are, however, determined exogenously to the model.

In land scarce countries, such as Korea, such models do not provide policy makers with a great deal of information on possible problems associated with the shifting of agricultural land to urban uses which occur during urban growth and national economic development. Such information would seem highly desirable if planners are to be able to guide the spatial growth of cities in such a way that it minimizes the losses to agriculture which are inevitable. A discussion of the role which land plays in this growth process is presented below.

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[17]Erik Thorbecke and E. Stoutjesdijk, Employment and Output, a Methodology Applied to Peru and Guatemala (Paris: Development Center, Organization for Economic Cooperation, 1971).

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Land and the Process of Urban Growth

As population becomes increasingly concentrated in urbanized areas, the space needed to accommodate this population and its ancillary works continues to grow. Even at the barest subsistence, shelter is an unavoidable need. If reasonable living conditions are to be provided, then basic services such as water, sewerage, waste disposal, roads, markets, schools, and recreational areas are required. Growth in industrial production requires the investment of public funds to provide energy; port, air, and rail facilities and feeder roads essential to modern industrial production. All these facilities make impressive demands on urban land.

The Expansion of Urban Centers

The outward expansion of urban areas has long been an established trend in both developed and developing nations. The decentralization of various segments of this urban mass during the process of growth is seen by Goldberg to be a result of urban density:

> . . . net flows have been occurring out of developed areas. Flows are taking place both ways, but less dense are net receivers of migrants; both firms and people. The net shift from older areas is probably due to two factors: congestion and external diseconomies which are present in the older areas and the availability of room to grow in the new areas. Room for growth also explains the move to the suburbs which is observed in developed areas.[18]

It is Goldberg's hypothesis that as density increases the attractiveness of an area increases, up to a point, after which increased density has a negative effect. Schmore and Klaff have added weight

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[18]Michael A. Goldberg, "Transportation. Urban Land Values, and Rents: A Synthesis," Land Economics 40 (1965), 345.

to this explanation in their analysis of United States urban census data for the 1950s and 1960s. From their analysis they concluded that (1) the larger the urban area the slower the city growth and the faster the peripheral growth, (2) the smaller the urban area the faster the concentration and the slower the peripheral growth, and (3) the older the city the faster the growth in peripheral areas.[19]

Alonso approaches the question of inter-urban migration to the periphery in developing economies from a slightly different perspective. He holds that during the process of economic development the number of individuals, especially those in the upper and middle income groups, who require low density suburban residential acreage increases. He believes that this increased demand is generated for very much the same reasons it has occurred in the United States: (1) improvements in transportation permit longer journeys to work, (2) changes in tastes and culture, including the changing role of women and the meaning of the family, has led to a change in preferences toward housing with more open space, and (3) rising incomes have permitted the acquisition of land by a larger number of persons and the relegation of accessibility to the status of an inferior good.[20]

The composition of urban expansion seems to be slightly different in developing countries than that which has occurred in the

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[19]Leo F. Schmore and Vivian Klaff, "Suburbanization in the Sixties: A Preliminary Analysis," Land Economics 48 (1972), 25-26.

[20]William Alonso, Location and Land Use: Toward a General Theory of Land Rent (Cambridge: Harvard University Press, 1964), pp. 47-53.

United States and other developed areas. Alonso articulates both the differences and similarities between the two cases in the following manner:

> First, that the cities of the developing countries exhibit more of a patchwork of areas than do the cities of the United States, where changes over space are more gradual. Secondly, that whereas the United States slums are typically central, the slums of the developing countries are typically peripheral. Thirdly, that suburbanization by the middle and upper class is occurring in the developing countries as well as in the United States. And fourthly, that the peripheral slums that are to be seen in these countries are phenomena of groups rather than individuals or individual families.[21]

The presence of rather large urban squatter areas in the developing countries can be attributed, partially at least, to the retarded growth of urban incomes. In the United States urban income rose at a sufficient rate to allow residents to move from the less desirable housing areas within the urban center to suburban residental areas on the periphery. This process proceeded at such a rate as to provide a supply of vacant lower quality housing in the urban core which could be occupied by low income rural migrants. Alonso has observed that "this relative balance of supply and demand for the cheapest shelter led to the development of central slums as receiving and accumulating area"[22] for poor rural migrants. He goes on to state that in the developing countries "the demand for housing far exceeds the supply of the cheapest housing, and this surplus of demand spills onto the nearest available space, resulting in the squatter ring or

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[21]William Alonso, "The Form of Cities in Developing Countries," Papers of the Regional Science Association 21 (1972), 8-9.

[22]Ibid., p. 168.

peripheral slum."[23] Friedman in his analysis of urbanization in South America reiterates this difference when he says, "I am aware of the traditional inverted ecological pattern in Latin American cities where, contrary to the experience in the United States the poor not only occupy the center but extend in massive 'belts of misery' around the urban core."[24]

A similar growth pattern has evolved in many Asian cities. In the cities of Korea, for example, the rich and influential have traditionally chosen to live at lower elevations close to the urban center. Historically, this can be traced to the times when the affluent lived within the city's fortifications while the peasant classes were required to reside on the urban periphery outside the city walls and travel into the city to trade and work during the day. While this pattern has tended to be modified as cities have grown and transportation has become more available, there is evidence that even today poorer rural migrants generally reside on the periphery of Korea's larger cities. They tend to locate in areas that are less accessible than those chosen by the more affluent urbanites who have recently begun to relocate in more spacious accommodations on the urban periphery.[25]

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[23] Ibid.

[24] John Friedman, "The Future of Urbanization in Latin America: Some Observations on the Role of the Periphery," Papers of the Regional Science Association 23 (1973), 162.

[25] The information concerning Korea's urban growth and settlement patterns was obtained through a personal interview with the Regional Economist working with the Ministry of Construction-United

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As a result the urban periphery becomes a series of residential pockets, each dominated by different income groups very much along the line of Hoyt's theory of urban sectors.[26] While the growth of peripheral slums does have a significant effect on municipal expenditures and the aesthetic quality of the city, there seems to be little evidence to substantiate the belief that the two income groups, the rural poor and the more affluent urban migrants, compete vigorously at all times for the same type of land area. As Alonso points out, ". . . squatter areas develop frequently by the simple moving . . . into areas which are unwanted because they are subject to flooding or to difficult terrain . . . their development is opportunistic . . ."[27] It is only when these less desirable areas are developed that squatter settlements come in direct competition with more conventional development.

The eviction of squatters, using legal sanctions, to make way for more conventional development has proven, especially in Asia, to be a difficult task. Hahm in his discussion of Korean law and tradition expresses the problem in the following manner:

> Traditionally, the Asian people never had the experience of regarding law as something for their benefit. The law was always looked upon as an instrument of oppression by the bureaucrats of a despotic ruler. . . . When a person hauls another person into court, he is in fact declaring war on

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Nations Development Program's regional development project in Seoul in November 1975.

[26]Homer Hoyt, The Structure and Growth of Residential Neighborhoods in American Cities (Washington: U.S. Government Printing Office, 1939).

[27]Alonso, "The Form of Cities," p. 168.

> him. This signifies a complete breakdown of the traditional decent way of solving problems. He is now resorting to norms made by the state and enforced by the governmental power. He has lined himself up on the side of the bureaucrats to use the power of the state to oppress his fellowman.[28]

This aversion which an individual has to asserting his legal rights especially in property has led to the payment of compensation to the squatter to vacate an owner's land.[29] In Seoul, the city government has recently accepted certain areas of squatter settlements as legal residential areas and is attempting with minimal disruption to improve the areas.[30]

The development of the higher income areas is more deliberate and generally occurs in the more desirable areas (with respect to terrain and transportation) much along the lines of modern location theory. Wholesale and retail outlets, government offices, commercial establishments and industrial firms also seem to follow the more conventional patterns found in the developed countries.

The ability of urban analysts to project the patterns and composition of urban growth is somewhat impaired by their lack of knowledge of these squatter areas. Alonso believes that ". . . we need to understand them better than we do to predict the future with confidence."[31] While squatters do pose a problem with future

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[28]Hahm, Pyong Choon, The Korean Political Tradition and Law (Seoul: Hollym Publishers, 1971), pp. 189-90.

[29]Ibid., p. 190.

[30]Information acquired from Mr. David Leibson, Urban and Regional Housing Office, U.S. Agency for International Development (Seoul, 1976).

[31]Alonso, "The Form of Cities," p. 169.

projections, the similarities between the growth and location of the other urban land uses between the developed and developing nations, seems to provide the analysts with sufficient grounds for making some statements about the pattern of urban growth in developing countries based on the Western experience.

Urban Expansion and the Process of Sprawl

Many developed countries following a variety of "laissez faire" approaches to land use planning have experienced patterns of urban growth which have been haphazard and inefficient. Powelson and Solow in their discussion of urban and rural development in the context of urban expansion, have described these inefficiencies in the following words:

> Problems of city and country are more closely analogous than would appear at first sight. . . . In each case an irrational combination of factors of production results, characterized by wasted capital and labor and often by insufficient utilized land as well.[32]

The pattern of growth which has resulted has been described by Higbee in the following manner: "while portions of today's suburbia grow . . . as tight complexes with no reserve for open spaces for future woods or recreational areas, other portions are scattered like shot from a blunderbuss without the slightest umbilical tie to their maternal metropolises."[33] This pattern of scattered high and low density development over the rural landscape has been called "urban

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[32] John P. Powelson and Anatole A. Solow, "Urban and Rural Development in Latin America," The Annals of the American Academy of Political and Social Sciences 360 (1965), 49.

[33] Homer Higbee, The Squeeze, Cities Without Space (New York: William Morrow, 1960), p. 119.

sprawl" by a number of analysts. Gottman uses this definition when he writes, "where two cities are close together the intervening rural space becomes peppered with new developments. This kind of leap-frogging sprawl outflanks some farms while it covers others."[34] Harvey and Clark, on the other hand, describe the physical nature of sprawl in the following words:

> Sprawl, measured as a moment in time, is composed of areas of essentially urban character located at the urban fringe but which are scattered or strung out, or surrounded by, or adjacent to underdeveloped sites or agricultural uses. A sprawled area has a heterogeneous pattern, with an overall density greatly less than that found in mature compact segments of the city.[35]

They go on to articulate three major types of sprawl: (1) low density continuous development such as that which occurs in residential areas with larger lot sizes, (2) ribbon development which is composed of segments compact within themselves but which extend axially along transportation corridors leaving intervening areas underdeveloped, and (3) leap frog development which is the settlement of discontiguous, although possibly compact areas, of urban use.[36]

There are a number of reasons presented in the literature to explain the presence of sprawl around rapidly growing urban areas. Many analysts see this type of spatial growth as a natural consequence

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[34] John Gottman, Megalopolis, The Urbanized North Eastern Seaboard of the United States (New York: The Twentieth Century Fund, 1961), p. 247.

[35] Robert O. Harvey and W. A. V. Clark, "The Nature and Economics of Urban Sprawl," Land Economics 41 (1965), 2.

[36] Ibid., p. 6.

of imperfections in the urban land market. Scofield outlines these imperfections in the following manner:

> Instead of a single market, or several closely integrated markets, land transactions occur in hundreds, and possibly thousands, of local markets, with no standarization, little exchange of information, and a minimum of competitive bidding. Furthermore, the volume of transfers is often too low to permit the establishment of a level of prices that can be observed and reported objectively.[37]

The imperfect signals generated by the market are processed by a variety of buyers and sellers, each with his own unique preferences. On the supply side, sellers must determine if and when they wish to sell their holdings. As the city expands and the demand for land in a given area strengthens, prices begin to rise. Some owners who believe the demand to be short lived or who are unable to hold their property because of a variety of different budget constraints may sell immediately. Others who can absorb the holding costs and who anticipate even higher prices in the future may elect not to sell. Clawson associated this scattered sales pattern with the lack of appropriate knowledge on the part of the sellers. He states:

> The chance for profit in holding suburban land for development arises entirely out of error in consensus or out of individual judgments more astute than the consensus. If there was complete knowledge as to the time of future conversion, as to value at that time, as to holding costs . . . then obviously everyone would be in complete accord as to present worth. There would be no opportunity for speculative gain, because all future value would have been fully and accurately discounted into present value.[38]

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[37]William H. Scofield, "Prevailing Land Market Forces," Journal of Farm Economics 39 (1957), 1500.

[38]Marion Clawson, "Urban Sprawl and Speculation in Suburban Land," Land Economics 46 (1970), 104.

Knetsch, while recognizing the problems on the supply side, holds that, "scattered development would go on even if we had a perfect market, no difference in sellers, and an undifferentiated plane with growth generated by an urban center."[39] His views are based on his observations of the demand side of the market. As urban expansion occurs, developers buy up land placing higher preference and thus price on parcels closer to the urban center. These buyers continually make decisions based on their relative preferences and relative costs and will often substitute cheaper land further from the urban center for more expensive closer parcels. As Knetsch points out:

> The consequences of such choices is that much distant land is developed while land closer to the urban center remains unused. Meanwhile all land prices continue to rise, including new lands located on the ever moving fringe, deriving their value from expectation of continuing urban demands.[40]

Schmid mentions that these expectations have a tendency to feed on themselves driving up prices far beyond the economic level. He observes:

> As many owners hold out for higher prices they will observe that prices do in fact increase, in part because of their holding action. This bolsters their view of the future even more as even higher prices are asked, and the process goes on until the bubble breaks.[41]

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[39]Jack L. Knetsch, "Land Values and Parks in the Urban Fringe Areas," Journal of Farm Economics 44 (1962), 1720.

[40]Ibid., p. 1719.

[41]Allen Schmid, Rural to Urban Land Conversion: The Economics of Non Marginal Change, No. AE 69/3 (Guelph, Ontario, Canada: Department of Agricultural Economics, University of Guelph, 1969), p. 3.

This cumulative process of speculation feeding on speculation has led Schmid to point out that ". . . present land prices have lost touch with what can be reasonable expectations of future values."[42]

While the market has been cited as the main casual factor in the formation of urban sprawl, other actions which aid and abet market forces have been emphasized by various analysts. For example, government investments in urban infrastructure and the effect they have on land rent and accessibility tend to cause sprawl. As Clawson points out, "the extension of essential public services to particular areas or districts will bring land within such areas or districts closer to the point of actual development or building." He goes on to point out, however, that while such services are necessary for development they are not sufficient to generate it. He believes that, "other factors--above all--overall demand must be present."[43] Public regulations also give rise to sprawl by imbalancing the attractiveness of competing areas. In many instances public regulations apply only to areas within corporate limits not to the total urban market area involved. If, for example, building and land use controls are generally more stringent within a corporate area than they are for the entire urban housing market area, then the standards themselves may impel the development of housing units outside the controlled area and thus contribute to sprawl. Another problem arises with such

[42]Allen Schmid, "Suburban Land Appreciation and Public Policy," Journal of the American Institute of Planners 36 (1970), 40.

[43]Clawson, "Urban Sprawl," p. 102.

standards if they are not firmly enforced. Clawson alludes to this when he says:

> If master plans, zoning and building codes were explicit, firm, enforceable, and enforced, and if there were confidence they would remain so, they would greatly limit if not completely determine land values in many areas. In fact, zoning in particular and others to some degree can be changed under political and other pressures. . . . Public action through zoning and other related measures affects land values; but the major effect may be through the uncertainty created.[44]

Such uncertainty adds to the general lack of knowledge already in the market. Finally because of certain geographical features certain areas are not suited for continuous development. Sprawl may be necessitated by the existence of mountains, rivers, swamps, oceans, or underground mineral deposits. In general, the growth and development of an urban area will proceed on land which is most readily and economically available. Quite often what appears to be sprawl and is alleged to be uneconomic is simply the least cost expression of available development sites.

The Adverse Consequences of Urban Sprawl

The "laissez-faire" development of urban areas through the phenomenon of urban sprawl has a number of adverse economic consequences. Some, in their criticism of this development pattern, have pointed to the effect that sprawl has on agriculture. The scattered sale of land in farm areas which accompanies sprawl has the tendency of increasing farmers' expectations concerning the profitable sale of their land for nonagricultural uses. Such heightened expectations tend to influence farmers' investment decisions to such an extent

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[44]Ibid., p. 102.

that they cease to invest in farm operations. Vogel and Hahn outline this sequence in the following manner:

> . . . farmers on the urban fringe observe development occurring; they find out the selling price of the land, hope to sell their land at the same price, and hold off making costly new investments. They consequently become non-competitive and cease farming, even though only a fraction of them are able to sell their land at high prices.[45]

Conklin and Bryant see the decline in capital investment in agriculture to be a direct result of the increased uncertainty which is generated by speculation. They point out:

> Speculative conditions in which some though not all of an area will sell at high prices and in which the high priced sales seem to occur in unpredictable patterns increase the degree of uncertainty under which the farmer must make his investment decisions.[46]

This increased level of uncertainty not only affects farm level decisions but also adversely influences the investment climate in the agri-business sector as a whole within the sphere of urban influence. Such a tendency seems to question some of the more favorable results that urbanization has on agricultural factor markets as described by Schultz and Nichols. This adverse effect is highlighted in the following quote by Conklin and Bryant.

> Speculation not only discourages continuance of the flow of needed new investment into farming but also discourages investment in agri-businesses that are needed to service

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[45] Ronald J. Vogel and Alan J. Hahn, "On the Preservation of Agricultural Land," Land Economics 48 (1972), 190.

[46] H. E. Conklin and W. R. Bryant, "Agricultural Districts: A Compromise Approach to Agricultural Preservation," American Journal of Agricultural Economics 56 (1974), 608.

> farming. Gradually confidence and interest in farming deteriorate.[47]

Knight points out that a certain degree of specialization emerges in areas where speculation occurs. Professional speculators tend to enter and take over the bearing of risk and uncertainty while another group conducts the physical production activities.[48]

In the case of land, speculators buy up agricultural land in limited amounts and then lease the land back to farmers for production. The amount of land leased is generally less than that which has been bought. As Conklin and Bryant point out:

> Since the speculative specialists wish to retain a high degree of flexibility in their dealings, they do not wish to invest in the expensive improvements needed to maintain active farming. They often will not even sign leases that are long enough to justify lime applications, drainage improvements and other shorter term investments needed just for crop growing.[49]

This pattern of scattered development seems to pervade the landscape even after urban development has engulfed and passed an agricultural area. Clawson substantiates this view in the following statement, ". . . land within the suburban zone, not actually used for urban purposes is not used at all. Our best estimate is that there is about as much idle land in and around cities as there is land used.[50] These statements have been given validity through a

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[47]Ibid.

[48]Frank H. Knight, Risk, Uncertainty and Profit (Boston: Houghton Mifflin, 1921), p. 259.

[49]Conklin and Bryant, "Agricultural Districts," p. 608.

[50]Clawson, "Urban Sprawl," p. 107.

number of empirical investigations. The National Commission on Urban Problems in its 1968 study estimated than 24.5 percent of urban land in 106 U.S. cities was vacant. This constituted 1,349,041 acres of which 892,598 were considered as buildable.[51] In an earlier study Bartholomew estimated that for cities with population greater than 100,000 over one-fifth of the city area is vacant, while for cities of 5,000 or less, the proportion rises to about six-tenths.[52] Northam classifies this vacant land into five basic types: (1) remnant parcels which are generally small and/or irregular shape which were not included in the development process and are now of dubious developmental value; (2) parcels which may be very large in size but which are unusable because of natural features such as slope; (3) corporate reserves retained by firms to provide space for future expansion or relocation; (4) individual or corporate parcels held for sale at a later time for speculative purposes; and (5) institutional parcels held by various public and quasi-public organizations for development as the need arises or as funds become available.[53]

The incorporation of rather substantial areas of vacant land within urban boundaries constitutes not only an inefficient use of space but may also lead to an increase in the overall costs of urban

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[51]National Commission on Urban Problems, "Land Use in 106 Large Cities," in Three Land Research Studies, Research Report No. 12 (Washington: U.S. Government Printing Office, 1968), pp. 112-16.

[52]Harland Bartholomew, Land Use in American Cities (Cambridge: Harvard University Press, 1955), p. 107.

[53]Ray M. Northam, "Vacant Urban Land in the American City," Land Economics 47 (1971), 349.

services. Research conducted by Gabler examining thirty cities in the United States indicated an inverse relationship between urban population density and public employment and expenditures required to provide urban services such as highways, police and fire protection, and water and sewer services.[54] More recent work done by the Real Estate Research Corporation indicates rather substantial savings in capital construction expenditures are possible in high density planned communities as opposed to low density sprawl communities.[55] Using a hypothetical community of 10,000 housing units, they determined that the capital costs of facilities such as housing, transportation, public facilities, schools, etc. in high density planned communities would be 59 percent of those for a low density sprawl area.

While few would argue with the relationship which exists between sprawl and the costs of urban services, a number of analysts have overlooked the effects that sprawl has on the urban land prices. Maisel in his study on land appreciation during the development process found that a typical family lot in California rose in price from $1,300 to $3,850 between 1950 and 1962. He estimated that 28 percent of the increase in lot value was due to changes in the lot size, while 52 percent was due to the increase in value of the raw land.[56]

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[54] L. R. Gabler, "Population Size as a Determinant of City Expenditures and Employment--Some Further Evidence," Land Economics 47 (1971), 134.

[55] Real Estate Research Corporation, The Costs of Sprawl: Detailed Cost Analysis (Washington: U.S. Government Printing Office, 1974), pp. 87-94.

[56] Sherman J. Maisel, "Land Costs for Single-Family Housing," in California Housing Studies (Berkeley: Center for Planning and Development Research, University of California, 1963), p. 94.

Wagner in a study in Illinois found the value of farmland to appreciate 2,037 percent during the development process.[57] Schmid indicates that, "higher land prices do effect the chances of people becoming home owners as well as the quality of housing they can afford."[58]

Such rapid appreciation in land prices not only affects housing but hinders government policies aimed at controlling sprawl. As Schmid points out, "this promise of great gain to somebody creates tremendous pressures against maintenance of a public plan development. This is often more than ever the most angelic legislative body can resist, and not all such bodies remain angelic."[59] The development of new and innovative policies which address the pressures of land appreciation and sprawl are needed to assist planners in carrying out the implementation of efficient land use policies. A discussion of some of the more prominent techniques presently being used and developed in selected countries is presented below.

Land Use Planning and Controls

The Rationale for Government Involvement in Land-Use Planning

Governments have always taken some interest in sanctioning or controlling the use that individuals make of land. The degree of

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[57]Percy E. Wagner, "A Critical Analysis of a Developing Subdivision," paper presented at the National Convention of the American Institute of Real Estate Appraisers, Miami Beach, Florida, 1961, p. 5.

[58]Schmid, Rural to Urban Land Conversion, p. 4.

[59]Ibid., p. 6.

sanction and the selection of the various control instruments to be used has depended to a large extent on the political, social, and economic conditions which have existed at a given point in time in a given country. In socialistic and communistic countries where a great portion if not all land is under government ownership, the allocation of land to various uses is often decided by the ruling officials subject no doubt to considerable pressure from public opinion. In the capitalist countries where land is held under private ownership, allocation is carried out via price signals generated by the activities of buyers and sellers in the real estate market. When these signals over or underestimate the value of land to the society as a whole an inefficient allocation of land resources occur. As Furubotn and Pejovich point out, "whenever the private terms of exchange fail to account for some harmful or beneficial effects to the contractual parties or to others,[60] the market solution will appear inconsistent with the social value of the bundle of property rights in the goods that are exchanged.[61] Welfare theorists, in the past have pointed to the existence of these imperfections in the market as providing the

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[60]Economists generally refer to these effects as "externalities." A wide range of articles is available which attempts to rigorously define the concept of an externality and how it interferes with the efficient allocation of scarce resources. Some of the more prominent articles include: James M. Buchanan and William C. Stubblebine, "Externality," Economica 29 (1962), 371-84; and S. Chung, "Transaction Costs, Risk Aversion, and the Choice of Contractual Arrangements," Journal of Law and Economics 12 (1969), 1-12.

[61]Eirik G. Furubotn and Svetozar Pejovick, "Property Rights and Economic Theory: A Survey of Recent Literature," The Journal of Economic Literature 36 (1972), 1145.

necessary conditions for government intervention. Such intervention is based on the belief that:

> The public sector has a responsibility for the efficient allocation of resources both in private markets and within the public sector itself. Regulatory public policy should be directed toward off setting or countering imperfections in private markets so that such markets may serve more effectively as guides to private decisions.[62]

While the existence of market imperfections provide a necessary condition for government intervention they do not in every instance provide a sufficient reason for government involvement. Demestry correctly points out that the existence of externalities in a market provide necessary and sufficient conditions for government intervention only if the benefits derived from such intervention exceed the costs associated with the government action.[63] In some instances, "the internal benefits from carrying out the activity, net of costs may be greater than the external damage that is imposed on other parties."[64] Under these circumstances a nation's productive efficiency would be worse off than before the implementation of the regulations. As Dolbear points out in these instances the most rational policy calls not for the elimination of all externalities but

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[62] Jesse Burkhead and Jerry Miner, Public Expenditure (Chicago: Aldine Publishing Co., 1971), p. 6.

[63] Harold Demesty, "Toward a Theory of Property Rights," American Economic Review 57 (1967), 329.

[64] James Buchanan and William Stubblebine, "Externality," Economica 29 (1962), 381.

for the outcome which maximizes net benefits or, in other words, leaves in effect the optimum amount of externality.[65]

The identification of externalities in the transfer of land have been dealt with in the previous discussion concerning the effects of urbanization. When a description of these market imperfections is combined with information which articulates the costs and benefits associated with general public policy intervention strategies that result may provide economic justification for government intervention in addition to an indication of where such intervention is needed. It does not, however, provide decision makers with the specific policies which are required to make the needed adjustments in the land allocation system. In reality, the complexity of the problems associated with land use, i.e., speculation, loss of prime agricultural land, environmental degradation, sprawl, etc. call for a variety of policy instruments. Norman alludes to the complexities involved in such a system of controls when he says:

> We are trying to deal with private investment in land use, and with the planning of public facilities. We are also trying to deal with financial planning, to see whether we can afford all of this. Any system which does not coordinate all three of these simply isn't in the ball park.[66]

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[65]Trenery F. Dolbear, "On the Theory of Optimum Externality," American Economic Review 57 (1967), 97.

[66]David P. Norman, "The Timing of Land Use Controls," in Future Land Use, ed. by Robert W. Burchell and David Listoken (New Brunswick, N.J.: Center for Urban Policy Research, Rutgers University, 1975), p. 30.

Comprehensive Land Use Planning

In a number of countries comprehensive land use planning has been employed to both articulate and coordinate the policies needed to effectuate a coordinated system of land use controls. As Petersen points out there are at a minimum two basic concepts of planning. The first is deductive where, "the planner draws up a blueprint . . . and the design is completed before the first steps are taken to its realization."[67] The second definition is essentially inductive where planning is viewed as a means of coordinating "public policies in several overlapping economic and social areas."[68] Myrdal sums up this definition of planning in the following manner, "coordination leads to planning, or rather it is planning as the term has come to be known in the Western world."[69] Galloway articulates the concept of planning when he speaks of coordination as "a technique of adapting means to ends, a method of bridging the gap between fact-finding and policy making."[70] Such a definition assumes that the planning process is never completed, that it is both pragmatic and dynamic.

While the two basic definitions cited by Petersen are mutually inconsistent, in reality planning takes on characteristics of both.

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[67] William Petersen, "On Some Meanings of Planning," Journal of the American Institute of Planners 32 (1966), 131.

[68] T. J. Kent, The Urban General Plan (San Francisco: Chandler Publishing Co., 1964), p. 2.

[69] Gunnar Myrdal, Beyond the Welfare State, Economic Planning and Its International Implications (New Haven: Yale University Press, 1960), p. 63.

[70] George B. Galloway, Planning for America (New York: Henry and Co., 1941), p. 5.

The more static components of the first definition can be seen in the overall objectives of a plan. The more fluid concepts alluded to by Myrdal and Galloway can be found in the variety of policy instruments which are proposed in a plan to bring about the plan's stated objectives. In an attempt to coordinate the overall objectives of a national land use plan with those of national economic development many developing countries have adopted the strategy of including either explicitly or implicitly their land use planning objectives in their national economic development plans.[71] Such a strategy provides national planning agencies with the opportunity not only to check the consistency of land use goals with national growth objectives but also to examine the effect that specific national investment activities will have on land use and economic growth.

A variety of land use objectives appear in these national plans. They tend to vary from country to country depending on the unique historical, political, social, and economic backgrounds and the nature of the problems confronted by the respective government. Sah reports in Japan, for example, national land use policy is based on the following objectives: (1) mitigating the seriousness of the mammoth city problem, (2) promoting economically rational and balanced decentralization of viable industrial locations to ease the pressure on the giant cities and to bridge the gap in income differentials between regions and between city and country, (3) expanding

[71]A number of countries, especially in Asia, have adopted this strategy in developing their national economic development plans. These countries include: Japan, India, the Republic of China, Thailand, Pakistan, and Hong Kong.

and promoting the "basis of living," such as housing and living environments, (4) planning and redeveloping existing cities and eliminating traffic congestion, (5) establishing new towns around new industrial developments, (6) utilizing and conserving land in a rational manner, especially agricultural land, and (7) checking the excessive rise in land prices and curbing land speculation.[72] India lists the following rather broad interrelated social objects as the goals to its land use planning activities: (1) to achieve an optimum use of urban land, (2) to ensure the availability of land in adequate quantity, at the right time and for reasonable prices to both public authorities and individuals; (3) to encourage cooperative community and bona fide individual builders in the field of land development, housing and construction, and (4) to prevent the concentration of land ownership in the hands of a few private individuals. To achieve these goals, the Government of India has outlined a number of specific policies. These include: the development of regional land use planning, the use of large scale public ownership and distribution of land on a lease hold basis, the adoption of measures to curb land speculation and the initiation of positive programs of land reservation, price preference in land allotment, and financial aid in low cost housing.[73]

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[72] J. P. Sah, "Land Policies for Urban and Regional Development in the Countries of the ECAFE Region," No. E/CN. 11/I & NR/PURD/L.4 (New York: The United Nations Economic and Social Council, 1969), p. 3.

[73] Government of India, Planning Commission, Third Five-Year Plan (New Delhi: The Government Printing Office, 1966), pp. 52-53.

The combination of national objectives and action policies within the context of land planning seems to be unique to Japan and India. Other countries such as Pakistan, Thailand, and Taiwan while adopting a number of specific policy efforts have not been very successful in integrating these policies into the national economic planning process. For example, Taiwan has long shown a concern for comprehensive land use planning for urban areas and has only recently begun to coordinate and combine these programs with their regional agricultural land use planning efforts.[74] The piecemeal policy approach exhibited by many countries in Asia, with respect to land use planning has led Sah to comment:

> These measures are mostly ad hoc and sporadic, however, and do not seem to form part of a well knit overall policy. . . . Even where land policy objectives are implicit in the approach and thinking in individual countries . . . they lack in such basic aspects as control on speculation and mounting urban land values. Furthermore, the objectives have not been integrated in the form of an overall multi-measure policy-frame.[75]

While the need to coordinate policy objectives with national growth objectives is important, of equal concern is the need to design appropriate policy instruments which will effectively control the land conversion and sprawl problems in a given country.

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[74]Republic of China, Joint Commission of Rural Reconstruction, "Survey and Planning of Land Resources in Taiwan," Taipei, 1975, p. 3 (Mimeographed).

[75]Sah, "Land Policies," p. 17.

Land Use Instruments Employed to Control Urban Growth

In many countries land use controls have been developed in an attempt to control both the direction, nature, and timing of urban development. The number and variety of different control instruments which have or are being developed attests to the importance of indigeneous legal and economic factors in the formulation of such policies. For example, the majority of land use codes in the United States attempt to regulate land uses through the execution of the police powers (zoning, subdivision controls, building codes) rather than through eminent domain (compulsory acquisition) as is the case in England. The decision to control indirectly through the police powers rather than directly was based on the rather long and cumbersome legal process which is required to fulfill conditions set down in the Constitution of the United States.[76] Similar legal constraints in addition to political considerations prevented the use of eminent domain in both Germany and Italy until the 1960s.[77]

In an attempt to cope with the variety of controls in a systematic manner, land use planners have classified land use policies into five general categories: the police powers, eminent domain, public taxation, public ownership and public investment. Problems arise, however, when such a topology is applied to the more modern

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[76]The Fifth Amendment to the U.S. Constitution requires that "No person . . . shall be deprived of life, liberty or property, without due process of law; nor shall private property be taken for public use without just compensation.

[77]Roy J. Burroughs, "Should Urban Land Be Publicly Owned?" Land Economics 42 (1966), 14.

land use programs. These programs tend to be multi-faceted, combining a number of tools into one hopefully comprehensive land use control package, i.e., the United States, France, and England, etc. In almost all instances such programs are tied to a physical land use mapping and information system which is periodically updated to reflect the present status of the land use system at any given point in time. Such mapping programs are presently underway in a variety of developing countries in Asia, South America, and Africa.

In many countries which have adopted land use controls the basic thrust has been directed at limiting the available supply and location of land needed for development. Such an approach attempts to concentrate growth in compact areas thus minimizing sprawl and the expensive provision of urban services to residents dispersed over large land areas. Possibly the most effective policy in this regard has been the development of a system of land banks in various countries. Such a system, a form of advanced land acquisition on a large scale, has been used in Stockholm, Sweden since 1904 and more recently in Canada and Puerto Rico. Stockholm for instance, has acquired over the last six decades approximately 134,000 acres of land, on its outskirts for future development purposes. The recent success of the program is attested to by the fact that more than half of the land has been acquired since 1960. This land acquisition program in combination with the construction of a number of high speed transit lines has resulted in the development of a number of semi-autonomous cities which now surround Stockholm, each with their own shopping areas, cultural facilities and in some cases base industries grouped at high density nodes around transit stations. These new centers are separated from the city proper by open space, farmland, and woodlots.[78]

The impressive design and layout of Stockholm suburbs have resulted in the adoption of land banking in a number of other countries. A number of cities in Western Canada, notably Calgary, Saskatoon, and Red Deer have made extensive use of land banking to control growth. Their success led the Canadian Task Force on Housing and Urban Development to recommend that:

> Municipalities or regional governments as a matter of continuing policy, should acquire service and sell all, or a substantial portion of the land required for urban growth within its boundaries.[79]

This recommendation has to be reaffirmed by a number of other commissions and land use planners. For example, the National Commission on Urban Problems in the United States recommended in 1968 that:

> . . . state governments enact legislation enabling state and/or local development authorities or agencies for general purpose government to acquire land in advance of development for the following purposes: (a) assuring the continuing availability of sites needed for development; (b) controlling the timing, location, type and scale of development; (c) preventing urban sprawl; and (d) reserving to the public gains in land values resulting from the actions of government in promoting and serving development.[80]

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[78]Hans Calinfors, Francine F. Rabinowitz, and Daniel J. Orisch, Urban Government of Greater Stockholm (New York: Frederick Praeger, 1967), pp. 99-102.

[79]Canadian Task Force on Housing and Urban Development, Report (Ottawa: The Queen's Printer, 1969), p. 43.

[80]National Commission on Urban Problems, Building the American City (Washington: U.S. Government Printing Office, 1968), p. 251.

Levin, Rose, and Slavet while agreeing with these advantages have gone on to point out that such a system:

> provides a method of reserving specific sites needed for public purposes . . . tends to reduce capital costs and also to increase the opportunities of using public facility construction to guide development patterns . . . sites in the land bank can be released from time to time in accordance with development plans as well as market conditions. And, finally, land banking provides a simple and direct method of reserving open space to protect stream valleys, flood plains and scenic areas.[81]

Clawson points out that while such a system is advantageous, a government as a rule of thumb should acquire approximately 60 percent of the land in its general area for use 5, 10, or even 20 years ahead.[82] The initial capital outlay for such a large area of land even though diminished in the long run by future sales and leases is a major stumbling block in its adoption in a number of countries.

In a number of countries alternative policies somewhat less expensive than actual government fee simple ownership but much more negative in stature have been developed to control the location and timing of development. In France, for example, land on the urban fringe may be classified as "priority development areas" or as "deferred development areas." New development in the former is being is being encouraged and concentrated through the use of public investment and public and quasi-public agencies. In these areas local authorities or concessionaires such as the mixed economic companies

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[81]Melvin R. Levin, James G. Rose, and Joseph S. Slevet, New Approaches to State Land Use Planning (Lexington, Massachusetts: Lexington Books, 1974), p. 36.

[82]Marion Clawson, Suburban Land Conversion in the United States (Baltimore: Johns Hopkins University Press, 1971), p. 206.

(mixed enterprises with capital contributed directly by the state, part by the local authority and part by private investment) have been granted the power of compulsory acquisition (eminent domain) and are provided technical aid and subsidies to generate rapid development. Local authorities are also given the power to restrict development in these areas if adequate public services are not available. "Deferred development areas" are essentially held in reserve until needed. While land sales are allowed in these areas, any person wishing to sell his land must offer it first to the local authority. If agreement cannot be reached with respect to the sale price between the two parties then legal expropriation is activated. Burroughs commenting on these latter restrictions points out that:

> The private owner has no opportunity to gain by land speculation. No premature development, or scattered development, which makes demand for public services, is permitted.[83]

While the French system places particular emphasis on the control of urban growth it does not forget the necessity of industrial dispersion or agricultural development. Two national organizations, the "Société d'Aménagement Foncier et d'Establissement Rural" (SAFER) and the "Fonds d'Action Sociale pour l'Aménagement des Structures Agricoles" (FASASA) have been organized both at the national and local level to support agricultural related projects.[84] The former organization is responsible for elevating the fragmentation

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[83] Burroughs, "Urban Land," p. 15.

[84] In their efforts to disperse industry from the Paris area to less developed areas the French government has initiated a dual support system of grants and long term low interest loans and tax exemptions for those industries who wish to relocate or locate new facilities in designated areas.

in agricultural property which has occurred through a program of land consolidation and land improvement. The latter agency's attention parallels that of the first but focuses on agricultural manpower. The FASASA arranges pensions to enable farmers to quit their holdings; it assists farmers to set up businesses to reception areas and makes installation grants; grants are available for the retaining of farm workers and also to help pay for the education of farmers' sons who have to remain in the family business.[85]

While the above package of programs and policies are unique to France other countries have incorporated bits and pieces of the French approach into their own land use control system. For example, Spain has adopted land use controls in selected urban areas to compel prompt development of urban land and to retain other land in an urban land reserve. If an owner fails to build on land equipped with utilities which is considered ready for development he may lose the land via expropriation at a publicly determined price. On urban reserve land no building may be constructed unless they comply with the purposes of the city's urban plan.[86]

The town of Ramapo, an 86 square mile area in New York State adjacent to New York City has formulated a rather unique land control system which combines elements of both zoning and public investment planning. The town has adopted a land use control ordinance which

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[85] R. C. Richard, "Regional Planning and Horticulture in France," Planning 34 (1968), 185.

[86] United Nations Economic Commission for Europe, Committee for Housing, Building and Planning, Working Papers (Geneva: The United Nations, 1965), p. 175.

encourages development only in those areas which have adequate urban services such as roads, sewers, drainage, firehouses and parks. Developers who wish to build in other areas may wait for the local government to put in the facilities which are specified in an 18 year public capital improvement plan or they may provide them themselves.[87]

Another state, Hawaii, confronted with a rapidly expanding urban sector, a need to preserve scenic areas for its active tourist industry and a shrinking agricultural land base adopted a land use program which combined zoning with taxation under legislation, mostly adopted in 1961 and 1963, a statewide Land Use Commission was formed and authorized to classify all land in the state into one of four major districts: urban, rural, conservation, and agriculture. Urban districts included a reasonable area for expansion, with counties administering all planning and zoning for all but the conservation districts, which were under exclusive state control.

The use of land in agricultural districts was placed under the control of the state commission, although counties may allow other uses through special permit.[88] The combination of land planning, zoning, and taxation has been accomplished through the development of a series of tax maps showing the land use districts based on county planning and zoning determinations. Such maps not

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[87] Robert Freilick and David T. Greis, "Timing and Sequencing Development: Controlling Growth," in Future Land Use, ed. by Robert W. Burchell and David Listoken (New Brunswick, N.J.: Center for Urban Policy Research, Rutgers University, 1975), pp. 39-41.

[88] John Hagman, "The Single Tax and Land Use Planning: Henry George Updated," University of California, Los Angeles Law Review 39 (1962), 784.

only set up rather broad use districts but also allow tax assessors to include both the present use of land in addition to any possible future use in the calculation of a site's taxable value. Such a procedure has resulted in areas of extensive use such as agricultural and open space land being taxed at relatively low rates while areas of intensive use receive higher levies.

In Japan, a system of land use zoning has been adopted which differs substantially from that of Hawaii. Recent Japanese policies have focused on methods which would provide sufficient land at the appropriate time and price for urban expansion. This seemingly contradictory approach to agricultural land conversion in a country which many believed to be land scarce has been fostered by the increased productivity of Japanese agriculture and the growing demands for urban land. Prior to the enactment of the New Town Planning law in 1968, which forms the basis of this new approach, agricultural policies were geared to maintaining existing farmland in agricultural production. Approval for the conversion of agricultural land to non-agricultural uses was controlled by local agricultural committees dominated by the national agricultural cooperative organization. The overall success of the government rice price support system in addition to the trend toward more intensive especially around urban areas, has led in the eyes of many to an excess commitment of land to agricultural use at the expense of urban development.[89] To relieve

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[89]According to M. Honjo some experts believe that up to two million hectares of agricultural land can be converted during the 70s with little or no effect on agricultural production. The interested reader is referred to M. Honjo, "Comment 1," in Land for the Cities of

this situation the New Town Planning Act provides for the classification of land in and around municipal planning areas into three categories: urbanized, urbanizing, and urbanization controlling areas. Such a system attempts to clearly delimit the area of future urban expansion in which the local government will provide urban services.

Agricultural land within such areas is assessed at market value and taxed at comparable urban rates rather than the lower rates normally associated with farmland. Honjo points out that one of the problems with the policy is that it provides a mechanism by which farmers who are outside the municipal planning area can have their land included in the urbanizing zone. Even though they incur higher tax levies many farmers have had their land reclassified in anticipation of speculative profit which is lightly taxed. This has resulted in the expansion of metropolitan planning area far beyond the size for which urban facilities can be provided. As a partial control on speculation and as an attempt to control soaring land prices, the legislation provides a land price, notification system which sets a standard price per square kilometer for each of the three zones.[90]

Unlike Japan, the State of California has initiated a zoning program specifically designed to protect the state's prime agricultural land. Legislation adopted in 1967, provided counties with the authority to classify land as "agricultural preserves" if such land was larger than 100 acres and contained in the county's land use plan

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Asia, ed. by Allen M. Woodruff and John R. Brown (Hartford: The John C. Lincoln Foundation, University of Hartford, 1971), p. 216.

[90]Ibid., p. 218.

as agricultural land. Within such preserves, land uses were to be limited to agricultural or "compatible" uses as determined by the county. Once such preserves were designated the county could enter into binding contracts with farmers to retain their land in agricultural use. Such contracts were automatically renewable each year and qualified farmers for tax levies calculated on the value of their land in agricultural use not the higher tax rates associated with urban development. In the event that a farmer wished to sell his land for a nonagricultural use he is required to pay 50 percent of the land's full tax value in the unrestricted use to the state.[91]

A number of countries have attempted to influence the timely and uniform development of land through a variety of tax policies, some connected with general plans, others in separate policies. Such policies generally fall into three broad categories: property taxes, vacant land taxes and betterment taxes. In the United States where land taxes are assessed and collected by state and local governments on the basis of market or "ad valorem" value, a number of property tax incentives are used to modify land use patterns. With specific reference to agriculture nineteen states have adopted taxation policies which provide for preferential tax assessment rates to be applied to bona fide farmland if the owner agrees to keep his property in farming for a specified number of years.[92] Such tax provisions attempt to alleviate the rather heavy tax burden which is generated

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[91]Levin, New Approaches to State Land Use, p. 40.

[92]Raleigh Barlowe, James Ahl, and Gordon Bachman, "Use-Value Assessment Legislation in the United States," Land Economics 49 (1973), 207.

by inflated farmland values around urban areas. This tax approach assumes the general ad valorem property tax to be one of the major causes behind the conversion of farmland to nonfarm uses.

Other countries have also provided special tax provisions which favor agriculture. In Taiwan, a progressive land value tax which applies to land located within an urban planning area has been adopted. Within such areas land is taxed at a rate of 1.5 percent of a set registered value per annum. If the market value exceeds this registered value then a surcharge is added on to the tax. As such taxes may vary from 1.5 to 6.0 percent of market value per year. The laws do provide, however, for the complete exemption of farmland from urban taxes or a reduction in the rate of taxation. Agricultural land falling outside these planning areas generally is taxed relatively lightly.[93] In Thailand, a general property tax, the "local development tax," is levied on all land both inside and outside municipal limits. Taxes are assessed on the average value of land in terms of rai (1,600 square meters) every four years. Allowances (exemptions) are provided both for land used as a personal residence and agricultural land. For example in class one, two, and three municipalities, a person is allowed to exempt 400, 800, and 1,600 square meters of land from taxes. In rural areas the exemption is 8,000 square meters.[94] Agricultural land held in excess of these

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[93]W. S. King, "Urban Land Policy and Land Taxation of the Republic of China," Land for the Cities of Asia, ed. by Allen M. Woodruff and John R. Brown (Hartford: The John C. Lincoln Foundation, University of Hartford, 1971), pp. 217-24.

[94]Sah, "Land Policies," p. 21.

limits is assessed one-half the normal rate while vacant land is assessed at two times the normal levy. While such a scheme does provide revenue for local development it is relatively low and does not play an active role in land use control.[95] Tax rates similar to those in Thailand are also evident in the Philippines. There land is assessed at 30 to 50 percent of its market value. Reassessment is conducted at extremely long intervals, up to 10 years, so that intermittent rises in value are not captured by the tax. The tax accounts for less than 1 percent of the value of all land and total revenues are limited due to widespread tax evasion. In 1956-57 only 85 percent of urban and 55 percent of rural taxes were collected.[96]

In a number of countries including some of those mentioned above the general property tax has been supplemented by a variety of tax measures specifically aimed at controlling speculation and bringing vacant land into use. The "betterment" or speculative land tax was first used in England in 1945. Taxes of this nature attempt to recoup at the time of land conversion part or all of the incremental value of the land (purchase-selling price) which has resulted from public investment in services and facilities. In England initially 100 percent of this increment was taxed. The severity of the tax resulted in a period of stagnant development in which owners of low

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[95] Nid H. Shiranan, "Comment 1," in Land for the Cities of Asia, ed. by Allen M. Woodruff and John R. Brown (Hartford: The John C. Lincoln Foundation, University of Hartford, 1971), p. 63.

[96] Leandro A. Viloria, "The Nature of Urban Land Problems in the Philippines," in Land for the Cities of Asia, ed. by Allen M. Woodruff and John R. Brown (Hartford: The John C. Lincoln Foundation, University of Hartford, 1971), p. 127.

value land refused to sell their land to higher value uses since all monetary incentive for doing so was taxed away. The law was abandoned in 1952, and again reinstated in 1967 but with the lower incremental rate of 50 percent.[97]

Similar taxation schemes have been adopted in a number of countries in Asia, including Korea, Philippines, Japan, and Taiwan. In Korea, a 50 percent levy is administered on the incremental value minus inflation of all land which is transferred. In the Philippines a levy of 100 percent on land held for less than one year and 50 percent on all other land is imposed at the time of sale.[98] In Japan the value of such an increment is considered as a capital gain and taxed as income if the property is held for less than five years. If held for more than five years, it may be taxed as a capital gain at 40 percent or as income.[99] In Taiwan a progressive tax rate ranging from 30 percent of the increment value for land which has appreciated from 0 to 100 percent to 90 percent on land which has appreciated 300 percent or more has been adopted, but at present is not in effect because of adverse political pressure. Special

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[97] John Delafons, Land Use Controls in the United States (Cambridge: The Massachusetts Institute of Technology Press, 1971), p. 107

[98] Viloria, "Urban Land Problems," p. 131.

[99] Honjo, "Comment 1," p. 218.

provisions have been included in the law to reduce the tax rate on lands sold for industrial and residential purposes.[100]

Vacant land taxes have also been adopted in a number of countries including Taiwan and Costa Rica to force urban land into more intensive use. Japan has attempted to formulate such a law but has failed because of her inability to define vacant land. In the Taiwan statute vacant land is defined as any privately held land in urban planning areas which has been designated as buildable but upon which buildings are not constructed or land upon which a building has been constructed which is valued at less than 20 percent of the land's value. Land used for public purposes or agriculture is excluded from the definition of buildable land. Urban land which is completely vacant if not built upon in three years of being declared as such is taxed at from two to five times its normal rate. Land which is in the second category of vacant land is given a five year grace period and is taxes in the same manner as above.[101]

While the above taxation policies form an important part of any land use policy they cannot stand alone. Without other forms of land use controls such as overall land planning and zoning they generally prove to be an ineffective tool for guiding land use policy. This is true, however, of any one of the policies if taken separately. Only through the adoption of a comprehensive package of land use

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[100] Cheo Ih Kwei, "A Preliminary Study of Taxation on Urban Vacant Land," in Land for the Cities of Asia, ed. by Allen M. Woodruff and John R. Brown (Hartford: The John C. Lincoln Foundation, University of Hartford, 1971), p. 321.

[101] Ibid., p. 324.

planning, zoning, and taxation administered in such a way as to account for the needs of both urban and rural property owners can a country hope to guide land use patterns toward their selected goals.

CHAPTER III

ECONOMIC GROWTH AND LAND USE IN KOREA, 1965-1974

Introduction

The impressive economic growth which the Republic of Korea has experienced since 1962 has had some rather dramatic effects on the economic, social, and institutional structure of the nation. To achieve the remarkable increases in industrial production, especially in the export sector, and in per capita income the government has found it necessary to invest rather substantial sums in the development of industrial infrastructure, especially roads, rail facilities, electrical generating plants, and port facilities. Such growth has led to the expansion of industrial employment opportunities and a general rise in the material aspirations of individuals in almost every segment of Korean society. Rapid shifts in population from rural to urban areas to take advantage of urban employment and amenities, have led to an increase in demand for the already overtaxed urban services. National and local governments have responded to these new demands by allocating a larger share of public revenues for social overhead capital projects such as schools, housing, medical, and park and recreational facilities. All of these services and facilities, both industrial and urban have required land which in many instances has been taken out of agricultural production.

The following chapter attempts to examine the physical demands for agricultural land as they have unfolded over the past decade. This examination includes a general discussion of Korea's past economic growth and the structural changes which have accompanied it. An attempt is then made to determine what effect this growth has had on national and urban land use patterns. This second section concludes with a brief comparison of the various land use data series available including a discussion of the problems associated with each series.

Korean Economic Growth and Structural Change

Since 1962 the Korean economy has experienced a remarkable rate of growth. Beginning at a position uncomfortably close to the bottom of the international income scale and without the benefit of significant natural resources, the country embarked on a course of export-led industrial growth that has become one of the outstanding success stories in international development.

Undoubtedly this rapid growth has been the result of a number of interacting economic, political, and social factors which can neither be easily quantified, nor conveniently ranked by importance. It is readily apparent, however, that manufactured exports which rose from less than \$10 million in the early sixties to well over \$4 billion in 1974, indicating a real growth rate of 55 percent per annum have been, in a real sense, the engine of growth. According to rough estimates, manufactured exports have accounted for about one-third of the incremental output of the manufacturing sector which expanded, in value added terms, at an average rate of 19 percent per annum during 1963-74.[1] This rapid expansion in export manufacturing has resulted in a trebling of Gross National Product (GNP) in real terms and a per capita GNP of $425 in 1974, well over double the level ten years ago.

This rapid growth has generated a number of structural changes in the Korean economy. A summary of the various indicators of this change are presented in Table 3.1. As indicated, the structural changes which have transformed Korea from an agricultural society into a semi-industrialized country have been highlighted by a rise in the share of manufacturing in GNP from 11 percent in 1963 to 32 percent in 1975. This rise was accompanied by a corresponding decline in agriculture's share in GNP from 40 percent to 22 percent. In his discussion of these trends Kim believes that the unbalanced growth strategy adopted by Korea:

> . . . expedited the rapid growth of export industries while maintaining low grain prices and wage rates through the importation of foreign farm products which were abundantly available at concessional terms. During this period it appears that the agricultural sector contributed significantly to the acceleration of industrial growth at the sacrifice of its own growth opportunities especially food grain production which constituted about 72 percent of total agricultural production in 1974. This sector has provided the industrial sector with not only low-priced food grains but also an abundant supply of cheap labor.[2]

Agriculture, even though heavily taxed during the period managed to maintain quite a respectable growth rate of 4 percent per

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[1] Unpublished estimates developed by the Korean Development Institute, Seoul.

[2] Kim Sung Hoon and Kim Dong Min, "Population and Food in Korea" (paper presented at the Food and Agriculture Organization Seminar on Population, Food and Agricultural Development, Rome, Dec. 1-5, 1975), p. 25.

Table 3.1.--Principal Indicators of Structural Change, 1965-1975.[a]

	1963	1966	1969	1972	1975	1963-75
The Proportion of GNP for:						
Agriculture	40	39	31	25	22	-18
Manufacturing	11	15	21	26	32	+21
Services[b]	38	36	36	36	33	- 5
Social Overhead Capital[c]	7	9	13	13	14	+ 7
Allocation of GDP						
Consumption	93	86	82	84	64	-29
Gross Fixed Capital Formation	13	17	27	22	26	+13
Exports	4	7	13	21	28	+24
Imports	14	14	24	27	27	+13

[a]Unit: in 1970 won.

[b]Includes: wholesale and retail trade, banking, insurance and real estate, ownership of dwellings, and public administration, defense, and education.

[c]Includes construction, transportation and storage, and electricity, water, and sanitary services.

Source: 1963-72: Korea Gallup Statistical Institute, Statistical Yearbook (Seoul: Sung Moon Publishing Co., 1975), pp. 214-15 and p. 250 and Economic Planning Board, "Monthly Statistics of Korea," 4 (1976), 137.

annum. This, however, was overshadowed by the manufacturing sector which expanded more than four times as fast. Under the impetus of sharply rising manufactured exports, the ratio of exports to Gross Domestic Product (GDP) rose steadily to 28 percent in 1975 from less than 4 percent in 1963.

At the same time, the ratio of fixed capital formation to GDP which averaged around 12 percent during 1960-62 rose to an average of about 24 percent during 1973-75 reflecting a rapid growth in real investment. A large portion of this real fixed investment which increased at double the rate of GNP during the last ten years was directed toward urban and industrial infrastructure improvements. A massive public investment program in the second half of the sixties in transportation, power and communications designed essentially to remove emergent bottlenecks in the country's infrastructure in the face of the expanding manufacturing sector, strongly supported the overall economic expansion. The results of this investment program are presented in Table 3.2.

This intensified investment program led to the increase in government real fixed capital formation of 473.3 billion won, during the ten year period 1966-75.[3] This investment resulted in the expansion of a variety of public facilities. For example, Korea's electrical power generating capacity increased over five times. The nation's road transportation network increased 1.3 times, with paved roads expanding slightly less than five times and approximately

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[3]Calculated in 1970 won from data presented in Economic Planning Board, Korea Statistical Yearbook (Seoul: Sin Heung Printing Co., 1975), Table 143, pp. 244-45.

Table 3.2.--Expansion of Social Overhead Capital 1965-1974.

	Units	Years 1965	1970	1974	1965/74 Increase
Electric power generation	Million Kwh	3.250	9.167	16.835	5.2 times
Rail transportation					
Track	Km	2980.0	3193.2	3143.4	1.1 times
Rolling Stock[a]	1000 cars	10.6	14.4	16.1	1.5 times
Highways					
Expressways	Km	--	536.3	998.6	--
Paved roads	Km	1627	3864	7820	4.8 times
All roads[b]	1000 Km	33.4	40.2	43.6	1.3 times
Port Loading-Unloadig Facilities	Million MT.	11.3	43.3	63.7	5.6 times
Communication Facilities					
Post Offices	Offices	1460	1842	1921	1.3 times
Telephone Exchanges	Offices	5	9	12	2.4 times
Telegraph Offices	Offices	9	20	32	3.6 times
Education Facilities					
Primary & Secondary Schools		7034	8458	8777	1.3 times
College & Universities[c]		168	191	258	1.5 times

[a]Includes boxcars, gondolas, flat cars, refrigerator cars, tank cars, and cabooses.

[b]Includes paved, gravel, unrepaired roads and national expressways.

[c]Includes junior colleges, junior teacher and technical colleges, nurse's training schools, four year colleges and universities and graduate schools.

Sources: The Bank of Korea, Economic Statistics Yearbook (Seoul: The Bank of Korea, 1975 and 1971) and Republic of Korea, Economic Planning Board, Korea Statistical Yearbook (Seoul: Kwang Myong Printing Co., 1966, 1971, and 1974).

one thousand kilometers of modern expressway being opened. Port loading and unloading facilities were expanded over five times to accomodate the increased flow of imports and exports. Also, communication facilities such as post, telegraph, and telephone offices were expanded slightly over 1.3 times. During the period increases in fixed capital investment and the corresponding growth in industrial production led to some substantial shifts in total employment. A breakdown of the nation's employment structure for the period is presented in Table 3.3.

As the data indicates total employment in agriculture in 1975 was only marginally higher than it was in the early sixties. During the period this sector's share of total employment dropped from 56 percent to 31 percent in 1975. Manufacturing employment over this same period increased three-fold while its share of total employment rose from 10 to 19 percent. Persons employed in the social overhead capital sector also rose from 31 to 34 percent of total employment.

Generally speaking, industry provided at least one job out of every three created during the latter part of the period. A partial explanation for this rapid rate of growth in industrial employment is related to Korea's concentration on labor intensive industries such as textiles, clothing, electronics, wigs, and plywood. Such a growth policy led to a decline in the already low capital output ratios from 1.6 in 1963-67 to 1.3 in 1963-72.[4] In addition, the general rise in employment, specifically in manufacturing employment helped to precipitate a decline in the open employment rate

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[4]Unpublished research results from the Korean Development Institute, Seoul.

Table 3.3.--Structure of Korea's Labor Force, 1965-1974.[a]

Year	Total Pop.	Employable Population	Persons Employed			Non-Agricultural Employment		Unemployment Rate[b]
			Agri-culture	Manufac-turing	Social Over-head Capital	Total	% of Econ. active Pop.	
1965	28,327	8,859	4,810	772	2,547	3,319	37.5	na
1966	29,160	9,071	4,896	833	2,634	3,467	38.2	7.1
1967	29,541	9,295	4,811	1,021	2,791	3,812	41.0	6.2
1968	30,171	9,647	4,801	1,176	3,072	4,248	44.0	5.1
1969	30,738	9,888	4,825	1,232	3,243	4,475	45.3	4.8
1970	31,435	10,199	4,916	1,284	3,434	4,718	46.3	4.5
1971	31,828	10,542	4,817	1,336	3,762	5,098	48.4	4.5
1972	32,360	11,058	5,346	1,445	3,714	5,159	46.7	4.5
1973	32,905	11,600	5,569	1,774	3,749	5,523	47.6	4.0
1974	33,459	12,080	5,584	2,012	3,940	5,952	49.3	4.1
1975	34,681	12,339	5,424	2,204	4,140	6,344	51.4	4.1

[a]Unit: 1,000 persons.

[b]Source: Economic Planning Board, Korea Statistical Yearbook (Seoul: Sin Heung Publishing Co., 1975), Table 27, pp. 66-67 and Economic Planning Board, "Monthly Statistics of Korea," No. 4 (1976), Table 4, pp. 6-7.

from 7.1 in 1963 to 4.1 in 1975 and a substantial rise in real wages, averaging 11 percent per annum and 8 percent per annum respectively in the manufacturing and farm sectors from 1967 to 1974.

This differential growth rate in real income between urban manufacturing residents and rural farm residents fostered a rural-urban income disparity which was still evident in 1974. This disparity which is highlighted in Table 3.4 reached its largest absolute gap in 1970, tended to decline rather sharply beginning in 1971. By 1974, rural household income was 4.6 percent greater than that of an urban wage earner's household. The rather rapid decline in this income gap can be attributed in part to the very sluggish growth of real wages in urban areas during 1971 and 1972[5] and to the massive increases in the support prices for rice and barley,[6] amounting to 142.8 percent and 138.5 percent respectively during 1970-74. Even with this substantial increase in farm household income it is important to note that farm worker income was slightly less than half of urban worker income in 1974.

These income disparities in addition to rapidly expanding urban labor demand led to a substantial shift in the urban-rural population distribution.[7] During the period from 1965 to 1975 the nonfarm

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[5]During 1971-72 real wages paid to industrial wage earners only increased 11.4 percent.

[6]Rice accounts for over 60 percent of the gross agricultural receipts of farm households.

[7]While income and employment opportunities are important incentives in the decision to migrate, other factors, such as, urban amenities and educational opportunities must also be considered. The latter, which is very important in Korean society, may prove to be

Table 3.4.--Comparison of Per Capita Incomes of Rural and Urban Households for Selected Years, 1967-1974.[a]

	1967	1969	1971	1972	1973	1974
Rural Households						
A. Household Income	149,470	217,874	356,382	429,394	480,711	674,451
B. Per Capita Income	24,423	36,373	61,129	75,200	84,040	119,161
C. Per Worker Income	47,907	73,606	122,049	144,092	164,065	235,822
Salaried and Wage Earners Households (all cities)						
D. Household Income	248,640	333,600	451,920	517,342	550,080	644,520
E. Per Capita Income	45,538	61,550	85,591	97,981	104,777	123,708
F. Per Worker Income	192,744	254,656	339,789	386,076	404,471	477,422
A/D[b]	60.1	65.3	78.9	83.0	87.4	104.6
B/E	53.6	59.1	71.4	76.7	80.2	96.3
C/F	24.9	28.9	35.9	37.3	40.6	49.4

[a]Unit: Won.

[b]The interpretation of these ratios should be undertaken with caution since the sample universes of the two sample surveys which generate the data presented above are not entirely compatible. The sample universe for the rural survey contains all farm households while the sample universe for the urban survey only contains wage and salary earner households with monthly incomes of less than 300,000 won. The exclusion of higher income urban households most likely generates a downward bias on the urban income data. The extent of this bias is, however, not known.

Calculated from: Economic Planning Board, Korea Statistical Yearbook (Seoul: Sin Heung Printing Co., 1975), pp. 105, 107, and 225.

population, which in general resides in urbanized areas grew at an average rate of 17.2 percent per annum. This rapid increase corresponded to a gradual decline in farm population of 17 percent during the period. By 1974 the percentage of the total population classified as nonfarm residences had reached slightly over 62 percent. These shifts in population and estimates of the population living in ten of Korea's major urban areas is presented in Table 3.5.

This shift in Korea's rural-urban population is exemplified in the rapid rate of growth experienced by Korea's major cities during the decade. During this period, the population in these areas increased slightly more than 80 percent or at an average annual rate of 18.1 percent. Seoul led this growth with an average annual increment of 19.8 percent, followed by Suweon and Busan. The slowest growing city was Chuncheon registering an average annual increase of 13.9 percent.

This rapid increase in urban population has precipitated a rise in the demand for urban services such as transportation, housing, education facilities and commercial establishments. For example, from 1965 to 1974 the road system in Seoul and Busan was expanded slightly less than four times. The number of educational institutions were expanded 1.2 times and medical facilities were increased 1.3 times. The national housing situation, which has always been a problem,

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the most alluring factor in present rural-urban migration trends. It is believed that young students from rural areas who are sent to the better urban schools generally tend to remain in the cities after they complete their education rather than return to the rural areas. If this is true, this factor alone would have a substantial effect on urban growth trends.

Table 3.5.--Rural-Urban Population Mix and Population Residing in Major Urban Areas, 1965-1975.[a]

	1965	1967	1969	1971	1973	1975[e]	Average Yearly Increase
Urban population[b]							
Total	12,515	13,463	15,149	17,117	18,260	21,573	17.2
% of national pop.	44.2	45.6	49.3	53.8	55.5	62.2	1.8
Rural population[c]							
Total	15,811	16,078	15,588	14,711	14,644	13,108	-1.7
% of national pop.	55.8	54.4	50.7	46.2	44.5	37.8	-1.8
Population in major urban areas[d]							
Seoul	3,470.8	3,969.2	4,776.9	5,850.9	6,283.6	6,884.0	19.8
Busan	1,419.8	1,463.3	1,675.6	1,941.0	2,072.0	2,451.0	17.3
Incheon	485.5	535.6	577.9	671.1	728.6[f]	797.1	16.4
Suweon	123.1	131.0	161.0	175.7	191.7	223.8	18.2
Chuncheon	101.3	103.8	112.7	126.0	135.3	140.4	13.9
Chungju	120.9	126.6	133.2	154.6	167.0	192.5	15.9
Daejon	307.6	329.5	365.2	436.6	462.8	506.2	16.5
Jeonju	216.9	223.8	243.4	271.5	285.7	311.3	14.4
Kwangju	365.6	432.6	491.1[f]	532.4	552.4	606.5	16.6
Daegu	811.4	887.1	1,034.2	1,132.6	1,212.5[f]	1,309.5	16.1
Total population	7,423.0	8,202.5	9,517.2	11,292.3	12,091.5	13,422.2	18.1

[a]Unit: 1,000 persons.

[b]Urban population is assumed to equal nonfarm population and is the residual left after subtracting farm-population from the total national population.

Table 3.5--Footnotes (continued)

[c]Rural population is assumed to equal farm population compiled from the Ministry of Agriculture and Fisheries, Yearbook of Agriculture and Forestry (Seoul: Sung Moon Publishing Co., 1976), p. 23.

[d]Compiled from statistical yearbook published yearly by each of the cities cited.

[e]Unpublished preliminary estimates from the 1975 Census of Population and Housing, Economic Planning Board.

[f]Estimates generated using linear interpretation.

tended to worsen even though construction increased twofold. The status of national housing is presented in Table 3.6.

Table 3.6.--Status of Housing in Korea for Selected Years 1967-1974.[a]

Year	Population	Households	Houses	Houses Constructed	Housing Number	Shortage %
1967	29,597	5,145	4,097	95	1,048	20.4
1972	32,350	5,774	4,493	110	1,251	22.2
1973	32,844	5,934	4,503	181	1,325	22.3
1974	33,337	6,609	4,763	208	1,306	21.5

[a]Unit: 1,000.

Source: Ministry of Construction, Evolution of National Housing Policy in Korea (Seoul: The Republic of Korea, 1975), p. 3.

During the period from 1967 to 1974 the shortage in housing reached 21.5 percent. This figure in itself is somewhat alarming but when compared with results from the 1970 Census of Population and Housing it becomes severe.[8] This census discovered that the housing shortage in urban areas with populations of 50,000 inhabitants or more stood at 42 percent. This meant that two out of every five urban households were without proper housing. With the rapid increase in the construction of urban dwellings since 1970 this ratio has most likely declined. In all probability, however, it is still substantially higher than the level indicated above.

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[8]Economic Planning Board, Bureau of Census, 1970 Census of Population and Housing; Vol. 1 Complete Enumeration (Seoul: Economic Planning Board, 1971), Table 5, p. 398.

The provision of adequate urban facilities, such as those mentioned above, over the past decade has required the use of substantial areas of land. In many instances this land has been taken out of agriculture production. These shifts in land use both at the national and city level are examined below.

Land Use Estimates

A limited variety of data is available which can be used to reconstruct Korea's past land use trends. Many of the data series, however, suffer from a number of problems. In general, they have been developed for agency specific purposes and thus lack consistency in definitions, area coverage, and collection methods. These inconsistencies at best cause some major problems, since many of the series contain data gaps and biases which cannot be easily accounted for by using alternative series. This is not a problem unique to Korea but one which is shared by a number of developed and developing countries.

This section attempts to present two of the major data series presently available in Korea. An attempt is made to examine each separately and then to point out some of their similarities and inconsistencies. The development of a composite series has not been attempted since the complexity of such a task would require a separate research project in and of itself. The methods and data, however, which might be used in this task is discussed at the close of this section.

The Development of Land Use Data From Land Registration Records

Two types of land registers, one for purposes of registering ownership rights and one for land tax purposes, are presently maintained in Korea. Data associated with the former was first collected and tabulated following the completion of a national land survey[9] by the Japanese in 1918. The Land Register developed through this survey is based on the principle of material composition with land parcels listed by lot not by owner. Updating of the register is presently carried out via a personal report system as required by the Civil Code adopted in 1960. This Law requires that, "any changes including the acquisition and loss of real rights caused by legal acts on real estate shall be valid only when they have been registered."[10] A second register, the Public Land Register, is maintained for tax purposes. This latter register attempts to maintain an up-to-date description of land not its legal status. As such, it lists the location of land, lot number, land use classification,[11] acreage, and the addresses and names of the owner. Information collected to update this register is collected from two sources: the Land Register and periodic

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[9]This survey had three primary objectives: (1) to survey ownership rights, (2) to survey land prices, and (3) to survey topographical and terrain features.

[10]The Republic of Korea, Civil Code, 1960, Article 186.

[11]Twenty-one classes of land are presently used including paddy land, upland, residential land, mountains, roads, railroad right-of-way and terminals, man-made reservoirs, irrigation canals, river beds, river banks, small ponds, parks, temples and graveyards, waterworks and pipeline right-of-way, mineral lands, historic ruins, and miscellaneous.

administrative surveys conducted by local tax officials. Pak et al. describe the relationship between these two types of registers as follows:

> There exists the following relationships between the land register and the public land register which lists only the de facto (not legal) conditions of land:
> (a) As far as changes in the status of rights on land are concerned, the matters entered in the former become the basis for entry of matters in the latter
> (b) As far as the de facto conditions of the land are concerned, entry of matters in the former depends upon the matters entered in the latter.[12]

Since 1970 the data in this latter register has been used to compile yearly national land use statistics by land class.[13] This data aggregated into six land use classes is presented in Table 3.7.

As of 1974, the total land area of the Republic was approximately 9.879 million hectares. A major portion of the land area, approximately 66.7 percent, being relatively mountainous was classified as forest land. About 22.4 percent or 2,213.8 thousand hectares generally located along the west and southern coasts and in the four major river valleys was classified as arable. Of this 1,259.6 thousand hectares or 56.9 percent was classified as being used in paddy rice production, with the remaining area, 954.2 thousand hectares, being employed in the production of a variety of upland crops. Residential land, essentially land containing a permanent structure other than those associated with agriculture, accounted for 1.7 percent

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[12]Pak Ki Hyuk et al., A Study of Land Tenure System in Korea (Seoul: Korea Land Economics Research Center, 1966), p. 302.

[13]Prior to 1970, only private land was included in these estimates. All government and unregistered parcels were excluded.

Table 3.7.--National Land Use Pattern, 1970-1974.[a]

	1970	1971	1972	1973	1974	Change
Cultivated land	2207.0	2204.0	2203.8	2205.4	2213.8	+ 6.8
--paddy	1266.9	1260.2	1258.6	1258.9	1259.6	- 7.3
--upland	940.1	943.8	945.2	946.5	954.2	+ 14.1
Forest land	6645.5	6650.5	6658.0	6583.5	6585.5	-113.1
Residential	157.3	161.9	165.2	169.5	172.2	+ 14.9
Urban Services[b]	166.3	167.6	180.7	190.1	182.1	+ 15.8
Water resources[c]	569.1	558.0	559.6	630.5	640.2	+ 71.1
Other land[d]	76.0	77.9	80.2	83.0	85.4	+ 9.4
Total	9821.2	9819.9	9847.5	9862.0	9879.2	+ 58.0

[a]Area is in 1,000 hectares.

[b]Includes land used for roads, rail facilities, and water supply systems.

[c]Includes area of rivers, lakes, small and large rivers, and irrigation and drainage works.

[d]Includes land used for mines, temples, parks, graveyards, historic ruins, and miscellaneous uses.

Source: Ministry of Home Affairs, Registered Land Statistics (Seoul: Ministry of Home Affairs) for the appropriate years.

of the total land area or 172.2 thousand hectares while land devoted to roads consumed 170.2 thousand hectares. Water resources, including rivers, lakes, and irrigation systems absorbed 640.2 thousand hectares or 6.4 percent, with other land uses totalling 85.4 thousand hectares.[14]

A closer examination of the data in Table 3.7 indicates the presence of some minor changes in the nation's land use pattern. Over the five year period the land area of Korea increased by approximately 58 thousand hectares. Rather substantial shifts occurred in both the forestry and water resources classifications. The former declined by 113.1 thousand hectares while the latter increased by approximately 71.1 thousand hectares. The land area used for structures and urban facilities also increased by almost 31 thousand hectares. According to the data agricultural land, which was thought to be declining, actually increased by slightly less than 7 thousand hectares. This increase resulted from a growth in upland of 14 thousand hectares and a decline in paddy of just over 7 thousand hectares.

Although the period covered by the data is relatively short, making trend analysis difficult, there are a number of trends and discontinuities implicit within the data series which are of some interest.

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[14]Other uses include the remaining land use classifications such as, mineral land, rail facilities, potable water supply systems and miscellaneous. Approximately 20 percent of this area can be classified as urban land. A complete listing of the land in each of the 21 use classes is presented in Appendix II.

As would be expected given the rapid increase in Korea's urban areas during the period, residential land increased steadily, expanding approximately 15 thousand hectares between 1970 and 1974. A much more striking increase, however, occurred in the national land area and the area of land devoted to water resources in 1973. During this year the latter jumped almost 71 thousand hectares while the former increased approximately 55 thousand hectares. These increases were matched by a rapid decline of 113 thousand hectares in forest land. A major portion of this decline, 74.5 thousand hectares during 1972 and 1973. While there would seem to be a logical connection between shifts of this magnitude, neither the data nor its source provide any insight into their underlying causes.

With respect to agricultural land, a surprising trend emerges. During the earlier years of the period (1970-72) paddy land declined 8,300 hectares, leveled off sometime in 1973 then increased by the end of 1974 by 1,000 hectares. While the general movement of this trend seems to agree with data published by the Ministry of Agriculture and Fisheries, which is discussed below, the relative magnitude of the changes are far smaller than those recorded in the latter series. An interesting point which seems to appear in the above series, which does not appear in the Ministry of Agriculture and Fisheries data due to its exclusive focus on agricultural land, is the relationship which might exist between the decline in paddy area early in the period and the rapid expansion starting in 1972 of the nation's road system. During the period from 1972 to 1973 the area employed for roads increased 21 thousand hectares. If a two year lag between the initiation of construction and the opening of a major road is assumed, then it would seem reasonable to hypothesize that a substantial part of the 8,600 hectares of paddy land lost during 1970-71 may have been used for the expansion of the nation's transportation system. Both the construction dates and location of the Seoul-Busan Expressway would seem to lend merit to this hypothesis. If such a relationship is true then it might be important enough, given the present magnitude of future highway construction plans to warrant further investigation.[15]

The expansion of upland during the period which tended to offset some of the paddy area lost during 1970-72 seems to be the major impetus behind the overall increase in cultivated land. As the data indicates, this land use increased rather gradually from 1970 to 1973 then jumped almost 7,300 hectares in 1974. The increase in this year alone offset decreases experienced in paddy land over the whole five year period and was responsible for generating the positive increase in agricultural land shown in Table 3.7. This rather erratic pattern of increases tends to be suspect since neither its direction nor the magnitude of the changes follows those recorded by the Ministry of Agriculture and Fisheries during the period. These latter estimates are discussed below.

The Development of Land Use Data From Agricultural Cultivation and Reclamation Statistics

Another major source of land use data with specific reference to agriculture is compiled by the Ministry of Agriculture and

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[15] The Ministry of Construction in its ten year development plan begun in 1972, plans to construct 1,944 kilometers of expressways and 12,360 kilometers of other roads.

Fisheries. This Ministry has for a number of years been interested in calculating and publishing yearly estimates of the nation's agricultural land base. Their efforts have generally focused on determining, through sample surveys and administrative reports, the nation's total arable land area by land type (upland and lowland) and that portion of the overall area which is used for crop production.[16] These latter estimates are used as one of the principal inputs in the calculation of yearly crop production estimates.

From 1966 to 1973 the Ministry expanded its data collection efforts to include both estimates of land publicly or privately reclaimed for agricultural use and land lost to agriculture via conversion or natural disasters.[17] This information when combined with the data on arable land formed the basis of a balance sheet which recorded the flow of land into and out of agricultural use. Even though the estimates of reclaimed land were collected through administrative channels and considered by some to be of dubious validity they did, when combined with the estimates of arable land form the only source of information which attempted to trace the yearly internal, as well as, external shifts in the agricultural land base. The estimates from 1966 to 1973 are presented in Table 3.8.

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[16]Prior to 1973 this data was collected in addition to yield estimates through the Ministry's administrative reporting system. Because of biases encountered in the annual yield estimates, however, they decided to shift to sample survey collection methods in 1973. Time series results of these estimating procedures are published and updated yearly by the Ministry of Agriculture and Fisheries in The Yearbook of Agriculture and Forestry Statistics.

[17]Unfortunately this data series was abandoned in 1973 when the sample survey format was adopted.

Table 3.8.--Agricultural Land Conversion 1966-1973.[a]

Year	Cultivated Land at the Beginning of the Year		Reclaimed Nonagricultural Land		Net Land Converted from[b] Paddy-Upland		Net Total of Other Land Added or Lost to Agriculture[c]		Cultivated Land at the Beginning of the Next Year		Land Converted to Nonagricultural Uses		Total Agricultural Land Lost During the Year
	Paddy	Upland	Paddy	Upland	Paddy	Upland	Paddy	Upland	Paddy	Upland	Paddy	Upland	Area
1966	1,286,201.8	970,194.6	11,701.4	52,300.6	+6342.5	-6342.5	-13,012.7	- 5,917.3	1,287,117.8	1,005,970.5	4,115.2	4,264.9	8,380.1
1967	1,287,117.8	1,005,970.5	6,513.7	25,449.5	+3472.6	-3472.6	- 3,701.0	- 3,923.7	1,290,523.9	1,021,397.4	2,879.2	2,626.3	5,505.5
1968	1,290,523.9	1,021,397.4	4,356.5	17,503.4	+2006.3	-2006.3	- 3,082.9	- 3,351.4	1,289,323.3	1,029,452.7	4,480.5	4,090.5	8,571.0
1969	1,289,323.3	1,029,452.7	3,071.2	10,939.2	+ 156.3	- 156.3	- 4,372.0	- 7,330.1	1,283,023.0	1,028,146.5	5,155.8	4,759.0	9,914.8
1970[d]	(1,283,023.0)	(1,028,146.5)							(1,272,954.3)	(1,024,563.0)	(10,068.7)	(3,583.5)	(13,652.2)
1971	1,272,954.3	1,024,563.6	5,211.2	13,204.4	- 633.7	+ 633.7	-11,874.5	-23,632.0	1,264,840.4	1,006,466.9	816.9	8,302.8	9,919.7
1972	1,264,840.4	1,006,466.9	5,971.6	13,494.2	+3287.7	-3287.4	- 3,996.7	-22,691.1	1,259,441.6	982,848.8	10,661.4	11,133.5	21,794.9
1973	1,259,441.6	982,848.8	6,299.7	10,701.4	+2328.6	-2328.6	- 366.3	- 7,082.8	1,262,637.0	978,615.8	5,066.6	5,523.0	10,589.6
TOTAL											42,244.3	44,283.5	88,327.8

[a]In 1,000 hectares.

[b]Indicates net flow of upland converted to paddy and vice versa.

[c]Other land lost or added includes: abandoned land, land converted to forestry, paddies used as ponds or for fish production, land converted to burial grounds, illegally cultivated land which reverted to its former use by government order and building sites returned to agricultural use.

[d]Only estimates of cultivated land are available for 1970. Estimates of reclaimed land for this year were not collected because of the time required to administer the 1970 Agricultural Census.

Source: Crop Statistics Division, Ministry of Agriculture and Fisheries, Result of Surveying Basic Agricultural Statistics (Seoul: Republic of Korea, 1974), Table 8, pp. 20-21.

As the data indicates, losses of agricultural land to non-agricultural uses tended to be much more severe than those indicated in Table 3.7. Only considering the estimates of cultivated land at the beginning and end of each period shows a decline of slightly less than 51 thousand hectares from 1966 to 1973. These estimates are, however, somewhat low since they do not incorporate additions and losses to the agricultural land base during the year. When these are combined with the latter estimates an overall loss of 88 thousand hectares is indicated. This loss was divided almost equally between paddy and upland the former declining 42 thousand hectares and the latter decreasing by 44 thousand hectares.

Because of rather erratic fluctuation in the magnitude of the loss from year to year any statement about the trends involved would be highly speculative. What does seem to be evident is a slightly more pronounced tendency of paddy land conversion vis-a-vis upland conversion prior to 1971. For example, during the period from 1966-70 for every hectare of upland lost, 1.38 hectares of paddy were lost to agriculture. However, after 1970 the situation reversed, such that, from 1971 to 1973 for every hectare of upland lost only .7 hectares of paddy were lost.

This year also seemed to mark a turning point with respect to land reclamation. Prior to 1970 reclamation activities aimed at converting nonagricultural land into both paddy and upland were on the decline. For example, the reclamation of paddy land dropped from approximately twelve thousand hectares in 1966 to only three thousand hectares in 1969. Similar trends were also evident in upland reclamation activities. By 1971, however, these trends had been reversed to such an extent that by 1973 slightly more than twice the area was converted into paddy as was the case in 1969. Similar trends were also evident in the reclamation of upland to paddy. In 1966 the net flow of upland converted to paddy was slightly more than six thousand hectares. By 1971 this conversion rate had declined to such an extent that net additions to paddy acreage became negative. During this year approximately six hundred hectares of paddy were converted to upland production.

These trends seem to indicate a change in the relative value of paddy acreage vis-a-vis upland. A partial explanation for this shift can be found in the intensification of government efforts to increase rice production. This additional effort was fostered by a drop in the nation's rice self-sufficiency index.[18] This index declined from 99.1 percent in 1966 to 93.1 percent in 1970. This decline led to an increase in rice imports from 3.1 million dollars in 1966 to 141.5 million in 1970. Such a large loss of foreign exchange in turn provided the rationale for intensifying government programs aimed at decreasing rice consumption and increasing production. The effects which these policies had on the total value of output for selected paddy and upland commodity groups is presented in Table 3.9.

As Table 3.9 suggests, the total value of a hectare of paddy remained rather stable from 1966 to 1968. During this three year

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[18]The rice self-sufficiency index is a measure of Korea's ability to produce a sufficient quantity of rice to meet internal consumption requirements. A percentage of less than one indicates that internal consumption exceeds production. This requires the importation of rice to fill the deficit.

Table 3.9.--Total Value of Output per Hectare for Selected Commodity Groups, 1966-1973.[a]

Year	Rice		Fruits[b]		Vegetables[c]		Soybeans	
	Value	Index	Value	Index	Value	Index	Value	Index
1966	157.4	100.0	248.7	100.0	295.5	100.0	26.6	100.0
1967	152.3	96.8	269.7	108.5	310.4	105.0	39.4	148.2
1968	172.3	109.5	313.5	126.1	340.7	115.3	33.7	126.7
1969	271.6	172.6	349.3	140.5	349.5	118.3	34.9	131.7
1970	270.9	172.1	327.7	149.9	423.2	143.2	56.8	213.8
1971	346.3	220.1	443.1	178.2	567.5	192.0	60.6	228.1
1972	437.5	278.0	941.3	378.5	570.6	193.4	73.4	276.0
1973	519.4	330.0	996.0	400.5	574.2	194.3	86.1	324.0

[a]Unit: 1,000 won per hectare.

[b]Includes apples, pears, peaches, oranges, and grapes.

[c]Includes cucumbers, sweet melons, chinese cabbage, radishes, garlic, and watermelon.

Source: Ministry of Agriculture and Fisheries, Yearbook of Agriculture and Forestry Statistics (Seoul: Sung Moon Publishing Co., 1976), Table 24, pp. 74-86 and Table 143, pp. 410-15.

period a hectare of upland employed in vegetable production was approximately 1.96 times as productive as a comparable hectare of paddy. Substantial increases in yields, however, in 1969 and an increasing government price support policy for rice from 1969 onward led to a rapid increase in the value of rice acreage after 1969. From 1970 to 1973 the total value of production hectare of past paddy increased from 270 thousand won to 519 thousand won. The absence of a similar trend with vegetable acreage led to a reduction in its value vis-a-vis paddy land. By 1973, one hectare of upland was only 1.11 times as productive in value terms as a hectare of paddy, a substantial decline from the 1970 level.

While the above trends, especially those indicated by the agricultural land use data, show some shifts in land use patterns, they become more pronounced when the land use patterns around major urban centers are considered. An examination of these trends are presented below.

Urban Land Use Patterns

As indicated in the opening section the rapid expansion of urban and industrial infrastructure place rather severe conversionary pressures on open space areas in and around urban centers. It has been in these areas, the urban-rural fringe, where a substantial part of Korea's land use changes have occurred in the past. This can be seen in an examination of the land use data presented in Table 3.10.

Land use changes in Korea's major urban areas tended to differ significantly from those in the country as a whole. In general, there was a tendency for land to shift from more extensive

Table 3.10.--Land Use Patterns in Ten Major Urban Areas, 1970-1974.[a]

	1970	1971	1972	1973	1974	Percentage Change	
						10 Cities	National
Agricultural	44,831.5	40,886.2	39,552.5	39,822.0	36,712.6	-4.5	-0.6
--paddy	25,995.6	23,865.9	22,884.9	22,464.7	20,762.9	-5.0	-0.1
--upland	18,835.9	17,000.0	16,637.6	17,352.6	15,949.6	-3.8	-1.3
Forest	78,481.2	77,433.8	75,503.2	77,822.0	77,347.8	-0.04	-0.2
Residential	36,691.1	40,765.8	42,520.1	43,466.1	46,690.2	+6.8	+2.4
Urban services	9,301.4	9,306.9	9,633.4	10,302.1	10,588.1	+3.5	+2.4
Water resources	16,071.2	16,624.2	17,578.3	17,577.9	17,330.9	+0.2	+3.1
Other	5,688.9	6,210.2	6,622.7	6,785.0	7,194.9	+6.6	+3.1
Total Registered Land	191,065.3	191,208.0	191,380.1	195,774.8	195,864.5		

[a]Estimates are for the cities of Seoul, Busan, Incheon, Suweon, Daejon, Kwangju, Daegu, Chuncheon, Chungju, and Jeonju in hectares.

Sources: Ministry of Agriculture and Fisheries, Yearbook of Agriculture and Forestry Statistics (Seoul: Sung Moon Publishing Co.), for selected years and Ministry of Home Affairs, Registered Land Statistics (Seoul: Ministry of Home Affairs), for selected years.

to more intensive uses. For example, in the ten cities surveyed cultivated land declined slightly more than 8 thousand hectares or 18 percent from 1970-74. This decline, equivalent to 4.5 percent per annum, was slightly more than seven times that of the national average. Examining the rate of decline in paddy and upland areas the data indicates that over five thousand hectares of the former and slightly less than three thousand hectares of the latter were transferred out of agricultural production. These losses represented a decline of 20 percnet in paddy area and 15 percent in upland area during the four year period. When compared to the national loss rate, losses of paddy in these urban areas were more than sixty times those for the country as a whole. Upland losses, on the other hand, were slightly less than three times as great in the urban areas.

Another interesting point brought out in the data is the relative preference for paddy over upland for conversion. For every one hectare of paddy lost only one-half hectare of upland was converted. This is the reverse of the national trend where the ratio was one hectare of paddy to 1.07 hectares of upland. The apparent preference of developers for urban paddy over upland might be explained by their desire to minimize site preparation cost. On paddy, which is virtually level, very minimal expenditures would be required to convert the land to residential uses. On upland, where bench terracing and drainage is required the preparation costs are higher, making the site less desirable for development.

The other land use trends presented in Table 3.10 while similar to those at the national level in direction, tend to be much more pronounced. For example, from 1970-74 residential land in the ten city area increased 10 thousand hectares or slightly more than 28 percent or 6.8 percent per annum. This rate of growth was approximately 2.8 times that of the national growth rate. This is easily understandable if one considers the large influx of people who migrated to these cities and the rapid rate of industrial growth which occurred there during the period. In addition, land used for urban services and other uses also increased. The former which consumed 1.2 thousand additional hectares grew at a rate 1.5 times faster than its national counterpart. Other land, which includes many urban orientated uses, such as parks, burial grounds and temples grew 1.5 thousand hectares or 2.1 times faster than the national average.

The rapid expansion of Korea's urban areas and the resulting decline in agricultural land over the last decade have proved to be one of the major factors responsible for the formulation and adoption of new land use policies. In general, these policies have been designed to lessen the adverse effects emanating from these rapid conversionary trends. An examination of these policies and their effects on these trends is presented in Chapter IV. Before proceeding, however, a few comments concerning the land use data series presented above are in order.

Problems With the Existing Data Series

Both of the basic data series presented above tend to suffer from a number of problems when used as a data base for land use planning. These problems arise in general from the disparity which exists between the goals and objectives of the data series and the data requirements of land use planners. For example, the principal reasons for collecting land use data in the dual set of public registers is the maintenance of an accurate record of legal ownership of property and the tabulation of tax assessment data. For a number of reasons the linking of these two data series tend to interfere with the maintenance of an accurate set of land use data. First, because the former register is concerned with ownership, not use, it tends to employ land use classifications which are not totally consistent with the needs of land use planners. Thus, five classes of water resources are used while only one is employed to record built-upon land.[19] As a minimum this latter class should be subdivided into four subclasses: residential, industrial, commercial, and institutional. Second, because the registers are used for tax purposes and are operated on a "self-reporting" system a number of errors are incorporated into the data. When land is converted from agricultural to residential uses there are incentives on the part of the new owner to retain the old classification to avoid taxes. This results in an overestimation of cultivated land and an underestimation of residential land. Even though recent efforts have been intensified using aerial photos and field investigations to alleviate these errors there still remains a substantial difference between the area of cultivated land listed in the register and survey estimates generated by the Ministry of

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[19]These five categories include: ponds, river beds, small streams, large ponds (reservoirs) and river banks.

Agriculture and Fisheries.[20] This difference seems to be much more pronounced in urban areas where land conversion is proceeding at a much more rapid pace than in rural areas. In 1974, the most recent year when printed data was available for both series, the land area classified as cultivated land by the register was 1.36 times larger than the Ministry of Agriculture and Fisheries survey estimates. Finally, the lag time required between the collection and publication of the land use data appearing in the register is extremely long. As mentioned above, the latest data available is for 1974. Such delays make it extremely difficult to incorporate the data effectively into a land use planning system where the monitoring of more short term changes is required.

With respect to the Ministry of Agriculture and Fisheries' agricultural land use data, which is considered to be more accurate than that published in the register, the basic problem is its limited scope. At present only estimates of cultivated land are provided. These, however, do not provide an adequate data base for agricultural land use planning purposes. A much more detailed breakdown which registers both shifts in and out of agriculture and shifts between upland and paddy land classifications is required. This does not mean that the past system which relied on administrative reporting should be reinstituted. Rather a new data collection system,

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[20]An additional source of deviation is the lack of consistency between the definition of cultivated land used by the two ministries. The Ministry of Home Affairs includes all land associated with agriculture (i.e., land used for homes, barns, farm roads, etc.) while the Ministry of Agriculture and Fisheries limits its estimates to land which can be used in production of crops.

possibly connected with the yearly agriculture survey would seem more appropriate. To be useful such a system would have to meet two basic demands. First, it would have to collect data at the national level of sufficient specificity so that an agricultural land use balance sheet could be maintained similar to that presented in Table 3.10. Second, in areas where conversionary pressures tend to be strongest, such as those which surround large urban centers, a more detailed record should be maintained. Such a record would not only include the monitoring of changes in the agricultural land base within and between agriculture and other uses but the monitoring of the final use destination of land coverted out of agriculture. This latter monitoring function would provide the necessary inputs for determining which of the nonagricultural uses was mounting the greatest conversionary pressures on agricultural land and what type of agricultural land was being threatened by which nonagricultural uses. Such information is extremely important in formulating and adopting land use policies which are use-specific in nature.

CHAPTER IV

KOREAN LAND USE POLICIES SINCE 1965

Introduction

In response to the conversionary pressures, examined in Chapter III, a number of public policies have been adopted since 1965 which have attempted to control the speed, type, and direction of both agricultural and nonagricultural development. Some utilizing the police powers, especially zoning and subdivision regulations, have prohibited growth on specific types of land and have provided for the orderly development of structures on other land. Policies have also been adopted to control rapidly rising urban land prices either through direct price controls or the imposition of special taxes on land sales. Still other policies involving the provision of tax incentives and/or penalties have been promulgated to influence the location of new construction and the intensity of land use on specific types of urban land.

The administrative responsibilities delegated through these policies have been vested in a number of ministries and quasi-government agencies. In many cases policies have been specifically designed and implemented to accomplish the goals of the administering agency. But the effects of these policies have often transcended the agency's immediate area of administrative concern and have interfered with the activities and objectives of other ministries. Conflicts and inconsistencies between land use policies tend to arise naturally in any country because of the complex nature of government's involvement in land use and development and the internal complexities associated with the land market itself. In Korea these inconsistencies have been exacerbated by reliance on a short-term approach to solve land use problems and the absence of a national long-term land use policy.

The following presentation analyzes Korea's major land use policies which have been adopted since 1965 and delineates some of their more obvious effects. For purposes of presentation the policies which are examined have been divided into two major categories, those which embody an exercise of the police powers, and those which are related to the government's power to tax. The chapter concludes with an evaluation of the policies with respect to their effect on land conversion and prices and some general suggestions on future land use policies with specific applications to agriculture. Before proceeding to this discussion, however, a few comments concerning the legal basis for Korean property ownership are in order.

Legislation Affecting Land Ownership Prior to 1965

Three pieces of legislation adopted prior to 1965 have tended to set the tenor of land ownership trends in Korea. Individual ownership of property is guaranteed in the Constitution. Article 20 of this document guarantees the right of property to all citizens as long as the exercise of such rights do not interfere with the public welfare. This latter phrase sets the stage for government control and intervention in the individual's exercise of rights in land.[1]

The rights of the individual to own property are further articulated in the Civil Codes. According to Section 211 of these codes, "An owner has the right, within the scope of the law, to use, take the profits of, and to dispose of an article to establish a plan for their balanced development and use."[2] In carrying out this responsibility the Constitution empowers the government to, ". . . impose restrictions or obligations necessary for the efficient utilization, development and preservation of farming land, forest and other land."[3]

The individual's rights to property are much more explicitly stated in the Civil Codes adopted in 1958. This set of codes sets down the scope of individual ownership rights in the following manner, "An owner has the right, within the scope of law, to use, take the profits of, and dispose of the articles owned."[4] The codes go on to state where the articles owned is land which have value,

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[1]The Republic of Korea, The Constitution of the Republic of Korea, Article 20 Section 1-3 in Laws of the Republic of Korea (Seoul: Korean Legal Center, 1975), p. 3.

[2]Ibid., Chapter XI, Article 117, Section 2, p. 15.

[3]Ibid., Article 118.

[4]The Republic of Korea, Civil Codes, Chapter II, Section I, Article 211, in Laws of the Republic of Korea (Seoul: Korean Legal Center, 1975), p. 182.

then an individual's rights extends both above and below the surface."[5]

In these laws, farmland and its ownership have received specific attention. To abolish the inequitable tenant-landlord relationship which existed at the close of World War II, the Constitution specifically stated that, "Tenant farming shall be prohibited in accordance with the provisions of law."[6] This prohibition was expanded in the Farmland Reform Law of 1949. The purpose of this Law was:

> . . . to secure the independence of farmers' economy by appropriate distribution of farmlands among the farmers, and thus to improve the farmers' living conditions, keep the balance of, and develop, the national economy by increasing agricultural production.[7]

To secure these objectives the law redistributed to farmers farmland publicly owned by the government during the Japanese occupation, farmland held by individuals in excess of the three chongbo limit (1 chongbo = 2.45 acres or 1 hectare) and farmland owned but not personally tilled by the owner. To encourage private reclamation activities the legislation excluded partially reclaimed lands or tidal flats and farmland reclaimed after the enforcement of the law. In addition, farmland located in special areas such as plateaus or mountainous regions specified by the government, land used for

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[5]Ibid., Article 212.

[6]Constitution, Chapter XI, Article 118, p. 15.

[7]The Republic of Korea, Farmland Reform Law, Law No. 31 promulgated June 21, 1949, Article 1 in Farmland Reform in Korea (Seoul: Ministry of Agriculture and Fisheries, 1975), p. 61.

perennial crop production and land used by the Government, public organizations, educational institutes, etc. were excluded from the law.

This law resulted in the redistribution of slightly more than 550 thousand hectares. As such, the proportion of farmland operated by tenant farmers dropped from 60 percent in 1945 to 1.7 percent in 1955.[8] While this legislation did have beneficial effects on the distribution of ownership of productive resources and on agricultural production itself, there is some question whether or not the 3 chongbo limit is still a viable regulation. With the rapid growth which has occurred in agriculture since the adoption of the legislation some have argued that the acreage limit has begun to act as a constraining factor on capital investment and farm mechanization. Such arguments may have some theoretical validity especially in agricultural areas around urban centers where production might be more technically and capital intensive.[9]

While the discussion concerning the limitation is still a contested issue, a number of other public policies have already been adopted which affect the nation's land use patterns. A review and commentary of the major policies adopted since 1965 is presented below.

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[8]Ibid., pp. 19 and 37.

[9]The studies of Nichols and Tang sighted on p. 12 would hypothetically tend to substantiate the belief that farmland near urban centers has undergone some substantial changes in capital and technical inputs. However, very little information is available to prove or reject the belief that the 3 chongbo limit is in effect constraining the future growth of farm productivity.

Korea's Use of the Police Powers to Control Land Use

The rapid horizontal expansion of the cities of Seoul and Busan during the latter part of the 1960s led to the designation of greenbelt zones around each of these cities in 1968. These early attempts at developmental zoning were essential stopgap measures promulgated to control horizontal urban growth until such time as comprehensive land use policies could be formulated to protect suburban areas from the pressures of urban expansion. The rationale for establishing these open space areas in and around these cities was presented as far back as 1961 in the National Physical Development Plan formulated by the Ministry of Construction (MOC). This plan recommended that land on the periphery of large urban areas be designated as open space using the following rationale:

> . . . in order to enhance the efficiency of land use of cities at various levels, upland expansion and high concentration will be prevented; and city beautification and good functioning of cities will be ensured by means of designating areas in which only special activities are to be developed and areas where development will be restricted (Greenbelts).
>
> . . . following urbanization and mechanization, needs for parks and greens are becoming greater than ever before. In urban planning, the main function of greens is to provide urban dwellers with open spaces for rest and recuperation, strolling, appreciation of nature, and to provide protection from natural disasters including fire and earthquake.
>
> . . . parks and greens must be improved in their functioning as a means for separating industrial area from residential area.
>
> . . . for metropolitan areas of Seoul, Busan and Daegu, Greenbelts will be designated as a means of controlling their horizontal expansion.

> . . . to prevent horizontal urban expansion encroachment upon fertile suburban land.[10]

These policy goals were given substance through the promulgation of an Urban Planning Law in 1971. Under the authority vested by this law, the Ministry of Construction was empowered to create greenbelts around eleven additional major cities:

> . . . in order to restrict urban development to prevent disorderly urban expansion and to preserve the natural environment around the cities, and, hence, to maintain a healthy living environment; or if it is necessary for security purposes as defined by the Minister of Defense.[11]

The purposes of these greenbelts, as defined in the law were quite broad. They were to (1) protect agricultural, forest, and other lands with resource significance, (2) prevent the disorderly growth of urban centers, (3) prevent the conversion of open spaces adjacent to the greatest concentrations of population in the country, and (4) to contribute to the national defense. Apparently the law does allow for the transformation of land if it does not entail the removal of large amounts of soil or does not violate the intent of the law.[12] Such a provision does allow or may even encourage the reconstruction of paddy land where minimal construction work is necessary. All other changes such as "the construction of buildings and structures,

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[10] National Land Development Plan 1972-1981 (Seoul, The Ministry of Construction, 1971), p. 247.

[11] The Republic of Korea, The Urban Planning Law, Article 2, Section 14, Law No. 2291 (January 1971) as amended by Law No. 2435 (December 1972).

[12] Ibid., Article 2, Section 20.

the transformation or subdivision of land and any urban planning project which would violate the purposes of the Greenbelt designation"[13] were strictly prohibited. Specific procedures to uphold these prohibitions were promulgated by Presidential decree in July of 1971. The decree stated:

> . . . the city mayor or the district chief shall not issue permission for construction of buildings or transformation of land as listed in the Urban Planning Law (transformation of land: planting of trees or bamboo; removal of soil or rocks; building, repairing, or expansion of buildings or other structures; or installment of piling of objects that are not easy to remove) unless such an act is:
> (a) for the public good;
> (b) for such activities that will not violate the purpose of the designation of the Greenbelt (for example, agricultural, forestry or agriculture operated by those who live in the Greenbelt);
> (c) better located in the Greenbelt than in a dense area;
> (d) maintenance work on existing houses or other structures that existed at the time the Greenbelt was designated.[14]

The above ordinance seems to allow for some flexibility in the use of land within a greenbelt. For example, section (a) above would seem to provide significant latitude for the incorporation of selected urban uses into the greenbelt area. These might include sites for low density institutional uses, for selective industrial uses and other extensive land use activities. In addition, section (c) suggests that with the proper analytical evidence of the trade-offs involved, urban development, might be allowed to encroach on the poorer agricultural lands protected by the greenbelt rather than upon

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[13]Ibid., Article 2, Section 21.

[14]The Republic of Korea, The Presidential Ordinance for Urban Planning, Law No. 5721 (July 1971) as amended by Law No. 5806 (October 1971).

prime paddy land located close to the urban area but not within the protective greenbelt.

Since 1972, two nationwide agricultural zoning ordinances have been adopted to prohibit the conversion of agricultural land, most specifically paddy lands which have received some form of public investment, to nonagricultural uses. The first statue, of the Law for the Preservation and Utilization of Agricultural Land, defined agricultural land as any land used for cultivation or pasturage or the raising of perennial crops or land which was designated and announced to be such, regardless of its legally registered classification.[15] For purposes of administering the law the Ministry of Agriculture and Fisheries (MAF) adopted a series of administrative guidelines early in 1973 which divided all farmland into two categories; permanent and relative farmland. The former category contained: (1) paddy land which had been improved through irrigation, drainage, or consolidation carried out with public funds, (2) farmland where collective farming was possible, or (3) farmland where mechanized agriculture was possible. The relative farmland category included paddy land with incomplete nonpublic irrigation and land improvement projects, upland areas and small isolated farms fields in residential, industrial, or rural village areas. The guidelines prohibited any development, other than that specifically authorized in the Law, to occur on permanent farmland and only development with government approval on relative farmland. The level of administrative

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[15] The Republic of Korea, Law on the Preservation and Utilization of Agricultural Land, Law No. 6549 (March 1973).

approval in this latter case was dependent on the size of the land area to be converted. With conversions of over 10,000 pyong (1 pyong = $3.3m^2$), approval from the Minister of Agriculture and Fisheries was required; between 6,000 and 10,000 pyong, clearance from the Provincial Governor was necessary; and for conversions below 6,000 pyong, local approval was required, either from the Mayor or District Administrator.

As a first attempt at comprehensive agricultural zoning, the Law and its companion administrative procedures did a commendable job in treating both land and development as nonhomogeneous commodities. With respect to the former, the policy implicitly recognized that different tracts of agricultural land have different values. The classification system, however, fell somewhat short in assessing actual value since it relied exclusively on absolute measures, i.e., paddy vs. upland and investment vs. noninvestment rather than more relative measures such as the net value of production or the level of investment.

The concept of coordinating the level of administrative approval with the scale of the project seemed to be an appropriate method of controlling the impacts of land conversion at the administrative level where the project would be planned and negotiated and where the impacts of the conversion would be most intensive. Large projects such as privately financed industrial developments and major construction ventures which consume large areas of land are generally planned, negotiated, and carried out at the national level. This level of planning and implementation seems to be appropriate in these projects since their effects normally transcend both local and regional boundaries. Projects of smaller scale such as local housing and wholesale and retail marketing facilities are normally carried out at the provincial and subprovincial level and thus should only require local approval.

The Law, however, had a number of shortcomings which affected its efficiency as a land use control instrument. For example, farmland located in specific areas was exempted from the Law. The Law did not protect paddy or upland in "an urban planning area or a proposed industrial estate area or in an industrial development stimulation."[16] This essentially excluded agricultural land located in the urban fringe area, other than that protected by greenbelt zoning, from any type of control. In addition, the Law excluded certain types of large scale public construction from control. As the Law stated:

> . . . a national governmental organization wishing to convert agricultural land or public facilities outside urban planning areas for use of an official or public facility must obtain the agreement of the Minister of Agriculture and Fisheries . . . , except if the conversion is for:
> (a) the site of a defense/military facility; or
> (b) the site of an expressway, national highway, railroad, port or airport facility; or
> (c) the site of an agricultural land improvement facility; or
> (d) the site of a land preservation facility; or
> (e) the site of a multi-purpose dam or the area covered under water by the dam; or
> (f) the site of expansion of an existing school or other educational facility as provided under the Law of Education.
> . . . an effort should be made to make only essential conversions.[17]

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[16]Ibid., Article 4, Section 3.

[17]Ibid., Article 4, Section 5.

These exemptions did present some significant problems for effective agricultural land use planning. For example, section (b) above excluded MAF from examining or providing a critical review of plans to construct 1,994 kilometers of expressways and the paving and widening of 5,568 kilometers of national highways by 1981.

The inability of the Ministry to coordinate or control large public developments on agricultural land coupled with the political pressures which accompanied the desire for food self-sufficiency led to the adoption of a new and stronger agricultural zoning law in early 1975.[18] The new statute upheld the permanent-relative dichotomy and slightly altered the process of administrative approval required for converting farmland. Permanent farmland was not, as in the old law, to be converted without Ministerial approval. The new law, however, required that:

> Prior to the granting of approval, consultation or permission for the diversion of permanent farmland . . . the Minister of Agriculture and Fisheries is empowered to request that the person, or persons who is/are diverting permanent farmland pay an amount of money sufficient to reclaim an equivalent area of farmland. The said payment shall be made prior to approval and deposited with the Seoul City Mayor, Busan Mayor or Provincial Governor under whose jurisdiction the diversion is to occur.[19]

Theoretically, this requirement if imposed will increase the cost borne by the developer to a level at par with the social opportunity cost of the agricultural land lost. This would only be true, however,

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[18]The Republic of Korea, Revised Law on the Preservation and Utilization of Farmland, Law No. 8093 (April 1976).

[19]Ibid., Article 2, Section 4.4.

if the reclamation charge was a realistic charge for actual reclamation costs.

Like the old bill the new Law does allow for the conversion of permanent or relative farmland for a number of public projects, such as: industrial growth, tourism, port facilities and urban infrastructure projects within existing city planning zones. As such, almost 20 percent of the nation's agricultural land which is presently within urban planning zones is exempted from the agricultural zoning law. This is unfortunate since the agricultural land in these areas is the most severely threatened by conversion. In a more positive vein, however, the new requirements are somewhat more restrictive since they grant access only to that farmland which is already in a planned development zone. Any additions to these zones must have the consent of the Minister of Agriculture and Fisheries. This new requirement is presented in the following manner:

> Mutual agreement shall be arrived at between the Ministry of Agriculture and Fisheries and another concerned Ministry or Ministries in the case where farmland formerly outside a city planning zone is to be designated within such a zone or when farmland within a greenbelt, or a restricted zone or a city planning zone is to be diverted from agricultural uses.[20]

In addition to the tighter control of agricultural land within presently prescribed areas, the Ministry of Agriculture and Fisheries also has been given approval power over the conversion of farmland for certain public purposes. As the Law states:

> A mutual understanding should be arrived at between the Minister of the Ministry of Agriculture and Fisheries and other concerned ministries if these ministries wish to divert farmland for any of the following public purposes:

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[20] Ibid., Article 2, Section 4.2.

1. the diversification of absolute farmland for national security or military purposes
2. the diversification of farmland for the construction of roads, railroads, harbors, and airports as authorized by the Road Law
3. sites used for farm reform
4. sites used for facilities required for territorial integrity
5. an area needed for a multi-purpose dam
6. sites for school facilities as authorized by the Education Law

Mutual agreement will not be required for the diversion of relative farmland for flood control, national security and military purposes.[21]

The new legislation also attempts to place some new restrictions on the conversion of relative farmland. Prior to the conversion of such land a person must receive the approval of the Minister of Agriculture and Fisheries. Such approval is not required under circumstances outlined above in the discussion of permanent farmland and when the use of relative farmland is for residential settlement or as a site for an agricultural facility.

In addition to the above general zoning ordinances a number of other policy instruments have been adopted to control the rapid increases in land price which have occured in urban areas. Three specific statutes have been promulgated to control land prices in areas where speculation is likely to occur due to the announced location of a major public project. Each provides the administrative power required to fix land prices in areas which will be purchased for public projects. The Land Utilization and Management Law[22]

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[21] Ibid., Article 4, Section 5.1.

[22] The Republic of Korea, The Land Utilization and Management Law, Law No. 128 (March 1973), as amended by Law No. 147 (September 1974) and Law No. 151 (March 1975).

specifically addressed itself to the construction of industrial estates within prescribed industrial zones by the Ministry of Construction. The Land Compulsory Sales Law authorizes government in general and local government agencies in particular to set land prices. The Law states:

> The government or any other local government who wish to perform bona fide public projects approved by the Ministry of Construction may make an appraisal through public appraisal agencies of the perspective land under consideration to ascertain the actual market price at the time of appraisal and the standard real estate tax assessment price. These appraisals may be submitted to the Central Land Mobilization Committee. . . . The price confirmed by the committee is then announced as the price to be frozen.[23]

The Urban Planning Law already discussed also empowers the Ministry of Construction to set land prices with respect to land designated for new town developments. In the majority of instances these Laws have not been used to control overall land prices but to regulate the price of land directly linked to a specific project. In doing so they have tended to minimize public expenditures on land associated with a given project but have not proven to be effective in controlling the rapid increase in land prices and speculation which has occurred in peripheral areas. In addition, the initiation of these policies has generated a great deal of local dissatisfaction. This is only natural when a property owner sees the value of his property frozen while property values of adjoining plots skyrocket. Such policies can only result in the loss of local grass root support for government land use

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[23]The Republic of Korea, The Land Compulsory Sales Law, Law No. 4114 (October 1969), as amended by Law No. 5103 (June 1970) and Law No. 5732 (August 1971).

policies in general and an increase attempts to evade the highly discriminatory pricing policies.

Korea's Use of Taxation to Control Land Use

Korea's system of property taxation as presently structured is essentially a dual system of taxation which views nonfarm real estate somewhat differently than farm real estate. Both systems are subject to four general types of levies: (1) the general property tax, (2) registration tax, (3) acquisition tax, and (4) a variety of special tax sanctions and penalties each developed to influence a particular type or pattern of land use. A breakdown of each of these levies and the various taxes administered by the different levels of local government is provided for the interested reader in Appendix I and II.

Possibly the most striking feature of the system is the method used for determining the general property tax in farm and nonfarm areas. On farmland the amount of tax collected is based on the volume or market value of the crops produced and is levied on individual farm households. In the case of paddy land the value of production is determined by output value associated with the land's productivity classification by the end-of-year wholesale price associated with each commodity.[24] Recently a progressive tax rate ranging from 6 to 10 percent of the market value of production has been adopted superseding the old flat rate of 6 percent. In upland areas, land

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[24]Average yields for each of 16 classes of paddy are set by Gun and Eup headmen. Yields are generally conservative and in 1975 equaled 63 percent of actual yields.

productivity is determined by local survey conducted by Gun and Eup headmen at the end of the growing season and valued at end-of-year wholesale prices. The tax rate on this type of farmland is also progressive ranging from 10 to 20 percent of the land's value. As such, agricultural land is taxed only on its value in agriculture not at its market value as is the case in the United States.

In contrast, the property tax on nonagricultural land is levied on the market value of both land and buildings. In rapidly growing urban areas, where the competition for building sites and commercial space is high, this results in taxes being levied on a value base generally higher than would be the case if the net rent producing potential of a site in its present use were considered. Such an evaluation procedure combined with meaningful tax rates may have a significant impact on urban land use decisions. In general these higher tax rates when combined with other cost factors force less extensive uses, such as residential housing, into more intensive and thus more lucrative rent producing uses. The use of the nonagricultural property tax to enhance the intensification of land use within the urban sphere has not occurred to date in Korea. The major obstacle to the use of the tax in this manner has been the maintenance of a relatively low tax rate. At present the rate on nonagricultural land is set at a flat levy of 3 percent for buildings and 2 percent for land. As such the tax does not seem to generate a cost sufficient to control land use patterns.

In addition to the general property tax, a variety of taxes are levied when farm and nonfarm property is transferred. All persons who are buying land are required to register the deed with the appropriate government office. In the case of farmland the tax rate is 1.5 percent of the market value of the property. For nonfarm property a 2 percent tax is administered. An acquisition tax similar to a sales tax, is also administered on nonfarm property sales equivalent to 3 percent of market value.[25] In addition a defense and stamp tax are also collected on both farm and nonfarm property transfers. The former is assessed at 20 percent of the combined acquisition and registration taxes payable while the latter is assessed at 10 percent of the acquisition tax alone. Hypothetically the above transfer taxes when combined are equal to 6.5 percent on nonfarm property and 1.95 percent on farm property. For example, if farm or nonfarm real estate were sold for 100,000 won the buyer would be required to pay the following taxes:

Tax	Farm Property	Nonfarm Property
Acquisition Tax	Exempt	3,000
Registration Tax	1,500	2,000
Defense Tax	300	1,000
Stamp Tax	150	200
Total Taxes Payable	1,950	6,200

A variety of special levies have also been adopted over the last several years which have a direct bearing on the transfer, use, and location of real estate. A direct attempt has been made since 1967 to control rising urban land prices through the enforcement of a

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[25]Prior to January 1, 1975 an acquisition tax of 2 percent was collected on all sales of farm property. The tax has since been cancelled.

capital gains tax on land sales.[26] The original intent of the Law was to impose a transfer tax on the buying and selling of most parcels of land and buildings much like that imposed in England and Taiwan.[27] However, under strong public pressure, presumably from special interest groups, the government was forced to exempt the sale of buildings, private homes and undeveloped land from taxation. When the Law was finally promulgated in November 1967, only land utilized for large buildings was still subject to the capital gains tax. The legislation, however, did set down the current formula used to determine the amount of tax to be paid. This amount was determined by taking 50 percent of the selling price minus the initial purchase adjusted to account for inflation and equipment improvement costs. The limited scope of this law led to the promulgation of a much broader based speculation law in 1973. The intent of the Law which was entitled The Transfer Income Tax Law was to tax all excess profits accruing to an individual resulting from the sale of real estate in areas subject to speculation. The Law applied to land sales in Seoul and Busan, land along major expressways and land in other suburban and urban areas as designated by Presidential Decree. The Law specifically states:

> When any person transfers a parcel of land to another person for value in an area subject to the tax, the original acquisition price of the land minus the amount multiplied by the rising percentage of the wholesale price from the time of acquisition to that of transfer and excluding, therefrom the management costs, shall be deemed profit resulting from

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[26]Republic of Korea, The Real Estate Speculation Control Tax Law, Law No. 1972 (November 1967).

[27]See Chapter II, pp. 53-55.

> speculation in real estate, and fifty one-hundreds of this amount shall be taxed as speculation control tax.[28]

Unlike the 1967 tax the new law provided for very few exceptions. The statute goes on to state that:

> The tax will be exempted under the following instances:
> a. When the amount involved is less than W500,000.
> b. When, in the execution of national policy. a parcel of land is transferred to an individual or the State or a local autonomous body, or when a public corporation transfers land under its ownership to a third party.[29]

This Law has recently been expanded to include all land both urban and rural.

In addition to the above law a number of changes were incorporated in the general property tax system to effect the location and use of land. Revisions in the Local Tax Laws effective April 1, 1973 required that new factories if they located in urban areas were to be taxed five times their normal rate. If the factories chose to relocate or expand in rural areas then they would be exempted from taxation for a five year period. Additional changes were incorporated into the system by a Presidential Decree promulgated on January 14, 1974.[30] This measure has substantially increased the acquisition and property tax levied on luxury property such as large houses, golf courses and vacation villas while decreasing the tax burden on normal real estate. This latter measure was accomplished by increasing the

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[28] Republic of Korea, The Transfer Income Tax Law, Law No. 2705 (December 1974).

[29] Ibid., Article 2, Section 1.

[30] Republic of Korea, Presidential Emergency Measure No. 3 (January 1974).

exemption level to W60,000. With respect to the former the decree increased the acquisition tax on luxury property to 15 percent of market value. Also the general property tax rates for land used for golf courses, exclusive recreational areas, vacation villas, or other luxury pursuits was to be taxed at 5 percent of its market value per annum. Luxury buildings valued at 5 million won were to be subject to a progressive tax rate ranging from .5 to 5 percent. Finally the decree sought to intensify the use of idle land by levying a 5 percent tax on all unutilized property whether it be owned separately or held by a corporation for speculative purposes.

The Effect and Consistency of Korea's Land Use Policies

As the above indicates, Korea has over the past ten years attempted to modify and control rapid urban growth through a variety of tax and administrative controls. The following section examines the effect of these policies on both the rate at which land has been transferred from less extensive to more intensive uses and on urban land prices. It closes with a series of general comments and suggestions which might be incorporated into future policies. Particular emphasis in these remarks is placed on agricultural lands.

The Effect of Land Use Policies

The effect of the policies outlined above on the rate of land conversion and urban land prices is at best a very difficult relationship to isolate. This is true in any country since the flow of land from one use to another is affected not only by price and policy variables but also be a number of social and cultural factors.

Any attempt at ascribing changes which have occurred in the past to any one of this complex web of forces is at best speculative and prone to error.

This already difficult task is further complicated in Korea by a number of factors. For example, two major pieces of legislation, the Transfer Income Tax Law 1974, and the Revised Law on the Preservation and Utilization of Farmland 1975, were promulgated so recently that there isn't any date available which can be used to determine their effectiveness. In addition, earlier legislation such as the Real Estate Speculation Control Laws (1967), was so limited in scope that any effect which it might have had on land prices and/or conversion rates would have been overshadowed by general market trends. Hee comments on the ineffectiveness of this legislation in the following manner:

> . . . it (the law) did not end the land speculation in Seoul . . . and what has happened is that buyers and sellers in areas where the tax applies are no longer reporting the true sale price in an attempt, usually successful, to reduce the amount of transference tax they must pay.[31]

The real price of commercial property in Seoul (Table 4.1) if examined in the absence of other market conditions would tend to suggest that the legislation may have had some effect on checking the rise of speculation.[32]

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[31]Hee Rho Yung, "Comment 1," in Land for the Cities of Asia, ed. by Allen M. Woodruff and John R. Brown (Hartford: The John C. Lincoln Foundation, 1971), p. 203.

[32]Only commercial property is considered since the Law when finally promulgated only applied to land used for large buildings.

Table 4.1.--Average Market and Real Prices for Commercial, Residential and Industrial Land in Seoul, 1965-1975.[a]

Year	Commercial		Residential		Industrial		Av. Real Price
	Market Price	Real Price[c]	Market Price	Real Price	Market Price	Real Price	
1965	56,019	56,019	17,210	17,210	3,766	3,766	25,665
1967	114,085	87,603	36,372	27,929	7,370	5,659	40,397
1968	157,307	108,018	50,133	34,425	13,644	9,369	50,604
1969	273,506	165,932	79,950	48,505	17,283	10,485	74,974
1970	288,467	151,737	79,859	42,007	21,065	11,080	68,275
1971	334,860	157,968	89,390	42,169	26,152	12,337	56,768
1972	337,016	138,815	92,708	38,186	25,348	10,441	62,481
1973	343,479	129,142	92,121	34,636	25,565	9,612	57,797
1974	396,368	117,659	111,055	32,966	33,478	9,938	53,621
1975	519,410	123,961	130,600	31,169	43,900	10,477	55,202

[a]In won per pyong.

[b]Real prices are in 1965 won and have been deflated using the implicit GNP price deflator.

Source: Korean Appraisal Board, Urban Land Price Index, 1963-1974 (Seoul: Korean Appraisal Board, 1975) and Land Price Statistics (Seoul: Korean Appraisal Board, 1976).

For example, the real price of commercial property while rising almost five fold from 1965 to 1968, began a sharp decline in 1969. This decline continued from 1969 to 1974, with real prices dropping approximately 29 percent. Assuming a two year price response lag from the time the bill was adopted to the time when an effect would be monitored in commercial land prices, the reversal in prices initiated in 1969 would suggest that the Law did have some effect on prices. The strength of this conclusion, however, is significantly weakened by the fact that the real price of residential land, not controlled under the Law, also began to decline during the same year. If the Law were the sole cause of the price decline, there is no reason for residential property prices to decline. Any attempt at measuring the effectiveness of this or any other land use controls adopted during the period is extremely difficult due to the rather confusing trends which occurred in the nation's economy in general and the construction sector in particular during the 1970-74 period. From 1970-72 this latter sector's contribution to Real Gross National Product remained essentially constant at or around 150 billion won. In 1973 the sector's contribution jumped to 180 billion won and again leveled off rising only 1.6 billion won in 1974. This rather erratic behavior was picked up both in the private construction industry and in the urban land market. For example, the construction of new structures authorized by building permits (Table 4.2) mirrored very closely the shifts in the construction industries' shared Gross National Product. According to the data floor area of new structures rose from 7.7 million square meters in 1968 to 10.8 million square meters by

Table 4.2.--Authorized Construction of Structures, 1968-1974.[a]

Year	Total	Commercial	Residential	Industrial
1968	7,717	3,811	1,742	1,283
1969	9,572	4,776	1,996	1,525
1970	10,787	5,885	2,009	1,529
1971	9,619	5,594	1,787	1,164
1972	8,701	4,529	1,543	1,514
1973	16,572	7,924	2,212	4,836
1974	16,884	10,300	2,372	2,808

[a]In 1,000 meter^2.

Source: The Bank of Korea, Monthly Economic Statistics, Vol. 9 (1975), Table 84, p. 111.

1970, declined in 1971 and 1972, almost doubled by 1973 and again leveled off in 1974.

These fluctuations also found their way quite naturally into the urban real estate market. As Table 4.1 indicates, average real prices for land rose from 1965 to 1969, almost trebling during the period. However, in 1970 real prices began a downward decline which did not end until 1974. Recent price data for 1975 seems to indicate that real prices had regained some of this loss but still stood at a level comparable to that which was present during 1968-69.[33] The average real price of residential property which began declining in 1971 was hardest hit, dropping almost 26 percent during the period. This was followed by commercial land prices which dropped 25 percent

[33]Korean Appraisal Board, Land Price Statistics.

from 1970 to 1975 and industrial land prices which declined 23 percent from 1971 to 1973.[34]

Theoretically, such price trends would tend to indicate a slackening of demand for urban land. This seems to be partially borne out when the land conversion trends in major cities are examined. The trends for Seoul and Busan are presented in Table 4.3. In Seoul, the conversion of land from less extensive uses such as agriculture and forestry to more intensive uses such as residential property and urban services declined in both 1971 and 1972. During this two year period, the area devoted to agriculture and forestry declined 22.8 and 23.1 percent respectively. There was, however, a significant change in the rate of decline from 1971 to 1972. For example, during 1971 the area devoted to crop production dropped 19.9 percent. In 1972, these losses were reduced resulting in only a 2.9 percent decline during the year. The slowing in the conversion rate became so pronounced that by 1973 an increase in cultivated area, 6.3 percent, was experienced. This increase can be almost totally attributed to an increase in the land area devoted to upland crop production.[35]

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[34]It should be noted that these price trends were not unique to Seoul but also occurred in each of the ten major urban areas during the period.

[35]Apparently, this rise in upland was due to the presence of a very tight money market during the period. Because of this prospective homeowners who had already secured and terraced land for housing construction were unable to secure adequate financing to complete construction as planned. In the interim, these new home owners rented the terraced area, which was quite substantial, to farmers for upland cultivation resulting in a rapid rise in the upland area. In 1974, the money market began to soften allowing construction to commence on a number of sites which resulted in a sharp rise in the conversion rate.

Table 4.3.--Land Use Trends in Seoul and Busan, 1968-1974.[a]

	Seoul[b]				Busan					
	70-71	71-72	72-73	73-74	68-69	69-70	70-71	71-72	72-73	73-74
Cultivated land	-19.9	-2.9	6.3	-10.1	-5.6	-13.9	-16.2	-5.1	-13.4	-0.7
Paddy	-18.7	-4.4	-2.3	- 8.7	-7.0	-12.5	-14.3	-6.1	-16.5	-0.1
Upland	-21.2	-1.1	16.8	-11.5	-3.2	-16.4	-19.2	-3.9	- 7.5	-2.0
Forest land	- 3.6	-0.2	2.6	- 1.9	-0.6	- 0.8	- 0.6	0.1	- 1.7	0.9
Residential land	11.2	1.3	1.0	4.3	9.5	15.1	13.9	6.9	9.3	0.6
Urban services	6.2	4.1	2.5	3.2	-2.5	7.5	3.9	2.2	5.9	4.8

[a]Figures in the table indicate the yearly change in the area devoted to a given use. For example, the area of cultivated land in Seoul declined 19.9 percent from 1970 to 1971 while residential area increased 11.2 percent. Unit: in percent.

[b]Land conversion data for Seoul was not available prior to 1970.

Sources: The Ministry of Agriculture and Fisheries, Yearbook of Agriculture and Forestry Statistics (Seoul: Sung Moon Publishing Co.) for the appropriate years. The Ministry of Home Affairs, Registered Land Statistics (Seoul: Ministry of Home Affairs) for the appropriate years.

During this year, the city's upland cropping area expanded 16.8 percent while paddy acreage continued to shrink, declining 2.3 percent over the 1972 area.

In Busan, a slightly different pattern of conversion occurred. Like Seoul, there was a decrease in the rate at which land was being transferred from extensive to intensive uses during the 1970-72 period. For example, during the 1970-71 period cultivated land declined 16.2 percent. By 1972, the rate had declined so that the total area devoted to crop production declined only 5.1 percent. However, unlike Seoul, the conversion rate again increased with the cultivated area declining 13.4 percent in 1973. The increased rate of conversion experienced in this year might be partially attributed to the completion of the final link in the Seoul-Busan Expressway and the peripheral growth which ensued during the period. This expansion was short lived with a rapid decline in both the conversion and growth rates occurring during 1973-74.

Possibly the most striking feature of this period was the absence of any new major land use legislation in either city. As such, there is little if any evidence to substantiate the hypothesis that the declines in agricultural and forest land conversion trends during this period were caused by the adoption of land use policies. On the contrary, the analysis above seems to indicate that major downward shifts in conversion occurred because of a general slowdown in the economy not because of explicit government land conservation activities.

Comments and Suggestions Concerning Future Land Use Policies

It is inevitable that some agricultural land will be lost to urban uses in the future given the present level of urban migration and birth rates and the supply of convertible land in close proximity to Korea's urban centers. As the construction sector tends to recover from the sluggish growth patterns of the early 70s renewed pressure is going to be brought to bear on the less extensively used land areas in the urban periphery. The conversion of agricultural land in these areas presently is controlled by a number of policies. It may be located in an area which is designated as a special development district or a greenbelt zone under the direction of the Ministry of Construction, it may fall within an area protected by the Revised Farmland Preservation and Utilization Law administered by the Ministry of Agriculture and Fisheries or it may be in an area which is unprotected.

The division of agricultural land which is deemed important enough to be protected between two different ministries may in the future prove to be undesirable. As the demand for land for non-agricultural uses increases, the Ministry of Construction will most likely find it necessary to shift a portion of the agriculture which it presently protects from conversion by designating it as a greenbelt and special development district into more intensive urban uses. As mentioned, a certain amount of flexibility is already provided in the Greenbelt Zones set up by the Urban Planning Law. Although the Ministry has proven its expertise in those areas where it has been traditionally involved, i.e., urban and industrial infrastructure design and development, it does not seem likely that they will have the time nor the interest to devote a great deal of effort in addressing the question of which quality of agricultural land under their jurisdiction should be protected. Other considerations such as the cost of infrastructure and location may override questions of agricultural productive potential.

In the long run it would seem advisable for the Ministry of Agriculture and Fisheries, which is intimately concerned with the protection of the nation's agricultural land base, to consolidate its control over the more productive agricultural land located within the urban periphery. Movement toward this goal while not easy would require at least two basic steps. First, the Ministry would have to explicitly define a set of criteria which would be used to determine which agricultural land should be protected and which would be allowed to be converted. The present paddy-upland classification scheme found in the Revised Farmland Preservation and Utilization Law is not explicit enough for this purpose and would have to be changed. A new system which classifies land according to its net productive value in agriculture and its replacement cost would be more appropriate. Results obtained from applying this classification scheme in concert with such factors as projected population and urban land demand, and the location and the physical size of agricultural areas could be used to define a series of urban agricultural districts which would form a viable unit which the Ministry could protect from conversion.[36]

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[36]Both the location and the size of these districts would be important decision variables in the development of such districts. Failure to consider such variables might result in the definition of

In cases where these districts overlapped areas which are presently designated for development or areas which are under the control of other ministries, the Ministry of Agriculture and Fisheries could negotiate "land trades" in which they would relinquish control over agriculturally less productive areas to gain control over the more productive areas presently outside its jurisdiction. Presumably the Ministry would be willing under this system to trade off some marginally productive paddy areas which are generally preferred for urban development because of the low site preparation and development costs.

To enhance the likelihood that land, especially that located on the periphery of these districts, would remain in agricultural use it would seem advisable that serious consideration be given to exempting farmland within the districts from both the size and agricultural use restrictions presently in use.[37] Exemption from the size restriction, which limits an individual farm to three chongbo (one chongbo is approximately one hectare), would allow for the formation of larger farm units within the districts setting the stage for a more capital intensive type of agriculture. In addition, exemption from the agricultural use restriction would allow individual farmers to freely convert land from paddy to upland production in response to prevailing market conditions. Both of these exemptions

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a number of very small districts surrounded by urban areas which would be very difficult to maintain in agriculture.

[37]The former exemption would require an amendment to the Farmland Reform Law (1948) while the latter would require the addition of a section onto the Revised Farmland Preservation and Utilization Law (1976).

when combined would most likely have an inflationary effect on farm income generated by land within the district. Such preferential treatment would seem justified as a means of providing partial compensation to farm owners for retaining their property in agricultural production rather than covering it to more profitable nonagricultural uses.

Such a system of agricultural districts if large enough and properly maintained would in effect augment the open space areas maintained in the greenbelt zones. At present these zones are located on the outer periphery of urban areas. In some instances the inner boundaries of these zones are far enough from present built-up areas to allow substantial development to occur before these zones are reached. The incorporation of agricultural development districts into this system would allow for the location of open space areas devoted to agricultural production not only on the urban periphery as presently planned but between future built-up areas within the city itself.

In addition to providing the basis for classifying some of the more productive urban agricultural land and setting the stage for the maintenance of open space areas the data base required for setting up these agricultural development districts would prove to be an important source of input into national urban location policies. Such data would provide a convenient source for determining the nonhomogeneous production potential of land which abuts Korea's urban centers. Such information would be useful in implementing urban policies which would favor the expansion of those cities having peripheral lands of lower productivity or having more nonagricultural lands available for development.

The incorporation of this information into national urban location policies would likely have a significant impact on agriculture. For example, the conversion of 1,000 hectares of paddy land around Busan in 1974 would have resulted in a loss in production of approximately 3.11 metric tons of rice. The same conversion of land near Daegu would have resulted in losses of 3.70 tons. An implicit advantage of incorporating agricultural productivity into the urban relocation decision is the potential effect it may have on national income distribution. By weighing the location policy in favor of areas of low agricultural productivity which are generally lower income areas, the policy implicitly tends to relocate growth in those areas where it is most needed.

To institute the above system it is essential that an agricultural land classification system be developed. Such a system would have to be flexible enough to be able to incorporate and classify a large variety of agricultural use situations while specific enough to provide relatively accurate information about the costs associated with conversion at different locations within Korea. An initial attempt at formulating such a system is undertaken in Chapter V.

CHAPTER V

METHODS FOR ESTIMATING FUTURE URBAN LAND DEMANDS AND THEIR COST TO AGRICULTURE

Introduction

The development of a set of procedures or a model to determine the future level of demand for land for nonagricultural urban uses can like any other predictive tool be extremely complex or relatively simple. The level of complexity chosen depends largely on a number of factors such as model development, the level of funds available, the availability of competent staff and the presence of an adequate data base essential for both model parameterization and operation.

Each of these factors plays an important role at different points in the design and implementation phases of model development. Many have argued that data availability, while important should not be a critical consideration at the initial design stages. While this argument is valid to a point, at the more practical decision making level where models are used to generate informational input into the decision making system, the existence of relevant and accurate data becomes a critical link between model design, performance, and its usefulness in policy formualation.

A number of alternative model formulations or procedures are available to predict future land demand. The final methodology chosen must recognize the fact that the demand for land is essentially a derived demand dependent upon the future level of demand for the goods and services provided by land. The articulation of a procedure to predict these levels is intimately connected with data availability. This is especially true for short term research efforts such as undertaken here. Theoretically, if a wide variety of land use information such as use, prices, and income data is available, models can be designed to predict the level of demand for goods and services provided by land. Once arrived at, these levels can be converted into spatial equivalents to determine the amount of land required in the future.

In developing countries it is often difficult, if not impossible, to find or generate sufficient data to develop and parameterize such models. Various basic components such as price and income elasticities for land services and cross-sectional income data normally required for model parameterization are not available. Korea, while better than some countries, does not differ markedly from this position with respect to its land related statistics. For example, while there is some urban cross-sectional income data no effort has been made to link it with urban land services such as housing, even though this latter land use is one of the nation's largest consumers of nonagricultural land. In fact, housing statistics are so sketchy that it is difficult at present to determine with any certainty the exact size or composition of urban housing stocks.[1]

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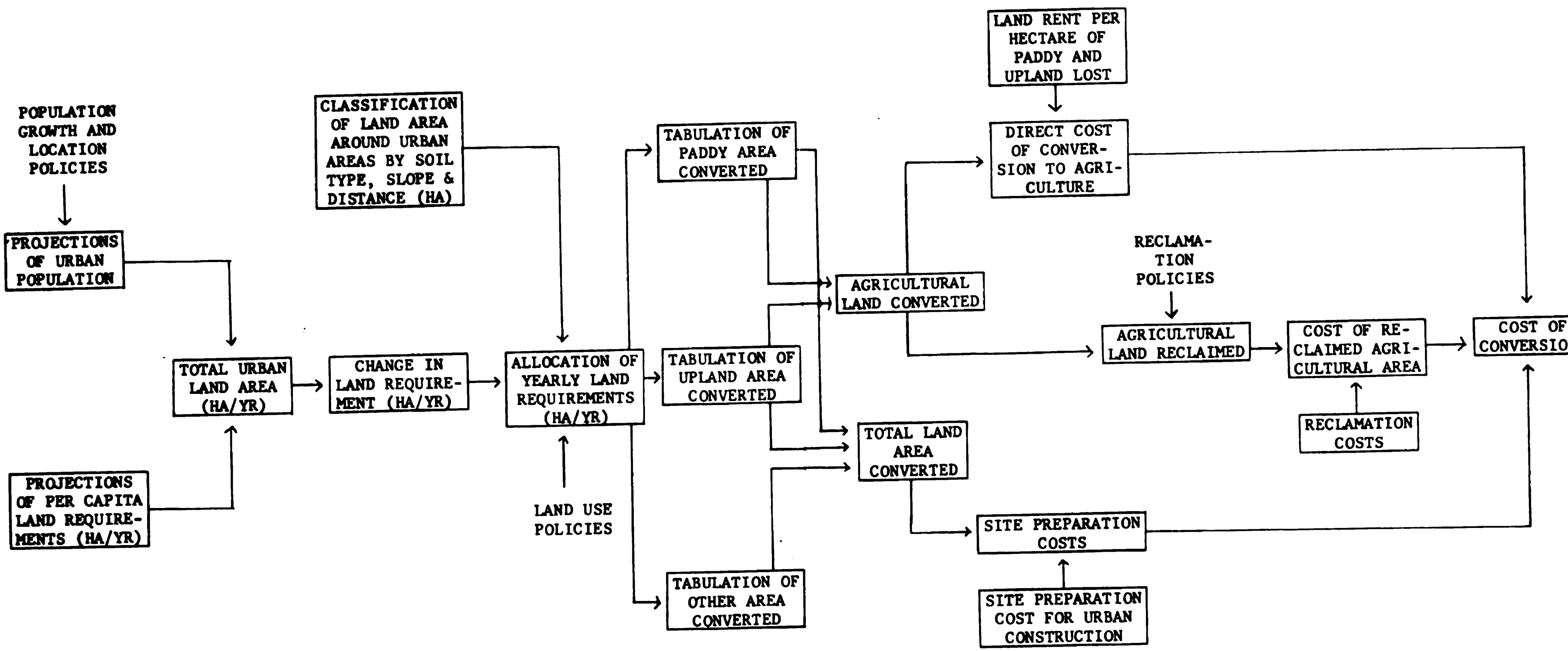
[1]Data on urban housing stocks were collected in the 1970 and 1975 Census of Population and Housing, Economic Planning Board. Results from the 1975 census have not as yet been tabulated while the

Because of these constraints the following chapter presents a relatively simple set of procedures which might be used to provide estimates of the quantity of land which may be required for urban growth and the costs associated with its conversion from agricultural use. A schematic presentation of the methodology employed in the study is presented on the following page.

Because of data problems, the procedures adopted rely on projections of past trends rather than estimates of urban services developed by supply and demand models. In the study projections of both urban population and per capita land requirements are combined to form estimates of the total and yearly increases in urban land area which will be needed to meet increasing demand. Using a land classification scheme, developed in the chapter, in conjunction with various land use policies a method of distributing these demands on the land surrounding urban centers is developed. These allocation procedures were developed as a means of determining the quantities of paddy, upland, and other land which was likely to be converted during urban expansion. The costs of this conversion is assessed using per hectare estimates of the agricultural land rent foregone by the conversion, estimates of the costs of reclaiming the area lost and the costs associated with the preparation of the land so that it could accommodate urban structures. A more detailed discussion of the individual steps employed including the areas selected for study and the various policy options examined follows.

1970 data provided no income data. As such, it is difficult to attempt a supply and demand type of analysis of this sector.



SCHEMATIC PRESENTATION OF RESEARCH METHODOLOGY

Methods for Developing Future Land Use Requirements

Selection of the Study Area

Two different distinct but overlapping study areas were selected for inclusion into this portion of the study. For the first section of the analysis which was relatively aggregated ten of Korea's major cities were selected. These included: Seoul, Busan, Incheon, Suweon, Chuncheon, Chungju, Daejon, Jeonju, Kwangju, and Daegu. Their selection was based on the following reasons. First, each of the ten cities represented a major growth center during the past decade. For example, the per annum population growth in each of the cities, a major indicator of urban expansion, ranged from 9.8 percent in Seoul to 3.9 percent in Chuncheon.[2] Second, cities with rapidly expanding populations generally tend to be those which consume the largest amount of agricultural land. As such they tend to be the most important focal points in determining future land requirements. Third, each of the cities selected constitutes a major government center. Both Seoul and Busan are classified as special cities while the other eight are sites of provincial government headquarters.

In this first part of the analysis all data was aggregated and examined on the basis of three regions. Such a regional scheme attempted to capture the differences in agricultural productivity

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[2]According to the 1970 Census of Population and Housing, the population in these cities constituted 33.6 percent of Korea's total population and 81.7 percent of its urban population. Urban population in this instance was defined as all persons living in urban areas with populations of 20,000 inhabitants or more.

associated with the different climatic and topographical zones in Korea.[3] These differences in productivity have a direct effect on the magnitude of the cost associated with agricultural land conversion and as such are important in assessing the cost of urban growth. In addition the use of regions provides a convenient base for comparing the monetary effect of different regional growth rates in addition to examining the effect that population redistribution policies might have on these costs. The first region, the double cropping region, encompassed Jeolla Nam, Jeolla Buk, Geong Sang Nam and Geong Sang Buk provinces and the cities of Busan, Chungju, Jeonju, Kwangju, and Daegu. The second region, the single cropping area, included Gyeonggi and Chung Cheong Nam provinces and the cities of Seoul, Incheon, Suweon, and Daejon. The third region, the upland cropping region, was composed of Gangweon and Chung Cheong Buk provinces and included the city of Chuncheon. Within this regional context estimates of urban land requirements were developed for each city examined and then aggregated to the regional level while estimates of agricultural productivity were developed at the regional level. The methods associated with each set of estimates are examined below.

A second and much more in-depth analysis of Busan was also undertaken to demonstrate the use of the land classification system developed in the latter part of this chapter and the effects of various land use policies on the city's anticipated growth pattern.

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[3]This regional breakdown was first used by Carl Wright, Kim Young Sik and Kim Kwang Hee in their publication entitled, Crop Production Data and Relationships, Special Report No. 8 (East Lansing: Korean Agricultural Sector Study, Department of Agricultural Economics, Michigan State University, 1972).

This city was selected for a number of reasons: (1) it is in a relatively productive agricultural area where land conversion is likely to have a marked economic effect, (2) land use data was available back to 1968 rather than 1970 as was the case in other cities, and (3) it is one of Korea's major growth centers being located at the southern terminus of the Seoul-Daegu-Busan growth corridor.

Methods for Projecting Urban Population and Per Capita Land Requirements

Future land demands for urban services are highly dependent on the interactions between future urban populations and how individual members of this population are likely to use land. The methods used in this study to project these demands relied on the projection of past time series trends of both urban population and per capita land requirements over the period from 1975-1985. In both instances the projections were developed by fitting the time series data to four types of function, a linear, an exponential, a log and a power function, using least squares regression. The estimating equation which generated the highest coefficient of determination (R^2) was then selected as the predicting equation for that variable for the period. Estimating equations for each of the ten cities mentioned above were developed to allow for the inclusion of various population dispersion policies into the aggregate estimates. Once developed they were aggregated to form regional estimates of population residing in the selected cities.

In the case of per capita land requirements only one set of aggregate estimating equations, one for residential land and one for urban services, was projected. The results generated by both sets of equations, i.e., those for urban population and per capita land requirements, were then multiplied to produce aggregate estimates of the land which would be required for the two different land uses for each year during the projection period. A more detailed description of the actual methods used for both population and land requirements follows.

As mentioned, time series data (Table 3.5) covering population growth in each of the ten cities was examined using the above regression techniques to select and parameterize a set of equations which could be used to project the population in each of the cities over the period from 1975 to 1986. A list of the estimating equations for each city and its corresponding R^2 is presented in Table 5.1.

Table 5.1.--Equations for Projecting Urban Population in Ten Korean Cities, 1976 to 1985.

City	Regression Equations	R^2
Seoul	$Y = 3309.7315e^{.07x}$	97.82
Busan	$Y = 1276.844e^{.0578x}$	97.63
Incheon	$Y = 465.116e^{.0498x}$	98.67
Suweon	$Y = 113.97e^{.0609x}$	98.34
Chuncheon	$Y = 92.828 + 4.43x$	97.13
Chungju	$Y = 110.998e^{.0464x}$	97.00
Daejon	$Y = 275.738 + 20.998x$	97.91
Jeonju	$Y = 203.7751e^{.0387x}$	98.44
Kwangju	$Y = 352.5x^{.2149}$	97.44
Daegu	$Y = 756.567 + 51.209x$	99.29

Urban population trends generated by the above methods assume that not only will past trends continue into the future but also the government efforts to curb or redistribute the population would have little if any effect on the growth of urban populations. To lessen the severity of these assumptions two alternative projections were undertaken.

The first assumed that population control policies would be exclusively adopted and enforced in Seoul generating a decline in the city's expected population.[4] This was incorporated into the base population projections by assuming that population in the city would expand linearly, not exponentially, as in the base estimates. In addition, it was assumed that 50 percent of the population that would have migrated to Seoul in the absence of population control policies would still migrate to one of the nine remaining urban areas. This additional population increment was distributed amongst the nine cities for each year in the projection period using the following two-step procedure. First, the yearly population estimates for Seoul developed using the exponential and linear growth functions were subtracted to develop estimates of the population loss due to government policy. Second, half of these estimates were then redistributed amongst the remaining nine cities using weights developed by dividing an individual city's annual average growth rate by the aggregated growth rate of all nine cities during the projection period. The resulting population

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[4]At present the government is attempting to limit Seoul's population by encouraging industrial dispersion through tax incentives and discourage residence through a residence tax and the limiting of participation in the city's guaranteed work program to city residents not migrants.

increments were then added to the cities' base population for each year.

The second set of alternative projections reflected the assumption that government programs to decrease urban population would have some limited effect on discouraging migration to all of the urban areas examined.[5] To incorporate this assumption into the projections it was assumed that those urban areas that had grown exponentially in the past would follow a linear growth rate in the future. Areas which grew linearly were assumed to continue increasing but only at 60 percent their normal rate. The results of these estimating procedures appear in Appendix II.

In addition to these population projections a set of aggregate per capita land requirements were projected for each of the regions for each of two urban land uses, residential land and urban services. The remaining four land use classes--cultivated land, forests, water resources and other land--all extensive uses were not estimated under the assumption that they would be converted to the more intensive urban uses as required by growth. Initially it was thought that projections of these two uses could be undertaken using regression equations parameterized in the same way as those used in the population projections. Time series data describing the land area in each

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[5]Programs which equalize the income differential between rural and urban areas administered through the agricultural price support system in addition to programs which improve the level of rural amenities may influence some potential urban migrants to remain in rural areas. The base data for cultivated land were provided by the Ministry of Agriculture and Fisheries, while data for the other five land use classes were supplied from local tax registers administered by the Ministry of Home Affairs.

use during the period from 1970 to 1974 (Table 3.10) was available for this purpose. Problems with this data, however, required that intermediate adjustments be made to the data prior to parameterizations of the equations.[6]

Interviews conducted with representatives from the Ministry of Home Affairs who were responsible for maintaining the land use data above tended to indicate that the estimates of cultivated land appearing in Table 3.10 were overestimated while estimates of residential land were probably underestimated. These discrepancies were based partially on the fact that the Ministry defines all land associated with farming to be cultivated land. This includes some land not used directly for crop production such as houses, roads, and other structures. In addition, some of the land classified as cultivated in the Land Register has actually been transferred out of agriculture for residential uses but has been retained on the local tax rolls in the less extensive classification to avoid higher property taxes.

To account for these discrepancies it was necessary to deflate the estimates of cultivated land and to inflate those for residential land for each city and year prior to parameterization. The inflator chosen to increase estimates of the residential land in each city was assumed to be equal to the difference between the cultivated land area estimates which appear in the Land Register and those compiled by the Ministry of Agriculture and Fisheries in their yearly survey

[6]For a full discussion of these discrepancies the reader is referred to pp. 91-95.

of Agriculture. Interviews indicate that this latter series was considered to be reasonably accurate.

Once these adjustments were completed for each city and year, regional per capita residential land requirements were calculated by dividing a given region's residential area by its population during each of the five years in the base period. These per capita estimates were then fitted to regression equations using the same methods employed in the population projections.

The other variable, the projected land area for urban services also had some problems. These were not associated with the reliability of the base data, but with the variability which occurred in the data from year to year. Such variability, while reasonable given the uneven capital investment pattern in urban infrastructure which occurred during the period, generated extremely low R^2 values when fitted to the regression equations. To account for this, it was assumed that per capita demands for land used for urban services were a function of the per capita area required for residential uses. This seems reasonable since many of the services are directly linked to the size and density of their service area, which tends to increase as residential land demands increase. Estimates of the per capita requirements for residential and urban services are presented in Appendix III.

To develop base estimates which could be used in parameterizing the regression equations, the following procedures were used. Per capita estimates of land area required for each city and year were developed. These estimates were then aggregated to the regional level and ratios between regional urban service requirements and residential land requirements were developed. These ratios were then used to parameterize the regression equation. Selection of appropriate estimating equations was done using the methods previously discussed. The actual per capita area required in each region was then generated by multiplying the projected ratios by the estimates of per capita residential land area required for each region and year.

The basic data used in developing the equations for both residential land and urban services and the equation selection for projecting each variable are presented in Table 5.2 below. This table, also includes estimates for Busan, which were developed using the above adjustment procedures.

Calculation of Future Land Demands

Once projections of future per capita land requirements and population were developed, it was a relatively simple matter to develop estimates of the future level of urban land requirements in each region and in Busan. The former was accomplished by multiplying the projected per capita requirements by each of the three levels of population generated for each region. Using these estimates, the yearly rate of change in the requirements was calculated for each region and the amount of land required for agriculture determined. This latter step assumed that not all of the urban land requirements would be met by the conversion of agricultural land but a portion would be converted from other land uses such as forestry.

To determine the extent of the new urban area which would be converted from agricultural use, the adjusted land use data originally taken from the Land Register for each of the ten cities was

Table 5.2.--Basic Data and Regression Equations Used in Estimating Future Urban Land Requirements by Region, the Nation and the City of Busan.[a]

Area	Base Data					Regression Equation	R^2
	1970	1971	1972	1973	1974		
Double Cropping Region							
--residential land	12.59	13.13	13.27	13.91	15.81	$Y = 12.232e^{.031x}$	95.3
--urban service ratio	.288	.276	.274	.262	.247	$R = .298 - 01x$	95.3
Single Cropping Region							
--residential land	11.35	11.61	12.05	12.20	11.55	$Y = 11.055 + .299x$	96.9
--urban service ratio	.343	.314	.307	.320	.321	$R = .344 - .013 \ln x$	39.6
Upland Cropping Region[b]							
--residential land	18.11	18.35	18.81	18.73		$Y = 18.093 + .512 \ln x$	87.9
--urban service ratio	.589	.578	.553	.549		$R = .604 - .015x$	93.5
All Cities							
--residential land	12.52	12.89	13.20	13.35	13.72	$Y = 12.278 + .286x$	98.4
--urban service ratio	.356	.334	.326	.339	.320	$R = .352 - .018 \ln x$	64.5
Busan							
--residential land	8.82	9.74	10.03	10.67	9.64	$Y = 7.810e^{.051x}$	95.8
--urban service ratio	.328	.299	.285	.276	.288	$R = .323 - .029 \ln x$	83.9

[a]Residential land is in pyong per person while urban services is the ratio of per capita urban service land to the per capita residential land requirements.

[b]An increase in the area of Chungcheon in 1973, the only city examined in this region rendered the per capita estimates ambiguous. Therefore, only the per capita data and ratio for the years from 1969 to 1972 were used in the parameterization of the estimating equation.

examined.[7] Average requirements for each region were developed from this data by dividing the overall change in paddy and upland recorded during the period from 1970 to 1974 by the overall change in urban land requirement. These calculations resulted in estimates of the percent of urban land requirements which have in the past come from agriculture. Implicitly, such a procedure assumes that all of the cultivated land lost in the past was in fact converted to urban uses. While this may not be entirely accurate since a small portion of the cultivated land most likely has reverted to nonurban uses such as forestry, the overall trend seems to support the assumption. The resulting estimates which were assumed to remain constant during the projection period are presented in Table 5.3 below.

Similar calculations of the absolute and yearly change in urban land requirements were also developed for Busan. However, since the source of new urban land requirements were to be determined by slope and distance from the center of the city, the calculation of the above percentage requirements was not necessary. The estimates of urban land requirements developed using the above procedures for each region and Busan are presented in Appendix III. The yearly changes which occur in these estimates are discussed in Chapter VI.

Methods for Estimating the Costs of Agricultural Land Conversion

Part of the above land requirements will in all likelihood be met by the conversion of agricultural land to nonagricultural

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[7]For an explanation of the reasons for conducting the adjustments and the methods used, the reader is referred to pp. 91-95 and pp. 132-33.

Table 5.3.--Percentage of Urban Land Requirements Taken from Paddy and Upland, 1970-1974.

	1970	1974	Change Over the Period		Regional Change Percent
			Hectares	Percent	
Double					
--upland	27,558.4	24,329.3	3,229.1	.261)	.722
--paddy	39,409.3	33,705.6	5,703.7	.461)	
--urban	50,346.7	62,719.3	12,372.6		
Single					
--upland	19,741.5	16,200.8	3,540.7	.311)	.751
--paddy	27,405.6	22,396.5	5,009.1	.440)	
--urban	41,554.0	52,942.4	11,388.4		
Upland					
--upland	1,149.0	1,058.7	90.3	.162)	.406
--paddy	1,312.2	1,176.0	136.0	.244)	
--urban	3,158.7	3,716.0	557.3		

uses. One of the factors which should be considered before the Ministry of Agriculture and Fisheries adopts a set agricultural land use policy is the cost of this conversion and how it is affected by the various policy options now available. These costs in turn are affected by the type and quality of agricultural land which is converted under each policy alternative. The following section develops a simple technique which can be used to simulate the location of future urban land demands under various land use policies. The technique is based on information developed from Korea's soil survey completed in 1971.[8] As such it provides estimates of the location

[8]A major soil survey was conducted in Korea between 1966 and 1972 through the joint efforts of the United Nations Development Program (UNDP) and the Institute for Plant Environment, Office of Rural Development, Ministry of Agriculture and Fisheries. The following two publications which were developed by the survey team were used extensively in developing the above methodology. These

of urban growth but also provides some indication of the quality of land which might be lost, its present use, its slope and its drainage capabilities. Each of these factors are important in determining the costs associated with converting land from a less extensive to a more intensive use. These costs and a set of procedures which are helpful in determining their magnitude given a particular agricultural land use policy are also presented. The more specific information concerning the location and cost associated with urban growth is used to assess the impact of urban expansion on agricultural land in the Busan area. More generalized data on a regional level is also generated which is used to assess the impact of growth generated in the ten urban areas.

For purposes of presentation the section is divided into three parts: the first discusses the development of a land classification system using soil survey maps, the second examines the costs associated with conversion, and the third talks of how these costs are affected by the form of land use policy selected.

Methods for Developing an Agricultural Land Classification System

The development of a land classification system which can be used to assess the impact of future urban development must provide information on the present use of land, any qualities which would affect its productivity in agriculture or its potential convertibility

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publications are: The Soils of Korea, AGL: SF/KOR 13, Technical Report 1 (Rome: Food and Agricultural Organization of the United Nations, 1970) and Soil Reconnaissance of Korea, AGL: SF/KOR 13, Technical Report 2 (Rome: Food and Agricultural Organization of the United Nations, 1971).

to nonagricultural uses and its location vis-a-vis present urban centers. The soil survey literature including both the description of the various soil types found in Korea and the soil survey maps provide a convenient source of this information. For example, the descriptions of the various soil types provide information on present use, productivity, slope and drainage for each soil type. This information, especially indications of present use and productivity, forms the basis for determining the monetary costs associated with converting agricultural land to nonagricultural uses. In addition, slope and drainage data associated with each soil type provide insights into the costs of preparing land for agricultural uses via reclamation or for nonagricultural urban uses. The mapping of those soil types on soil survey maps in turn provides a convenient base for determining the distance of any given soil type from present urban centers. When this distance and various other soil characteristics such as slope and drainage are combined, the resulting classification scheme can be used, given future land demands, to ascertain the most likely growth pattern an urban area may follow, what soils are likely to be used to accommodate this growth and the costs associated with converting each soil type.

The methods developed in this research used the fifty-eight tiered soil classification system developed during the Korean soil survey. This system in addition to separating soils by physical characteristics also provides information of present use, slope, and drainage. Information on present use tends to be important since agricultural soils even those which are heavily suited to a particular agricultural use are in reality almost never used exclusively for that use. For example, the survey recommends that fine loams and silty soils found in narrow valleys should be used for rice production. However, only about 70 percent of these soils are actually used in paddy production. The remaining 30 percent is divided equally between upland and forest production. These use ratios were combined with other information in the survey to estimate the proportion of the land found in a specific soil type which was being used for paddy and upland production. The division of the soils by agricultural use provided the basic structure required for assessing the costs of converting upland and paddy land to nonagricultural uses.[9]

Because of the importance of paddy acreage to the total agricultural productivity of Korea, paddy soil was further classified into three productivity levels, each associated with different yield levels.[10] The three productivity levels were developed by considering a soil's inherent limitations with respect to rice production, the risk of damage involved when they are used and the way they respond to treatment. For example, soils associated with the high productivity class are well suited to rice production with little if any natural limitations. They are generally nearly level to level, moderately

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[9]The division of the major soil types between four major uses: paddy, cultivated upland, forest, and others was done by the Institute of Plant Environment, Office of Rural Development. A list of the soil types, present land use in percent, area and recommended use can be found in "Map Symbols and Soil Names of Reconnaissance Soil Survey in Korea," Seoul, Institute of Plant Environment, Office of Rural Development, 1972 (Mimeographed).

[10]Procedures used in developing these yield estimates for each productivity level are discussed in a later section of this chapter.

well to poorly drained, and in a soil family characterized by deep, fine loam of clay soils. Soils in the medium productivity range while still usable for paddy, need special development and management. These soils are generally sloping, moderately well to poorly drained and in loam or clayey soil families. Because of slope and soil texture they tend to be difficult to work, susceptible to erosion and requires well-developed irrigation systems. The third class of soils, the low productivity soils, are generally gently sloping to sloping, moderately well to poorly drained, deep to moderately deep, often gravelly and in fine loam to clayey soil families. They are much more difficult to work and need special attention with respect to irrigation and erosion.

Within the overall system, upland areas are assumed to be essentially homogeneous cropping areas. In reality, however, such areas are used for a number of different agricultural operations. For example, they may be employed in some combination of grain, pulse or vegetable production, they may be used for perennials or as pasture land. In the future when more time and manpower are available, it might be advisable to breakdown this class into productivity levels similar to those associated with rice.[11] A breakdown of the various soil types, their present use, slope and drainage is presented in Appendix IV.

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[11]The soil survey literature presently breaks down upland areas into seven productivity classes. The first three classes are employed in upland crop production, each with varying levels of management, the fourth class is best suited for perennial vegetation, the fifth for grazing and forestry, the sixth for forest production and the seventh which is unsuited for any type of cultivation and is best left in its wild state.

The next step in the classification scheme, the actual measurement of the coverage area of each soil type and its location with respect to an urban area, was undertaken using the 1:50,000 soil survey maps of Busan and its environs.[12] It should be noted here that the techniques used are not limited to Busan but can be applied to any urban area in Korea. The first step in the procedure was to subdivide the area surrounding Busan into seven distance zones emanating from the center of the city.[13] The first of these zones, largely the built-up area of Busan, encompassed land within five kilometers from the center of the city. The remaining six zones contained land falling within bands around this initial circle every 2.5 kilometers. For example, the second zone contained land falling in an area 5 to 7.5 kilometers from the center, the third from 7.5 to 10 and so on up to and including 20 kilometers.

After demarcating the soil maps into these zones the area of each soil type in each zone was estimated using a planimeter. To account for measurement error, two readings of each area were taken, with the average being multiplied by a constant (in this case 10^4)

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[12]Ministry of Agriculture and Fisheries, Reconnaissance Soil Map--Busan City and Gyeong San Nam Do, No. 8 (Seoul: Institute of Plant Environment, Office of Rural Development, 1971), Plates 30, 31, 40, and 41.

[13]Originally it had been planned to construct the zones using time travel distance from the urban center rather than linear distance. This would have resulted in zone boundaries which would have been pushed outward along existing transportation routes and contracted in areas where roads were not present. The incorporation of the existing transportation system into the construction of the zones was precluded, however, by the absence of any time travel data for Korea.

to generate estimates of the area of each soil type and zone in square meters. In the process of measuring certain areas were excluded from consideration. For example, areas having a high concentration of structures (forty or more per one-half centimeter or two per hectare) were assumed to be primarily residential in nature and were excluded from the estimates of available land. Land containing major roads such as the Seoul-Busan Expressway or other transportation facilities such as railroad marshalling yards were also excluded. The results of these procedures are presented in Appendix V.

These procedures provided estimates of the area in each general land class by soil type and distance from the center of Busan. Additional information on the slope associated with each soil type was also incorporated into the classification scheme. In the original survey the slope of each soil class was described by an indication of its overall and dominant slope ranges. In many instances these ranges were much too broad to be of use in the study. For example, soils classified as type Ana, which are located in narrow valleys and valley flats, were found to range in slope from 2 to 30 percent with the majority of the soils ranging from 2 to 7 percent. Because of this it was necessary to develop a technique which would partition the area in each soil class into much more finely delineated slope ranges. A slope classification scheme encompassing nine ranges was selected for this purpose. The first range contained soils which ranged from 0 to 2.5 percent, the second from 2.5 to 5.0 percent and so on up to 20 percent. Soil types located on slope greater than 20 percent were assumed to be nondevelopable.

The partitioning of the total area of each soil type found in and around Busan on the basis of these nine ranges was undertaken by assuming an unequal distribution of the soil throughout its overall range. This distribution assumed that twice as much of the area of each soil type would occur in those slope ranges which fell within the bounds of the dominant range designation found in the soil survey as would occur in the slope ranges falling outside the dominant range but within the overall range. For example, if soil type X was listed as having an overall slope range of 0 to 15 percent and a dominant range of 7.5 to 12.5 percent in the survey and there was 100 hectares of the soil, then each slope range outside the dominant range would be assumed to include 12.5 hectares of the area while the ranges within the dominant range would include 25 hectares. Thus, the slope range from 0 to 2.5 percent would include 12.5 hectares of land, the range from 2.5 to 5.0, 12.5 hectares, the range from 7.5 to 10, 25 hectares and so on, up to 15 percent slope. By linking the area in each of these slope ranges with estimates of its distance from the center of the city, estimates of land area by slope and distance were generated. These estimates were then used to determine the potential future growth pattern of Busan and the costs associated with this growth. A discussion of these costs and the method used to assess them are presented below.

Assessment of the Costs Associated with Urban Expansion on Various Types of Agricultural and Nonagricultural Land

Because of the many imperfections which occur in the real estate market, the selling price of a given agricultural site while important to the individuals involved, has limited importance to the economy as a whole. In essence, such a sale is merely a capital transfer from one sector of the economy to another. It does not provide a great deal of information concerning the effect that the transfer will have on net national income nor how it should be interpreted in the context of land use planning goals.

What is of greater concern to the nation is the opportunity costs of a site, or the value of the land in the best alternative use which has to be given up if building development is to take place. From a land use planning point of view, it seems desirable that any measure, embodying economic considerations, designed to evaluate the costs and benefits associated with the conversion of alternative types of agricultural sites to nonagricultural uses be based on opportunity cost rather than selling price. Such a system would provide valuable information to land use planners who will be required to sanction or prohibit the conversion of a particular agricultural site to nonagricultural uses.

In developing countries such as Korea where both land and capital are relatively scarce it seems appropriate that the technique be developed to examine three basic categories of costs. First, there are the net costs associated with the removal of specific types of farmland from agricultural production. Second, there are the costs associated with the reclamation of nonagricultural land to replace that lost to other uses. In Korea, where grain self-sufficiency is a key issue, the replacement of paddy land lost takes on an added degree of importance. Third, there are the costs associated with developing different types of agricultural and nonagricultural land to the point where actual conversion may occur. This latter cost is important in determining the capital that might be required if all or part of future development is to be located on land not presently used for agricultural production.

The estimates developed in this type of analysis can prove to be a useful source of information to the land use planner who must formulate public policies which influence the special distribution of future land uses. It is one of many that might be used and does not involve the normal benefit-cost or cost-effectiveness approaches generally used in public policy evaluation. It is in essence a least-cost formulation to land use planning. A more detailed description of the actual steps taken in formulating the cost estimates is presented below.

Costs Associated with the Loss in Agricultural Production

A variety of costs and benefits are associated with the conversion of a given hectare of agricultural land to other non-agricultural uses. The direct cost to the agricultural sector, as a whole, is the net value of agricultural production foregone due to the land use change. The magnitude of this value will vary from hectare to hectare depending on the type of crops produced, the level of land utilization and the variable cost associated with the production of each crop. This latter component can be viewed actually as a benefit resulting from conversion since it represents the direct cost saving to the nation of converting agricultural land to another use. In essence, the capital and labor once employed in the production of crops on the converted hectare is now available for use in another productive area either within agriculture or in another sector of the economy. Unlike crop production, it is not lost but simply transferred to another use. As such it is subtracted from the total value of production foregone to arrive at the net costs associated with the conversion of the hectare under consideration. This net cost of conversion is analogous to the concept of land rent.

As mentioned above, both the variety of crops produced and the level of land utilization play important roles in determining the gross productivity of a hectare of agricultural land. Both variables, however, tend to vary from area to area. For example, paddy land in the southern part of the country tends to be utilized much more intensely than in other areas because of the relatively long growing season. In this area paddy acreage is generally double cropped with barley being sown in the fall and harvested in late spring followed by rice. In the northeast section of the country where the growing season is short, paddy is generally used for rice production with very little barley being sown.

To estimate the physical productivity of paddy and upland acreage in each region, procedures were used which generated estimates of the average composite productivity of a hypothetical hectare for each land type in each region. For example, in the double cropping region three grains are grown although not exclusively on paddy acreage: rice, common barley, naked barley. To account for this multiple cropping pattern the estimate of the physical productivity associated with the region's hypothetical hectare of paddy included a certain quantity of each of the three grains.[14] In developing these estimates the production levels of eleven different crops were examined in each region.[15] The various crops and their associated land type are presented in Table 5.4.

Table 5.4.--Crop Varieties and Associated Land Types Used in the Research.

Paddy Crops	Upland Crops		
Grains	Grains	Vegetables	Pulses
Rice	Common barley	Chinese cabbage	Soybean
Common barley	Naked barley	Garlic	
Naked barley		Sweet melon	
		Cucumber	
		Sweet potato	
		White potato	
		Red pepper	

It should be noted that the above classification scheme assumes that vegetables and pulses are cultivated exclusively on upland acreage while naked and common barley can be grown on either paddy or upland acreage. In addition, rice is assumed to be exclusively grown on paddy.

A three step procedure was used in calculating the production level for each crop, land type and region. The first step was to determine the total area of upland and paddy land cultivated in each of the three regions during 1974. The total production of each of

[14] Wheat was excluded from consideration because of the absence of production cost data required to develop estimates of land rent.

[15] Crop production data for each region for the 1974 production season was used in determining these levels.

the crops in each region, measured in metric tons was then calculated. By dividing the latter by the former estimates of the production in metric tons per hectare for each crop, land type, and region were generated.[16] The yield estimates for paddy rice in each of three regions were then adjusted to account for the three levels of soil fertility employed in the soil classification system explained previously. These adjustments assumed that highly productive paddy soils would increase the regional yields by 9 percent, while low quality soil would decrease yields by 11 percent. Soils of medium quality were assumed to produce yield equal to the original estimates.[17]

Once the per hectare yields for each crop and region were developed they were converted into monetary terms by multiplying the yield estimates in each region by the land rent per metric ton associated with each crop in 1974. These estimates of land rent were developed as a residual by subtracting the direct and indirect cost of production, excluding land, from the price paid to farmers per metric ton for each crop. A number of steps were involved in developing these land rent estimates.

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[16]The area of cultivated land and the level of production for each crop and region were calculated from data published by the Ministry of Agriculture and Fisheries in The Yearbook of Agriculture and Forestry Statistics (Seoul: Sung Moon Printing Co., 1976), Table 24, pp. 74-83. Unfortunately, this publication does not separate barley and wheat production by land type. This was done using national weights developed by dividing the area of upland and paddy land sown in each crop by the total area sown in the nation in 1974. The data concerning area sown can be found in Table 39, pp. 124-25 of the above publication.

[17]These adjustments are based on national estimates generated from survey data collected by the National Agricultural Economics Research Institute, Seoul.

First, typical crop budgets for the eleven crops under consideration were developed. Production cost estimates covering both direct and indirect costs for grains were taken from the yearly farm household production cost survey conducted by the Ministry of Agriculture and Fisheries.[18] The production costs associated with vegetables, pulses, and potatoes were developed from survey data collected by the Agricultural Development Corporation in conjunction with the paddy reclamation efforts.[19]

Since these estimates were developed for the purpose of project evaluation, certain transfer payments such as taxes and interest were excluded. These were incorporated into the crop budgets from a variety of different sources. Interest on operating and fixed capital were developed from data provided by the National Agricultural Economics Research Institute. In the case of variable capital a 12 percent interest rate, equal to that levied on short term production loans provided by the National Agricultural Cooperative Federation, was used. The employment of variable capital was assumed to vary according to the length of growing season associated with each crop. Fixed capital costs were calculated using a 6.25 percent interest

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[18]Direct costs included expenditures for labor, materials, and equipment while indirect costs included interest of fixed and variable capital taxes and public charges and management costs. Unpublished and unofficial 1974 estimates compiled by the Ministry of Agriculture and Fisheries.

[19]Sanyu Consultants Inc., <u>Final Feasibility Report for Imjin Area Development Project in Korea</u>, Appendix (Seoul: Agricultural Development Corporation, 1975), Annex G-1, Table VI, p. 743.

rate which represents a median rate between that charged by the National Agricultural Cooperative Federation for medium and long term facility loans.[20]

Neither the Ministry nor the National Agricultural Economics Research Institute have ever attempted to estimate the managerial costs associated with the production of the commodities considered. These were estimated by assuming that 10 percent of total value product associated with each crop was a realistic return to management. This estimated rate of return was based on three factors: (1) the normal rate adopted in the United States where management information is available is 7.5 percent; (2) conversations with Korean orchard owners who employ manangers, indicated management costs in the range of 12 to 13 percent per hectare; and (3) given the level of technology employed in paddy and upland production and the overall level of wages in Korea, a 10 percent return seemed to be reasonable.

Finally, estimates of taxes and public charges paid by farmers while available for grains from Ministry of Agriculture and Fisheries survey data were not available for upland crops. As such they were estimated to be 1 percent of the total value product associated with each upland crop. This rate which is extremely low given the tax laws in effect in 1974, was based on the estimated taxes paid on grains generated by the Ministry of Agriculture's sample

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[20]National Agricultural Cooperative Federation, Agricultural Yearbook 1974 (Seoul: Yun Hwan Kim, 1975), Table 1975, p. 170.

survey.[21] The crop budget estimated using the above procedures, appears in Appendix VI.

The second step in determining the land rent associated with each crop was to aggregate these costs by crop, convert them into costs per metric ton and then to subtract them from the average prices per metric ton paid to farmers in 1974. Since the cost estimates excluded returns to land, this procedure resulted in the generation of estimates of the land rent per metric ton for each crop. The actual procedures used in calculating these estimates were as follows: (1) the total production costs associated with the production of each commodity (Appendix VI) were divided by the national average yield in metric tons per hectare to generate estimates of production costs per metric ton; (2) prices per metric ton by commodity were calculated from Ministry of Agriculture and Fisheries' data for 1974, and (3) the estimates were subtracted by crop with the residual being the land rent per metric ton associated with each crop. These estimates appear in Table 5.5.

The third and final step in determining the land rent associated with the production of each crop by region was to multiply the yield estimates developed previously by the estimated land rent associated with each crop. These calculations assumed that: (1) the production expenditures and consequently, the land rent associated with rice was the same per metric ton for each of the three levels of

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[21]Results from the Ministry of Agriculture and Fisheries <u>Farm Household Survey</u>, if correct, tend to indicate the rather widespread incidence of tax evasion amongst farmers.

Table 5.5.--Land Rent Per Metric Ton for Selected Crops, 1974.[a]

Commodities	Price Paid To Farmers (Won/MT)[b]	Costs of Production (Won/MT)[c]	Land Rent (Won/MT)
Rice	184,363	79,065	105,298
Barley			
--common	135,273	93,491	41,782
--naked	92,131	78,553	13,578
Sweet melon	61,867	55,013	6,854
Cucumber	53,867	53,368	499
Chinese cabbage	28,000	18,724	9,276
Red pepper	938,333	526,083	412,250
Garlic	134,400	131,478	2,922
Sweet potato	44,800	29,422	15,378
White potato	56,267	25,460	30,807
Soybean	142,853	120,284	22,769

[a]Land rent is calculated as a residual by subtracting the cost of production per metric ton (excluding land) from the price paid to farmers per metric ton in 1974 for each crop considered.

[b]Calculated from the Ministry of Agriculture and Fisheries, Yearbook, 1976, Table 144, pp. 411-17.

[c]Calculated from crop budgets, Appendix VI.

paddy examined; (2) the costs and land rent associated with barley production was assumed to be the same for both upland and paddy land production; and (3) the cost and land rent by crop were assumed to be the same across all regions. This latter assumption, which may seem severe at first glance, is not totally unreasonable since many of the prices of farm inputs used in the production of the crops examined are controlled by the Ministry of Agriculture and Fisheries through its local system of cooperative unions. As such, prices for certain inputs are uniform throughout the country.[22]

Some errors in the estimates of land rent, due to regional variances in production costs and cropping patterns, are unavoidable using the above procedures. It is anticipated that these errors have been minimized through the calculation of land rent in terms of metric tons rather than hectares and the use of regional rather than national yields. The estimates of land rent by crop and region are presented below in Table 5.6.

These estimates were then used to compute the land rent associated with a hypothetical hectare of paddy and upland in each of the regions. These estimates were developed by aggregating the rent associated with each crop by land type and region. For example, the land rent associated with a hectare of highly productive paddy land in the double cropping region included the rent generated from 3.76 metric tons of rice, .25 metric tons of common barley, and .66 tons of naked barley. On a hectare of upland acreage in the same

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[22]The National Agricultural Cooperative Federation presently supply fertilizer, seed, production chemicals, machinery, tools and other production materials to farmers at administratively fixed prices which are uniform throughout Korea.

Table 5.6.--Estimates of Land Rent Per Hectare for Selected Crops by Region, 1974.

Cropping Region and Commodity	Yields Per Hectare of Cultivated Land[a]				Land Rent[b] (Won/MT)	Land Rent[c] (won)			
	Double	Single	Upland	National		Double	Single	Upland	National
A. Paddy Crops									
1. Rice									
--high	3.76	3.95	3.55	3.75	105,298	395,921	415,927	373,808	394,868
--medium	3.45	3.62	3.26	3.44	105,298	363,278	381,179	343,271	362,225
--low	3.07	3.22	2.90	3.06	105,298	323,265	339,060	305,364	322,212
2. Barley									
--common	.25	.15	.27	.22	41,782	10,446	6,267	11,281	9,192
--naked	.66	.10	.01	.26	13,578	8,961	1,358	136	3,530
B. Upland Crops									
1. Barley									
--common	.64	.36	.32	.44	41,782	26,740	15,042	13,370	18,384
--naked	.09	.01	--	.03	13,578	8,690	136	--	407
2. Sweet melon	.11	.27	.08	.15	6,854	754	1,851	548	1,028
3. Cucumber	.10	.31	.06	.16	499	50	155	30	80
4. Chinese cabbage	1.07	1.69	.85	1.20	9,276	9,925	15,676	7,885	11,131
5. Red pepper	.08	.08	.14	.10	412,250	32,980	32,980	57,715	41,225
6. Garlic	.14	.12	.12	.13	2,922	409	351	351	380
7. Sweet potato	.83	.14	.12	.36	15,378	12,764	2,153	1,845	5,536
8. White potato	.10	.08	.25	.14	30,807	3,801	2,465	7,702	4,313
9. Soybean	.39	.40	.47	.42	22,769	8,880	9,108	10,701	9,563

[a]Calculated by dividing the total quantity of each commodity produced per hectare by the number of hectares of cultivated paddy and upland in each region.

[b]From Table 5.5.

[c]Calculated by multiplying regional yield by the land rent per metric ton associated with a given crop.

region, the land rent was generated from .64 metric tons of common barley, .09 metric tons of naked barley, .11 tons of sweet melon, .10 tons of cucumber, 1.07 tons of chinese cabbage and so on. The aggregated rent associated with these composite hectares by region and land use are presented in Table 5.7.

Table 5.7.--Estimates of the Land Rent Generated on a Hypothetical Hectare of Paddy and Upland by Region, 1974.[a]

Type and Quality of Land	Region		
	Double	Single	Upland
Paddy			
--High Productivity	415,328	423,552	385,225
--Medium Productivity	400,586	388,804	354,688
--Low Productivity	358,467	346,685	316,781
Upland	104,993	79,917	100,147

[a]Estimates are in 1974 won.

As mentioned in the introduction to this section, the net loss in productivity associated with conversion of a given hectare of paddy or upland is only one of the cost components which needs to be examined. In Korea, where grain food self-sufficiency is a major goal, the costs associated with land reclamation required to replace the agricultural land which has been converted also need to be considered. The procedures used in determining this component of the overall cost of conversion are presented below.

<u>Reclamation Costs Associated with Land Conversion</u>

Additional capital costs sometimes overlooked and generally excluded in the calculation of the market price of a given hectare of agricultural land is the capital which must be invested in land and water development to maintain constant production levels which are depleted by conversion. These capital expenditures, sometimes considered negligible in countries with abundant supplies of agricultural land, play an important role in land scarce countries, such as Korea. In Korea, such investment normally takes one of four distinct forms: the reclamation of uncultivated land into upland areas, the reclamation of upland into paddy, the more intensive development of existing acreage through drainage and irrigation improvements and the reclamation of tidal lands. Only the costs of the first two types of reclamation are examined in this study. Time precluded the analysis of the more intensive development projects while tidal land reclamation being a relatively long term solution to conversion, would have very little effect on alleviating the effects of conversion during the time period selected for study.[23]

Before proceeding to an examination of the costs involved, a few comments are in order. The cost estimates represent only gross costs and are not deflated to account for benefits generated during the study period as a result of the reclamation. The calculation of reclamation expenditures in this manner is in keeping with the objectives of developing a least cost method of assessing the effect of conversion. In addition, it provides a method of assessing the impact of conversion on the agency that bears the cost, the Ministry

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[23]Past experience with this type of reclamation project indicates a minimum of two to five years is required between the time construction begins until crop production commences. This lag is even longer if one considers the time required for project design, evaluation and funding.

of Agriculture and Fisheries. Estimates of the actual costs used were developed from cost information associated with a medium-sized watershed development project in the southern part of Korea.[24] As such they reflect only one estimate of cost which may because of local conditions, over or underestimate the actual costs incurred in other areas of the country. These errors, if they are present would seem to be minimal since the cost estimates are calculated as the average cost of reclamation on a number of different slopes. Finally, the original cost estimates were presented in terms of gross hectares reclaimed. During the reclamation process, however, a certain portion of the land is lost. The actual losses vary with the type of area being reclaimed and the slopes involved.[25] Since the objective of this portion of the research was to determine the reclamation costs associated with the conversion of a hectare of cultivated land, the cost estimates were inflated to represent the costs per usable hectare, not hectares reclaimed.

As mentioned, average cost estimates were developed for two different types of reclamation projects, the reclamation of uncultivated upland to upland and the conversion of upland into paddy. In the first instance, the average cost estimates were based on the

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[24]The Government of the Republic of Korea, Comprehensive Development Project on Naeseong and Miho Watersheds (Seoul: The Republic of Korea, 1975).

[25]In reclamation projects which are converted upland to paddy, almost 10 percent of the original area is used for bunds, risers, roads, feeders, and drains. In uncultivated areas which are being reclaimed for upland agriculture, the ratio of uncultivated to cultivated land range from 1.127 to 1 at slope of 5 to 10 percent to 1.702 to 1 at slopes from 20 to 35 percent.

reclamation costs associated with four different slope ranges. In the latter case, seven slope ranges were employed. In each of the two different types of reclamation projects examined, six different expenditure categories were used to determine total costs. These include both skilled and unskilled labor, heavy equipment charges, supplies and overhead. The average costs associated with each type of project are presented in Table 5.8 below.

Site Preparation Costs Associated with the Conversion of Land to Urban Uses

The last general cost category considered in this study were those associated with the upgrading of a particular site so that it could be used for the construction of urban structures. Some sites because of terrain, accessibility, or drainage may require additional capital inputs to upgrade the site to a level where construction can begin. These costs while not borne directly by the agricultural sector, do represent a real cost to the nation and should be considered in analyzing the costs associated with a particular conversion pattern. In the past, such costs have been minimized by locating nonagricultural development on sites which were relatively level, well drained and close to transportation facilities. However, these sites are also well suited for agricultural production, especially rice. Any policy which attempts to protect such sites forces nonagricultural development to less favorable sites which require additional capital outlays before construction can begin.

The cost estimates developed below only consider the costs associated with developing land for residential building sites. This

Table 5.8.--Reclamation Costs for Upland and Paddy Land for Selected Slope Ranges, 1974.[a]

Slope	Labor		Heavy Equipment	Materials	Total Input Costs	Overhead	Land Ownership Survey	Total Costs
	Unskilled	Skilled						
Cost of Reclaiming Upland for Paddy Production								
0-2.00	98,336	18,932	170,400	88,763	376,431	112,657	18,893	507,981
2.00-6.00	251,753	42,954	334,364	219,542	848,613	255,239	18,893	1,122,745
6.00-10.00	267,083	62,625	512,869	324,195	1,166,772	348,190	18,893	1,533,855
Average Cost of Reclamation								1,054,860
Cost of Reclaiming Uncultivated Upland for Upland Production								
5.00-10.00	154,189		198.401	35,059	387,649	97,170		484,819
10.00-15.00	164,431		207,000	40,046	411,477	103,200		514,677
15.00-20.00	175,682		237,416	45,927	459,025	114,851		573,876
20.00-35.00	234,405		265,817	61,133	561,355	134,593		695,948
Average cost of Reclamation								567,330

[a]In won per usable hectare. The original costs were presented in won per gross hectare. They have been converted to net hectares using adjustment factors on pp. 95 and 174.

Source: The Government of the Republic of Korea, Comprehensive Development Project of Naeseong and Miho Watersheds (Seoul: The Government of Korea, 1975), pp. 97 and 176.

land use constitutes the single largest user of converted agricultural land in Korea today.[26] The site preparation costs associated with the development of commercial and industrial sites which may be somewhat higher than residential site preparation costs on higher slopes, have been excluded from consideration. The impact of excluding these latter areas in the cost calculation is somewhat mitigated by a number of factors: (1) the estimated land use requirements for residential land include all three land uses: residential, commercial, and industrial; (2) large scale commercial and industrial developments are normally located in areas of lower slopes where the site preparation costs are lower and more in line with residential site preparation costs; and (3) many of the smaller commercial establishments are located with or in residential structures so site preparation costs would be the same for each type of land use.

The construction activities associated with the development of upland areas for residential housing tend to differ somewhat from those used for agricultural land previously discussed. In the case of residential areas, the sites tend to be somewhat larger in the higher slope ranges than those developed for agriculture. In the following, a standard lot with dimensions of thirty by forty meters is assumed. Cost estimates are presented in terms of hectares. As indicated in the cost estimates, the greatest cost difference between both types of reclamation tends to be associated with the constructing of retaining walls in residential housing areas. These are required

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[26]City planners at the Ministry of Construction estimate that up to 80 percent of all land converted is used in residential housing construction.

for structural as well as erosion control purposes.[27] In the following estimates, retaining walls of concrete and stone are assumed to be constructed on all terraced areas. A transportation distance of twenty-five kilometers has been assumed in calculating the construction cost associated with the retaining structures.

In addition to these costs, four other expenditure categories were included in the estimates. The first, the earth moving costs, assumed that 70 percent of the work would be done by heavy equipment with 30 percent being done by manual labor. A separate transportation cost was computed for the movement of heavy equipment to the construction site. Surface preparation costs included expenditures for both contouring, soil compaction, and the removal of tree stumps. The last cost category contained all expenditures associated with the design and supervision of the construction work.

Each of the five expenditure categories outlined above were calculated for 7 different slopes: 0, 2.5, 5.0, 7.5, 10.0, 12.5, and 15 percent. These estimates were then used to develop estimates which represented the cost of terracing land of medium slope in each of 6 slope ranges. The slope ranges included were: 0-2.5, 2.5-5.0, 5.0-7.5, 7.5-10.0, 10.0-12.5, and 12.5-15.0. Slopes greater than 15 percent were assumed too steep for use as construction sites and were excluded from the cost estimates. The various estimates by slope and cost category are presented in Table 5.9 below.

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[27] In agricultural areas, risers are sloped and seeded with grass rather than reinforced as in residential areas.

Table 5.9.--Site Preparation Costs by Slope.[a]

	Slope Range[b]					
	0-2.5	2.5-5.0	5.0-7.5	7.5-10.0	10.0-12.5	12.5-15.0
Excavation						
--Equipment	26.9	80.6	139.5	188.1	233.7	291.3
--Labor	22.0	74.5	136.3	183.7	228.3	284.1
Stone Pitching	424.8	1368.7	2265.4	2973.3	3634.1	4578.0
Site Clearing and Leveling						
--Tree Removal	35.5	35.5	35.5	35.5	35.5	35.5
--Compaction	39.6	122.7	215.9	291.1	361.7	450.7
Miscellaneous Costs[c]	14.5	358.4	586.1	768.3	935.6	1170.6
Construction Costs Subtotal	666.9	2040.3	3378.5	4440.0	5428.8	6810.1
Land Survey Costs	7.0	7.0	7.0	7.0	7.0	7.0
Supervision and Design[d]	86.4	265.5	439.8	578.0	704.8	886.5
Total Costs	767.3	2319.8	3832.3	5031.9	6149.1	7710.5

[a]In 1000 won per hectare in 1974 prices.

[b]Costs are for the median slope in each range.

[c]Calculated as 27 percent of total equipment costs.

[d]Calculated as 12 percent of construction cost subtotal.

Calculated by the Slopeland Reclamation Corps, Agricultural Development Corporation; Seoul, June 1976.

Methods Used to Measure the Effects of Urban Land Conversion

The conversion of agricultural land to nonagricultural uses and the policies adopted to control it generate a number of different effects both inside and outside of the agricultural sector. Within agriculture these losses tend to decrease the quantity of agricultural commodities produced in any given area and the nation as a whole. In addition, household incomes which are generated by farm production tend to decline as does the amount and value of labor use in production. Attempts to mitigate the effect of conversion on production, income, and employment also have their own sets of consequences. The maintenance of a constant agricultural land base in light of conversion, necessitates the use of generally scarce investment funds to reclaim land to replace that which has been lost. Policies which attempt to prohibit or modify this conversion process, not only have a direct effect on the patterns of future urban growth, but also tend to modify the effect that growth will have on the variables outlined above.

This section develops the methodology used to examine the effects of four different agricultural land use policies, first considering all ten urban areas and then Busan. In the former case each policy is examined with respect to its effect on agricultural production, income, and employment, and on the level of reclamation activities required. In the case of Busan where slope and distance information is available, the methodology provides techniques to measure the various growth patterns which would occur under each policy option and the effects these options would have on site preparation costs.

For purposes of presentation, the following discussion has been subdivided into four sections. The first section discusses the four policy options which are considered. The second looks at the assumptions which have been implicitly or explicitly assumed in developing the methodology. This is followed by a discussion of the procedures used to measure the effects of urban land conversion caused by growth in the ten cities at a regional and national level. The last section examines the procedures used to examine the effects of growth in the city of Busan.

The Land Use Policy Options Examined in the Analysis

As stated above, the effects of four basic agricultural land use policy options were examined in the analysis. The first, Option One, assumes the presence of land use policies similar to those in existence during the 1970 to 1974 period. As such, it assumes a continuance of the past conversion trends. Policy Option Two assumes the enactment of an exclusive paddy land zoning ordinance which prohibits the conversion of paddy areas to alternative nonagricultural uses. Option Three assumes that this law will not be totally enforceable and that 25 percent of future growth will occur on paddy land. Option Four assumes a mixed agriculture zoning ordinance which allows the conversion of low quality paddy land and prohibits conversion on paddy of upper and medium quality.

Each policy option has the effect of shifting development to different agricultural land use areas. As such, they effect the costs associated with urban conversion in varying levels of magnitude. Option One being the "status quo" case is the least restrictive. It is essentially analogous to the "before" case employed in project evaluation. As such, it is used as the base against which the effects of the other two options are compared. Option Two and Three exclude conversion, in varying degrees, on paddy land, thus forcing urban development onto upland areas. This results in a loss in upland crop production and an increase in site preparation costs. Option Four is a compromise between the no policy option and the exclusive paddy zoning approach presented in 2. As formulated it implicitly assumes that low quality paddy areas might be more productive in urban uses rather than agriculture.

The absence of soil quality data for all cities examined precluded an analysis of the effects of option Four in each of the three cropping regions. In Busan, however, where soils were classified by productivity, it was possible to examine the effects of each policy option. In addition, the effects of each policy option were examined assuming the three different levels of land requirements previously described.

General Assumptions Used in the Analysis

To determine the costs associated with urban growth, selected variables such as cropping mix, yields, prices, and construction costs were assumed to remain fixed at their respective 1974 levels. As such, all the costs associated with conversion including the net loss in productivity, expenditures on reclamation and site preparation were assumed frozen in time at their 1974 levels. In making this assumption, it was realized that relative changes in the variables and their associated costs will have a direct effect on the magnitude of the cost associated with that of the policy options examined. However, the data requirements needed to project these costs through time to determine if the relative cost position of each policy option has changed, far exceeded the scope and objectives of this research effort. The present effort was designed only to assess the costs of each option at a given point in time, not how they might change through time.

To develop a basis for comparing the various policy options, all costs occurring after 1974 were discounted back to the base period. This was done using a discount rate of 10 percent. This rate was selected to represent the social discount rate because of its wide use in the past as the appropriate rate to be used in assessing the impact of large scale land and water development projects. Further studies of this nature may wish to select a range of discount rate to determine their effect on the cost stream associated with each policy option. Time, however, precluded such analysis in the present study.

A number of other assumptions were made in the analysis which were specific to the two areas examined. These assumptions and the methods used to assess the effects of growth in both the regional context and in Busan appear below.

Methods Used in Assessing the Effects of Urban Growth in the Three Cropping Regions

As previously mentioned, data constraints, primarily information on soil productivity, limited the analysis in the three cropping regions to an examination of only the first three policies. In addition, the absence of information on present land use and slope constrained the analysis even further. The absence of the latter precluded the calculation of the slope preparation costs associated with each option since these costs were assumed to be a function of slope. The absence of the former information necessitated the development of estimates of the paddy and upland areas which would be required to fill the future urban land demands.

The methods used in formulating these estimates were presented in a previous section.

What remained was the examination of the consequences of land conversion under each of the three levels of urban land conversion for each of the three policy options in each of the three regions. As such, nine different overall costs were assessed in each region, one for each combination of urban land and policy option. Each of these overall cost components were composed of two subcomponents, the costs associated with the loss of agricultural land and those associated with reclamation of land to replace that lost through conversion.

Each combination of policy and land requirement level generated a different amount of paddy and upland that would be converted in each region. In the case of Policy Option One, the percentage of land required from each agricultural land use to meet urban land demands were taken from Table 5.3. Option Two by definition assumed that all the agricultural land required for urban growth would be taken from upland areas. The calculation of the extent of the upland area required was undertaken using the total percentage requirements calculated in Table 5.3 for each region. Option Three partitioned the overall requirements generated with respect to Option Two into paddy and upland area requirements using the 75-25 percent split associated with the policy option. A schematic representation of the various agricultural land areas required for urban growth is presented in Table 5.10 below. Because of the duplicity of the procedures in each of the regions, the double cropping region has been selected for use in the table.

As Table 5.10 indicates, 15 different estimates of the physical area required to meet urban land demands were developed in each of the three regions. Each of these estimates in each of the regions were then converted to costs by multiplying them by the appropriated land rent estimates. The total direct cost associated with each land requirement level was then calculated by adding the appropriate paddy and upland costs. This resulted in nine sets of costs for each of the three regions. These procedures were duplicated in each of the ten years in the study period. The resulting nine streams of costs were then discounted back to 1974 and summed to develop estimates of the direct loss in agriculture production due to the different growth levels and policy options.

The fifteen different estimates of agriculture land required for urban growth were also used to develop estimates of the effect of conversion on production, the value of agriculture labor and farm income. Estimates of each of these values were developed by year for each of the fifteen estimates by multiplying the land estimates by three different values. In the case of the quantity of crops lost each year, the per hectare yields appearing in Table 5.5 were multiplied by the area of paddy and upland converted. These estimates were then summed across years to develop estimates of the total physical production lost by crop associated with each of the nine combinations.

Table 5.10.--Schematic Representation of the Agricultural Land Required for Urban Growth Under Various Policy Assumptions.[a]

Region	Urban Land Requirements	Land Use Policy Option	Type of Agricultural Land Converted	% of Total Urban Requirements
		1	Paddy Area	.461
	Level 1	2[b]	Upland Area	.261
		3	Paddy Area	.181
			Upland Area	.542
		1	Paddy Area	.461
			Upland Area	.261
Double Cropping Region	Level 2	2	Upland Area	.722
		3	Paddy Area	.181
			Upland Area	.542
		1	Paddy Area	.461
			Upland Area	.261
	Level 3	2	Upland Area	.722
		3	Paddy Area	.181
			Upland Area	.542

[a]Taken from Table 5.3.

[b]Only upward area is assumed converted under Option Two.

The same procedures were also used to generate estimates of the total amount of farm income and the value of farm labor displaced by urban land conversion. In the case of the former, the value of both direct and hired labor associated with a hypothetical hectare of upland and paddy land, were used. In the case of the latter, estimates of farm income assumed to be the cost of family labor plus management costs were used.[28] Unlike the land rent estimates, these values were not discounted back to the present for two reasons: (1) they were already incorporated in the estimates of land rent previously used and (2) when summed across all years they represented the value of income and labor foregone in constant 1974 prices.

The calculation of the second major component in the cost associated with each policy option and requirement level, the costs associated with reclamation, also used the yearly estimates of paddy and upland required to meet urban land demands. Two levels of reclamation were assumed to occur. The first assumed that all land lost would be replaced via reclamation. This resulted in three different reclamation activities--the reclamation of upland to replace paddy land lost, the reclamation of uncultivated upland to replace the upland area converted to urban uses, and the reclamation of uncultivated upland to replaced the upland converted to replace paddy. A second level of reclamation activity was also considered which assumed only the replacement of paddy land lost to urban uses. In this case an additional cost component was added to the reclamation

[28]Per hectare estimates of each of these values were developed using the same techniques employed to develop estimates of land rent per hypothetical hectare of paddy and upland.

to account for the loss in agricultural production resulting from the decrease in upland.

To estimate these costs, the upland area reclaimed to paddy was multiplied by the land rent associated with a hypothetical hectare of upland at the national level. These cost estimates were added to those calculated below. This latter assumption seemed to be the most conservative estimate of the area that would need to be reclaimed given the government's present policy of grain self-sufficiency.

The above estimates of land area by type and year were then converted to yearly costs by multiplying them by the average cost of reclamation associated with paddy and upland areas in 1974 (Table 5.9). The cost streams thus generated were discounted back to the present and summed. These procedures generated two cost estimates for each policy-land requirement level combination. When added to the direct cost estimates previously discussed, this generated two estimates, each dependent on the level of reclamation of the total direct and reclamation costs association with each of the nine policy-land requirement level combinations.

Methods for Determining the Effects of Urban Growth in Busan

The presence of data on the soil types in and around Busan, especially data on productivity, distance and slope provided the basis for a much broader examination of the costs associated with future urban land conversion in the city. For example, the classification of the land area around the city by slope and distance provided the basic information required to simulate the future growth patterns which were likely to occur, assuming the three levels of urban growth associated with the city. Slope data provided the basis for incorporating site preparation costs into the analysis. And finally, the presence of productivity estimates provided the basic data needed to analyze Policy Option Four.

The availability of the above data necessitated some minor alterations in the methodology. The most striking difference was the method in which future growth was distributed around the city. Three basic assumptions were used in distributing these urban land requirements. The first assumed that growth would emanate from the center of the city outward. This assumption is based on the hypothesis that new urban development would locate in available areas close to the urban center in an attempt to minimize transportation costs. The second assumed that new developments would occupy land within the lower slope range first. Only after completely filling the land in these ranges would it move to higher slopes. This assumption was based on the hypothesis that builders would attempt to minimize site preparation costs which tend to be lower on the lower slope. The third and final assumption assumes that growth will occur over time in a sequential pattern. A schematic representation of this pattern is presented in Table 5.11.

As Table 5.11 indicates, growth will occupy land area X, then move to land a little farther from the urban center but at the same slope level (X_2). The next step was to occupy land in the second slope range closest to the city (X_3), then move to land in the lowest slope area of distance zone 3 (X_4) and so on. In every case

Table 5.11.--Schematic Representation of the Growth Pattern Assumed to Occur In and Around Busan.

Slope Range \ Distance Zone	1 0-5	2 5-7.5	3 7.5-10.0	4 10.0-12.5	5 12.5-15	6 15-17.5	7 17.5-20.0
0-2.5	X_1	X_2	X_4	X_7	X_{11}	X_{16}	X_{21}
2.5-5.0	X_3	X_5	X_8	X_{12}	X_{17}	X_{22}	X_{26}
5.0-10.0	X_6	X_9	X_{13}	X_{18}	X_{23}	X_{27}	X_{30}
10.0-12.5	X_{10}	X_{14}	X_{19}	X_{24}	X_{28}	X_{31}	X_{33}
12.5-15.0	X_{15}	X_{20}	X_{25}	X_{29}	X_{32}	X_{34}	X_{35}

it was assumed that all of the available land in each slope and distance class was consumed before growth moves to the next class.[29] The use of this procedure to distribute future growth precluded the necessity of using percentage estimates of upland and paddy land which would be converted under each land use requirement level.

Using this simple procedure, the future land use requirements projected previously were distributed on the land surrounding Busan in accordance with the location restrictions imposed by each of the four policy options. The costs associated with each policy option--land requirement level were calculated in the same manner previously discussed. An additional component was added to the total cost of each growth pattern to account for site preparation costs. Estimates of this cost were developed by multiplying the area of land in each slope range and year that would be converted by the 1974 site preparation cost associated with the slope. These costs were then summed across slope ranges, discounted back to 1974 and summed. This generated estimates of the discounted site preparation costs associated with each policy option and land requirement level combination. By adding these to the direct and reclamation cost associated with

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[29]In the basic projections of land requirements used in association with Policy Option One, the area of available land that could be used to accommodate urban growth was limited to those areas below 15 percent slope that were not located in a green belt or recreational planning zone. All other land including that located in special development districts was assumed to be available for growth.

each policy, the total cost of each combination was developed.[30] In developing the reclamation cost, only the conservative reclamation policy option was considered. This option required that only paddy area lost to conversion be replaced.

The presence of the four land use policy options in addition to estimates of site preparation costs slightly altered the analysis format used in examining the results of the projections. This analysis examined the trade offs between site preparation, reclamation and direct costs associated with each cost stream to determine who would bear the costs associated with each policy. This analysis assumed that the cost associated with site preparation would be borne by public or private groups outside of agriculture while the costs associated with losses in crop production and reclamation would be born by the agricultural sector. The results of this evaluation are presented in Chapter VI below.

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[30]Estimates of the direct and reclamation costs associated with each policy option--land requirement combination were developed using the same procedures employed in the regional analysis.

CHAPTER VI

THE EFFECTS OF URBAN LAND CONVERSION ON AGRICULTURE

Introduction

The adoption of policies which decrease or shift population or those which alter the supply of convertible land for urban growth will have a direct effect on the costs associated with urban land conversion. The following chapter examines the costs and related physical effects associated with each of the land use and population policies examined.

The chapter is composed of four parts. The first presents a brief review of the various policy options which are considered. The second examines the projected land use requirements associated with each of the four population projections. Special attention is given in this section to determining the reasonableness of these projections in light of past and present urban development trends. Section three, examines the effect that each of the population and land use policy options have on the area of agricultural land converted, the effect of this conversion on production, farm employment and income and the costs associated with each policy. Section four, examines the various patterns of growth which occur under various policy assumptions in and around Busan. Of particular importance is the

viability of each of the land use policy options, given Busan's physical landscape and the cost trade-off which occurs as a result of the adoption of each of these policies.

A Review of the Policy Options Examined in the Analysis

Before proceeding to a discussion of the land use projections, a review of the basic policy options examined in the study might be of some help. In all, three different sets of policies were examined. These included four population policies, four land use policies and two reclamation policies. A brief description of each is presented in outline form below.

1. Population Policies. Each of the population policies generated a different level of urban population in each of the ten cities and a different level of urban land requirements. As such the analysis addresses each policy by referring to its associated land use level.
   a. Land Use Level 1 assumed that urban population will continue to grow at the rates established during the base period.
   b. Land Use Level 2 assumed that the population in Seoul would grow in linear fashion rather than exponentially as was the case during the base period. This assumption assumed that the yearly difference in population generated by these projections would move to one of the other nine cities.
   c. Land Use Level 3 assumed that only 50 percent of the yearly difference would move to the other nine cities.

d. Land Use Level 4 assumed that growth in each of the ten cities would decline to 60 percent of the level experienced during the base period.

2. Land Use Policy Options

   a. Policy Option 1 assumed the presence of policies similar to those in operation during the base period.

   b. Policy Option 2 assumed the adoption of an exclusive paddy land zoning law which forbade the conversion of paddy to nonagricultural uses.

   c. Policy Option 3 differed from 2 only in that it assumed that the zoning law would be 75 percent effective.

   d. Policy Option 4 assumed that a zoning bill was adopted which only excluded conversion on paddy of high and medium quality. Low quality paddy was assumed convertible to nonagricultural use.

3. Land Reclamation Policies

   a. Full Reclamation assumed the replacement of all paddy and upland lost to other uses in addition to upland lost to replace paddy.

   b. Partial Reclamation assumed that only paddy land lost would be replaced.

The effects associated with various combinations of these policies are examined below. The discussion begins with a look at the basic land use projections used in the study.

An Examination of the Projected Land Use Requirements

As Chapter V indicates, the land use requirements developed in the study were based on two components, projections of the aggregate population in each of the ten cities by region and projections of the per capita urban land requirements associated with each of these regions. The importance of each of these projections to the level of land required from agriculture and the costs associated with the shifts in land use are obvious. As such, each of the projections have been examined to determine its reasonableness in light of past and present trends.

An examination of the four population projections tends to suggest a substantial increase in the number of urban residents residing in the ten cities. This seems to be true even under the low growth assumption associated with Alternative IV. A summary of these projections is presented in Table 6.1 below.

Assuming that population will continue to grow at the same rate as in the past, the urban population in the ten cities increased slightly more than 11 million persons during the projection period. This resulted in an average annual rate of growth of 8.12 percent per annum, slightly larger than the 1965-75 rate of 8.06 percent. The single cropping region, which included the cities of Seoul, Incheon, Suweon, and Chungju, led this growth with an annual rate of 9.40 percent per annum. This is not surprising since Seoul, which grew at an annual rate of 9.83 percent during the base period, is located in the region. During the projection period Seoul continued to grow at a slightly accelerated pace of 10.14 percent per annum. It was

Table 6.1.--The Absolute and Average Increase in Population Per Annum Associated with Four Urban Growth Policies, 1975-1985.[a]

	Population Growth Alternative			
	I	II	III	IV
Increase in Population During the Period				
--double	2,282.4	4,892.9	3,882.6	1,675.0
--single	8,182.4	5,932.0	5,207.5	4,137.0
--upland	44.3	264.2	172.1	26.6
--all cities	11,089.1	11,089.1	9,262.2	5,838.6
Average Rate of Growth of Population Per Annum				
--double	5.95	9.95	7.97	3.51
--single	9.40	6.89	6.07	4.85
--upland	3.13	17.58	11.80	1.90
--all cities	8.12	8.12	6.81	4.34

[a]In 1000 persons.

estimated that growth in this and the other cities in the region would generate an additional 8.2 million urban residents by 1985.

These basic projections also provided estimates of the absolute increase in population which was likely to occur in major urban areas in the double and upland cropping regions. Assuming the continuance of past trends in the former region, the population in the region's five major urban centers was projected to increase 2.3 million over their 1975 level. This equated to an average annual increase of 5.95 percent per annum. In the latter region, the only major urban center, Chuncheon, considered in the analysis was expected to grow by 44 thousand persons during the period or at an annual rate of 3.13 percent per annum.

The development of alternative projections generated by applying the assumptions associated with Alternative Two through Four tended to alter the basic projections discussed above. In general, Alternative Two and Three tended to shift population out of the single cropping region and reallocate it in the double and upland cropping regions. Alternative Four while not effecting the general distribution of population did generate an overall decline in population growth in each of the regions.

Under Alternatives Two and Three, which assumed a linear growth rate in Seoul, the city's population increased 3.6 million during the period. This was almost 3.8 million less than that projected under Alternative I. Under each of these alternatives, all or a portion of this decline was redistributed to the remaining nine cities.

Under Alternative II, which assumed a 100 percent redistribution of this decline, the cities in both the double and upland regions grew much more rapidly than projected in Alternative I. For example, the five cities in the double cropping region grew at a yearly rate of 9.95 percent or 4 percent faster than previously projected. This accelerated growth resulted in an additional 2.6 million persons residing in these cities by 1985. Overall, the population in these cities was expected to grow almost 4.9 million during the period.

Similar results occurred in the upland cropping region. Under this alternative the region's single urban center, Chuncheon, grew at the alarming rate of 17.58 percent per annum, approximately 14.5 percent faster than previously projected. This resulted in a population increase of 260 thousand or 200 thousand more than that estimated in Alternative I.

Increases in population in each of these regions resulted in a decline in the population residing in cities in the single cropping region. This decline was not equal to the decline in Seoul's population but somewhat less since a certain portion of the population which was to reside in Seoul under Alternative I was relocated in the three remaining cities in the region. The net effect of these shifts was to drop the population increase in the four cities by 2.3 million persons. By 1985 the four cities were projected to grow by 5.9 million at a yearly rate of 6.89 percent per annum. This latter rate was slightly more than 2.5 percent less that of the growth rate associated with Alternative I.

The projections developed under Alternative III tend to be the same as those above, but of lesser magnitude. This was a direct result of the assumption that only 50 percent of the population displaced from Seoul would be relocated in the other nine cities. Under this assumption cities in both the double and upland cropping region grew faster than projected in Alternative I but slower than those in Alternative II. For example, cities in the double cropping region grew at an annual rate of 7.97 percent per annum. This resulted in an increase in the cities' population of 3.9 million residents during the period. While this growth was 1.6 million more than recorded in Alternative I, it was 1.0 million less than registered in Alternative II.

Similar results were generated in the upland cropping region. Here the population in Chuncheon grew at 11.8 percent per annum, almost 5.8 percent slower than under Alternative II. As a result, the city was projected to house only 172 thousand new residents rather than the 264 thousand estimated in Alternative II. This increase, however, was still 127 thousand more than that projected in Alternative I.

With population growing at a slower pace in each of these regions, it would seem logical to assume that the decline in population growth in the single cropping region would also be moderated. This, however, was not the case. Under this alternative, the four cities in the region grew at an annual rate of 6.07 percent per annum. This resulted in an additional 5.2 million persons residing in the cities in the region by 1985, This increase was almost 700 thousand less than that projected in Alternative II and 2.9 million less than Alternative I. This continued decline in the growth of the region's urban population can be linked to the fact that while Seoul's population growth was declining at the same rate assumed in Alternative II, the increase in growth in the regions' other three cities which offset some of this decline, was moderated by the assumption that only half of the decline in Seoul's population would be reallocated.

The regional shifts in population associated with the above policies were not evident in the population projections developed by Alternative IV. This alternative while retaining the same regional population distribution as exhibited in Alternative I, did cause major declines in the anticipated growth in each of the regions. For example, population in the single cropping region was projected to grow at a per annum rate of 4.85 percent. This was almost 4.6

percent below the rate estimated in Alternative I. Consequently, population growth in the region's four major cities dropped to 4.1 million, almost half of that projected in I.

Similar results occurred in the double and upland cropping regions. In the former, the growth rate dropped to 3.51 percent per annum and in the latter, to 1.90 percent per annum. These rates of growth generated increases in population of 1.7 million and 26 thousand respectively, far below those registered in Alternative I.

The ability of any one of these projections to accurately project urban growth trends in the cities examined is highly dependent on the type of population control policy adopted by the Korean government. Present policies including programs to improve rural incomes, to construct public housing and industrial facilities in smaller cities and to tax both individuals and corporations who wish to locate in large urban areas all seem to be aimed at moderating the rapid migration trends of the past decade. Whether these policies will be sufficient in the future to overcome the economic, aesthetic and recreational attractions presently associated with Korea's large cities is questionable. These cities still contain the country's major educational institutions which attract thousands of students each year and provide a major portion of the nation's primary and secondary industrial employment opportunities. These trends in addition to the rapid development of a more efficient urban and intra-urban transportation systems now underway, would tend to perpetuate past growth trends with slight shifts in growth from primary to satellite cities. Consequently, it would seem that

Alternative I, II, or some intermediate projection would be most appropriate for estimating future growth patterns.

Before proceeding, however, a word of caution concerning both of these two projections is in order. Under both alternatives, the projections of growth in the upland cropping region were extremely high and in all probability do not reflect a realistic growth rate for the region's only urban center, Chuncheon. Even though these estimates were assumed inflated, they were still incorporated into the study since the errors they introduced while significant in terms of Chuncheon were relatively minor when compared to the level of population growth in the other regions.

The second major component needed to generate estimates of urban land requirements in the ten cities were estimates of the area required by each new urban resident in each of the regions. These per capita requirements were projected over the study period by year and then multiplied by the regional estimates of urban population to develop total urban land requirements in each year and region. A summary of these projections showing both the absolute and percentage change for each region and Busan are presented in Table 6.2.

As Table 6.2 indicates, the per capita requirements for residential land tended to increase in all the regions and Busan, while the land required per person for urban services tend to rise in some areas and fall in others. It was initially thought that both these variables would tend to decline over time as more and more people located in the ten cities. However, the base data and the projections generally tend to deny this hypothesis. Apparently, the

Table 6.2.--The Projected Change in Per Capita Land Use Requirements, 1975-1985.

Area and Land Use	Change in Per Capita Requirements	
	In pyong	In percent
Double Cropping Region		
--residential land	+5.85	+40.7
--urban services	- .77	-21.8
Single Cropping Region		
--residential land	+3.30	+26.3
--urban services	+ .79	+20.1
Upland Cropping Region		
--residential land	+ .53	+ 2.8
--urban services	-2.95	-30.2
Busan		
--residential land	+7.91	+78.5
--urban services	+1.51	+54.3

data seems to indicate that Korea's major cities are presently expanding horizontally rather than vertically as was previously anticipated.

These results tend to generate two basic questions. First, what factors have generated the horizontal growth in the past, and second, are they likely to contribute into the future so that such growth patterns will be retained?

A closer examination of the background data collected to describe the base period (1970-74) does provide certain clues which are helpful in answering this first question. Korean cities have always been and continue to be rather densely populated. For example, the average density of the ten cities examined in the study stood at slightly less than 6,500 persons per square kilometer in

1974. Over the previous ten year period, this density had increased almost 64.7 percent from its 1965 level of slightly less than 3,900 hundred persons per square kilometer.[1]

These increasing densities when combined with past trends in urban incomes and land prices seem to provide ample reason to support the validity of the horizontal growth hypothesis. During the period, real family income has tended to increase while the real price of land in each of the ten cities (Table 4.1) has remained relatively stable or has declined. The pressure for outward expansion generated by growing urban densities when combined with the relatively favorable price position of urban land could have provided the basis for such a horizontal growth trend.

Even though these trends were present in the past, the key question still remains, are they likely to change in the future, thus making the projections used in the study invalid? To answer this question with any degree of certainty is extremely difficult and fraught with problems. Past and present trends would seem to suggest that urban densities, real incomes and real land prices will most likely increase in the future. Even the most conservative population projections, examined previously, indicate that the cities studied will be required to support an additional 4 million inhabitants by 1985. Under such pressures there is little likelihood that the high densities presently exhibited in the cities will decline, but in fact

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[1] These estimates most likely underestimate the true densities associated with the ten cities since in many cases, the geographic area of the cities includes rather substantial portions of vacant land used for agriculture or forestry.

may increase in the future. As such, the pressures exerted on families who are affluent enough to move to the less densely populated suburbs will in all probability continue.

Trends in real family income and land prices also seem to indicate the continued tendency of affluent urban residents to locate in new homes in the suburbs. Given past growth in real GNP and those anticipated in the future, real urban household incomes are likely to continue to rise over the next decade.[2] Given the present distribution of income, there is reason to believe that a disproportionate amount of this income will be captured by the upper-middle and upper income groups in the country.[3] If it is assumed that these groups exhibit a positive income elasticity of demand of single family housing, then it follows, certibus paribus that the number of single family dwellings required in urban areas in the future will increase.[4] These dwellings generally occupy more land per capita than other types

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[2]The Fourth-Five Year Economic Development Plan (1976-81) projects real GNP growing at 9 percent per annum. This would result in per capita GNP reaching 642,000 won by 1981.

[3]Relatively few studies have been undertaken to examine the distribution of income in Korea. The World Bank, using 1970 population census data estimated a GINI coefficient of .4065 for the whole country. An analysis of 1971 urban household data presented in the same study, produced a GINI coefficient of .3381. A discussion of this data and the methods used in its analysis can be found in Shail Jain, Size Distribution of Income, of Population Data (Washington: International Bank for Reconstruction and Development, 1975).

[4]At present there isn't any empirical evidence to substantiate or disavow this assumption. However, limited observations of the housing market in and around Seoul and conversations with representatives of the Korean Housing Corporation and others do lend support to the assumption.

of dwelling which suggest an overall increase in the area devoted to such housing in the future.

Rising incomes alone, however, do not provide the necessary and sufficient conditions required for projecting an increase in the demand for land devoted to single family housing. Changes in the real price of land and the structures themselves will play a critical role in altering this demand. In the context of Korea, real prices for both land and buildings are likely to increase in the future. What effect these price increases will have on total land area required for residential use is dependent on the price elasticity of demand present in the urban land market and the magnitude of the anticipated price changes. If unitary or inelastic demand conditions prevail, lot sizes will tend to remain constant or increase, given price increases. Under conditions of increasing real incomes this would result in an increase in the area devoted to residential use.

The present high cost of urban land in and around Korea's major urban centers would tend to question the presence of either the unitary or inelastic demand conditions mentioned above. In reality, these land markets most likely operate within the context of positive price elasticities of demand. As such, price increases would be expected to generate a decline in lot size. If sufficient enough these increases might cause a decline in the total area required for housing either through a significant decline in individual lot sizes or by altering the composition of housing demand away from single family dwellings toward multiple family residences. This would be the case even under conditions of rising real family income.

While real increases in prices are anticipated in the future, they are not likely to be of a sufficient magnitude to cause a decline in the total area required for housing. The presence of modest price increases in the future is suggested by a number of factors. Present housing policies tend to indicate that the Korean government will pursue a vigorous policy of low and medium public housing construction to alleviate the severe housing shortage present in the country's major cities.[5] As such, it will be in their vested interest to maintain only modest increases in both land and construction costs. Also, the presence of the new land speculation law, if properly enforced, is likely to prevent rapid rises in land prices such as those experienced in the late 60s. Finally, the construction of new and the improvement of present urban transportation systems presently underway is likely to open new areas for urban development. This will tend to increase the urban land supply and moderate price increases.

Increases in land required for both private and public housing in addition to the land required for commercial and industrial facilities implicit in the GNP growth projections, all seem to suggest that per capita residential requirements will continue to grow in the future. Thus, the projections of residential land summarized in Table 6.2 would seem reasonable. The projections of land for urban services on the other hand, do present a problem. The background data collected doesn't provide a clear explanation of the changes in sign associated with these projections.

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[5]Such a housing policy will likely have little impact on the demand for single family dwellings since it is aimed at a different target group than that which require such living units.

If errors are present in these projections, their effect on the total costs associated with conversion is likely to be rather minor. This is the case since these costs are based on the year to year changes in requirements. In each of the projections, the magnitude of the increase or decrease in per capita requirements is relatively small ranging from -2.95 pyong in the upland cropping region to +1.51 pyong in Busan. On a yearly basis such per capita requirements produce very little change in overall requirements. As such, their impact on total costs would seem to be minimal.

These per capita projections when multiplied by the four levels of population generated estimates of the total urban area required in each region during each year. These gross requirements, however, were not of paramount interest. Of greater interest were the year to year changes in the requirements which would be taken out of agriculture under the three policy options evaluated. These physical requirements and the costs associated with each are examined below.

The adoption of a given land use policy with respect to agricultural land and shifts in population from one city to another combine to cause shifts in the type and quantity of agricultural land needed for urban growth. The area of agricultural land likely to be converted during the study period given the twelve sets of population and land use policies is presented in Table 6.3

As Table 6.3 indicates, each of the land use policies examined tends to shift the location of the conversion but not the extent. For example, a simple projection of past trends, Policy Option I Level I, indicates that slightly over 75 thousand hectares

Table 6.3.--Agricultural Land Required in All Ten Cities Under Various Population and Land Use Policies, 1975-1985.[a]

Policy Option and Land Type	Land Requirement Level			
	I	II	III	IV
Policy Option 1				
--paddy	45,390	46,170	40,126	28,451
--upland	30,039	29,293	25,816	18,708
--total	75,429	75,463	65,942	47,159
Policy Option 2				
--paddy	--	--	--	--
--upland	75,429	75,463	65,942	47,159
--total	75,429	75,463	65,942	47,159
Policy Option 3				
--paddy	18,875	18,863	16,487	11,812
--upland	56,556	56,598	49,942	35,156
--total	75,429	75,461	65,945	47,158

[a]In hectares.

of agricultural land will be required to meet urban demands during the period.[6] Of this total 60 percent or 45 thousand hectares will be taken from paddy acreage while 40 percent or 30 thousand hectares will come from upland. Under Policy Option 2, which prohibited the conversion of any paddy, the same level of losses occurred but were not exclusively composed of upland acreage. In Policy Option 3, which assumed a partial enforcement of the paddy land zoning policy, slightly less than 19 thousand hectares of paddy were consumed with the remainder of the requirement, almost 57 thousand hectares, being taken from upland areas.

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[6]During the base period, agricultural losses in the ten city area equaled 6,100 hectares per year only 19 percent less than the average yearly losses registered during the projection period.

These shifts in the composition of the losses which resulted due to shifts in land use policy tend by assumption to be constant across the four population or land requirement levels. The level and in some instances, the composition of these losses, however, tended to vary according to which population assumption was chosen. For example, under Land Requirement Level II, which assumes a redistribution of a portion of the population growth in Seoul, the level of total requirements rose slightly. This rise was accompanied by a slight shift in composition with 61 percent or 46 thousand hectares being taken from paddy acreage and the remaining 39 percent, 29 thousand hectares, being converted from upland acreage.

To understand the factors which underlie these subtle shifts in conversion, it is necessary to examine the regional shifts in requirements which occurred under Land Requirement Levels II and III.

As the data indicates, shifts in population precipitated increases in land requirements in the cities located in both the double and upland cropping regions and declines in cities in the single cropping region. In the double cropping region, paddy requirements increased 50.2 percent or 7,215 hectares while upland losses grew 46.8 percent or 3,809 hectares over those recorded in the base projections. In the upland cropping region where per capita land requirements tended to be high and the influx of new migrants large in terms of the base population, these increases were substantial. In this region, both paddy and upland requirements increased eight-fold during the period with an additional 562 and 374 hectares of paddy and upland being required.

Table 6.4.--Change in the Level and Composition of Regional Agricultural Land Requirements, 1975-1985.[a]

	Land Requirement Levels			
	II		III	
	Area	% Change[b]	Area	% Change
Double Cropping Region				
--paddy	21,598	+ 50.2	17,987	+ 25.1
--upland	11,953	+ 46.8	10,182	+ 25.0
--total	33,551	+ 48.9	28,169	+ 25.0
Single Cropping Region				
--paddy	23,993	- 22.6	21,781	- 29.6
--upland	16,915	- 22.6	15,397	- 29.5
--total	40,848	- 22.6	37,178	- 29.6
Upland Cropping Region				
--paddy	639	+729.9	358	+364.8
--upland	425	+733.3	237	+364.7
--total	1,064	+731.3	595	+364.8

[a]All estimates are for Land Use Policy Option 1. The other two policies were not presented since the changes in composition associated with them were constant across land requirement levels. Estimates are in hectares.

[b]The land requirements associated with Level I (no change in population growth patterns) were used in calculating the percentage changes.

These increases more than compensated for the decline in land requirements associated with the movement of population out of the single cropping region. These disproportionate shifts were largely due to differences in the per capita urban requirements associated with each region.[7] For example, the relocation of an urban migrant from the single cropping region where he required an average of 18.51 pyong to the upland or double cropping regions resulted in additional requirements of 9.13 and 1.74 pyong respectively. This data tends to point out the rather obvious conclusion that the movement of urban population from the high density urban centers in the single cropping region to the less densely populated areas in the double and upland cropping regions can only result in a rise in the total land requirements of all the cities.

The decline in the level of urban migrants incorporated into Level III generated an overall decline in total requirements of 12.6 percent over those projected in Level I. During the ten year period slighlty less than 66 thousand hectares of agricultural land were required for urban uses. Under Policy Option 1 this total was composed of 64 percent paddy and 36 percent upland. This slight shift in composition again was due to differences in regional per capita requirements. Under Policy Option 2 the total requirement, 66 thousand hectares were taken from upland areas while under 3, 16

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[7]An additional alteration in the composition of the losses in each region was due to the differences which occured between the assumed historical composition of the losses in each region referred to on pp. 157-58.

thousand hectares came from paddy with the remaining 50 thousand hectares being converted from upland.

At the regional level urban requirements followed the same pattern as developed in Level II. However, due to a decline in the number of urban migrants in each of the three areas, requirements in each region dropped over those estimated in two. For example, in the double cropping region, total requirements decline 23.9 percent over those estimated in two. These estimates were still 25 percent larger than those estimated in Level I.

As was expected, declines in both regional and total urban land requirements were associated with Land Requirement Level IV. This projection resulted in an overall decline in requirements of slightly more than 28 thousand hectares over those projected in one. Under Policy Assumption One this resulted in the loss of 28 thousand hectares of paddy and almost 19 thousand hectares of upland. Under assumption two all of these losses were shifted to upland areas. This resulted in the conversion of 47 thousand hectares. Under assumption three, almost 12 thousand hectares of paddy and 35 thousand hectares of upland were lost to urban growth.

The impact of these losses on agricultural production, income and employment tended to vary from policy to policy. A summary of the production losses associated with each policy combination is presented in Table 6.5. For simplicity, the losses in vegetable production associated with the conversion of upland have been aggregated into a single category. These are presented below with estimates of the losses in rice and barley production.

Table 6.5.--The Yearly Loss in Agricultural Production Associated with Different Levels of Land Use Conversion.[a]

Policy Option & Crop Variety	Land Requirements Level			
	I	II	III	IV
Policy Option 1				
--grains				
rice	15,610	15,880	13,810	9,787
barley	3,600	3,590	3,140	2,250
--vegetables	7,980	7,790	6,870	4,970
Policy Option 2				
--grains				
rice	--	--	--	--
barley	3,550	3,550	3,100	2,210
--vegetables	20,070	19,520	17,070	12,290
Policy Option 3				
--grains				
rice	6,500	6,510	5,660	4,060
barley	3,560	3,570	3,120	2,230
--vegetables	14,790	14,650	12,800	9,200

[a]Losses are calculated assuming constant 1974 yields and expressed in metric tons per year.

In general, the losses follow the same overall pattern established in the discussion above. The greatest losses in rice production, 15,880 metric tons, occurred under Policy Option 1, Level II. Paddy losses were also the largest under this policy combination. Production losses associated with the various land requirements levels under Policy Option 2, show no loss in rice production, a slight decline in barley losses and substantial increases in losses in vegetable production. Production declines associated with the latter reached their maximum, 20 thousand metric tons per annum under Level I. With paddy land again being converted under Policy Option 3, losses in rice production again appeared. These were only approximately one-third of those experienced under option one and were accompanied by a decline in vegetable losses.

Throughout the projections, barley losses remained almost constant ranging from 3.6 to 3.55 thousand metric tons. Rice and vegetable production tended to vary widely as conversion losses shifted from paddy to upland acreage. For example, rice losses ranged from 0 to 15.9 thousand metric tons, while vegetable losses ranged from 8 to 20 thousand metric tons per annum. The effect of the shift in population from Seoul to the other nine cities represented by the differences in loss between land requirement level I and II, tended to be negligible.

In any case, the losses presented above when compared with total agricultural production, do not seem to be significant. The maximum loss in rice, 15.9 thousand metric tons, constituted less than 1 percent of total paddy production in 1974. Even if yields were allowed to increase as would be the case during the period, it is unlikely that the total losses in production would constitute a serious problem to increasing agricultural production.

When examined in light of past yield increases in rice production, these losses still do not seem significant. Assuming that the yearly losses of 15.9 thousand metric tons were experienced during the 1966 to 1974 period, this would have resulted in a 15 percent decline in yearly yield increases. This decline would have depressed the annual rate of growth in production from 3.05 to 3.00 percent per annum.

Shifts in the level and composition of agricultural land losses are also likely to affect the value of farm income and employment. As land is converted and used for nonagricultural uses farm labor must seek new employment opportunities and income sources. Farm income in this context is composed of the value of family labor and management income while the value of farm labor is the total value of family and hired labor.[8]

Both variables tended to be affected by the level and composition of farmland converted. As would be expected, the values increased as the land area converted increased. The value of farm household income displaced reached its maximum of 10.4 billion won under Policy Option 1, Level II and its minimum of 4.4 billion won under Policy Option 2, Level IV. The value of farm labor displaced followed the same pattern ranging from 9 billion to 4.3 billion won over the period.

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[8]Estimates of these values were taken from the farm budget data appearing in Appendix V.

Table 6.6.--The Value of Farm Labor and Income Displaced by Agricultural Land Conversion, 1975-1985.[a]

Policy Option and Value	Land Requirement Level			
	I	II	III	IV
Policy Option 1				
--farm income	10,202.4	10,444.6	9,093.2	6,409.9
--farm labor	8,830.3	9,007.8	7,846.8	5,543.2
Policy Option 2				
--farm income	6,934.5	7,027.6	6,133.4	4,355.8
--farm labor	6,883.0	6,952.8	6,067.1	4,311.4
Policy Option 3				
--farm income	8,288.1	8,417.4	7,345.0	5,202.3
--farm labor	7,691.7	7,805.7	6,794.8	4,821.8

[a]All estimates are in million won and assume 1974 prices and labor input levels.

The adoption of a paddy land zoning system tended to generate a decline in both the value of farm labor and income displaced by conversion. The former declined 32.0 percent while the latter, 22.1 percent. These declines were precipitated by the fact that upland crop production tends to be less labor intensive than paddy production. In addition, farm income is in a large part made up of management income which tends to be higher on paddy acreage.[9] Declines in the acreage of paddy lost, even though these losses are shifted in toto to upland areas, result in a decline in the income displaced by conversion.

[9]Management income which accounts for 23 percent of the production costs per hectare in rice production was calculated as 10 percent of the total value of production. The relatively high price support policy presently in effect in Korea tends to inflate the value of management costs abnormally above those for vegetables.

These values while they may seem substantial are not overly excessive. For example, losses in farm labor when converted to persons per year using 1974 labor mix ratios and wage rates, indicate that a maximum of 80 thousand persons would be displaced by conversion during the period. On a yearly basis, these losses do not seem to be large enough to present a significant unemployment problem. In fact the displacement of labor by conversion may benefit agriculture by supplying additional farm labor during peak labor demand periods.

Loss in farm income also tended to be rather insignificant when compared to total farm income for the nation. In 1974 the maximum loss in farm income was slightly more than 1.0 percent of this total.

Each of these three values: production, income, and the value of labor are incorporated into the estimates of the direct costs associated with conversion. These costs in addition to those for reclamation are presented in Table 6.7. All costs have been discounted back to 1974 to facilitate the comparison of the monetary effects of conversion under each policy combination and reclamation level.

A rather wide range of costs were associated with the various policy combinations. Overall they went from 67.6 billion won under the assumption of full reclamation (Policy Option 1, Level II) to 3.2 billion with partial reclamation under Policy Option 2, Level IV. In general, this latter policy option encountered the least cost of the three examined. The costs associated with it were approximately one-half those associated with option one and two-thirds of those associated with option three.

Table 6.7.--Discounted Direct, Reclamation and Total Cost Associated with Agricultural Land Conversion, 1975-1985.[a]

Policy Option and Cost Category	Land Requirement Level							
	I		II		III		IV	
	Reclamation		Reclamation		Reclamation		Reclamation	
	Full	Partial	Full	Partial	Full	Partial	Full	Partial
Policy Option 1								
--direct costs	12.2	12.2	12.3	12.3	10.9	10.9	8.0	8.0
--reclamation costs	54.8	30.5	55.3	31.9	48.7	28.1	35.8	20.0
--total costs	67.0	42.7	67.6	44.2	59.6	39.0	43.8	28.0
Policy Option 2								
--direct costs	4.8	4.8	4.1	4.1	3.6	3.6	3.2	3.2
--reclamation costs	25.8	--	25.9	--	22.9	--	16.9	--
--total costs	30.6	4.8	30.0	4.1	26.5	3.6	20.1	3.2
Policy Option 3								
--direct costs	7.4	7.4	7.5	7.5	6.7	6.7	4.9	4.9
--reclamation costs	37.9	15.1	37.9	13.1	33.5	11.5	24.8	9.8
--total costs	45.3	22.5	45.4	20.6	40.2	18.2	29.7	14.7

[a]In billion won measured in constant 1974 prices.

The level of these total costs tended to depend quite extensively on the type and magnitude of reclamation activity adopted in response to conversion. In those cases where such activities were initiated, reclamation costs tended to vary from a maximum of 55.3 billion won under the full reclamation policy associated with Policy Option 1, Level II to 16.9 billion won under the partial reclamation policy associated with Policy Option 2, Level IV. Overall, these costs averaged 83.5 percent of total cost under the assumption of full reclamation and 68.5 percent under the partial reclamation assumption. They ranged from 86.3 percent of total costs in Policy Option 2, Level II to 63.2 percent in Policy Option 3, Level III.

Shifts in total costs tended to depend on the type of reclamation policy adopted and the land use-population policy option in effect. With respect to the former, total costs tended to be 44.0 percent lower under the partial reclamation policy than those experienced under full reclamation. The greatest decline, excluding the four cases under Policy Option 2 where no reclamation costs were incurred, occurred under Policy Option 3, Level IV. Here total cost dropped approximately 37 billion won.

A breakdown of the shift in costs associated with different policy options and reclamation levels is presented in Table 6.8. In the table, a decline in costs is assumed to be a benefit accruing to the nation. As such, it assumes a positive value in the table.

As the data indicates, benefits tend to increase as urban migration and paddy losses decline. The largest cost savings are associated with the full and partial reclamation policies associated with Policy Option 2. Under the full reclamation option associated

Table 6.8.--Changes in Costs Associated with Shifts in Land Use and Reclamation Policies, 1975-1985.[a]

Policy Option and Cost Category	Land Requirement Level							
	I		II		III		IV	
	Reclamation		Reclamation		Reclamation		Reclamation	
	Full	Partial	Full	Partial	Full	Partial	Full	Partial
Policy Option 1[b]								
--direct costs	12.2	12.2	-.1	- .1	1.3	1.3	4.2	4.2
--reclamation costs	54.8	30.5	-.5	-1.4	6.1	2.4	19.0	10.5
--total costs	67.0	42.7	-.6	-1.5	7.4	3.7	23.2	14.7
Policy Option 2								
--direct costs	7.4	7.4	8.1	8.1	8.6	8.6	9.0	9.0
--reclamation costs	29.0	30.5	28.9	30.5	31.9	30.5	37.9	30.5
--total costs	36.4	37.9	37.0	38.6	40.5	38.6	46.9	39.5
Policy Option 3								
--direct costs	4.8	4.8	4.7	4.7	5.5	5.5	7.3	7.3
--reclamation costs	16.9	15.4	16.9	17.4	21.3	19.0	30.0	20.7
--total costs	21.3	20.2	21.6	22.1	26.8	24.5	37.3	28.0

[a]In billion won measured in 1974 prices.

[b]Figures shown under Level I are the actual discounted costs which would occur given no change in past trends.

with this policy, costs tended to decline anywhere from 54.3 percent under Level I to 70.0 percent at Level IV. The exclusion of the replacement of upland dropped reclamation costs to zero and resulted in declines in total costs for 88.8 percent under Level I to 92.5 percent under Level IV. This latter policy option generated the least cost policy of those examined.

Under Policy Option 3, costs rose and benefits declined due to the increased conversion of paddy land. On the average, total costs tended to rise assuming total reclamation to a level 20.2 percent higher than those under Policy Option 2. Under the assumption of a partial reclamation, policy costs tended to rise slightly more than 55 percent. In both cases costs were still under those recorded in Policy Option 1, Level I. Costs associated with the full reclamation policy tended to be 39.9 percent less while those associated with partial reclamation tended to average 55.5 percent less.

It is interesting to note that in only one instance did the costs associated with conversion tend to rise. In Policy Option 1, Level II, the costs associated with full and partial reclamation rose .6 and 1.5 billion won respectively. This rise in total costs can be directly linked to an increase in paddy conversion which was necessitated by a shift in population from Seoul. In both Option 2 and 3, such conversion is restricted. This resulted in an increase in cost saving in each of these instances.

The above costs are in effect only a partial analysis of the total costs associated with a given land use policy. Each policy option by adding to or reducing the total land area available for

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urban growth tends to affect the costs associated with preparing a site for urban development. The absence of development on paddy increases these costs since the site preparation costs tend to be higher the greater the slope. To acquire the full picture of the cost associated with conversion both the direct, reclamation, and site preparation costs need to be compared. This is done in conjunction with an examination of the growth patterns associated with urban growth in and around Busan over the next decade.

The Effects of Urban Land Conversion In and Around Busan

To fully appreciate the effects of conversion in Busan it is necessary to understand the physical features which are present in the area. These features, especially topography, play a major role in determining the shape and extent of growth which will occur in the future.

The city Busan metropolitan area is located in the southeastern section of the Korean peninsula. It is bordered on the south by the Daehan Strait, on the west by the Nakdong River, and on the east by the East Sea. Topographically, the area is rather mountainous, with mountainous terrain forming a development barrier to the north and east of the city. Relatively flat terrain is located in river valleys which bisect these mountains, along the sea coast to the west of the city and in the Nakdong River valley and delta to the east of the city. This latter area, the Kimhae Plain, is at present extensively used for both rice and vegetable production.

Because of the relief features in the area, only a small portion of the land area surrounding Busan is suitable for urban develo

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development. A breakdown of this area by present use and distance is presented in Table 6.9.

As the data indicates, a large portion of the land area around Busan is not usable for urban development because of slope. Approximately 53.2 percent of the land area or 22.8 thousand hectares falls within this category. The remaining area, some 21 thousand hectares is used for agricultural uses and forestry. Of this, slightly less than 14.2 thousand hectares or 32.6 percent of the total area is employed in paddy production, 1.9 thousand hectares or 4.4 percent in upland production and 4.6 thousand hectares or 10.6 percent are employed in other uses such as forestry production or as idle land.

The exclusion of a substantial area of land around Busan from potential development does seem to present some problems in light of projected future urban demands.

These demands vary according to the population growth rate assumed. Under a low rate of population growth, Level IV, 15 thousand hectares will be required for urban uses over the next ten years. Assuming present growth trends, these demands increase to 21.5 thousand hectares. If policies are adopted to redistribute all or a portion of the population growth in Seoul, these demands increase even further. In the case of the former alternative, they exceed 25 thousand hectares while the latter requires the use of 23.3 thousand hectares.

A comparison of the supply and potential demand of land suitable for urban development with the 20 kilometer radius of Busan

Table 6.9.--Land Area by Use and Distance from the Center of Busan.[a]

Present Land Use	Distance[b]							Total area[c]
	0-5.0	5.0-7.5	7.5-10.0	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	
Paddy								
--high quality	112.2	72.5	--	109.4	422.6	204.3	204.5	1,135.5
--medium quality	66.0	152.8	5.4	91.2	69.5	1,542.2	1,492.6	3,419.7
--high quality	6.4	504.2	1,527.3	2,748.5	2,883.3	1,363.1	645.8	9,678.6
Upland	116.6	231.0	215.0	201.1	362.8	424.2	376.9	1,927.6
Other	113.3	231.8	691.1	589.0	1,049.8	1,101.8	868.0	4,664.8
Area above 15% slope	589.4	958.0	1,387.3	2,742.3	3,633.8	5,415.7	8,121.0	22,847.5
Total area[c]	1,023.9	2,150.3	3,826.1	6,481.4	8,421.8	10,051.3	11,708.8	43,673.7

[a]In hectares.

[b]In kilometers measured from the center of Busan.

[c]Excludes rivers, lakes, built-up housing areas and major transportation facilities.

Table 6.10.--Additional Land Area Required for Urban Growth Assuming Four Different Growth Rates in Busan, 1975-1985.[a]

	Land Requirement Level			
	Level I	Level II	Level III	Level IV
1975	1,078	1,151	1,114	947
1976	1,188	1,291	1,239	1,008
1977	1,328	1,518	1,396	1,089
1978	1,481	1,602	1,570	1,172
1979	1,662	1,885	1,773	1,269
1980	1,839	2,129	1,978	1,354
1981	2,056	2,390	2,229	1,460
1982	2,307	2,730	2,519	1,582
1983	2,536	3,044	2,790	1,668
1984	2,838	3,451	3,145	1,800
1985	3,199	3,936	3,567	1,963
Total Requirements	21,512	25,127	23,320	15,312

[a]In hectares.

indicates shortages of supply under almost all of the policy options examined. Only under Level IV demands in Option 1 and 4 was there an excess supply of land within the twenty kilometer ring at the end of 1985. In the former case, 5.5 thousand hectares were still available while in the latter, only 959 hectares remained.

In all other policy combinations excess demand was indicated. This was most severe under Policy Option 2 where development was restricted to upland and other land below 15 percent slope. Under this option, excess demand ranged from 18.5 thousand hectares in Level II to 8.7 thousand hectares in Level IV. Supplies of available land in this instance tended to be exhausted by 1978 or 1979. Policy Option 4, which excluded high and medium quality paddy from development also demonstrated negative supply in Levels I through III. Supplies tended to last longer under this option, running out in 1983 or 1984. Under Policy Option I, supply problems also occurred, but were not as severe as those present in four. Here, excess demand ranged from 694 hectares in Level I to 4.3 thousand hectares under Level II demands. Demand tended to exceed supply in Levels I through III, either in 1983 or 1984.[10]

A comparison of the costs associated with each of the policy combinations was complicated by the above supply and demand

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[10]The underestimation of the potential area required for urban growth was precipitated by the failure to account for two factors: the fact that half of the area within the 20 kilometer radius was occupied by the sea and the very mountainous terrain around Busan. While an extension of the area classified would have been appropriate for a full examination of the cost of conversion, it was felt that the costs emanating from the more limited area would be sufficient for the purposes of the analysis.

Table 6.11.--The Physical Supply and Demand for Land Suitable for Development Around Busan Under Various Growth and Land Use Policies.[a]

	Demand for Urban Land[c]	Excess Supply or Demand for Urban Land[d]		
		1	2	4
Supply of land available[b]		20,826.2	6,592.4	16,271.0
Land demanded				
Level I	21,521	- 694.0	-14,928.6	-5,250.0
Level II	25,127	-4,300.8	-18,534.6	-8,856.0
Level III	23,320	-2,493.8	-16,727.6	-7,049.0
Level IV	15,312	5,514.2	- 8,719.6	959.0

[a]In hectares.

[b]The area of land available fluctuates from policy option to option since each option excludes agricultural areas from conversion.

[c]From Table 6.10.

[d]Negative values indicate excess demand while positive values indicate excess supply.

conditions. A full comparison of the costs associated with urban growth and conversion required that only the costs associated with the first three years of the projections be examined. These costs are presented in Table 6.12 below. A complete breakdown of the costs by category is presented in Appendix VII.

Table 6.12.--Average Cost of Urban Land Conversion Per Annum In and Around Busan, 1975-1977.[a]

Policy Option	Land Requirement Level			
	I	II	III	IV
1	2.19	2.42	2.28	1.83
2	1.34	1.71	1.62	1.18
4	2.16	2.34	2.14	1.80

[a]Estimated costs are in billion won and include the costs associated with loss in agricultural land rent, paddy reclamation and urban site preparation.

The average cost of conversion per annum tended to range from 2.42 billion won under Policy Option 1, Level II to 1.18 billion won under Policy Option 2, Level IV. The costs associated with Policy Option 2 tended to be the lowest of those estimated. Assuming past population trends, these tended to be .85 billion or 38.8 percent less than those recorded under Option 1 and .82 billion won or 38.0 percent less than those under Option 4. This was understandable since under this policy no paddy was converted. As such, land rent or the direct costs associated with conversion were minimized and the necessity of reclaiming paddy area equal to that converted was unnecessary.[11]

Possibly more surprising is the slight decline in conversion costs which occurred with the adoption of a modified agricultural zoning approach. Originally, it was thought that the movement of even a portion of potential urban growth to upland areas would inflate site preparation costs to such an extent that total costs would be greater than those generated assuming a continuance of past trends. This, however, does not seem to be the case. In every instance when the costs associated with Option 4 were compared with those in Option 1, a decline was noted. This decline in costs ranged from a high of 140 million won per year under Level III to 3 million won per year under both Level I and IV. While these costs were on the average approximately 46 percent higher than those generated under Option 2, the option did prolong the period in which the supply of land satisfied demand almost 5 years.

Shifts in the level of population in Busan also had a direct effect on the costs. Generally, the reallocation of population from Seoul generated an increase in the costs of conversion. These increases tended to range from 370 million won per annum under Option 2 to 180 million won under Option 3. A decline in the number of migrants relocated in Busan under Level III tended to decrease these costs. The decline, however, varied in intensity. Under

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[11]The reader will recall the land rent associated with upland areas within the double cropping region tended to be 78.4 percent of that generated by paddy. Also the adoption of a policy of partial reclamation precludes the necessity of replacing upland acreage lost to urban growth.

Policy Option 2, costs declined only 9 million won (5.3 percent) while the costs associated with options 1 and 4 dropped 140 (5.8 percent) and 200 (8.5 percent) million won per annum respectively. As such, it would seem that the costs associated with Policy Option 4 are much more sensitive to shifts in population than those in either 1 and 2.

This tendency, however, did not seem to be evident in the cost estimates associated with Level IV. Here, costs under Policy Option 2 tend to be much more sensitive to a decline in population, falling 440 million won (27.2 percent) over those in III. Both the costs in 1 and 4 were less responsive, falling 19.3 and 15.9 percent respectively. This shift in relative sensitivity seems to be associated with the relationship of absolute population size to land supply. A decline in the size of the city's population under Option 2 generated a lower demand for land each year, thus, allowing the upper slope areas to remain idle for a longer period. Since the slope areas were much more costly to develop, their exclusion from conversionary pressures generated a sharp decline in total costs. Under Option 1 and 4, where more of the lower and cheaper slope areas were available for conversion, the decline in population tended to shift costs less.

The costs associated with each policy will in all likelihood be borne by different sectors within the economy. For example, the majority of site preparation costs will be borne by the nonagricultural sector. In the final analysis, these costs will be in most instances paid by the consumer or by the government through its subsidized low income housing programs. Reclamation and direct costs on the other land will most likely be borne by the agricultural sector. These aggregate costs are presented in Table 6.13 below.

As would be expected, Policy Option 2 constitutes the cheapest policy alternative for agriculture. Here, the annual costs borne by the agriculture sector, as a whole, amount to only 3 or 4 million won per year. These costs tend to be extremely low since they were composed of only direct costs. Reclamation costs were not incurred under this option since paddy land was not available for urban development. Under this option, for every 1,000 won of cost borne by the nonagricultural sector, only 20 won in costs are borne by the agricultural sector.

While Policy Option 2 does generate significant savings to agriculture, it also caused a rather substantial increase in the costs borne by the nonagricultural sector. Under Policy Option 1 and 4, the average costs of conversion were .90 and .87 billion won per year. Under Policy Option 2, these costs rose to 1.43 billion won, an increase of 59 percent in the former case and 64 percent in the latter.

These shifts in cost incidence would tend to indicate a strong support within the Ministry of Agriculture and Fisheries for an agricultural zoning bill to protect paddy. On the other hand, strong opposition to such a bill would develop in ministries and government agencies responsible for urban development. When the cost levels borne by each sector under the various policy combinations were compared with those in Policy Option 1, Level I, the before policy case, only three policy combinations appear which would leave each sector either no worse or better off. Two of these

Table 6.13.--Sectoral Incidence of Per Annum Costs Associated with Urban Land Conversion in Busan, 1975-1977.[a]

Policy Option and Costs by Sector	Land Requirement Level			
	I	II	III	IV
Policy Option 1				
--Agriculture	1.27	1.42	1.33	1.10
--Nonagriculture	.92	1.00	.95	.73
--Ratio[b]	1.38	1.42	1.40	1.51
Policy Option 2				
--Agriculture	.03	.04	.04	.03
--Nonagriculture	1.31	1.67	1.58	1.15
--Ratio	.02	.02	.03	.03
Policy Option 4				
--Agriculture	1.24	1.40	1.32	1.01
--Nonagriculture	.92	.94	.82	.79
--Ratio	1.35	1.49	1.61	1.28

[a]Estimates are in billion won.

[b]Ratio of agricultural to nonagricultural costs.

required a decline in urban population of 60 percent. For example, the costs associated with Policy Option 1, Level IV reflect a cost saving to the agriculture sector of .17 billion won per year and a nonagricultural savings of .19 billion won per year. Under Policy Option 4, Level IV, the agricultural sector received similar savings while the savings to the nonagricultural sector dropped to .13 billion per year. The third policy combination, Policy Option 4, Level I, while leaving each sector as well off as before, did not require any shift in population. Under this policy combination, the cost to agriculture dropped 30 million won per year while the cost borne by the nonagricultural sector remained at the same level as in Policy Option 1.

Under all other policy combinations, either one or both of the costs borne by each sector increased. As mentioned, in the various levels in Policy Option 2, agricultural costs dropped while non-agricultural costs rose. In those policy combinations associated with either full or partial population relocation policies, Level II and III, costs borne by both sectors generally tended to rise. For example, under Level II, the costs borne by the agriculture sector rose 150 million won per year under Policy Option 1 and 160 million under Policy Option 4. In the case of the former, nonagricultural costs rose 80 million won per year while in the latter policy option, they increased 20 million won per year. Similar increases, although smaller, occur in Policy Option 1, Level III. Under Policy Option 4, Level III, however, the costs borne by agriculture rose 50 million won per year while those borne by the nonagriculture sector declined 100 million won per year.

The limited time period associated with the above analysis obviously restricts the validity of the comparisons and the conclusions which can be drawn for their results. To circumvent these restrictions, an analysis of the costs associated with Policy Option 1 and 4 was undertaken over the period from 1975 to 1981. Policy Option 2 was excluded from this analysis since it terminated in 1977. The total costs associated with each policy combination under these two options and their incidence are presented in Table 6.14 below.

As the data indicates, total costs associated with conversion at all levels tended to be slightly less under Policy Option 4. On the average, total costs declined slightly more than 42 million won per year. This decline ranged from 80 million won per year under Level II to 20 million won per year under Level III and IV.

This decline was not uniform amongst the sectoral costs. In all instances, the costs borne by agriculture declined while nonagricultural costs rose under Level I and III, dropped under II and remained the same under IV. The decline in the former costs seemed to be generated by the zoning policy which excluded the conversion of high and medium quality paddy acreage. The rather erratic fluctuations in nonagricultural costs seemed to be caused by the nature of the terrain and its location around Busan. For example, under Level I, nonagricultural costs rose from .94 billion per year to 1.00 billion won. This rise was due to the forced development of more upland under Option 4 to meet urban land demands. Under Level II, however, nonagricultural costs dropped from 1.11 billion to 1.08 billion annually. Under Option 1, increased demand generated by a rise in population increased the conversionary rate of land around

Table 6.14.--Average Annual Incidence of Costs Associated with Urban Land Conversion in Busan, 1975-1981.[a]

Policy Option and Costs by Sector	Land Requirement Level			
	I	II	III	IV
Policy Option 1				
1. Agriculture[b]	1.37	1.47	1.39	1.08
2. Nonagriculture[c]	.94	1.11	.99	.75
3. Total	2.31	2.58	2.38	1.83
4. Ratio (1÷2)	1.46	1.32	1.40	1.44
Policy Option 4				
5. Agriculture	1.26	1.42	1.36	1.06
6. Nonagriculture	1.00	1.08	1.00	.75
7. Total	2.26	2.50	2.36	1.81
8. Ratio (5÷6)	1.26	1.31	1.36	1.41

[a]Cost estimates in billion won.

[b]Includes both direct and reclamation costs.

[c]Includes site preparation costs.

Busan. As such, site preparation costs rose. Under Option 4, the same powers were in effect. However, because of the zoning policy a certain portion of paddy land was excluded from development. This forced new development further from the city onto low quality paddy land which was less costly to develop. Thus, a drop in site preparation resulted. The same forces were in effect in Level III, where site preparation costs rose in Option 4 to 10 million won per annum. The low population assumed under Level IV maintained land demand at a level under both policy options to generate no change in costs.

When the sectoral incidence of costs are compared with those which occurred in Policy Option 1, Level I, only two policy combinations remain which leave both the agricultural and nonagricultural sectors better off. Both occurred under the reduced population growth assumption associated with Level IV. Under Policy Option 1, agriculture's share of the conversion costs dropped .290 million won per year while nonagriculture's share declined .19 million. Under Policy Option 4, the former costs declined .200 million won per year while the latter costs declined 250 million.

Due to an increase in nonagricultural costs associated with Policy Option 4, Level I, previously discussed, this policy combination did not constitute a "better off" situation for both sectors, as was the case under the short term analysis.[12] Excluding the cost configurations generated under Level IV, this policy combination did present the most viable policy option since it did generate substantial declines in agricultural sector costs and only slight

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[12]Refer to p. 216.

increases in site preparation costs. Under this option, the former declined 110 million won per year while the latter only rose 60 million.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Introduction

The following chapter draws together the wide variety of components examined in the preceding chapters. It develops a set of conclusions based on the information brought out in the study and presents recommendations for future investigations which might be useful.

It is subdivided into four components: the first presents a brief summary of the research; the second, an examination of the results of the analysis; the third, a set of recommendations for changes in existing policies and procedures; and the fourth, a summary of topics needing further examination.

Research Summary

The rapid growth of the industrial and service sectors and the accompanying expansion of Korea's urban centers over the past two decades has generated dramatic shifts in Korea's land use pattern. The movement of large numbers of Koreans from rural to urban areas in search of urban amenities and employment has led to the horizontal expansion of the nation's major urban areas. To provide space for this growth, thousands of hectares of agricultural land have been converted to nonagricultural uses. In countries with abundant land supplies this growth has had relatively little effect on agriculture. In Korea where agricultural land is limited and the desire for food self-sufficiency strong, these losses have generated a great deal of concern.

To combat this conversion and to foster the orderly growth of urban areas, the Republic of Korea has promulgated a number of legislative incentives to control urban expansion and to prevent the further loss of prime agricultural land. These policies have, for example, included the adoption of taxation measures aimed at controlling land speculation, the development of urban planning and greenbelt zones around the nation's major urban areas and the adoption of an exclusive paddy land zoning bill to prevent paddy land conversion.

The present study has been developed to examine these policies and to evaluate the economic costs associated with conversion. The initial objective of the research, that of improving the understanding of Korean policymakers of the process of urban growth led to the development of three sections, each to a different component of the conversion process.

The first section draws together various studies and hypotheses which try to articulate and define the various forces which underlie urban growth and govern its spatial distribution. Its major purpose is to examine a wide range of policies which have been adopted in both developed and developing countries throughout the world to guide urban growth and to preserve agricultural land on the periphery of urban areas.

This review set the stage for a two part examination of Korea's past and present land use patterns. The first part of this discussion is devoted to an examination of the structural changes which have occurred in the Korean economy over the past decade. These changes are then examined in terms of their effect on the nation's land use pattern. Of particular interest here is the loss in agricultural land, the composition of the loss and the data series available for measuring the loss. Because of the questionable nature of the data series, a full examination of each is developed and improvements suggested.

The second component reviews the various land use policies which have been adopted in Korea since 1965 to control urban growth and protect agricultural land from urban conversion. These policies ranged from the Urban Planning Law which sets up the basis for land use planning in and around urban areas to an explanation of the new land speculation tax law. The effect of these policies and others are examined by looking at past urban land price trends and the rate of agricultural conversion in and around ten major Korean cities. An analysis of the interplay between past trends and policies forms the basis for a series of suggestions concerning the form of future land use policies.

Having completed an examination of the structural and economic factors which have shaped Korea's past land use patterns, the research shifts its focus to the future. The major emphasis in this section of the research is the development of a methodology which can be used to project urban land requirements and to assess the costs associated with these requirements.

Estimates of future requirements are developed by multiplying estimates of future population by per capita urban land requirements.

Each of these latter projections were developed using simple least squares regression. Four different levels of land requirements are developed each corresponding to a different population policy. The four policies examined are: one, a continuation of past trends; two, a decline in Seoul's population and a redistribution of potential urban migrants to other urban areas; three, a redistribution of the above population assuming a 50 percent decline in its size; and four, an absolute decline in urban growth in the absence of any distribution.

Because of the magnitude of work involved in developing the above estimates, the analysis is limited to only the ten largest cities in Korea. These are grouped into three regions, each corresponding to a major agricultural cropping zone. These zones formed the geographic basis for examining the potential effects of urban land conversion in and around the selected cities. A more detailed analysis of urban conversion based on soil and topographical conditions is also conducted in and around the city of Busan.

The effects of urban land conversion in the ten cities is determined assuming three different land use policies. The first assumes no change in policies from those in effect during the 1970 to 1974 period. The second assumes the enforcement of an agricultural zoning policy which prohibited the use of paddy for nonagricultural uses. The third, a variant of the second, assumed only a partial enforcement of the zoning policy.

The effects of each of these policies on agriculture are assessed using three sets of indicators. The first measures changes in the physical quantities associated with conversion. These include the area of paddy and upland lost and the effect that such losses have on production. The second examines changes which would occur in the value of agricultural labor and income displaced by conversion, while the third looks at the costs associated with shifts in land from agricultural to nonagricultural uses.

With respect to the latter costs two categories of expenditures, those associated with the direct loss to agriculture and those resulting from efforts to replace the land lost, are examined. The direct costs to agriculture are assumed to be equal to the land rent foregone because of conversion. Estimates of this value are developed using 1974 crop budgets developed for hypothetical hectares of paddy and upland in each region. The estimates of reclamation costs used are assumed to equal the 1974 average cost of reclaiming a hectare of paddy and upland in 1974. Two levels of reclamation activity were examined, one which assumed the replacement of all paddy and upland lost, and one which assumed only the replacement of converted paddy. To facilitate the comparison of costs associated with conversion under each policy, all of the above costs are discounted back to 1974 using a 10 percent discount rate.

The more detailed analysis of conversion in the Busan area requires a slightly more complicated approach. Here, the location of urban growth is assumed to be a function of topography and distance from the center of the city. To provide a basis for distributing the estimated future land requirements around the city, a land classification system based on soil survey data is developed. Using this system, the area of each soil type is measured and then classified by use, slope, and distance from the urban center. Land used for rice production is subdivided into three productivity classes while land above 15 percent slope is assumed not available for urban development.

Using this classification scheme, estimate of the future land requirements assuming three different land use policies are distributed on available land within a 20 kilometer radius of downtown Busan. The first two of the policy assumptions were identical to those used in the analysis of the ten cities. The third differs in that it allows the conversion of low quality paddy land while prohibiting conversion on high and medium quality paddy. This growth is distributed assuming three basic rules: (1) conversion occurs closest to the city first; (2) conversion occurs on land with the lowest slope first; and (3) growth occurs in a sequential pattern weighting slope more heavily than distance.

This method of distributing growth when combined with the above policy options, generates a set of different growth patterns each with their own level of paddy and upland losses. These losses are converted into monetary terms and discounted back to 1974 for purposes of comparison. In addition to the direct and reclamation costs previously mentioned, a third set of expenditures emanating from the need to prepare sites for urban construction is also included.

These latter costs provide the basis for a more detailed examination of the expenditures associated with the process of urban growth. Assuming that the incidence of these costs generally falls outside the agricultural sector, the study examines the potential support or opposition which might be generated, given the adoption of each of the three land use policy options. In addition, an analysis of the total and component costs associated with each option is presented.

The analyses of these costs and those associated with the ten city area do not in any way constitute a complete examination of the effects of conversion. Many costs such as those associated with congestion and urban pollution as well as the benefits associated with urbanization have been excluded. In effect, analysis constitutes only a partial sketch of the expenditures which would result, due to urban expansion in a limited geographical area, given the adoption of specific land use policies. The study while not addressing this broader issue does, however, provide the basic methodology through which the total effects of conversion might be examined. The conclusions and recommendations generated by the above study are presented below.

Research Results

Two interrelated components are examined in the research. The first examines past urban land conversion trends and assesses the effect that land use policies adopted between 1965 and 1974 have on moderating these trends. The second, develops and implements a methodology which is designed to assess the costs associated with a continuation of these trends over the next decade.

The analysis of the past conversionary trends has indicated the presence of some shifts in the nation's land use patterns. These shifts, however, tend to vary depending on the data source consulted. For example, an analysis of the agricultural land area cultivated yearly during the past nine years suggests a decline of 51 thousand hectares. When estimates of the paddy and upland area reclaimed during the period are considered, the overall losses rise to 86 thousand hectares: 42 thousand hectares of paddy and 44 thousand hectares of upland.

Examining these yearly losses more closely, a conversionary preference for paddy land vis-a-vis upland during the earlier years of the period seems to be evident. This preference tends to shift in the latter years with upland being more prone to conversion. This shift is correlated with increases in the value of paddy which have resulted from a significant rise in the government purchase price for rice. The link, however, between the rise in purchase price and the retention of more paddy in production is not as substantial as would first appear. Increases in the government's interest in paddy signified by the rise in purchase price may have made local government officials reluctant to report the full extent of paddy losses. Such occurrences have not been unheard of in the past.

Comparing the above loss estimates with those compiled from the Land Register, Korea's official land use statistics, major inconsistencies in trends are present. This latter data series suggests that during the 1970-74 period agricultural land actually increased by slightly less than 7 thousand hectares. This increase was the result of a 14 thousand hectare increase in upland which offset a 7 thousand hectare decline in paddy.

The inconsistency between the two series tends to make the data suspect. This is especially true with respect to the agricultural and residential land use data appearing in the register. Since the register forms the basis for property tax collection, it is very likely that property owners in an attempt to avoid taxes do not inform the appropriate officials when their property shifts from an agricultural to a nonagricultural use. This results in an overestimation of cultivated land and an underestimation of residential land.

Based on the likely presence of biases in the data presented in the register, it would seem that the agricultural land use data compiled via sample survey by the Ministry of Agriculture and Fisheries is more accurate than that found in the register. The land area devoted to residential structures, in the latter record, is also most likely underestimated and if used, needs to be adjusted to reflect unreported agricultural land conversion. Where conversion has been caused by government intervention such as in the provision of urban services or the expansion of water resources, data in the latter register seems to be relatively accurate.

The analysis of past conversion trends conducted using composite land use data from the above sources suggests that the rapid rate of growth in urban population and industrial infrastructure has generated substantial conversionary pressure on agricultural land in and around Korea's large urban centers. This is brought out in a comparison of the land use trends which have occurred nationwide and those which occurred around the nation's ten largest cities between 1970 and 1974. At the national level the data indicates a decline in agricultural and forest land with increases in land used for urban structures, services, water resources, and other uses. Land use trends in the ten cities area while having the same sign as the national ones tend to be much more intensive. For example, the growth in land used for urban structures and services in these cities is 2.8 and 1.5 times larger than the national rate. Also the rate of agricultural land conversion tends to be 7.5 times greater than that at the national level.

To control the rapid rate of growth in these and other urban areas, Korea has already enacted a number of land use controls. As would be expected under the nation's highly centralized form of government, the majority of these policies rely heavily on the police powers, specifically zoning.

An analysis of these laws, specifically the Urban Planning Law and the Revised Law on the Preservation and Utilization of Farmland, tends to indicate some potential problems. The former piece of legislation empowers the Ministry of Construction to create various types of zones in and around urban centers. The methods by which these zones are created, suggest a heavy emphasis on the provision of land for urban growth rather than the protection of agricultural land. These plans do consider some land to be nondevelopable. Such land, generally designated as greenbelts, is located in rather mountainous areas not suitable for urban let alone agricultural use. Agricultural land located in the lower elevations is not specifically protected by the law and in some instances are zoned for urban development. Paddy land in these areas constitute approximately 17 percent of the nation's total paddy acreage. The latter piece of legislation, the Revised Law on the Preservation and Utilization of Farmland, is also limited in scope. As promulgated, it excludes all agricultural land within urban planning zones from protection. No protection is provided for agricultural land within the rural-urban fringe even though these areas will inevitably bear the brunt of future conversionary pressures. In addition, this legislation fails to recognize the productive value of farmland as an important component in determining whether or not an area should fall within the protective devices of the law. The use of only two agricultural land uses, paddy and upland, in the law is likely to prove to be an inadequate decision rule to protect the most valuable agricultural land given shift in food demand and prices in the future. Under the present purchase price support system, rice acreage is the most productive agricultural acreage. In the future, however, changes in this administered price and/or increases in the price of upland agricultural commodities may alter the situation. The legislation as drafted is rather inflexible with respect to these potential price changes.

Finally, the general concept of zoning has been recognized for a number of years as a valid means of land use control. However, when zoning is used to restrict the right of use in land to a single use such as paddy without the payment of just compensation to the owner of the land it becomes questionable. Such a policy requires that individual farm operators forego the potential benefits which might accrue to them if their land is converted to a higher and better urban use. Requiring the farm operator to bear the total costs generated by these restrictions is inadvisable and likely to generate substantial economic pressure on farmers to evade the law in areas where strong urban land demands exists.

With the strong emphasis being placed on the adoption of legislation embodying uses of the police powers, taxation, government spending and ownership have received little attention as land use control mechanisms. In the area of taxation, the general property tax codes and a newly enacted anti-speculation law are the only pieces of legislation which might be used for land use control purposes. They are, however, not used directly for this purpose. Both agricultural and urban property taxes tend to be relatively small when compared to the value of the tax base. As such, they seem to have little influence over land use. In urban areas these rates range from 2 and 3 won per 1,000 valuation for land and buildings to 50 won per 1,000 valuation for luxury land and buildings. At face value agricultural property taxes, based on the productive value of land per household, seem to be much higher. A progressive tax ranging from 6 to 10 percent levied on the value of paddy production and 10 to 20 percent on the value of upland production is presently in force. In reality, however, the impact of this tax is much lower than the rate scale would indicate. For example, in 1974, only slightly more than 1 percent of the gross value of production of rice was paid in taxes. This would seem to indicate the widespread presence of underassessment or tax evasion at the local level.

The effects of the only other major property tax policy, the anti-speculation law, are somewhat difficult to ascertain. After the adoption of this legislation, real land prices in each city stabilized and began to decline. This decline, however, occurred during a period when there were rapid swings in the national economy caused by disturbances in the international food and energy markets (1972-74). The presence of these swings, especially the slump which occurred in the residential construction market and contractions in domestic money markets makes it extremely difficult to separate out what impact if any the anti-speculation measures had on land prices.

The development of a methodology to measure the economic impacts of both the present rate of agricultural land conversion and various selected public policies suffered from many of the same data problems mentioned earlier. The absence of accurate, historic, location-specific land conversion data in addition to basic economic data on the effects which price and income have on the demand for land and its services, combined to complicate the process of projecting future land demands. Cost data which was needed to determine the economic impact of conversion also presented a problem. Farm budget information from the National Agricultural Economics Research Institute while covering the major commodities, reflected the cost structure on only the more advanced farms, not that of an average farm. Data from the Ministry while usable in part, was limited in coverage to grains. Both data series were somewhat out of date, reflecting 1974 prices and input levels. In the end a composite set of data was compiled from farm cost information collected for land and water development project appraisals and from official Ministry statistics.

Turning to the results obtained when the methodology was applied to the ten city area, a number of interesting results were generated. The population projections developed in conjunction with estimates of per capita land requirements indicate an increase in population in these areas of 11 million persons over the period from 1975-85. This growth will be highly concentrated in and around the four cities in the single cropping region, with 74 percent of the growth or 8.2 million new residents living in Seoul, Incheon, Suweon, and Chungju by the end of the period. The projections also indicate that 21 percent or 2.3 million residents and 4 percent or 44 thousand new residents would reside in the cities in the double and upland cropping region.

Shifts in this population growth from Seoul to the other nine cities, accomplished by assuming a linear rather than exponential growth rate in the former city, did generate some rather noticeable changes in the above estimates. Assuming all of the decline moved to the other nine cities, the single cropping region would absorb 53 percent of the growth or 5.9 million persons, the double cropping region, 44 percent or 4.9 million persons, and the upland cropping region 3 percent or 264 thousand persons. Assuming the redistribution of only 50 percent of the decline, overall growth in the ten cities dropped 16.5 percent over the period to 9.3 million. The redistribution of this population followed the same proportions as those above. Assuming a decline in overall population growth of 40 percent of the projected level, resulted in an additional 5.8 million people residing in the ten cities by 1985.

The analysis of past per capita urban land requirements in each of the cities examined, suggests that these cities have expanded horizontally at a rather substantial rate. Extending these trends to 1985, the per capita requirement for residential land (including homes, commercial and industrial structures, and other structures) are projected to increase on the average 3.23 pyong (1 pyong = 3.3 meters^2) while per capita requirements for urban services are projected to decline 2.93 pyong per person. Cities in the double cropping region tend to exhibit the largest increase in residential land requirement, recording a 5.85 pyong increase. These cities are followed by those in the single cropping region where per capita requirements increased 3.30 pyong. In the upland cropping region, an increase of .53 pyong is expected. Per capita land requirements for urban services tend to fluctuate from region to region, with the double cropping region declining .77 pyong per person, the single cropping region rising .79 pyong per person and the upland cropping region declining 2.95 pyong per person.

The above population and per capita land requirements when combined generate estimates of urban land demand 19 percent higher than those registered in the base period. Assuming past trends conversion losses in the ten city area are projected to reach 75 thousand hectares by 1985. Of this total 60 percent or 45 thousand hectares would be paddy land while the remaining 40 percent or 30 hectares would be upland. The increasing rate of conversion indicated by these estimates is primarily due to the exponential nature of population growth and to rising per capita land requirements. After reviewing land prices, household income and population trends in the past and those which most likely will occur in the future, it was concluded that estimates of both variables did seem reasonable.

By assumption, the composition of these losses shifts under the two land use policy options examined. For example, assuming past population growth trends and the activation of an exclusive paddy land zoning ordinance, losses of paddy would theoretically drop to zero while 75 thousand hectares of upland would be converted. Assuming only a partial enforcement of this policy, paddy loss would run approximately 19 thousand hectares with upland areas declining 57 thousand hectares.

These conversion trends generate rather insignificant losses in production, farm income, and labor. For example, using 1974 yield levels, paddy land conversion would produce declines in production of 19.4 thousand metric tons per year. These losses would result in a 15 percent decline in the average per annum increase in rice yields calculated over the past decade. This decline would have depressed the annual rate of growth in production from 3.05 to 3.00 percent per year. The decline in vegetable production was even less pronounced, registering losses in production of 9 thousand metric tons per year.

Declines in farm income and labor also tend to be rather limited. For example, assuming the maximum loss in farm land that might occur, 80 thousand man years of labor and 10 billion won in farm income would be displaced. Given the present excess demand situation for seasonal farm labor and the rapid rate of growth of urban income and employment, these shifts should not constitute too severe of a problem in the future.

The analysis of the costs associated with the various level of projected agricultural land use conversion suggests that the maximum value of the losses could reach 67.6 billion 1974 won. This overall loss breaks down into 12.3 billion won for the displacement of agricultural land rent and 55.6 billion won in reclamation costs to replace the land lost. The latter estimates decline to 44.2 billion assuming only the reclamation of converted paddy acreage.

As would be expected, these costs tend to decline as more and more paddy land is excluded from urban development or as urban population growth declines. Under the enactment of strict urban migration policies and the enforcement of strict paddy land zoning, total costs drop to 20.1 billion 1974 won assuming reclamation of the upland acreage lost. Of this total 3.2 billion won is the direct result of lost agricultural land rent while 16.9 billion won is the cost of reclaiming upland acreage which was lost. Under a policy of partial reclamation which assumes the replacement of only lost paddy, the costs drop to 3.2 billion.

The analysis of urban growth in and around Busan did generate some rather interesting results. Topographically, the area is rather mountainous, with mountain terrain forming a development barrier to the north and the east and the sea precluding growth to the south. The presence of natural features and the constraints which they place on the location of urban growth were very evident in the analysis. This analysis indicated that only 20.8 thousand hectares of land below 15 percent were available for urban development with a 20 kilometer radius of the city. The remaining 22.8 thousand hectares or 53.2 percent of the area was above 15 percent slope and considered as undevelopable.

The exclusion of a substantial area of land from potential development indicates the presence of a significant land supply and demand problem. Only under the policy of restricted urban migration was there enough usable land within the 20 kilometer radius to meet future urban demand. In all other instances, excess demand was encountered. This ranged from 694 hectares assuming past population growth and land use policy trends to 18.5 thousand hectares assuming population redistribution from Seoul and the imposition of a exclusive paddy land zoning ordinance. Such strong urban land demands would tend to preclude the viable enforcement of any exclusive type of zoning ordinance which substantially limits the already limited developable space around the city.

The presence of a substantial area of nondevelopable land around the city also precluded a complete analysis of the costs associated with conversion. Assuming a relocation of population from Seoul and the imposition of a strict paddy land zoning ordinance, all available upland within the 20 kilometer perimeter is exhausted within three years. As such, the comparison of costs associated with conversion was limited to the three year period, not the ten year period as previously planned. These costs tend to range from 2.42 billion 1974 won per year under the above option to a low of 1.18 billion won under strict population control and exclusive paddy land zoning.

The full and modified zoning policies examined tend to have different effects on total costs. Under a policy of strict paddy land zoning cost reductions ranging from .65 to .85 billion won were encountered over those generated assuming past land use trends. The acceptability of such a policy is highly limited though, because of the limited availability of land. Reductions in costs under the modified zoning approach while lower than those encountered assuming past policy trends, did not decline as much. They ranged from 30 to 140 million won per year. The restrictions placed on the adoption of this policy by the limited developmental space available while still limiting, were less severe than those imposed under an exclusive paddy zoning policy. Here, the supply of land was exhausted after eight rather than three years.

The costs associated with each of these policy options will in all likelihood be borne by different sectors in the economy. The movement of urban growth away from paddy to upland areas while reducing land rent losses and the need to reclaim paddy, generates increased costs for site preparation which must be borne by the nonagriculture sector. Under the present conditions of excess housing demand, most or all of these costs are likely to be passed on to consumers.

If present land use policy controls continue or if a modified agricultural zoning approach is adopted, the agricultural sector will bear the greater portion of these costs. In general, agriculture's share ranged from 128 to 161 percent of those borne by the nonagricultural sector. The reader should bear in mind, however, that only site preparation costs were considered in the case of the latter under an exclusive paddy zoning policy. This cost structure was significantly changed with agriculture bearing only 2 to 3 percent of the costs borne by the nonagriculture sector.

Examination of the potential incidence of these costs indicates that the exclusive paddy zoning policy would be the cheapest option for agriculture. Under the various population levels, costs range from 30 to 40 million 1974 won per year. These costs are substantially less than those incurred assuming past trends. Here, the cost to agriculture ranged from 1.42 to 1.10 billion won per year.

Under this zoning approach, however, the cost borne by the nonagricultural sector is substantially higher than those incurred under the modified zoning and "status quo" policy cases. In each of these cases, the costs borne by this sector tend to range in the area of .75 to 1.0 billion won per year. On the average, nonagricultural costs were slightly lower under the modified zoning approach. Under the exclusive zoning approach these costs ranged from 1.15 to 1.67 billion won per year. While agriculture would be better off under this policy, the nonagricultural sector, especially those groups concerned with urban development, would be much worse off. When this information is combined with the presence of a limited supply of land, the ability to effectively implement such a zoning polich in the area becomes questionable.

A more plausible approach to implementing an effective agricultural land use policy would be the adoption of a policy which leaves each sector no worse off than before. Only three population-land use policy combinations examined fulfill this criteria. Two of these options require a significant drop in the population of the city while the third assumed no change in past population growth trends. Interestingly, this latter policy option embodied the modified zoning approach. Under this alternative the losses to agriculture decline 30 million won per year over those presently occurring while the cost to the nonagriculture sector remained constant. Even though there are some problems with this policy with respect to land availability, it would seem to constitute the most viable approach of those examined to agricultural land use planning in and around Busan.

Recommendations Generated from the Research

The examination of Korea's present land use planning system indicates a number of potential improvements. Because of the complexity of the issues involved, these improvements tend to range over a broad spectrum of governmental agencies and activities.

At the national level, the present policy which allows separate ministries to manage internally defined land use controls has led to the demarcation of the Korean landscape into various rigidly defined land use zones, each managed according to the objectives of the ministry in charge. In single use areas--such as rural areas used exclusive of agriculture--such a system seems to generate few problems. In areas where multiple uses are possible, conflicts have arisen. Such conflicts have led to: (1) the absence of an explicit set of accpeted national land use policy objectives; (2) a growing sense of competition between ministries over the right to manage the use of areas they consider vital in fulfilling their stated governmental obligations; (3) a significant lack of coordination between the land use policies which have been implemented by the various ministries; and (4) the adoption of single purpose policy instruments which tend to rely heavily on administrative authority rather than economic inducement as a vehicle for controlling land use.

To mitigate the interministerial conflicts which have arisen and to provide a set of national guidelines for land use planning, the following recommendations seem appropriate.

1. Policymakers must consider the multi-purpose nature of land in developing a national land use policy. The placement of long-term planning and management functions in ministries with vested interests in specific types of land uses seems to conflict with this multi-purpose perspective. As such, the separation of long-term planning management functions seems desirable.

2. The long-term planning functions presently housed in various ministries and agencies should be consolidated

under the auspices of one agency. Such an agency would be responsible for drawing up a set of long-term, national land use goals, developing a land use mapping and update system in conjunction with these goals, coordinating the various large scale development programs initiated by various land using or consumptive agencies, developing a more balanced program of land use controls and initiating and overseeing a research program in the area of land planning.

3. Because of the long-term planning and coordination functions carried out by this agency, it would seem logical that it be placed within the Economic Planning Board (EPB) at the bureau level. This would place the national investment and land use planning functions within one ministry where they could be better coordinated. In such a way, national investment policies could be used more effectively as a positive force in controlling and directing Korea's future land use patterns.

4. One of the major responsibilities of such a bureau would be the development of a national land use plan. Their responsibilities, however, need not extend to the actual physical development of the plan but could be limited to the development of long-term goals and an appropriate land classification system. This classification system could then be used by the various ministries to draw up their own land use plan which would be coordinated by the bureau to form a national plan.

5. The actual development of a plan and the maps which accompany it are not enough to assure the successful attainment of national goals. A national land use data and update system also need to be developed to complement the plan. The function of this system would be to monitor the actual changes in the nation's land use pattern from time to time and provide planners with data which could be used to evaluate changes in the land use system with respect to national goals.

6. With the vast amount of information required to develop and update such a system, Korea should seriously consider the use of earth satellite and computer mapping technology. At present, such systems are able to collect, store, and map land use information on a hectare by hectare basis. Because of the versatility of such systems, they are not limited to the development of land use information alone, but may be used for a variety of other applications. For example, they can be utilized to monitor agricultural cropping patterns for purposes of estimating production and identifying areas of problem drainage, drought, and disease; they can be used for soil surveying and

conservation planning, for mineral exploration and development, and for monitoring environmental pollution.

7. In a country such as Korea, with her limited land resources, the dangers associated with the horizontal rather than vertical expansion of urban centers need to be recognized. The present set of controls with its heavy emphasis on zoning, needs to be better coordinated and expanded. Such single purpose policy instruments, even in a heavily authoritarian setting, are not likely to be adequate in controlling future urban growth, given the continuance of strong urban land demand. The use of the urban property tax should be considered as a means of influencing the growth of private single family dwellings. Government housing programs should be limited to the construction of multiple family dwellings with loan and tax subidies provided to private builders who follow this trend. A program of land banking or the acquisition of development rights in areas zoned for extensive uses in and around urban centers should be examined. Such a system would go a long way in alleviating the inequities in the existing zoning system which require specific land user groups to absorb the total cost imposed when they are required to retain their land in an extensive use.

As indicated, the above recommendations all relate to steps that can be implemented to improve the overall land use planning capabilities at the national level. The implementation of these recommendations do not, however, supersede the role which the various ministries can take in managing and controlling land use within their own sphere of influence.

In this respect, the research has indicated a number of areas within the Ministry of Agriculture and Fisheries where changes could be made to improve the efficiency of their land use planning effort. These recommendations which touch on the areas of general philosophy, structure, policy, and data requirements are presented below.

1. In its effort to protect agricultural land from conversion, the Ministry should concentrate its efforts on farmland in and around urban centers. It is in these areas that the demand for land for nonagricultural use is likely to generate the greatest conversionary pressures. In these areas, the Ministry should determine the potential demand

for land given existing population and per capita nonagricultural land requirements. In areas where future demands are likely to require the conversion of substantial agricultural acreage, the Ministry should consider the development of long-term agricultural land use plans. The area coverage of these plans would be dependent on anticipated future demands and would vary from city to city.

2. In formulating such plans policymakers should consider the following:

   a. While the major objective of such plans is to retain prime agricultural production, policymakers should be aware that this is not the only benefit derived from preservation. The retention of such farmland as open space helps in the control of sprawling urban growth, helps provide the necessary buffer required for the development of satellite cities, allows for the more effective control of strip development along major transportation routes in and out of a city, and improves the urban living environment by providing aesthetically pleasing, open space. This close relationship between urban growth and agricultural land preservation requires a close coordination between both types of plans.

   b. The land classification system used in formulating these plans, while based on natural constraints such as climate, soils, and slope should also consider the productive value of land in agricultural use. The introduction of such economic criteria into the classification system does not negate the existing governmental agricultural production goals. Because of the strong role which government plays in agricultural commodities' market and the effect that this participation has on prices, an agricultural land use classification system based on productive value would allow for the incorporation of government production policies via prices into the classification system, in addition to allowing for shifts in agricultural land use as relative demand, prices, and policies change.

   c. Specific land areas within the plan should not be designated as single agricultural use areas unless otherwise constrained by physical conditions. A policy of multi-purpose agricultural development should be pursued which allows for shifts between agricultural uses as prevailing market conditions change. Given the past changes in this demand structure, it would seem advisable to allow vegetable production to encroach on paddy acreage, to encourage the development of pasturage in upland areas to support livestock production and to limit fruit production to areas not potentially useful for pasture.

d. The size of the areas designated for agricultural use should be sufficiently large so that they retain their agricultural character even after they have been engulfed by urban development. If these areas are too small they are likely to become the source of complaint on the part of urban residents because of unsightly odors as well as being continually plagued by weed and crop damage problems.

3. Movement towards the development of such a planning approach will require changes in the Ministry's land use control structure. Specific changes in these controls which might be considered are:

   a. The present regulations which limit the size of non-reclaimed farmland to three chongbo (three hectares) needs to be reexamined and allowed if conditions justify it to be floated upward on owner operated farms within the planning areas. Hypothetically, such an expansion would allow for the more efficient use of capital and technology in the form of labor saving machinery, foster more intensive use of the land, and increase its productive value in agriculture.

   b. The use of policy instruments such as exclusive paddy land zoning in these areas may be an inappropriate method of controlling conversion. The limited analysis of the Busan area indicates that a mixed zoning policy which allows for the conversion of less productive paddy might be a more practical approach to agricultural land preservation.

   c. While some forms of zoning may be necessary to combat conversion in these areas in the short run, this form of policy instrument should not be relied on as a long-run preventative measure. Most forms of zoning especially those which restrict land use to relatively extensive uses such as agriculture, do have a tendency in areas where urban land demand is strong to generate inequities over time. These inequities arise from the difference in land prices which occur between the zoned and unzoned agricultural land. Farm owners having land within the zoned areas see the price of unzoned land increasing as urbanization occurs and feel a strong urge to sell their property, outside the law, to capture some of the monetary gains accruing to other farms. A long-term land use control for such areas must recognize the existence of these pressures and develop mechanisms to mitigate them. One possible

> approach to this problem is government purchase of the development rights to land within the agricultural planning area. Such a program would provide for the payment of compensation to farmers who are required to retain their land in agricultural use, provide capital for expanding and improving the farm operation and assure that the land will continue to be used in agricultural production. Funds to finance the program could be generated by placing a small surcharge on the present land speculation tax. This surcharge would only be collected on the sale of unzoned agricultural land when such land was being converted to nonagricultural uses.

The management of such a system of agricultural planning areas to be successful, requires the quick and efficient access to location specific data. While the majority of components in this data system are presently in place within the Ministry, the addition of some optional pieces and the implementation of slight modifications in the existing components might be required. Some changes which might be considered are as follows:

A. At present at least three agencies within the Ministry collect and process such data. The Bureau of Agricultural Statistics collects yearly sample data which is used to calculate average farm household budgets for major grains. The Agricultural Development Corporation conducts similar surveys on a project by project basis for use in project evaluation. And finally, the National Agricultural Economic Research Institute compiles yearly farm budgets for "more advanced" farms using a combination of survey, research, and calculated data. To develop a unified set of farm budget data which is readably available for decision, the following steps might be considered: (1) the Bureau of Agricultural Statistics in conjunction with the National Agricultural Economics Research Institute should develop and distribute a standardized list of the procedures to be followed by bureaus within the Ministry when conducting sample surveys; (2) the former agency should be assigned the task of defining a common set of definitions and procedures to be used in all farm budget studies; and (3) all data collected by the various agencies should be centrally stored.

B. A more intensive data collection and processing system needs to be developed to supply up-to-date data to decision makers. In developing such a system, emphasis should be given to the agricultural planning areas. More sample points in these areas will be required. Also the type of data collected needs to be expanded to include to monitor land use changes within and out of agriculture and land prices from farms within and on the border of the areas.

C. All data collected needs to be stored by sample unit and assigned a map coordinate. Such coordinates should be the same as those used in the national land use plan so that the survey data can be used as ground verification data when updating the national land use maps.

D. All data should be collected and stored in such a way that the computer processing is possible. The Ministry should move toward developing a data system which is capable of processing and publishing survey data in weeks rather than months as is presently the case.

As indicated in the above recommendations, the Ministry of Agriculture and Fisheries needs to realize that agricultural areas in or near urban centers are unlike those in the more remote areas. As such, separate policies, safeguards and data are needed to protect these areas from conversion. These components, however, are not enough. Policymakers must understand the actual changes and conditions which are occurring at the farm level to assure their continued productive role in agriculture. Further research which is needed to develop this understanding is discussed below.

Potential Areas for Future Investigation

A wide variety of questions still remain to be answered concerning the interchange which occurs between the urban and agricultural sectors during periods of urban expansion. Of particular interest here is the structural changes which occur at the farm level due to urbanization. Comparative studies designed to articulate the present structural differences between urban and rural agriculture need to be carried out. Additional investigations into the structural changes which occur during urban expansion are also needed. Of particular interest here is the effect that extensions in the urban transportation system have on farm size, cropping patterns, input levels and on and off farm labor requirements. Such information is essential in understanding the basic economic nature of the urban farm.

On the urban side of the conversion process, more information is needed concerning the demand for land and the uses to which it is put. Studies which develop estimates of the income and price elasticities for urban services are essential in developing more articulate estimates of future demand. At present estimates of these values are not available nor are studies underway to generate them in the future. In addition, information on the monetary and nonmonetary costs associated with cities of different sizes and spatial configurations need to be developed to assist urban planners in developing future guidelines to monitor and control urban expansion.

With specific reference to the methodology developed in this study a number of changes could be made in the future to make the method more accurate and efficient. If the methodology is to be used to study conversion in and around the remaining thirty-four cities, serious consideration should be given to computerizing the model. Because of the relatively substantial use of purely accounting routines in the methodology, computerization should not be too difficult.

If this work is undertaken, two basic changes in the methods developed would be necessary. First, the manual allocation mechanism presently used to distribute urban growth on land around a city would need to be converted to a poly-period linear program. This would not be a substantial problem since the majority of data needed to run such a component is already generated by the methods developed in the study. Second, some consideration might be given to replacing the physical development zones used in the manual technique with time travel zones. This change would require the subdivision of the area around cities into time travel zones each with their associated travel costs. These costs in addition to the others developed, would be run in a least cost mode.

Finally, the estimates of agricultural land rent used in the analysis did seem to be reasonable given the prevailing market values reported for agricultural land at the regional level. To improve the accuracy of these estimates when used in analyzing the cost of conversion in and around cities, analysts might consider developing estimates based on more localized crop production data. These estimates would tend to capture the effect of unique cropping patterns in and around specific cities.

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APPENDICES

APPENDIX I

KOREA'S TAX STRUCTURE AS IT RELATES TO FARM AND NONFARM PROPERTY, JANUARY 1, 1975

APPENDIX I.1

KOREAN FARM PROPERTY TAX

THOSE REQUIRED TO PAY TAX

Taxes are assessed on farmland owned or cultivated by a household not individuals within a household

TAX BASE[a]

First class farmland (paddy-land used in rice and barley production) --the market value of the output

Second class farmland (farmland used in the production of other crops)--the market value of the output

TAX RATES

First Class Farmland[b]

150,000 won	.06
150,000 to 300,000 won	.08
300,000 won	.10

Second Class Farmland[c]

--with output valued at

150,000 won	.10
150,000 to 300,000 won	.15
300,000 won	.20

PAYMENT DATE

First Class Farmland

--November 1 and December 31

Second Class Farmland

--September 1 to September 15

--December 1 to December 15

COLLECTION METHOD

First Class Farmland

--payment in kind or cash[d]

Second Class Farmland

--payment in cash

TAX EXEMPTIONS

First Class Farmland

--373,000 won

Second Class Farmland

--37,000 won per half year

CLASSES OF FARMLAND NOT TAXED OR EXEMPTED

Non-Taxable Property
- --farmland owned by the government
- --farmland owned by a foreign government
- --farmland owned by an orphanage, a nunnery, a home for the aged, a temple or a church

Tax Exempt Property
- --farmland within a public reclamation project
- --farmland within a private reclamation project (filled, drained, or terraced) during certain time periods[e]

TAXES LEVIED AT THE TIME OF TRANSFER OF OWNERSHIP RIGHTS

THOSE REQUIRED TO PAY TAX

Buyer of farm property

TAX BASE

Purchase price of the land and buildings

TAX RATES

Registration tax[f]	.015
Acquisition tax[g]	
Defense tax	.20 (Acquisition & Registration tax)
Stamp tax	.10 (Registration tax)

PAYMENT DATE

At the time when the deed is legally recorded in the new owners name at the appropriate government office.

COLLECTION METHOD

Registration tax
- --in cash

CLASSES OF LAND NOT TAXED OR EXEMPTED

Non-taxable property
- --land purchased by the government for land or water reclamation

Tax-exempted property
- --acquisition tax--all persons who purchase farmland

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[a]Farm structures are taxed in accordance with the general property tax.

[b]First Class farmland is defined as farmland amenable to the production of rice. The production of barley on such land, as a second crop, was exempted from taxation on April 1, 1973.

[c]Second Class farmland is land used in the production of upland crops such as fruit, vegetables, tobacco, cotton, grain, etc. In the case of crop rotation each crop is assessed separately, with potatoes being exempted from taxation on January 1, 1975.

[d]Cash payment is collected in areas near large cities as of January 1, 1975.

[e]The exemption was raised from 5 to 10 years as of January 1, 1975.

[f]Prior to April 1, 1973, 50 percent of the market value of farm property was exempted from taxation. An additional 10 percent reduction in market value was also provided to encourage farmers to register their land. After April 1, the 50 percent exemption was cancelled and the 10 percent exemption changed to a 10 percent penalty.

[g]On January 1, 1975, buyers of farmland were exempted from paying the Acquisition Tax. Prior to that time the tax was levied at a rate of .02.

[h]Korean law requires that the transfer of real estate to be legal must be officially entered in a land register maintained in the appropriate government office.

Source: Ministry of Home Affairs, Local Tax Yearbook, 1975 (Seoul: The Republic of Korea, 1975), pp. 1-22.

APPENDIX I.2

NONFARM PROPERTY TAX

THOSE REQUIRED TO PAY TAXES

Registered owners of real property on the date of payment

TAX BASE

All real property valued at current market prices including:
- --Land
- --Buildings
- --Vessels
- --Mining Land

TAX RATES

General Property	
--Land	.002
--Buildings and vessels	.003
Mineral Land	
30 won per hectare	
Luxury Land	
--Land for housing	
100 pyong	.002
100 pyong	.005
200 pyong	.01
300 pyong	.03
500 pyong	.05
--Land for golf courses, recreational facilities and vacation homes	.05
--Land held by corporations not for corporate purposes	.05
--Land held idle by persons other than corporations	.05
Luxury Buildings	
--Dwellings (residential)	
5 mil won	.007
5 mil won	.005
10 mil won	.01
20 mil won	.03
30 mil won	.05
--Buildings for golf courses, vacation homes or luxury apartments	.05
--Luxury vessels	.05

New Industrial Buildings and Land Located in Large Cities[a]

--Land	.01
--Buildings	.015

PAYMENT DATE

By Regulation

COLLECTION METHOD

Common Collection Method

CLASSES OF PROPERTY NOT TAXED OR EXEMPTED

Non-Taxable Property
- --Land and buildings owned by the Korean government
- --Land and buildings owned by a foreign government
- --Land and buildings owned by a cooperative
- --Compost warehouses
- --Livestock barns
- --Land and buildings owned by a religious organization
- --Temporary dwellings
- --Rescue boats for foreign vessels

Tax Exempt Property
- --Buildings and/or dwellings valued at less than 60,000 won
- --Waste land
- --Fishing vessels valued at less than 150,000 won and other vessles valued at less than 50,000 won

TAXES LEVIED AT THE TIME OF TRANSFER OF OWNERSHIP RIGHTS

THOSE REQUIRED TO PAY TAX

The buyer of urban property

TAX BASE

Purchase price of the land and buildings

TAX RATES

Registration tax	.02
Acquisition tax	.03
Defense tax	.2 of Acquisition & Registration tax
Stamp tax	.1 of Registration tax

PAYMENT DATE

At the time when the deed is legally recorded in the new owner's name at the appropriate government office

COLLECTION METHOD

All taxes are payable in cash

CLASSES OF PROPERTY NOT TAXED OR EXEMPTED
Non-taxable property
--land purchased by the government for public purposes.

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[a]The property tax on new industries locating in large urban areas was increased on April 1, 1973, from .002 for land and .003 for buildings to .01 and .015 respectively. If industries relocate in rural areas they are exempted from taxes for 3 out of the first 5 years. These policies were adopted to encourage industrial dispersion from Seoul and Pusan.

Source: Ministry of Internal Affairs, Local Tax Yearbook, 1975 (Seoul: The Republic of Korea, 1975), pp. 21-22.

APPENDIX II

POPULATION PROJECTIONS FOR TEN MAJOR CITIES IN KOREA, 1976-85

A-II.1.--Alternative I--Base Population for the Korean Cities, 1976-1985.

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Seoul	7,666,553	8,222,441	8,818,635	9,458,058	10,143,845	10,879,356	11,668,199	12,514,238	13,421,623	14,394,801
Busan	2,554,845	2,706,866	2,867,993	3,038,583	3,219,388	3,410,952	3,613,914	3,828,953	4,056,788	4,298,179
Incheon	845,465	888,635	934,010	981,701	1,031,828	1,084,514	1,139,890	1,198,094	1,259,269	1,323,569
Suweon	236,686	251,548	267,344	284,131	301,972	320,934	341,086	362,504	385,266	409,458
Chuncheon	145,988	150,418	154,848	159,278	163,708	168,138	172,568	176,998	181,428	185,858
Chungju	193,700	202,900	212,536	222,630	233,204	244,279	255,881	268,034	280,763	294,098
Daejon	527,714	548,712	569,710	590,708	611,706	632,704	653,702	674,700	695,698	716,696
Jeonju	324,218	337,011	350,309	364,132	378,500	393,435	408,960	425,097	441,871	459,306
Kwangju	635,560	658,247	680,934	703,621	726,380	748,995	771,682	794,369	817,056	839,743
Daegu	1,371,075	1,422,284	1,473,493	1,524,702	1,575,911	1,627,120	1,678,339	1,729,538	1,780,747	1,831,956
Total	14,501,804	15,389,062	16,329,752	17,327,544	18,386,442	19,510,427	20,704,221	21,972,525	23,320,509	24,753,664

A-II.2.--Alternative II--Population Projections for Ten Korean Cities, 1976-1985.[a]

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Seoul	7,384,215	7,743,832	8,103,449	8,463,066	8,822,683	9,182,300	9,541,917	9,901,534	10,261,151	10,620,768
Busan	2,592,114	2,770,042	2,962,398	3,169,922	3,339,781	3,634,963	3,894,583	4,173,830	4,473,970	4,796,351
Incheon	878,216	944,154	1,016,972	1,097,120	1,185,083	1,281,372	1,386,539	1,501,168	1,625,884	1,697,057
Suweon	278,472	322,382	373,192	431,390	497,504	572,098	649,397	749,184	853,016	943,823
Chuncheon	165,752	183,921	204,911	228,927	256,189	286,932	321,408	359,887	402,661	445,610
Chungju	223,910	254,111	289,061	329,094	374,568	425,864	483,393	547,593	618,934	684,585
Daejon	560,748	604,709	635,387	707,122	766,282	831,260	902,477	980,386	1,065,473	1,158,258
Jeonju	346,523	374,821	406,809	442,736	482,872	527,502	576,936	631,501	691,548	757,455
Kwangju	669,158	715,201	766,041	822,025	883,598	950,945	1,024,710	1,105,281	1,193,152	1,288,853
Daegu	1,402,415	1,475,410	1,552,879	1,635,146	1,722,560	1,815,493	1,914,356	2,019,548	2,131,559	2,250,874
Total	14,501,522	15,388,583	16,329,097	17,326,549	18,385,121	19,508,730	20,695,716	21,969,912	23,317,498	24,643,633

[a]Alternative Two assumes a linear growth rate in Seoul (Y = 3050,410+362x) with 100 percent of the differential being redistributed amongst the nine other cities using their growth rates during the base period as weights.

A-II.3.--Alternative III--Population Projections for Ten Korean Cities, 1976-1985.[a]

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Seoul	7,384,215	7,743,832	8,103,449	8,463,066	8,822,683	9,182,300	9,541,917	9,901,534	10,261,151	10,620,768
Busan	2,573,479	2,738,454	2,915,135	3,104,252	3,306,585	3,522,957	3,754,250	4,001,391	4,265,379	4,547,265
Incheon	861,841	916,394	975,491	1,039,411	1,108,455	1,182,943	1,263,214	1,349,631	1,442,576	1,542,463
Suweon	257,579	286,965	320,268	357,760	399,738	446,516	498,431	555,844	619,141	688,737
Chuncheon	155,870	160,300	171,599	184,310	209,949	227,535	246,988	268,443	292,045	317,949
Chungju	203,315	218,005	250,798	275,862	303,886	335,071	369,637	407,814	449,848	496,009
Daejon	544,231	576,711	611,548	648,915	688,994	731,981	778,089	827,543	880,586	937,477
Jeonju	335,470	355,916	378,559	403,434	430,686	460,468	492,948	528,299	566,710	608,380
Kwangju	652,359	686,724	723,488	762,823	804,989	849,969	898,196	949,825	1,005,104	1,064,298
Daegu	1,386,745	1,448,847	1,510,186	1,579,924	1,649,235	1,721,360	1,796,348	1,874,543	1,956,153	2,041,445
Total	14,355,104	15,132,148	15,960,521	16,819,757	17,725,200	18,661,100	19,640,018	20,664,867	21,738,693	22,864,791

[a]Alternative Three assumes a linear growth rate in Seoul (Y=3080.410 + 362x) with 50 percent of the differential being redistributed amongst the nine other cities using their growth rates during the base period as weights.

A-II.4.--Alternative IV--Population Projections for Ten Korean Cities, 1976-1985.[a]

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Seoul	7,384,215	7,743,832	8,103,449	8,463,066	8,822,683	9,182,300	9,541,917	9,901,534	10,261,151	10,620,768
Busan	2,488,256	2,594,416	2,700,576	2,806,736	2,912,896	3,019,056	3,125,216	3,231,376	3,337,536	3,443,696
Incheon	828,100	859,493	890,886	922,279	953,672	985,065	1,016,458	1,047,851	1,079,244	1,110,637
Suweon	229,710	239,793	249,876	259,959	270,042	280,125	290,208	300,291	310,374	320,457
Chuncheon	142,444	145,102	147,760	150,418	153,076	155,734	158,392	161,050	163,708	166,366
Chungju	190,502	197,486	204,470	211,454	218,434	225,422	232,406	239,390	246,374	253,358
Daejon	510,916	523,514	536,113	548,712	561,311	573,910	586,508	599,107	611,706	624,305
Jeonju	320,114	330,136	340,158	350,180	360,202	370,224	380,246	390,268	400,290	410,312
Kwangju	617,410	631,023	644,635	658,247	671,859	685,471	699,084	712,696	726,308	739,920
Daegu	1,330,108	1,360,833	1,391,559	1,422,284	1,453,009	1,483,735	1,514,460	1,545,185	1,575,911	1,606,636
Total	14,041,775	14,625,628	15,209,482	15,793,335	16,377,184	16,961,042	17,544,895	18,128,748	18,712,602	19,296,455

[a]Alternative Four assumes linear growth functions for Seoul, Busan, Incheon, Suweon, Chungju and Jeonju. In the case of Chuncheon, Daejon, Kwangju, and Daegu which were originally projected using a linear function, the growth rate was decreased to 60 percent of that used in Alternative One.

APPENDIX III

PER CAPITA LAND USE REQUIREMENTS

1976 TO 1985

A-III.--Per Capita Land Use Requirements--1976 to 1985.[a]

	Per Capita Requirements for Ten Urban Areas									
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Cultivated Land	7.75	7.27	6.83	6.44	6.08	5.75	5.45	5.18	4.93	4.70
Paddy	4.14	3.77	3.43	3.13	2.85	2.60	2.37	2.16	1.97	1.90
Upland	3.61	3.50	3.40	3.31	3.23	3.15	3.08	3.02	2.96	2.91
Forest Land	17.80	17.49	17.22	16.98	16.76	16.56	16.37	16.02	16.04	15.90
Residential Land	11.22	11.27	11.31	11.36	11.39	11.43	11.46	11.49	11.51	11.54
Urban Services	2.49	2.48	2.48	2.47	2.47	2.46	2.46	2.45	2.45	2.45
Water Resources	3.99	3.90	3.80	3.71	3.62	3.52	3.43	3.34	3.25	3.15
Other	1.74	1.75	1.76	1.76	1.77	1.78	1.78	1.74	1.79	1.80

	Per Capita Requirements for Busan									
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Cultivated Land	2.69	2.35	2.01	1.70	1.44	1.21	1.01	.84	.63	.53
Paddy	1.66	1.40	1.18	.99	.83	.70	.59	.50	.42	.35
Upland	1.03	.95	.83	.71	.61	.51	.42	.34	.26	.18
Forest Land	24.83	24.13	23.50	22.93	22.40	21.91	21.45	21.03	20.63	20.25
Residential Land	12.36	13.01	13.69	14.40	15.16	15.95	16.78	17.66	18.59	19.56
Urban Services	2.74	2.72	2.70	2.68	2.66	2.65	2.63	2.62	2.61	2.59
Water Resources	2.02	1.77	1.52	1.27	1.02	.77	.52	.27	.02	.00
Other	.83	.80	.77	.74	.72	.69	.66	.63	.60	.58

[a]In pyong per person.

APPENDIX IV

SOIL CLASSIFICATION SCHEME

A-IV.--Soil Classification Scheme.

Symbol	Description	Present Use (in percent)				Percent Slope		Drainage[a]	Soil Productivity[b]	
		Paddy	Upland	Forest	Other	Overall Range	Dominant Range		Paddy	Upland
Fba	Coastal sand dunes	--	--	5	95	0-1		EX	U	7
Fbb	Coastal sand dunes	--	--	--	100	0-1		EX	U	7
Fta	Tidal flat	--	--	--	100	0-1		P	U	8
Fma	Coastal flat terrain	95	--	--	5	0-1		I	2	1
Fmb	Coastal flat terrain	95	1	--	4	0-2		I	3	2
Fmc	Coastal flat terrain	50	--	--	50	0-1		I-P	3	5
Fmd	Coastal flat terrain	95	--	--	5	0-2		P	1	3
Fmg	Coastal flat terrain	95	--	--	5	0-2	.5	P	3	3
Fmk	Coastal flat terrain	100	--	--	--	0-2		I-P	3	5
Fml	Crater bottom	100	--	--	--	0-1		VP	3	3
Apa	Inland flat terrain	90	5	--	5	0-2	.5	I	1	2
Apb	Undulating to rolling land	70	20	2	8	2-15	2-7	W-MW	2	1
Apc	Inland flat terrain	70	25	--	5	0-2	1	I-MW	3	2
Apd	Inland flat terrain	95	--	--	5	0-2	.5	P	1	3
Apg	Inland flat terrain	40	55	--	5	1-15	2-7	W-MW	3	2
Afa	Riverside flat terrain	10	80	1	9	0-3	1-2	M-MW	3	3
Afb	Riverside flat terrain	80	10	--	10	0-1.5	.5	I-P	3	2
Afc	Riverbed	5	15	2	78	0-3	1-2	EX	U	8
Afd	Riverbed	--	--	--	--	0-3	0-1	EX	U	8
Ana	Narrow valley & valley flat	70	15	5	10	2-30	2-7	I-MW	2	3
Anb	Narrow valley & valley flat	30	50	8	12	2-35	2-15	I-MW	3	3
Anc	Mountain foot slope	60	25	5	10	10-60	15-30	MW-W	3	3
And	Alpine mountain foot slope	--	50	45	5	7-100	30-60	MW-W	3	3
Raa	Gently sloping & rolling land	.2	50	45	4.8	2-30	2-7	W	4	2
Rab	Rolling land	.2	30	55	4.8	7-60	15-30	W-EX	U	4
Rac	Mountain foot slope	.2	50	45	4.8	7-35	10-25	W	3	3
Rad	Mountain foot slope	.2	15	70	14.8	2-60	7-30	W	3	4
Rea	Rolling land	.2	10	50	39.8	7-100	30-60	EX	U	7
Rsa	Rolling land	.2	15	65	19.8	2-60	7-30	W-EX	U	6
Rsb	Mountain foot slope	.2	25	65	9.8	2-30	2-15	W	3	4
Rsc	Mountain foot slope	.2	15	70	14.8	2-60	7-30	W	3	3
Rva	Rolling land	.2	25	65	9.8	10-50	15-30	W-EX	U	4
Rvb	Mountain foot slope	.2	25	65	9.8	10-50	15-30	W	3	4
Rvc	Mountain foot slope	.2	15	70	14.8	20-60+		W	3	3
Rvd	Rolling table land	70	20	8	2			W	3	2
Rla	Rolling land	.2	20	70	9.8	15-60	40	W	U	4
Rlb	Mountain foot slope	.2	30	60	9.8	7-60	15-30	W	3	3
Rxa	Narrow valley	70	20	8	2	2-35	2-15	I-MW	2	2
Lpa	Lava plain	--	80	20	--			W	U	3
Lpb	Lava plain	--	30	70	--			W	U	3
Lta	Lava terrace	--	30	70	--			W-EX	U	6
Ltb	Lava terrace	--	30	70	--			W-EX	U	6
Maa	Hilly land	.2	5	75	4.8	7-60	15-30	W-EX	U	6
Mab	Hilly land	.2	5	90	4.8	7-100	30-60	SEX-EX	U	7
Mac	Mountainous land	.2	2	88	9.8	10-100	40-75	SEX-EX	U	7
Msa	Hilly land	.2	5	90	4.8	2-60	7-30	SEX-EX	U	7
Msb	Mountainous land	.2	5	90	4.8	2-60	7-30	SEX-EX	U	7
Mva	Hilly land	.2	5	90	4.8	20-60+		SEX-EX	U	6
Mvb	Mountainous land	.2	2	88	9.8	7-60+	30-60	SEX-EX	U	7
Mla	Hilly land	.2	8	87	4.8	7-100	30-60	W-EX	U	6
Mlb	Mountainous land	.2	5	90	4.8	7-100	30-60	SEX-EX	U	7
Mma	Hilly land	.2	5	90	4.5	10-100	30-60	SEX-EX	U	6
Mmb	Mountainous land	.2	2	88	9.8	15-60	30-60	EX	U	7
Mja	Cinder cone	--	--	100	--			SEX-EX	U	6
Mua	Alpine land	.2	2	77.8	2	7-60	7-30	W	U	4
Mub	Mountainous land	.2	2	88	9.8	25-90+	40+	SEX	U	6
Ro	Mountainous land							SEX	U	8

[a]The symbols used to denote soil drainge characteristics are, in ascending order: very poor (VP), poor (P), imperfect (I), moderately well (MW), well (W), slightly excessive (SEX), and excessive (EX). A more detailed discussion of each drainage class can be found in the publication listed below, pp. 37-44.

[b]The soil survey classifies paddy and upland into a number of capability classes. Four classes are ascribed to paddy land, each with different yield estimates: class 1 (high), class 2 (moderate), class 3 (low), and class U (unusable for paddy production). Upland soils are graded into eight classes: class 1 (high), class 2 (moderate), class 3 (low), class 4 (perennial crop production), class 5-7 (forest grassland or pasture production) and class 8 unusable).

Source: Food and Agricultural Organization of the United Nations, United Nations Development Programme, Soil Survey, Republic of Korea, AGL:SF/KOR 13 (Rome: FAO, 1971), Table 12, pp. 211-15.

APPENDIX V

SOIL TYPES BY AREA AND DISTANCE

FROM THE CENTER OF BUSAN

Table A-V.--Soil Types by Area and Distance from the Center of Busan.[a]

Soil Description	Map Symbol	Distance[b]						
		0-5.0	5.0-7.5	7.5-10.0	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0
Riverside flat terrain	AFA			75.0		82.0		
Riverside flat terrain	AFB	8.0	34.0	4.0		932.5	231.5	364.5
Riverbed	AFC			385.9	340.5	627.9	544.0	206.0
				(10.0)				
Riverbed	AFD			30.5	58.5			227.5
Narrow valley & valley	ANA		44.0		5.0	53.5	34.0	28.5
flat							(2.0)	(21.0)
Narrow valley & valley	ANB	47.0	155.0	43.0	69.5	(45.0)	342.0	492.0
flat		(10.0)				(32.0)		
Mountain foot slope	ANC	50.0	128.0		131.5	64.0	259.0	315.0
Alpine mountain foot slope	AND							13.0
Inland flat terrain	APA	132.0	80.5	6.0	121.5	272.5	469.5	227.0
				(1.0)				
Inland flat terrain	APC		210.0	579.0	341.0	349.5	72.5	66.5
Inland flat terrain	APD					8.0	105.5	
Coastal sand dunes	FBA				2.0	50.0	8.5	
			(22.0)	(21.0)				
Coastal flat terrain	FMA	51.0	134.0	364.5	91.5	49.5	1,512.5	1,462.0
Coastal flat terrain	FMB	119.0	228.0	848.0	2,828.0	1,166.5	237.0	208.0
			(49.0)	(49.0)	(40.0)			
Coastal flat terrain	FMC	(14.0)	35.0	175.0	15.0		14.0	90.0
Coastal flat terrain	FMG		292.0	627.0				
Coastal flat terrain	FMK				14.0	750.0	813.0	275.0
Hilly land	MAA				55.0		189.0	9.0
							(162.0)	(11.0)
Hilly land	MAV	(190.0)	47.0	34.0	24.0	42.0	241.5	160.0
Mountainous land	MAC		(74.5)	314.5	362.5	536.5	879.0	2,577.0
Alpine land	MAU				88.5	148.5	128.0	47.5

Table A-V.--Continued.

Soil Description	Map Symbol	Distance[b]						
		0-5.0	5.0-7.5	7.5-10.0	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0
Mountainous land	MUB						20.0	
Hilly land	MVA	(315.0)	(314.0)		367.0	9.5	75.0	545.5
Mountainous land	MVB	(868.0)	(2,085.0)	1,430.0	759.5	2,005.5	2,454.5	1,717.0
		106.0	87.5					
Gently sloping &		(8.0)	(48.0)	220.5		23.0		148.5
rolling land	RAA	201.0	344.0					
Rolling land	RAB	21.0	(30.0)	109.0	19.5	101.0	150.5	134.5
			41.0					
Mountain foot slope	RAC	171.0	(66.0)	65.0	66.0	94.5	205.0	188.5
			17.0					
Mountain foot slope	RAD				48.0	130.5	81.5	345.0
Rolling land	REA							270.5
Rock	RO	(578.0)	(996.0)	456.0	623.0	486.0	1,539.5	1,954.0
Rolling land	RVA	(167.0)	(117.0)	310.5	568.5	458.5	92.0	414.0
		111.0	380.5					
Mountain foot slope	RVB	(286.0)	(158.0)	51.5	335.5	335.0		
		159.0	205.0					
Mountain foot slope	RVC		14.0	23.5				
Narrow valley	RXA	(19.0)	18.5				46.0	96.0
		40.0						

[a]In hectares. Numbers in parentheses which appear above estimates of land area indicate area in the green belt.

[b]In kilometers.

Source: Calculated from Ministry of Agriculture and Fisheries, Reconnaissance Soil Map--Busan City and Gyeong Sang Nam Do, No. 8 (Seoul: Institute of Plant Environment, Office of Rural Development, 1971), Plates 30, 31, 40, and 41.

APPENDIX VI

KOREAN FARM BUDGETS, 1974

Table A-VI.--Korean Farm Budgets, 1974.

Item	Rice	Barley		Sweet Melon	Cucumber	Chinese Cabbage	Red Pepper	Garlic	Potato		Soybean
		Common	Naked						Sweet	White	
Labor											
Hired	41,451	10,355	14,812	154,461	72,214	66,679	74,382	13,219	145,901	42,884	20,610
Family	81,602	62,978	58,774	279,168	286,277	73,535	90,445	161,318	101,909	56,424	42,147
Labor Subtotal	123,053	73,333	73,868	433,629	358,491	140,214	164,827	174,537	247,810	99,307	62,757
Materials											
Seed	6,070	6,594	6,977	27,224	12,100	13,642	24,451	317,615	31,711	81,914	9,196
Fertilizer	19,934	24,865	27,164	31,761	16,405	16,365	307,894	30,430	92,925	15,225	6,988
Other Chemicals	7,280	--		11,848	9,559	12,372	8,490	7,109	1,855	4,406	2,259
Other Production Materials	4,195	1,049	1,563	24,199	169,162	--	86,653	60,498	42,187	--	--
Materials Subtotal	37,479	32,508	35,704	95,032	207,226	42,379	427,489	415,652	168,679	101,546	18,442
Other Production Costs	57,100	27,143	31,005	18,280	12,957	15,608	13,562	9,861	19,208	9,619	9,740
Total Direct Costs	207,468	132,984	140,577	546,942	578,673	198,202	605,877	600,049	435,697	210,473	90,989
Indirect Costs											
Overhead											
Taxes & Public Charges	6,433	2,380	1,896	7,170	6,749	3,710	13,700	7,150	8,086	--	1,587
Interest on Fixed Capital	6,030	3,307	3,307	6,090	6,090	6,090	6,090	6,090	3,025	3,025	3,852
Interest on Variable Capital	5,001	2,864	3,300	5,697	10,063	2,995	5,415	14,671	3,388	2,894	1,220
Management Costs	68,398	23,943	19,808	71,703	67,124	37,100	136,997	71,501	80,864	61,387	15,867
Indirect Costs Subtotal	85,862	32,494	28,311	90,660	90,026	49,895	162,202	99,412	95,363	67,306	22,526
Total Production Costs, Excluding Land	293,330	165,478	168,888	637,602	668,699	248,097	768,079	699,461	531,060	277,779	113,515

APPENDIX VII

COSTS ASSOCIATED WITH AGRICULTURAL LAND CONVERSION IN AND AROUND BUSAN, 1975-85

Table A-VII.--Costs Associated with Agricultural Land Conversion In and Around Busan, 1975-85.[a]

	1975-1977						1975-1981			
	Option 1		Option 2		Option 4		Option 1		Option 4	
	Total	Average	Total	Average	Total	Average	Total	Average	Total	Average
Alternative I										
--Direct cost	0.92	0.31	0.10	0.03	0.88	0.29	2.30	0.33	2.07	0.30
--Reclamation cost	2.87	0.96	--	--	2.86	0.95	7.31	1.04	6.72	0.96
--Site Prep. cost	2.77	0.92	3.93	1.31	2.75	0.92	6.57	0.94	7.03	1.00
--Total	6.56	2.19	4.03	1.34	6.49	2.16	16.18	2.31	15.82	2.26
Alternative II										
--Direct cost	1.02	0.34	0.11	0.04	0.98	0.33	2.45	0.35	2.34	0.33
--Reclamation cost	3.25	1.08	--	--	3.22	1.07	7.84	1.12	7.61	1.09
--Site Prep. cost	3.01	1.00	5.02	1.67	2.81	0.94	7.79	1.11	7.55	1.08
--Total	7.28	2.42	5.13	1.71	7.01	2.34	18.08	2.58	17.50	2.50
Alternative III										
--Direct cost	0.96	0.32	0.11	0.04	0.93	0.31	2.31	0.33	2.23	0.32
--Reclamation cost	3.03	1.01	--	--	3.02	1.01	7.39	1.06	7.25	1.04
--Site Prep. cost	2.86	0.95	4.74	1.58	2.46	0.82	6.95	0.99	6.99	1.00
--Total	6.85	2.28	4.85	1.62	6.41	2.14	16.65	2.38	16.47	2.36
Alternative IV										
--Direct cost	0.79	0.26	0.10	0.03	0.71	0.24	1.79	0.26	1.73	0.25
--Reclamation cost	2.51	0.84	--	--	2.30	0.77	5.73	0.82	5.69	0.81
--Site Prep. cost	2.18	0.73	3.46	1.15	2.36	0.79	5.28	0.75	5.27	0.75
--Total	5.48	1.83	3.56	1.18	5.37	1.80	12.80	1.83	12.69	1.81

[a]In billion won.