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Implementing a New Indicator of Social Development in Mexico: Literate Life Expectancy (LLE)

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Acknowledgments

Abstract

For scientists, measuring social development has been a long-lasting objective; for the public, it has been a partially-resolved demand. Social indicators have been used informally for a very long time, particularly in economics, to assess the state of the nation and progress towards national objectives. Measuring people's quality of life emphasizes human well-being and particularly issues of equity, poverty, and gender.

In this context, this paper uses an innovative indicator of social development, Literate Life Expectancy (LLE), which was introduced by Lutz (1995). It is largely a demographically-based indicator that intentionally does not use any economic measurement but rather combines in one number both life expectancy and literacy. In other words, LLE is the aggregate average number of years that a person lives in a literate state. To demonstrate LLE's usefulness, we assessed the levels of social development in Mexico at the national, regional, and state levels. The obtained results at the national level were rather meaningful: between urban and rural women, we found a difference of almost 20 years of LLE at birth. At the regional level, there are great disparities among the regions from the North and the South. At the state level, the LLE reflected both the supremacy of the most urbanized centers, such as the Federal District and Nuevo Leon, and the impoverished social conditions of the states of Chiapas, Oaxaca, and Guerrero from the South.

The Literate Life Expectancy (LLE) index proved to be a very clear and simple comprehensive measure of social development at several levels of spatial aggregation. LLE is an absolute number that has a clear interpretation and therefore does not have the problems of abstract indices on a relative scale. Measured over time, it allows statements about the rate of change and not just static differences. Importantly, this index could be used to calculate future social development by adopting different mortality and educational scenarios which can be associated with specific policy assumptions.

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Introduction

The study of social development indicators represents a major challenge for policies aiming to foster sustainable human development. Sustainability involves improving the social, economic, cultural, political, and environmental conditions of a nation to develop the present human quality of life without compromising future generations. Generally agreed, improving human quality of life is the final goal of any economic, social or environmental program. For generations, humanity has sought the improvement of people's present and future conditions of life; the writings of Aristotle, Robert Malthus, Karl Marx, and J.S. Mill are a few which express humanity's concern about its present and future well-being. Throughout history and across the entire human species, the common good has been an aspiration of life that knows no borders and has universal validity for all people.

The conceptualization of human development and the strategies to foster it have varied through history. During the 1960s, most of the planners were concerned with economic growth having particular interest in the productive value of investment in training and education (Colclough 1993). The assessment of human development was mainly concentrated in the value of human capital (Schultz 1961; Becker 1964). In the 1970s, the international concern focused upon poverty and redistribution of wealth (Colclough 1993). International programs of health care and primary schooling targeted the poorest sectors of society. Aid and development loans were given to countries to explicitly benefit the poorest people. The measurement of 'life quality' was concentrated on more subjective indicators (Andrews and Withey 1976; Andrews 1986). By the end of the 1970s, however, the international community began to shift towards growth concerns (Colclough 1993), and social development assessment towards a more interdisciplinary approach, including not only social elements (Taylor and Jodine 1983).

In general, the developmental approach of the 1980s replaced the efforts of human development in the 1970s. The new orthodoxy argued for a sharp reduction of the state's role because, according to them, the intervention of the state produced an inefficient allocation of resources. This new approach overturned the pendulum of development to the extreme of placing in potential jeopardy the state's actions in support of human resources.[1] Towards the end of the 1980s, however, a new face began to emerge; international organizations and almost every government stressed their commitment in support of basic educational and health goals. For example, in 1990, both the World Conference on Education for All, an interagency initiative (UNESCO, UNICEF, World Bank, and the UNDP), and the World Summit for Children supported this cause.

Meanwhile, the United Nations Development Programme (UNDP) was emphasizing the need for placing people at the center of development because "people are the real wealth of nations" (UNDP 1990, p. 9). The new policies of the 1990s focus on poverty alleviation by providing the basic services to the poor. Primary education, health care, family planning, and nutrition and self-employment programs are among the most important services. The new strategy of the 1990s, especially for developing countries, calls for growth by empowering people's capabilities through education and health. The public provision of social services lies at the center of human development. Basic health and education are particularly crucial to address and solve poverty, stagnation, and recession.

The question then arises of how to allocate and measure the society's scarce resources. Are we doing it efficiently by targeting the group in most need? Are fairness and gender issues in play? Are we doing it with equity? Are we targeting the correct group of people? What about sex and residential differentials? The reflection of these questions lies in the foundation of the new developmental approach of the 1990s. Unfortunately, we have not been able to develop a sound measure of social development. The most recent attempt for measuring social development was made by the UNDP's 1990-94 "Human Development Index" (HDI). Although the HDI has attracted a lot of attention, it has significant conceptual limitations which misjudge the measurement of social development. Therefore, to advance the discussion over the importance of finding a more accurate measurement of social development, this paper will develop an empirical analysis by assembling statistical data of Mexico and

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[1] Extensive literature supports this argument and demonstrates the failure of the neo-liberal policies. See, for instance, Colclough (1991), Bloom (1991), Cornia et al. (1988), and Colclough and Manor (1991).

testing a new social indicator--Literate Life Expectancy (LLE). Developed at IIASA (Lutz 1995), LLE is innovative, simple, and accounts for only two essential elements of social development: literacy and life expectancy. These indicators are both measured as a single number and may be interpreted as the "average number of years a man or woman lives in a literate state" (Lutz 1995, p. 2). LLE is an aggregation of age-specific mortality rates and age-specific proportions literate at the societal level. Importantly, this indicator has never been used for any country as a tool to assess social development and has never been implemented as a scientific technique to measure present and future trends of development.

With the implementation of the LLE indicator, the author seeks to highlight the importance of using a pure social indicator which excludes economic elements. We strongly believe that if education and the provision of health are the leading sectors for social development at the end of this century, we need to measure them. In that sense, basic education and health are simply measured by the number of people who are literate and by the number of years of personal survival, respectively. Thus, in order to disentangle many residential, age, and sex differentials of Mexico's population, we have utilized a three-level approach for this study: a national level to measure the LLE of urban and rural men and women; a regional level to evaluate the average results of LLE by regions; and a state level approach to evaluate men and women of all the states independently. Our attention towards sex and residential differentials is very keen, particularly because of the long-run impacts that they have on the social and economic structure of the family.

1. Progress in Indicators of Social Development

Social indicators have been used informally for a very long time, particularly in economics, to assess the state of the nation and progress towards national objectives. During the second half of this century, however, the trend of the development of modern social indicators began. The pioneer work of Bauer's (1966) social indicators study developed the concepts of "statistics that enable us to assess where we stand and are going with respect to our values and goals." During the same decade, Biderman (1966) and Sheldon and Moore (1968) brought the idea of social indicators as a means by which progress towards a whole system of national goals could be measured, by implementing a balance sheet of social progress and setting national goal and priorities.

Scholars of the 1970s produced a large pool of literature on social indicators that ranged from the development of subjective indicators of quality of life[2] (Young 1977; Gilmartin et al. 1979), to the use of accounting and general social statistics (Cohen 1968; Henderson 1974; Murphy 1980; Carley 1981). In addition, increasing attention grew towards international comparisons (Kurian 1979; Estes 1988). This methodology motivated nations to meet a range of social norms or goals which gave them 'ratings' measured against various indicator yardsticks.

The Organization for Economic Cooperation and Development (OECD), during the 1970s and 1980s, implemented an important program to identify social concerns which were common to all nations. Once the problems were localized, the organization decided upon a series of indicators for these concerns (OECD 1973, 1982). For example, from 1974 to 1976 the OECD undertook a Social Indicators Program seeking to propose a basic set of factors which could describe the quality of urban environments. This program designed 19 indicators describing services, housing, environment, and environmental concerns (OECD 1978).

A more ambitious project was pursued in the mid-1970s by the World Order Models Project (WOMP) or World Policy Institute since 1982. In this study, the WOMP suggested a set of values and hoped that nations from different cultural and political backgrounds would accept these values (Garltung 1980). Likewise, Sullivan (1991) developed in an eight-year study a set of 'political and social' indicators of five values: (1) peace; (2) economic well-being; (3) ecological balance; (4) social justice; and (5) political participation. Sullivan's goal was to collect data from different nations to compare and judge them on the basis of these five values.

Recently, development has shifted from an economic idea to a socioeconomic emphasis. The most recent measurement approach (1990-1994) was developed by the United Nations Development Programme (UNDP). The UN designed the Human Development Index (HDI) to bring together income and social indicators--longevity, knowledge, and purchasing power (UNDP 1990). This measurement gives plausible attention to human development[3] or, as the UN calls it, to the "enlargement of people choices": live longer and healthier, be educated, and have the resources needed for living. This effort to get a more precise social indicator parameter, however,

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[2] 'Quality of life' is a concept which appeared in the early 1970s and refers to societal goals and objectives. Although it could be a very contentious concept, it holds that the welfare of a society should not be measured in economic terms alone. In measuring the 'quality of life' there ought to be more elements such as housing and health. See for instance, Glatzer and Mohr (1987).

[3] The 'human development' concept considers as infinite the opportunity of increasing one's development. However, if the three basic elements--*live longer, acquire knowledge and have access to economic resources for living*--are not met, there is no possibility to access any other opportunity of development. According to this concept, once these basic capabilities are acquired, we have to use them in some other aspects that we value as important, such as political affairs, creativity, and leisure.

appears to be inaccurate by using the GNP per capita. For example, the income element--purchasing-power adjusted--is a rather complex operation that gives less weight to the improvement of expenditure power at the higher level of income; the transformation of the deprivation index brings into question the quality and accuracy of the procedure (Kelley 1991; Anand and Sen 1992; Furntratt-Kloep 1995; Trabold-Nubler 1991).

Traditionally, nations strive to achieve a higher Gross National Product (GNP) per capita, as it is considered (erroneously) the single and most important element to measure their national prosperity. The use of GNP per capita as an indicator of social development fails to capture the distribution of economic progress. In other words, GNP per capita might produce a misleading picture of a country's social development, insofar as it does not reflect important elements of social prosperity such as education and health. But most importantly, the use of GNP per capita does not give visibility to the problems of deprivation, poverty, and income distribution.

Thus, while many nations face a major demographic challenge, developed and developing countries are confronted with the interest of finding a more comprehensive set of elements that could be used not only as a measure of people's quality of life but also as a tool for comparative purposes in the short and long run. The increase in population and its polarization increases the demands on the nation's social services, infrastructure, and environment. Accordingly, the techniques to address alienation, despair, and instability are more complex. Finding a social index which accurately mirrors and foresees social development constitutes a necessary task towards promoting a more equitable, just, and fair society.

2. Literate Life Expectancy (LLE)

2.1. Why a new perspective?

The demographic transition theory suggests that economic development precedes population growth. Increased economic activity is associated with an initial reduction in death rates, but not birth rates, leading to an increase in the population size. In addition, it is widely argued that the improvement in education, nutrition, sanitation, and medical care are responsible for this change. After some interval, however, birth rates fall as urbanization increases, more women enter the labor force, and the economic advantages of large families disappear. While this theory explains much of the demographic history, scientists and policy makers still do not agree how to evaluate social development.

While the paradigm of development at the end of this century and most likely for the beginning of the 21st century foretells the provision of public services, such as health and education in particular, as inevitable if economic progress is to be gained, scientists are still confronted with the question of how to measure social development. During the past years, major attention has been placed on the accumulation of wealth as a measure of social 'prosperity'. This approach has succeeded in the sense that wealth has been produced, although in many cases, success was at the expense of equity. For instance, in 1991 77 percent of the world's population earned only 15 percent of its income. In terms of GNP per capita, this mean that the average income of the smaller group of people--the wealthy--represents 18 times the average of the largest group (UNDP 1990, p. 23).

Inequalities are expressed not only in terms of income but also in terms of the allocation of social services. Being poor leads to a shorter life because the individual is not able to meet the basic needs of food, health, and shelter. For example, in Mexico a poor person is expected to live 20 years less than one from the high-income group (UNDP 1991, p. 26). Also, poverty correlates with less education. Poor children often have to drop out of school to make a living or help their parents. Sometimes, when they stay in school, they do not have sufficient energy to meet the training at school. Child malnutrition is more widespread among children from rural areas. Furthermore, the contrast of living in an urban or rural area is aggravated by imbalances in the delivery of social services. Inequalities also reflect on gender opportunities. The levels of education for women are still lower than for men. In countries with a large rural population, migration is the only alternative. For instance, in Mexico, the percentage distribution of rural-urban women aged 20 to 49 years shifted dramatically from 1976 to 1987. In 1976, 31 percent of the women were living in urban areas, but by 1987 the same group rose to 43 percent. In other words, rural Mexican women of this age group decreased dramatically from 31 percent in 1976 to only 26 percent in 1987 (UN 1993a, p. 7).

Widespread poverty remains a major challenge to development efforts. Poverty is often accompanied by several socially degenerative elements such as malnutrition, illiteracy, environmental pollution, and limited access to social and health services. The eradication of poverty implies more education, sanitation, and overall improvement of the quality of life.

The commitment of international agencies aiming at fostering national development are discouraged by the poor 'statistical' results that the recipient countries have shown over time. The failure in capturing the distribution of the benefits have meant for many countries two negative aspects: on the one hand, the reduction of foreign aid from donor countries, and on the other, the increase in the number of people living in poverty. In general, during the

1980s, donor countries reduced their percentage of aid to foreign countries and even failed to meet the agreed target of 0.7 percent of GNP for official development assistance (UNDP 1991, p. 53).

As the world moves into the 21st century the concern over social and welfare impacts increases. Nowadays, we are witnessing an accelerating physical, moral, and environmental decay; a growing concentration of poor, homeless, and unemployed people; a growing suburbanization and metropolitanization; a sharp economic transformation in the economic structure especially from the manufacturing sector to the service industries; and an increase in the inequalities within and between cities at the national, regional, and global levels.

In an era of demographic challenge, developed nations tend to worry about the aging of their population and the burden and vitality of supporting such an aged population. Developing nations, meanwhile, are concerned about the burden of providing health care, education, the creation of jobs, and the urban size and growth of their cities. To face this scenario, nations ought to be keen to develop indicators to monitor their own performance. The accurate measurement of a nation's social indicators is a crucial element for setting national goals and priorities. Social indicators assess the state of the nation and the accomplishment of the nation's development. The US Department of Health, Education and Welfare (1969, p. xii) notes that:

> ...social indicators could not only satisfy our curiosity about how well we are doing, but it could also improve public policy in at least two ways. First, it could give social problems more visibility and thus make more informed judgments about national priorities. Second, by providing insight into how different measures of national well-being are changing, it might ultimately make possible a better evaluation of what public programs are accomplishing.

The importance of finding a more absolute number to measure social development represents several things. Not only is it an extraordinary intellectual exercise, it could also lead to the improvement of the unfortunate lives of many people who have been passed over by the new trend in development. The economic globalization which might grow hastily in the 21st century comes with a more complex set of elements which make countries more interrelated but at the same time more vulnerable. The aim of economic growth with equity represents a challenge for economists, scientists, and policy makers in the break of the 21st century.

When evaluating social development at the regional and state level of a nation, issues are complicated. Lack of or insufficient statistical information make the evaluation of social programs more difficult. The exercise of comparing regions within each state and projecting future development further complicates matters. In large countries, such as Mexico, social policies have different impacts among regions. Historical, geographical, and cultural elements play a role at the local and regional levels, and therefore, a general standardization of social development does not fully represent the local scenario.

The development of a population lies at the micro-level, that is, the strengthening of the family cell. The development of a nation means more than the growth of GNP per capita. Social development means equal opportunity for all people, more and better education, increase in life expectancy and universal access to health services. Gender disparities must disappear if the nation aims for conditions to compete internationally to reach the 21st century. The urban and rural differentials ought to be erased by providing better targeted social programs to the rural areas. In the next century, a nation will rely heavily on the productivity of rural areas to provide food to the increasing urban areas. However, we need to be aware that almost every action at improving agricultural productivity has its environmental cost: from the use of fertilizers and pesticides to the creation of energy sources and production of machinery.

2.2. Explaining the new indicator (LLE)

The Literate Life Expectancy indicator is largely a demographically-based index which is a numerical sum of social development. It reflects in one number both life expectancy and literacy.[4] The systematic approach of LLE combines two basic aspects of human development: (1) the number of years a person lives, and (2) his/her level of education. The LLE indicator evaluates the age-specific mortality rates and the age-specific proportions literate. In other words, it is the aggregate average that a person lives in a literate state. The aim of this indicator is to look at a person's years of life but in a literate state.

Age-specific literacy describes the cumulative transitions of a person from an illiterate state to a literate one. LLE takes into account that not all years that a person lives are highly productive. Functional abilities are affected through time, especially in the oldest groups, and therefore, the LLE indicator is reflected with a lower literacy rates at oldest ages. Within the oldest age groups, it is assumed that the older one gets, the less literacy capabilities remain. The relevance of this description is that it projects the likely changes in age structure according to literacy.

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[4] In an international context, literacy is defined as "the ability both to read and to write." Thus, a literate person is one "who can, with understanding, both read and write a short, simple statement on his everyday life." Likewise, an illiterate person is one "who cannot, with understanding, both read and write a short, simple statement on his everyday life" (UN 1995a, p. 114). However, at the national level literacy and illiteracy could be defined differently according to each country's national policy.

In terms of public policy, it allows nations to estimate the kind and magnitude of the forthcoming social demands by foreseeing the social dimension of the replacement of generations.

The literate life expectancy indicator does not reflect any measure of economic income and therefore, there can be no failure in capturing the distribution of social benefits. The LLE indicator is based purely on individual characteristics: literacy and mortality, and not on national accounts of Gross Domestic Product (GDP). The measurement of wealth presents many kinds of problems, and the results depend to a great extent on the accounting techniques that are used.

This new indicator not only shows the current level of social development but it also portrays the nation's possibility for future development. LLE provides the literate state of the chores by age group and enables to foresee the levels of education and human potentiality of future generations. The opportunity of looking at the educational level of each generation provides a long-run prospective of each generational chore. LLE is an absolute number of social development and does not need any maximum or minimum assumption or adjustment. With the literacy and life expectancy information, sex differentials are seen throughout each age group for both rural and urban areas. With the systematic distribution of the population by age group, the LLE indicator underlines the individual years of life which are suggestive of a real 'literate state'. This social indicator assigns a more realistic level of the functional abilities and does not saturate the upper end of the age groups.

The versatility of the LLE indicator allows comparisons over time because it enables us to see present and likely future trends of each age group. Likewise, the LLE indicator gives more transparency to social development insofar as it can evaluate development by sex and residence differentials. The application of this indicator at the state level can reveal the concealing inequities within local states. Thus, there is great potential for improving human development by better distributing social services and by accurately restructuring budget priorities.[5] An increase in the level of education has positive economic, social, and environmental impacts. Higher levels of education correlate to more efficient production and consumption alternatives, and both patterns tend to benefit the environment.

The level of education of a society represents an asset for the nation's development. The literacy of a nation in the long run is one of the most--if not the most--important elements for development. In addition, human capital has an essential impact on a nation's future development, especially in countries where the largest groups of population are concentrated in the youngest generations. The analysis of a nation's age group replacement process by level of education is an important factor in projecting the potentiality of development of that generation and the nation.

3. Relevance of Education[6] and Life Expectancy in Social Development

3.1. Importance of life span

The concept of life expectancy involves the average length of life of a person which is influenced by social and, in a small degree, biological factors. The biological elements tend to show at an early age after birth; therefore, mortality tends to be higher during the first year of life. But most importantly, life expectancy is driven by social positive factors, such as shelter, health care, working conditions, intellectual stimulation, etc. and by negative aspects, such as malnutrition, poverty, armed conflict, stress, depression. Both positive and negative ingredients determine a person's quality of life.

When analyzing the life expectancy of a society, one studies its economic and social infrastructure. The infrastructure of a society refers to the production and distribution of wealth and the degree of access to food, medical assistance, and shelter. Life expectancy is also influenced by technological progress, working conditions, education, and emotional health. The option of life-style 'choice' is clearly undercut in societies where there is little or no alternative at all for a better life. Life expectancy portrays the social, economic and even the environmental conditions of a society.

The life expectancy indicator encompasses significant elements such as health care, children's health, food and nutrition, housing, use of technology, working conditions, and even psychological aspects like stimulation. In terms of economic value, the human value is enhanced when one's productive life is extended. Life expectancy is an important element which promotes the investment in human capital and adds value to the stock. When the state of

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[5] The main argument behind this observation is that even if we do not solve the problem completely, the new redistribution will provide equal opportunity to all members of the society.

[6] Although a significant part of the argument of this paper deals with the importance of attaining and measuring education as a social development indicator, the author does not address international comparisons or private and social rates of returns. The objective is to treat education in a general sense measured by literacy. In other words, having education means being literate.

health improves, productivity in the labor force increases--greater skills and less waste of time because of illness (Schultz 1981, pp. 34-40).

An increase in longevity also positively correlates with economic development. Apparently, an improvement in sanitation conditions, nutrition and medical care have an important effect on reducing mortality. A study of 150 countries analyzing the relationship between industrialization and health found that economic improvement "adds approximately 30 years to life expectancy and reduces infant mortality by 140 deaths per thousand live births" (Sagan and Afifi 1979, pp. 167-139).

When measuring the welfare of a nation, longevity accounts for social development because of the reduction in the levels of mortality. In other words, the increase of life expectancy represents development because we live longer (Usher 1980, pp. 223-292). In this context, the key issue is that everyone in a nation benefits to the same extent.[7] It does not matter if the life span was achieved by either the eradication of diseases or by the improvement of the environment.

Increasing the life span and reducing mortality is the result of improved health. And the direct effect of improved health is higher productivity (Ram and Schultz 1979, pp. 399-422). This implication, according to their argument, results from two aspects: (1) with the reduction of time, sickness and the prolongation of life, more man-hours are supplied, and (2) the increase of health brings greater vitality resulting in more productive workers. While the first effect tends to shift the labor supply to the right and lower wages, the second effect triggers an increase in the demand curve and wages rise. Both effects produce an efficient labor force.

The increase in life span has a symbiotic relationship with schooling; a longer life fosters the incentives to acquire more education. The productive life expands and as a result, the quality of the labor force increases. When life is short, there are less incentives to attend school, illiteracy is rampant, and the quality of life is low. When life is longer, there are more incentives to invest in education both privately and publicly. Thus, it results in the increase of human capital.

3.2. Relevance of schooling

Literacy is probably the most dramatic and significant indicator for the individual and for the rest of the society as well. Extreme proponents of the value of human capital (e.g. Simon 1981) have suggested that it is the 'ultimate resource' which will determine in the long run how to live in a better society and in a better world. Other economists have tried to highlight the relevance of the role of human quality (Grossman and Helpman 1991) in a world which constantly becomes more open and interrelated. The contribution of technological progress to the improvements in the standards of living should be accompanied by human quality.

Schooling is therefore an important strategy for planning the development of a community, a state, and a nation. Schooling helps at the individual level by improving the capacity to enjoy life, culture, and income. Education has the capacity to foster a state or nation's economic development (Marshall 1990, pp. 195-253) not only by making investments more attractive, but also by bringing "efficiency, quality, flexibility, and innovation." For example, Germany and Japan, which have scarce physical resources, have developed their human resources in order to meet the requirements of global competitiveness. Thus, it can be argued that knowledge, advanced technology, and human quality generate economic development.

Education triggers major effects in values of fertility. For developing countries, for instance, the relationship of women's education and fertility is inverse. That is, the more literate or educated a country is, the lower its fertility level . The relationship, however, changes over time as the fertility transition comes to an end (Jejeebhoy 1995). In a sociological sense, women's education has a set of benefits directly related to them, their children, their families, and to society in general. Through education, women have access to new ideas, knowledge, information, and independence. It encourages confidence, efficiency, emotional and economic autonomy, and delays the marriage age.

The evidence suggests that education influences fertility by means of several behavioral changes which eventually lead to a decrease in fertility and other social effects[8] (Freedman 1987; Federici et al. 1993). At the individual level, education increases job opportunities, at least, competition within the job market and income levels. Additionally, education helps women in family planning and financial independence. At the societal level, the education of women is an indicator for population stabilization, economic development, mortality, migration,

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[7] Some of these ideas are reviewed thoroughly by Usher (1980) in an attempt to design a statistical technique to measure economic growth. Though he uses an analogy between a country and a person's development, Usher takes a closer view at issues such as education, housing, health and food more than the increase of GNP.

[8] The strength of the effects of education in fertility varies greatly, depending on the cultural and developmental setting of each region. There is strong evidence which links fertility decline and education in societies that are in the process of rapid fertility decline, but in some other societies, the relationship varies. For the case of Mexico, see UN (1993b).

protection of the environment, and social equity. The direct and indirect effects of education have impacts in the short and long run over the individual and the society.

Education influences health through both market and non-market activities. The level of productivity of an individual is enhanced by a person's given level of education. At the same time, non-market or consumption activities result in higher quality depending on the level of education of the individual (World Bank 1980). Increasing the level of education is likely to increase a person's 'tastes'; a more educated individual will choose a better diet and have fewer health problems. This behavior has an impact not only on the health system but also on the economic budget of a nation.

The human resources of a nation are usually determined by the state of its "health", "nutrition standards", and the degree of "skills and competencies" (Blaug 1979, p. 361). Training and education are two essential factors of high human quality. The modernization process of a nation and the qualitative nature of its human resources are determinants to compete in a global economy. Nowadays, many regions of the world, such as Europe, North and South America, and Asia, are engaged in a global economy which demands more technical and human skills. International evidence of developing countries has demonstrated that the rates of returns of education are greater than the returns to capital of other economic sectors (Psacharopoulos 1973, 1985). Although the private rates of return of these estimates demonstrate that private rates are higher than social rates of return, both have an important effect on achieving development. The improvement in the levels of education have immediate and future positive impacts on the nation. In terms of production, people with better education are essential for the improvement in population quality and advances in knowledge. Better educated children will provide better future services to the nation and their families: future earnings, ability of self-employment, and future consumer satisfaction (Schultz 1981, pp. 18-34).

Theories of low fertility stress, the role of economic development and wealth, and sociological factors (Weeks 1994, pp. 123-156) are the influential elements for lowering the fertility rates. Nevertheless, it is clear that none of them fully explain the lowering in fertility rates. International evidence has shown, however, that literacy influences the demographic transition of countries by lowering fertility rates. Education is relevant in several ways to lower fertility. For instance, one is the access to information for family planning programs. More educated couples tend to have more access to family planning methods. However, one cautious note of this study is that fertility declines only at 'high' levels of literacy. Once this level of literacy is achieved, it "produces larger fertility declines" (Kenny 1991, pp. 113-128).

In a broader and more philosophical sense, education suggests the "transmission of ideas of value," ideas which are the result of thought and careful analysis. When we pass on these ideas to our children, they know what to do with their lives because education will help them to become 'whole' people. Education helps in fostering our ethical grounds. The modern way of life is more complex and requires that everyone become more highly educated (Schumacher 1973, pp. 70-92).

Becoming educated is the basic tool for individual and national development. It enables people to improve their living conditions by empowering them to protect and claim fully their social, economic, political, environmental, etc., entitlements. Education is the engine for development because it aids in the defeat of many adverse constraints, such as gender discrimination, and it empowers people to reduce their geographical disadvantages.

4. Implementing the LLE Indicator in Mexico

4.1. Sociodemographic characteristics of Mexico

Mexico consists of 31 states and a Federal District, where Mexico City, the nation's capital, is located.[9] The states are divided by municipalities--the smaller administrative and political unit of a state. In Mexico, there are 2,387 municipalities; the Federal District, however, has 16 *delegaciones* which function administratively as if they were municipalities. In total the Republic of Mexico is made up of 2,403 administrative units.

Currently, Mexico has a population of approximately 92 million, and it is estimated that by the year 2050, it will house 161,450 people.[10] Although Mexico has reduced its rate of demographic growth over the last decades, its population is largely concentrated in a few cities. From an average annual rate of 3.4 percent between 1960 and 1970, it changed to 3.2 percent between 1970 and 1980, and to 2.3 percent during the last decade. By 1992 the annual population growth rate was estimated at 1.9 percent (INEGI 1992a).

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[9] Appendix 1 contains a full description of the population and density distribution of each entity.

[10] This population projection is the 'medium variant' demographic indicator of the UN 1994 Revision (UN 1995b). Being more pessimistic about the population predictions, the same report projects the 'high variant' for the year 2050: a population of 209,112. The same report projects a 'low variant' of 126,328 persons for the same year (UN 1995b, pp. 564-565).

The yearly birth rate has shown a downward trend. Between 1980 and 1990, it changed from 34 to 31 per thousand. The mortality rate has been decreasing since 1950 as result of improved health services. For instance, between 1980 and 1990, infant mortality decreased from 39 deaths per thousand live births to 24. In the same period, expectancy at birth increased four years, from 66 to 70 (INEGI 1992a). Family planning programs were of major relevance during the 1970s in reducing the levels of fertility. See Table 1 for a historical demographic description of Mexico.

Table 1. Major demographic indicators of Mexico, 1950-1990. Source: Translation from INEGI 1995, p. 15.

	1950	1960	1970	1980	1990
Natural growth[a]	29.4	34.6	34.9	28.7	28.5
Birth gross rate[b]	45.6	46.1	44.4	34.9	33.7
Mortality gross rate[c]	16.2	11.5	9.5	6.2	5.2
Infant mortality rate[d]	101.3	73.8	68.5	38.8	23.9
Average of children born alive per women	4.4	4.6	3.1	2.8	2.5
Life expectancy at birth	49.7	58.9	60.8	66.2	69.6
Males	48.0	57.6	60.0	63.2	66.4
Females	51.0	60.3	63.9	69.4	73.0

[a] (Births-Deaths/total population) (1000)
[b] (Births/total population) (1000)
[c] (Deaths/total population) (1000)
[d] (Deaths between 0 and 1 years old/total born alive) (1000)

Analyzing the distribution of the population by age over the last decade, one can verify the effects of the change in the demographic components. This is especially true in the decrease in birth rate, which is reflected in the reduction of the proportion of young people. For instance, the percentage of population under 15 years of age changed from 46.2 percent in 1970 to 38.3 percent in 1990 (INEGI 1992a). Nevertheless, Mexico continues to be a country of young people for the most part, as half of the population is 19 years old or less.

The territorial density of the country's population has been increasing. In 1950 there was an average of 13 people per km^2, as compared to 24 in 1970. In 1990, the number of people increased to 41 per km^2. Within the country there are great differences in the territorial distribution of the population. While the Federal District has the highest density with 5,494 inhabitants per km^2, there are other entities with very low density. For instance, the state of Baja California Sur has 4 people per km^2, and the states of Chihuahua, Quintana Roo, Campeche and Sonora have 10 inhabitants per km^2 (INEGI 1992a).

The rapid urbanization growth of Mexico has caused large problems of unemployment, poverty, crime, and pollution, particularly in three cities--Mexico City, Monterrey and Guadalajara--which, in 1990, accounted for approximately 25 percent of the total urban population.[11] A recent estimate projects that by the year 2000, Mexico will have 77.7 percent of its population residing in urban areas (UN 1995b, pp. 82, 83). As Mexico becomes more urban, the concern over social and welfare impacts increases as the rural to urban transformation implies heavy pressure on social services and infrastructure.

Mexico is a country in which education levels have been improving through time (see Table 2). In 1990, more than 30 percent of the entire population enrolled in the nation's educational system. The number of teachers increased from 723,000 at the beginning of the 1980s to more than one million teachers in 1990.

Table 2. Selected indicators on education in Mexico, 1970-1990. Source: INEGI 1992a, p. 34.

Indicator	Period		
	1970	1980	1990
Literate population (%)	74.2	82.9	87.6
Students per teacher	80/81	85/86	89/90
Elementary	39	33	31
Middle	18	33	31
Higher	13	11	11

[11] This percentage was estimated by CONAPO (1994a, pp. 32, 43).

The literate population rose from 74 percent in 1970 to 88 percent in 1990 (INEGI 1992a). Despite the progress in the educational levels, poverty levels have been aggravated sharply. The demographic growth of the nation during the last fifty years brought with it new hopes of development, yet the level of poverty has worsened over time.[12]

The increasing difficulty to alleviate poverty in Mexico is due in part to demographic elements (Weeks 1994, p. 403; Coale and Hoover 1958, pp. 304-320) as well as social and gender inequities. Although fertility rates have declined considerably over the last years,[13] there is great pressure on social and structural services. The cyclical pattern of increasing poverty creates unsustainable manners of production and consumption for present and future generations. The age structure of the large young population increases the concern for reestablishing methods and strategies for the efficient allocation of resources in urban and rural areas. Since resources are shrinking and social demands are increasing, the planning and decision-making process for evaluating the state of the nation and the progress towards national objectives involves the evaluation of social indicators. Table 3 shows that in 1990, almost 60 percent of Mexico's population were already living in urban areas.

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[12] In 1990, the National Council of Population of Mexico (CONAPO) estimated that 63.2 percent of Mexico's employed population was receiving less than two *salarios minimos.* This wage is considered the minimum amount of money to fulfill the basic needs for survival. For a full description at the municipal level, see CONAPO (1994b).

[13] The fertility rate per woman in Mexico was 6.75 in the period 1950-1965; 6.70 in 1965-1970; 6.37 in 1970-1975; 5.03 in 1975-1980; 4.30 in 1980-1985 and 3.70 in 1985-1990 (UN 1995b, p. 326).

Table 3. Mexico's rural and urban population distribution in 1990.* Source: Calculated by INEGI (1992b).

	Total urban population	Total urban %	Total rural population	Total rural %
Men	22,646,866	27.8732	17,247,103	21.2273
Women	24,028,544	29.5737	17,327,132	21.3258
Both groups	46,675,410	57.4469	34,547,235	42.5531

* In 1990 Mexico had 81,249,645 people. There were 39,893,969 women and 41,355,676 men.

The nation faces important though contrasting demographic challenges for the next 20 years. Mexico, as most of the Latin American countries, is experiencing an urbanization process which requires large amounts of public investment to equip the cities to accommodate the population. In addition, the age structure of Mexico's population, ranging from 15 to 24 years of age, demands large amounts of jobs annually. Moreover, there is still a large population, mainly concentrated in the southeast and southwest region of the country, which has been unable to receive the basic benefits of development. Unfortunately, large groups of people have been historically marginalized from the national context of development and have not been able to share some of the scarce social benefits.[14]

Implementing the LLE indicator in Mexico by sex differentials for both rural and urban areas at the national level will give an important picture of the social development conditions of each population group. In addition, the implementation of the LLE indicator at the regional and state level will describe many differences within regions and states. Although Mexico is a country with a profound egalitarian tradition, it has historical distortions in its assignment of financial resources for urban and rural areas.[15]

Mexico has a long tradition in the struggle for achieving 'social justice'. The promulgation of the Constitution of 1917 gave the responsibility to the State to assure equal opportunities for all its inhabitants in terms of education and health. Mexico's distribution of wealth, however, is remarkably uneven, carrying an ideological chaos between free-market conservatives and social justice egalitarians. Traditionally, Mexico's social policy has been centralized in the federal government favoring inefficiency, corruption, and inappropriate distribution of resources. Social policy reform is underway in Mexico. The current administration under President Zedillo has proposed the adoption of a new strategy for social development. It focuses on the provision of the basic social services of education, nutrition and health. The new proposal seeks to foster social development and falls under the umbrella of the Programa Integral de Educación, Salud y Alimentación (PIESA) which includes 18 social programs. One part of these programs is oriented towards 29 million people--universal access--and the other towards 23 million people who are living under extreme conditions of poverty. The philosophy of this new social package is to give to the 31 local governments the independence of spending on social programs according to their estimates and avoiding the intervention of the bureaucrats of the capital.

4.2. Applying the LLE indicator

The calculation of the LLE requires empirical data of the age-specific mortality rates (ASMR) and the age-specific proportions literate (ASPL). The estimation of the LLE is performed without any complex mathematical operation in a life table which is used for summarizing the mortality experience of a population. The only new element is the weighted number of person-years at each age by the age-specific proportions literate. In the life table, the (L_x) column is multiplied by (PL_x) to generate the (LL_x) column. The formula of the Literate Life Expectancy indicator and notations in the model life table are as follow:

$$\left(L_x\right)\left(PL_x\right) = LL_x$$

L_x Total number of person-years living in age group x
PL_x Age-specific proportions literate
LL_x Literate person-years lived

Like in a regular life table, Literate Life Expectancy (Le^o_x) is drawn by dividing the cumulative literate person-years (LT_x) by the (I_x) column.

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[14] For example, in 1990 there were still 6.4 million Mexicans who spoke an indigenous language representing 7.9 percent of the total population (INEGI 1992a). It does not mean that speaking an indigenous language implies being margined of the social development of the nations; it only gives a picture of how large is the population that usually lacks the basic social services such as health and education.

[15] According to the official authorities of the Ministry of Social Development of Mexico (SEDESOL), in 1995, the capital of Mexico, Mexico City, received one-third of the total social subsidies of the nation.

$$Le^o_x = \frac{LT_x}{I_x}$$

Le^o_x	Literate life expectancy	
LT_x	Cumulative literate person-years	
I_x	Number of survivors at age x	

The literacy-life table uses the following notations in the model. First, the symbol is shown as it is used in the tables, followed by the conventional notation in square brackets and a brief explanation of the meaning of the symbol.

m(x)	$[_nm_x]$	Death rate in the life table population (number of deaths per person-years lived) between age x and x + n
q(x)	$[_nq_x]$	Probability at age x of dying before reaching age x + n
P(x)	$[_5L_{x+5} / _5L_x]$	The proportion of persons in a given five-year age group in the stationary population alive five years later
I(x)	$[I_x]$	Number of survivors at age x out of an original cohort of 100,000
L(x)	$[_nL_x]$	Number of person-years lived between age x and x + n by original cohort of 100,000 annual births and deaths
T(x)	$[T_x]$	Number of person-years lived at age x and over by an original cohort of 100,000
e(x)	$[e^o_x]$	Average numbers of years remaining to be lived (expectation of life) at age x

At the national level, the calculation of the age-specific mortality rates (ASMR) is drawn by weighting the average death rates for males and females for both urban and rural populations from the Demographic Yearbooks of 1988 (UN 1990) and 1993 (UN 1995a).

The ASMR of Mexico comes from a mathematical operation of combining the statistical information of the 1988 and 1993 Demographic Yearbooks. Since the 1993 edition gives only the death rates specific for age and sex without reflecting the geographical differentiation (rural or urban), we took only the female/male distribution for all ages: 6.0 for males and 4.4 for females (UN 1995a, p. 456). Then, taking the latest available edition of urban and rural distribution for Mexico from the Demographic Yearbook 1988, we applied the death rates of all ages by sex and place of residence: 6.4 for males and 5.0 for females (urban), and 7.5 for males and 5.8 for females (rural) (UN 1990, p. 490). Once we had this information, we weighted the average of the death rates for urban and rural females and males. We took the place of residence differential of the 1988 Yearbook and assumed the same ratio differential for the 1990 data. The 1988 Demographic Yearbook contains the death rates for 1979.

To get the age-specific death rates (ASDR) by sex and place of residence for 1990, we implemented the following formula for all population groups changing only the sex and place of residence information. For example,

$$ASDR_{1990}\,urban.male = ASDR_{1990}\,total.male\,\frac{DR_{1979}\,urban.male.all.ages}{DR_{1979}\,male.all.ages}$$

Because the UN Yearbooks give the age-specific mortality rates for both females and males beyond the age of 75, we weighted the death rate of the last age group (75+) from the last three age groups (75-79, 80-84, and 85+).[16]

The age-specific proportion literate (ASPL) was calculated from the XI census of Mexico (INEGI 1993a).[17] The age-specific proportion literate resulted from applying the following formula:

$$\frac{\sum' A'\,age.group}{\sum' B'\,age.group - \sum' C'\,age.group}$$

where   A = sum of male or female literate population by age group.
         B = sum of total population female or male by age group.
         C = sum of total population unspecified by age group.

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[16] The results of the ASDR by age group are included in Appendix 2.

[17] In Mexico, a person is considered literate when reaching 15 years or older, she/he knows how to read and write a message. Accordingly, an illiterate person is one who does not know how to write and read by the age of 15 years (INEGI 1992c, CD Codice 90). Although we adopted the official literacy definition given by the INEGI, there are literate people who are in the third age group of this study, 10-14 years old. For the purpose of counting those children under 15 years of age who are already literate, the author took into account as literate those who have reached at least the fifth grade of primary school. Normally, in Mexico a child starts primary school at the age of 6 and finishes at the age of 12. When children reach their fifth level of primary education, they are certainly considered literate.

The distinction between rural and urban areas was made based on SEDESOL (1996, p. 19). It defines an urban area as a locality with 15,000 inhabitants or more. A rural area is a locality with less than 15,000 dwellers. In other words, a municipality could be integrated by several rural and urban localities.

To gather the literacy by age group, we utilized the information of the XI census from Mexico (INEGI 1992c). It distributes the population by age group of five years and according to their literacy (see footnote 17). Yet, since the census has the age distribution up to 65 years and more, we had to estimate the literacy life average of the last three age groups (65-69, 70-74, and 75+). To get the ASPL of these last three age groups, we assumed that it will decrease as people get older and at the same rate as the previous age groups. In other words, the older people get, the less literacy they have. The results of the age-specific proportion literate, as applied to the Literacy Life tables for Mexico, can be seen in Appendix 3.

To calculate the Literate Life Expectancy at the regional level,[18] we weighted the ASMR and the ASPL of the state members of each region by the population of each age group. This process was applied to both men and women of the nine regions. This approach enabled us to obtain the LLE not only at birth but also by age group.

To create the LLE indicator at the state level, however, the author adopted the official mortality rate given by sex and age group in CONAPO (1996). Yet, since there are no official state mortality rates defined by place of residence urban and rural, we implemented the same ratio as the one at the national level, and defined the mortality rates per state for urban and rural areas.[19] The ASPL at the state level was calculated from the XI general population census of Mexico (INEGI 1992b).

5. Analysis of the LLE Results

The historic sociodemographic characteristics of profound social, economic, and cultural heterogeneity of Mexico make this section of the study a rather meaningful piece. In an era of adverse economic difficulties, a more critical and active society, and profound reform of the State, the nation faces important social and economic challenges. Unfortunately, the social nets that the government officials designed during the 1980s and early 1990s have been insufficient to ameliorate the negative impacts of the implementation of adjustment programs. Thus, the Mexican society is experiencing social dislocation and alienation, and heightened social and economic inequities. The common myth that early stages of economic growth has unavoidable intrinsically social inequities does not hold true anymore (UNDP 1996). Economic growth and social development must come together in the long run if sustainable development is to be achieved. The importance of re-evaluating the basic social conditions of human well-being--literacy and life expectancy--are of foremost importance in view of the failure of economic growth. We will attempt to interpret the results of this new social indicator at three different levels: national, regional and state. Our objective is not only to draw important conclusions at the macro-level, but also to disclose relevant issues at the micro-level.

Our analysis is divided into three parts. First, the national context evaluates the LLE of men and women of both urban and rural areas. At the national level, we obtained the LLE at birth and by age group of five years. Second, the regional approach consists of measuring the LLE of nine sociodemographic regions of Mexico.[20] At the regional level, the analysis of LLE is based on sex differentials and age groups. In other words, it does not cover the urban and rural differentials that were already evaluated at the national level. By dividing the nation into regions, we can compare the states of the region with other states of different regions. Third, at the state level our analysis of LLE focuses on both females and males of all age groups. We attempt to rank the states according to their performance of LLE with respect to the rest of the states and underline remarkable differences among the states. We give particular attention to urban and rural characteristics and their correlation to the levels of development. We believe that this final approach is very relevant for policy purposes at the micro-level. Mexico's decentralization of education and health services not only will enable local authorities to better address issues of development, but it will also solve long-lasting problems of accountability and efficiency.

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[18] In this context, region means two or more states which are integrated in one geographical area according to their social, economic and ecological characteristics. The 31 states and the Federal District comprise nine regions: (I) North East, (II) North, (III) North West, (IV) North Center, (V) Occident, (VI) Center, (VII) Gulf Coast, (VIII) South Pacific, and (IX) the Yucatan Peninsula. See Appendix 4 for the description.

[19] We found this method rather efficient as a supplement to the lack of information to differentiate the mortality rates for urban and rural areas at the state level.

[20] The regionalization implemented in this study was scientifically and practical motivated. This division is being used in Mexico for environmental and social studies of the INEGI and the Ministry of Social Development. In addition, the National Counsel of Population of Mexico (CONAPO) currently uses this division for empirical studies on population.

5.1. National context

The analysis of the LLE results at the national level seeks mainly to motivate the awareness of policy makers and scholars about the great differences of social development for urban and rural men and women of Mexico. Many social, environmental, and economic problems stem from social inequities, i.e. social unrest, water and air pollution, family disintegration, etc.[21] Implementing corrective measures to social developmental inequalities fosters the basic principles of justice and fairness. Naturally, life expectancy at birth is an important indicator in terms of social development. However, LLE at birth is the expectation of a child for living under literate conditions. Living under literate conditions has many positive consequences for social, economic, environmental, and political elements of life. Life expectancy, on the other hand, involves many psychological and, indirectly, economic aspects of a person's well-being.

By measuring the LLE at the national level, we were able to gather social differences in four large population groups: urban men and women, and rural men and women. In a country where there is a strong tendency to become urban,[22] it is important to develop residential differentiation. Perhaps one of the disadvantages of doing the LLE at the national level is that individual cases at the state level are going to be missed. However, with the implementation of the regional and state level analysis, those particular cases hopefully are solved. We strongly believe that the spectrum of the entire country of Mexico is too useful to measure the state of the nation.

In the first part of our analysis, we found that residential and sex differentials are rather meaningful between urban and rural women. For example, in 1990 urban women reached 57.16 years of LLE at birth while rural women had only 39.59 years. This inconsistency accounts for nearly 18 years of LLE differentials. Meanwhile, the LLE of urban and rural men at birth were 56.74 and 44.90, respectively. Urban men had the possibility to live almost 12 years longer in a literate state than rural men. Among the four groups, the highest LLE at birth was concentrated in urban women. This group had 0.42 years more than urban men; 12.26 years more than rural men; and 17.6 years more than rural women.

Table 4. Literate Life Expectancy at birth in Mexico by sex and place of residence in 1990. Source: Calculations by the author.

POPULATION GROUP[a]	Years of LLE[b] at birth	Percentage of the total population[c]
Urban men	56.74	27.9
Rural men	44.90	21.2
Urban women	57.16	29.6
Rural women	39.56	21.3

[a] In Mexico, an urban area is a locality housing 15,000 or more inhabitants.
[b] The LLE results are based on the information of INEGI (1992b).
[c] The calculation of the urban and rural percentage was made based on INEGI (1992b) and used the urban definition of SEDESOL (1996).

From Table 4 we can estimate that in 1990, Mexico had a mean of 52.91 years of LLE at birth. We found an important difference between urban and rural areas. The mean LLE at birth of the rural areas averaged 42.23 years; in the urban areas, the mean LLE was 56.95 years. In other words, in 1990, 57.5 percent of the population of Mexico had 56.95 years of LLE at birth (urban) and 42.5 percent had only 42.23 years (rural). This empirical analysis demonstrates a very important distinction between urban and rural women. While urban women ranked higher in terms of LLE at birth, rural women represented the lagging group. Both urban men and women have the highest LLE at birth, although in the long run, urban men surpass women, because men achieve higher levels of education. Significantly, both population groups comprise almost 60 percent of the total population of Mexico, or 46,675,410 people. This aspect demonstrates the relevance of the urban areas as an engine for social development. Thirty years of LLE differential is a huge gap between rural and urban citizens. The rural population of Mexico represents almost 43 percent or 34,547,235 people of the total population.

In developing nations like Mexico, the measurement of LLE at birth is a good indicator of the quality of public health that both mothers and children receive. Urban women rank first in years of LLE at birth because they have more easy access to health services and attend school as urban men do during their first years of life. This

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[21] In the last three years Mexico has experienced two guerrilla movements, one in the state of Chiapas and most recently in the state of Guerrero. Officially, both social movements have occurred because of the poor social conditions in which many people live. However, there have been important research projects which relate the uprising of Chiapas to environmental scarcity. See for instance, Howard and Homer-Dixon (1995) .
[22] The World Urbanization Prospects estimate that in the year 2000, Mexico will have 77.7 percent of its population living in urban areas (UN 1995b, p. 83).

argument is corroborated by looking at Figure 1, which shows that urban women are better off than any other group.

Figure 1. Literate Life Expectancy at birth in Mexico by sex and place of residence in 1990.
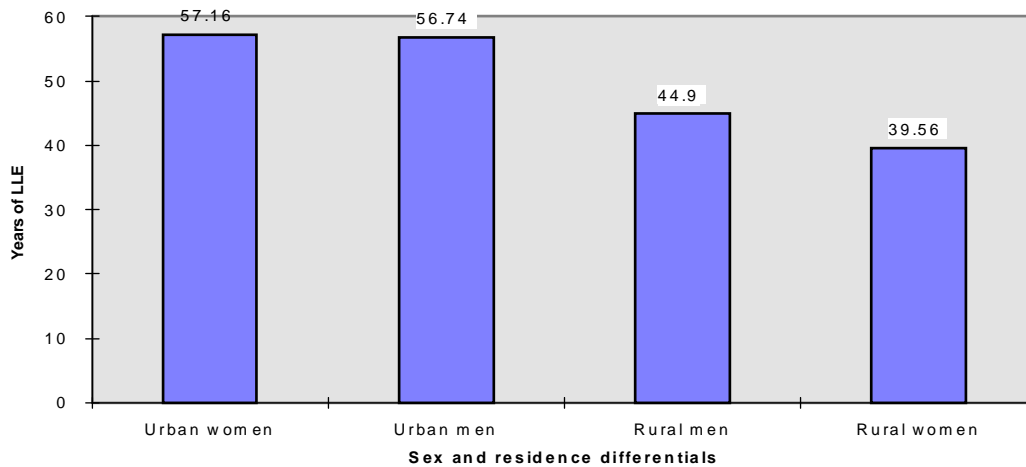
The highest LLE at birth of urban women, however, disappears over time, mainly because women drop out of school at older ages, usually after primary education. Therefore, the differences in the LLE among the four population groups are broader at the younger age groups and tend to narrow as the age groups get older.

Figure 2. Literate Life Expectancy by sex, place of residence, and age group in Mexico in 1990.
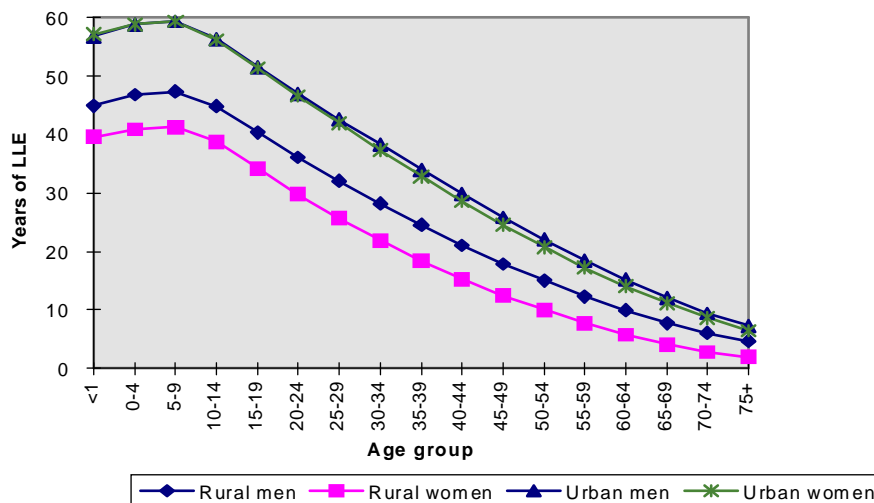

Urban men and women achieved the same levels of LLE during the early age groups but after the 15-19 age group, urban women began to drop slightly (see Figure 2). This is indicative that women are less likely to continue in higher education than urban men. Moreover, the difference of LLE at birth between rural men and women is almost five years. Interestingly, this gap remains constant in almost all age groups. It seems that rural men and women do not modify their behavior with respect to future education attainment--perhaps just to primary school--and that both have limited access to health services. Perhaps the most meaningful finding is the enormous gap of LLE at birth between rural and urban women. The difference between these groups is almost 20 years of LLE. In other words, it discloses the disadvantageous social conditions of rural women and the present and future potentiality of urban women for fostering national development. Neglecting both aspects is both unjust and inefficient.

Reviewing LLE by age group in Figure 3, we observed that urban women rank higher than any other group up to the 5-9 age group. Three conclusions can be drawn from this. First, urban women have a longer life expectancy than men and the LLE at early ages is larger for urban women than for any other group. Second, rural areas in Mexico still lack much of the basic social services of education and health. Third, the better long-run performance of men starts to differentiate from women at the 10-14 age group. Although not tested in this study, the traditional role of

women in Mexico, i.e. childbearing, might hinder them to continue studying and therefore, women's social development is reduced by their need to direct their household activities.

Figure 3. Literate Life Expectancy by age group of urban women of Mexico in 1990.
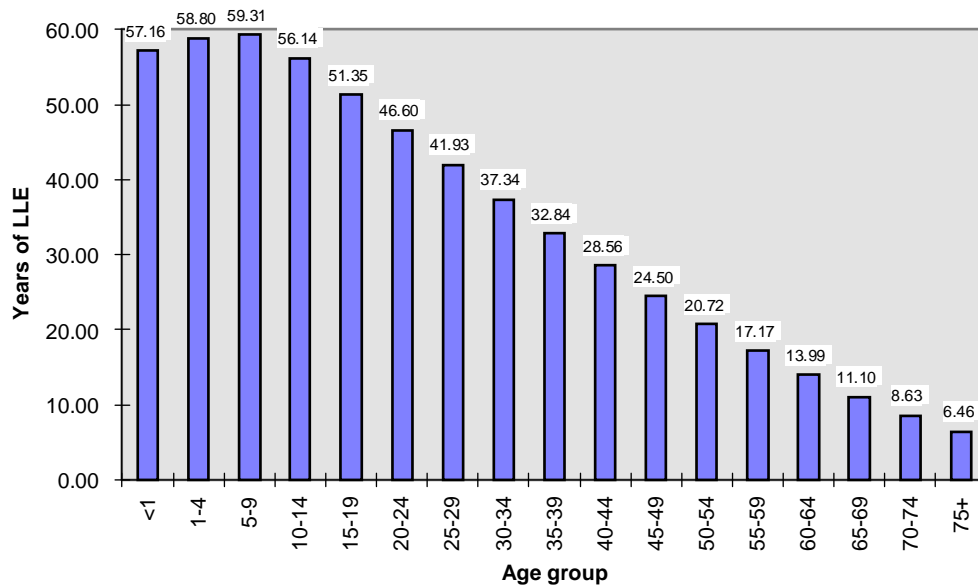
As can be seen in Figure 4, urban men kept a more even distribution among all age groups. This even distribution of LLE is probably because urban men have fewer 'reasons' to drop out of school. This is especially noticeable after the age of primary education (10-14 year group). Educational achievement makes the difference for urban men's development in the long run. Educational opportunity, training, and gender preference are among some of the causes which benefit urban men in the long run. In Mexico, as in other parts of the world, men still enjoy many more opportunities than women (UNDP 1995, p. 31). Opportunity and gender discrimination are two areas which Mexico could address strongly. The poor conditions of the rural families are worsened by gender discrimination within their rural group. Gender discrimination is deeply rooted and needs to be addressed not only in terms of delivering more educational and health services but also in terms of equal opportunity in all human activities. The sustainability[23] of rural and urban areas depends to a large extent on the full involvement of women.

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[23] The idea of having sustainable areas is derived from the Sustainable Development concept which was originally introduced by the World Commission on Environment and Development in 1987. In their report (WCED 1987), the World Commission defined sustainable development as the kind of "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (Nagpal 1995, p. 12).

**Figure 4. Literate Life Expectancy by age group of urban men
of Mexico in 1990.**
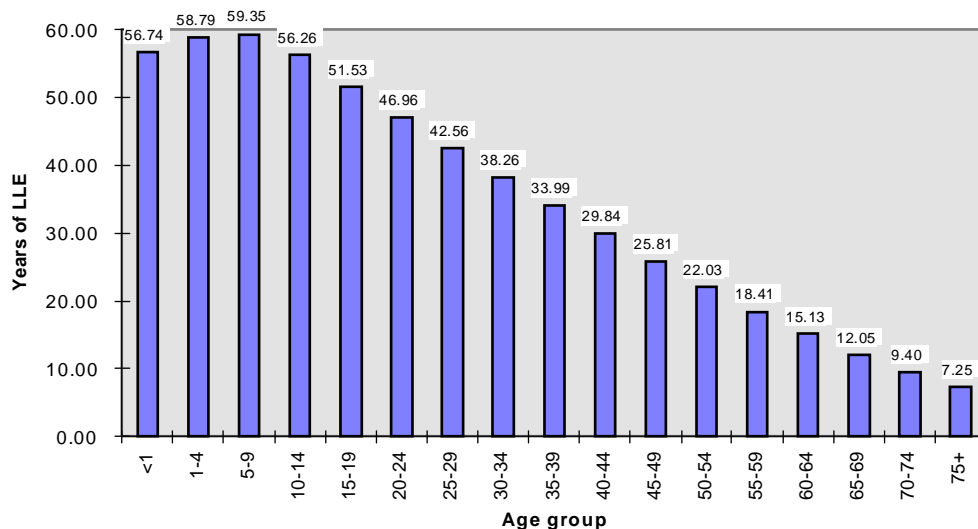
The role of women is vital for strengthening local governments and for mobilizing the community (WRI 1996, pp. 125-148). It is well known that the economic, social, political, and environmental role of women is vital for the full development of a nation, especially when governments are constrained by economic crises.
Among the rural groups, women are the most vulnerable (see Figure 5). They have the lowest level of LLE at birth, with 5.34 years less than men. Urban and rural men, however, do not have such a large LLE differentiation--although it is still meaningful. Urban men have approximately 12 years more LLE than rural men during the first six age groups. This difference narrows as the age groups get older. In general, considering the population proportion all the age groups, urban men do better than any other group. Adding the LLE of the urban men age groups, this sector of the population achieved 34.37 years of LLE, while urban women reached 33.68.[24]

**Figure 5. Literate LIfe Expectancy by age group of rural women
of Mexico in 1990.**
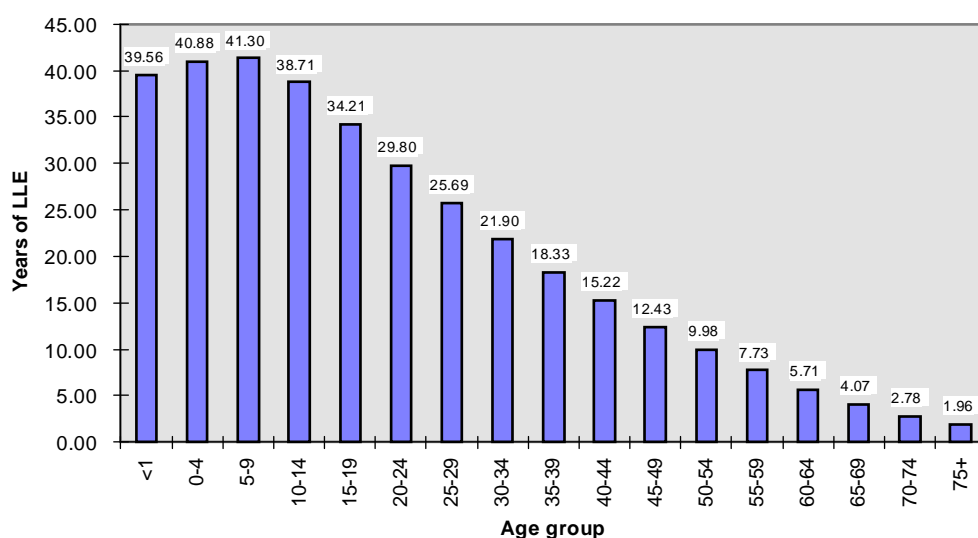
The results of Figures 1-4 illustrate that while the LLE gap between rural men and women remains constant--approximately five years--the difference between urban and rural women increases over time. That is, the younger rural generations are in more disadvantageous situations than their predecessors compared with the dwellers of

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[24] This result is drawn by adding the LLE of all age groups of urban men and urban women and dividing the result by the number of age groups. By doing this, urban men are higher than urban women by 0.69 years of LLE.

urban areas. This argument is supported by the fact that as the age groups get older, the difference diminishes. It could be interpreted in two ways: 1) that older generations of both rural and urban women had approximately the same level of opportunity for attending school and accessing health services; and 2) that younger generations of urban areas clearly have more opportunity to access educational and health services. For instance, in the age groups of < 1, 1-4, and 5-9, the LLE difference is almost 20 years, but in the oldest groups, it is only about five years. We could conclude that being born a woman in an urban or rural area may strongly predict the woman's and the family's future development.

In summary, considering the life span performance of the four groups, in 1990 urban men did better than any other group. Although urban women have the highest LLE at birth, it diminishes over time and urban men, throughout the age groups, do better than urban women. In other words, while urban men achieved 34.37 years of LLE in their life span, urban women reached only 33.68. Urban men also do better than rural men and women: while the first reached 25.86 of LLE, the second achieved only 20.59 years of LLE .[25]

5.2. Regional context

In Mexico, one of the most important social and demographic challenges is to foster regional development. The often unsolved cycle of poverty, high mortality and fertility, and early age of marriage tend to aggravate the social conditions of already impoverished regions. Although regionalization has been an overstated concept in Mexico, rarely has there been strong public and private support for such a developmental approach. With the implementation of this new methodology for measuring social development at the regional level, we hope to contribute on the one hand to strengthening the views of the importance of applying regional policies and on the other, to illustrating the different social conditions of all the regions of Mexico.

In large countries, like Mexico, cooperation between neighboring states is becoming more important in order to resolve mutual problems related to the environment, water supply, and even the application of justice. The creation of regional pacts are needed not only to reduce social inequalities and compete economically within regions of Mexico; it is fundamental to participate in the international market economy. In that context, regionalization is pivotal for achieving economic growth and social development. In Mexico, regional differences are extensive in many respects;[26] cultural, social, economic, and environmental peculiarities distinguish each region. For example, the northern states of Mexico lie on the border of the United States where technology, industrialization, and economic globalization is at its peak; meanwhile, the southern states rely heavily on an agricultural-based economy, carrying their Maya heritage. In the North social classes differentiate through their level of income; in the South, they differentiate sometimes by race.[27] Furthermore, historic regional disparities exist not only in terms of population growth but also in many other social and economic activities. Regional sociodemographic differences can be observed in Table 5.

Table 5. Regional distribution of the population of Mexico in 1990. Sources: INEGI 1995; INEGI 1993b; SEDUE 1990; and author's calculations.

Region*	Population (%)	Total regional population	Surface	Density (Inhabitants) per km^2)
Country	100.0	81,249,645	100.0	41
I North West	7.4	6,012,473	19.7	16
II North	7.1	5,768,724	26.3	11
III North East	6.6	5,362,476	7.3	37
IV North Center	11.1	9,018,710	9.5	49
V Occident	12.5	10,156,205	8.8	58
VI Center	32.0	25,999,886	4.4	300
VII Gulf Coast	9.5	7,718,716	5.0	79
VIII South Pacific	10.9	8,856,211	11.8	38

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[25] This conclusion is drawn by adding the LLE of all age groups of urban men and urban women and dividing the results by the number of age groups. By doing so, urban men are above urban women for less than one year of LLE; the only difference is 0.69 years of LLE.

[26] For example, Mexico has the largest number of ethnic groups in Latin America--in 1994 there were 56 (INEGI 1992a).

[27] For example, in the state of Chiapas race relations are more sharply defined than those of class. Unfortunately, this practice subordinates racial groups systematically at the state and national average (Howard and Homer-Dixon 1995, p. 6).

| IX Yucatan Peninsula | 2.9 | 2,356,239 | 7.2 | 17 |

*See Appendix 4 for regional breakdown.

The implementation of this regional approach provides a combined measurement of the age-specific death rates (ASDR) and the age-specific proportion literate (ASPL) for all the states of the region. The ASDR and ASPL are weighted for each age group, so that the LLE of the region is generated as if it were one state. This process allows an analysis across regions.

For the purpose of this analysis, the nine regions are (see also Appendix 4): (1) North West: Baja California, Baja California Sur, Sonora, and Sinaloa; (2) North: Chihuahua, Durango, and Coahuila; (3) North East: Nuevo Leon and Tamaulipas; (4) North Center: Zacatecas, Aguascalientes, San Luis Potosi, Guanajuato, and Queretaro; (5) Occident: Nayarit, Jalisco, Colima, and Michoacan; (6) Center: Federal District[28] and the states of Mexico, Morelos, Tlaxcala, Hidalgo, and Puebla; (7) Gulf Coast: Veracruz and Tabasco; (8) South Pacific: Guerrero, Oaxaca, and Chiapas; and finally, (9) Yucatan Peninsula: Yucatan, Campeche, and Quintana Roo.

The measurement of the LLE indicator at the regional level is an important tool for fostering regional development. Mexico's open economy and increasing plural society encourage regions to compete among each other for foreign capital, international research projects, governmental assistance and even political autonomy. Regional population policies are of particular importance in Mexico to reduce historical social inequities, particularly in rural zones such as South Pacific, Gulf Coast, and the Yucatan Peninsula.

The implementation of this new approach provides a combined measurement of the state members of the region by adding the LLE of each age group of the states into one region. The results of these regional differentials can be seen in Table 6.

Table 6. Average Literate Life Expectancy at birth of men and women of Mexico by region in 1990.* Source: Calculations by the author.

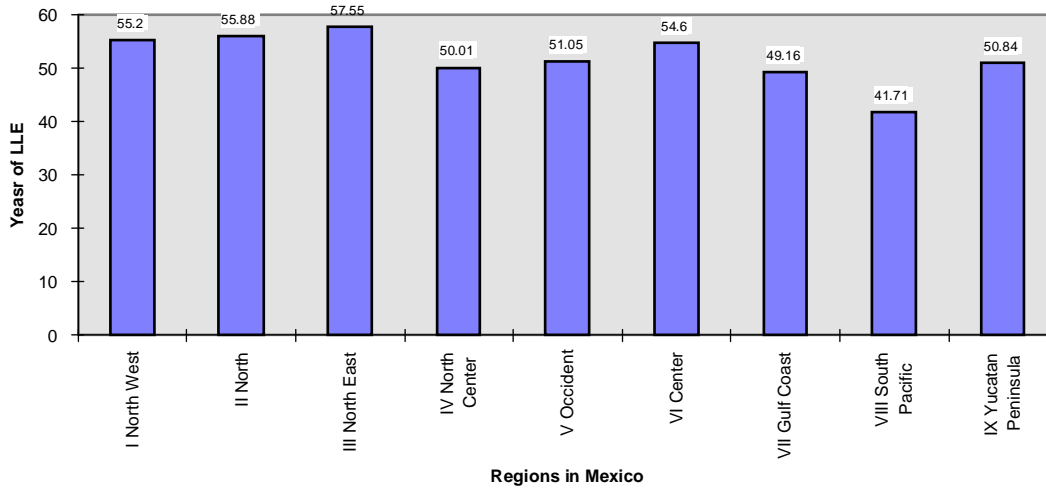| Region	Average Literacy Life Expectancy of Men at Birth in 1990	Regional Ranking at the National Level (Men)	Average Literacy Life Expectancy of Women at Birth in 1990	Regional Ranking at the National Level (Women)
I North West	55.20	3	59.05	3
II North	55.88	2	59.88	2
III North East	57.55	1	60.36	1
IV North Center	50.01	7	48.62	7
V Occident	51.05	5	52.79	5
VI Center	54.05	4	53.43	4
VII Gulf Coast	49.16	8	45.54	8
VIII South Pacific	41.71	9	34.65	9
IX Yucatan Peninsula	50.84	6	49.84	6

* In Appendix 5, the results of the LLE by age group for each region for both men and women are shown.

The distribution of LLE by region demonstrates two relevant issues: first, the significance of the three regions localized in the northern part of Mexico (North East, North West, and North) which placed first, second, and third, respectively, in both men and women's groups. Second, it highlights the disadvantageous social conditions of all the southern parts of the nation, in particular the South Pacific zone.

As can be seen in Figure 6, men from the North East region ranked higher than any other area; they achieved almost 16 years more of LLE at birth than the lowest South Pacific region, and 1.67 years more than the nearest group, the North region. The North and North West regions held the second and third best social conditions, respectively.
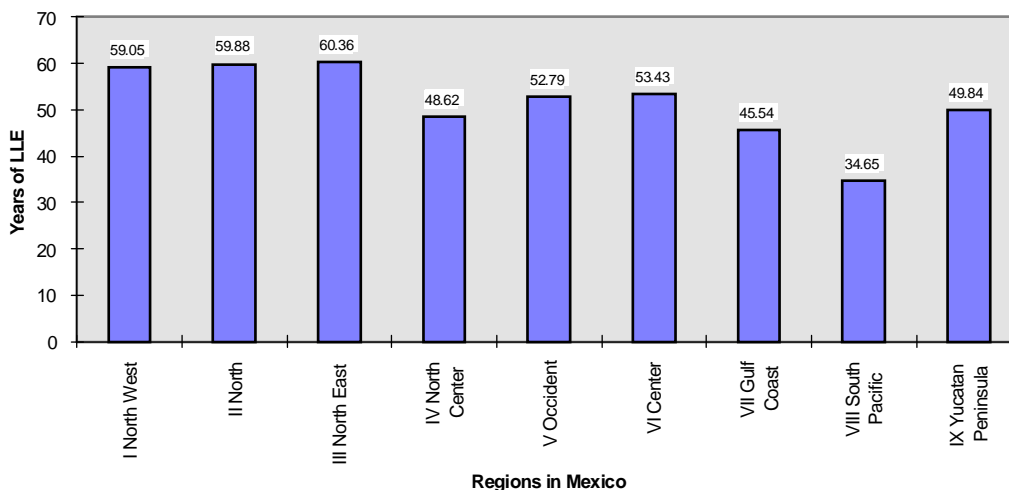
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[28] It is important to note that although the Federal District is not officially an administrative and constitutional state, for statistical purposes, it is considered in the census as if it were a state.

**Graph 6. Literate Life Expectancy of men at birth
by region in Mexico in 1990.**

The y-axis is labeled "Yeasr of LLE" ranging from 0 to 60. The x-axis is labeled "Regions in Mexico" with values:
- I North West: 55.2
- II North: 55.88
- III North East: 57.55
- IV North Center: 50.01
- V Occident: 51.05
- VI Center: 54.6
- VII Gulf Coast: 49.16
- VIII South Pacific: 41.71
- IX Yucatan Peninsula: 50.84

Women from the North East region have the largest level of social development at birth. Within the leading North East region women outbid men by almost three years more of LLE at birth (see Figure 7).

**Graph 7. Literate Life Expectancy of women at birth
by region in Mexico in 1990.**

The y-axis is labeled "Years of LLE" ranging from 0 to 70. The x-axis is labeled "Regions in Mexico" with values:
- I North West: 59.05
- II North: 59.88
- III North East: 60.36
- IV North Center: 48.62
- V Occident: 52.79
- VI Center: 53.43
- VII Gulf Coast: 45.54
- VIII South Pacific: 34.65
- IX Yucatan Peninsula: 49.84

The precarious conditions of the entire southern part of Mexico should bring awareness to the local governments and to the entire nation. The South Pacific region has the lowest LLE for both women and men. It is relevant to see that women from the North East region--the highest group--have almost twice as much LLE at birth as the women from the South Pacific region. Between men from the northern and southern regions, there are also relevant social differences. Men from the South Pacific region are lagging almost 20 years behind those with the highest years of LLE at birth. In short, the three regions of the southern part of Mexico have the lowest LLE at birth in both female and male groups.

Since the three regions from the center of the nation--North Center, Occident, and Center-- have a more even distribution of LLE, there are not many relevant aspects on which to comment. Men and women of these three regions differentiate for no more than four and five years of LLE at birth, respectively.

On the whole, the regionalization of the LLE social development indicator supports the results of the analysis at the national level. That is, while women from the most developed areas of the North are better off than men, in the less advanced regions of the South, women are lagging behind. The urban areas from the North are considerably better off than the southern regions. In sum, the regionalization of the LLE indicator provide rich meaning for policy purposes at the regional and national level. Targeting the right region with educational and health services programs is pivotal for achieving a balanced national development. Social justice is based on equal opportunity to access education and basic health services.

5.3. State context

The analysis of social development at the state level is perhaps the most relevant. Measuring the LLE at the state level not only highlights the social conditions of each state within the region but it also allows to disentangle many social differences that are more difficult to find with the national and regional analyses. Local social initiatives are more effective than national programs insofar as the local governments have more possibilities to direct and supervise the policies. In Mexico, with the new reform of the State underway, educational and health services depend upon the local authorities. In that sense, the decentralization of social services is relevant in two respects: first, local governments will have the autonomy to dictate and supervise their priorities and at the same time, local authorities will have the opportunity to motivate the society to take a more active role. Yet community intervention is by no means a substitute for government intervention. Second, the level of accountability will be greater for both local officials and members of the community. The increasing economic difficulties make accountability a very important issue for avoiding mismanagement and corruption.

An empirical analysis of the LLE at the state level brings more accuracy into the measurement of social development of Mexico and thus into our conclusions. The different levels of analysis serve different goals. While at the national level, we obtained a global picture of Mexico in terms of social development by sex and residential differential, at the regional level, we focused on regional distribution of men and women. With the state-level analysis, however, we were particularly interested in finding those social differentials which were overlooked at the national and regional levels.

As we can observe in Table 7, some previous conclusions that we reached at the regional level, e.g. that women and men from the North West region had the highest LLE at birth, are redefined by the state-level analysis. For example, the state analysis uncovers that women and men from the Federal District have the highest level of LLE not only at birth but also throughout the age groups. By combining the ASMR and the ASPL of the states members of one region, individual performances are combined with the other states. In other words, when we added the LLE results of the Federal District and other states of its region, the Federal District's performance diminished.

Table 7. Literate Life Expectancy at birth for women and men of Mexico at the state level in 1990. Source: Calculations by the author.

| State*	LLE of men at birth in 1990	Ranking at the national level	LLE of women at birth in 1990	Ranking at the nation level
Aguascalientes	55.46	9	57.59	10
Baja California	58.31	3	61.60	2
Baja California S.	57.34	4	60.88	4
Campeche	50.37	22	48.66	21
Coahuila	57.00	5	60.21	7
Colima	52.77	14	55.72	13
Chiapas	40.96	32	32.45	32
Chihuahua	55.82	8	60.34	6
Federal District	60.39	1	62.13	1
Durango	54.33	11	58.71	9
Guanajuato	48.54	26	46.29	25
Guerrero	41.31	31	37.29	30
Hidalgo	46.75	29	42.30	29
Jalisco	53.64	13	56.16	11
State of Mexico	54.83	10	52.15	16
Michoacan	46.87	28	46.69	24
Morelos	52.54	15	51.68	17
Nayarit	51.21	20	54.98	14
Nuevo Leon	58.58	2	61.55	3
Oaxaca	42.73	30	34.79	31
Puebla	47.49	27	42.84	28
Queretaro	49.10	24	44.83	27
Quintana Roo	51.42	19	49.75	20
San Luis Potosi	49.84	23	48.52	22
Sinaloa	51.81	18	55.84	12
Sonora	56.27	6	60.52	5
Tabasco	51.86	17	48.08	23
Tamaulipas	56.13	7	58.78	8
Tlaxcala	53.72	12	49.90	19
Veracruz	48.58	25	45.01	26
Yucatan	50.79	21	49.97	18
Zacatecas	52.34	16	53.81	15

* Listed in alphabetical order.
With the state-level analysis, it became clear that the Federal District's LLE is greater than any other state of Mexico. It ranks first with an average of 61.26 years of LLE at birth for both men and women.[29] Incidentally, in 1990, 99.7 percent of the total population of the Federal District lived in urban areas. In addition, the state of Nuevo Leon was second with an average of 60.06 years of LLE at birth for both sexes, and the state of Baja California third with 59.95 years of LLE average for both sexes. Interestingly, while Nuevo Leon is ahead of Baja

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[29] In 1990, the Federal District represented 10.13 percent of the total population of Mexico (INEGI 1992a).

California in the men's group, the opposite order occurs within the women's group.[30] Importantly, Nuevo Leon and Baja California had 92 and 90 percent of their total population living in urban areas, respectively.

It is also valuable to note the relevant role of the state of Baja California Sur. This northern state places fourth in both females and males, and on average has 59.11 years of LLE at birth. Compared with the previous three states, Baja California Sur has a rather small population: in 1990, it had only 317,764 inhabitants, of which 78 percent was urban.

Revising the LLE results of the states showing the lowest levels of social development, we corroborated our previous findings of the poor conditions in the South Pacific region, which has the lowest levels of LLE at birth. The average LLE of females and males at birth were 36.7 for Chiapas, 38.76 for Oaxaca, and 39.3 for Guerrero. Not surprisingly, in 1990 these states were mainly rural: 60.5 percent Oaxaca, 59.6 percent Chiapas, and 47.7 percent Guerrero. Among other relevant findings, perhaps the most striking are the poor conditions of social development in which rural women live. Figure 8 describes the enormous differences in social conditions and opportunities between urban and rural women.

Figure 8. Literate Life Expectancy at birth of urban and rural women of Mexico in 1990.
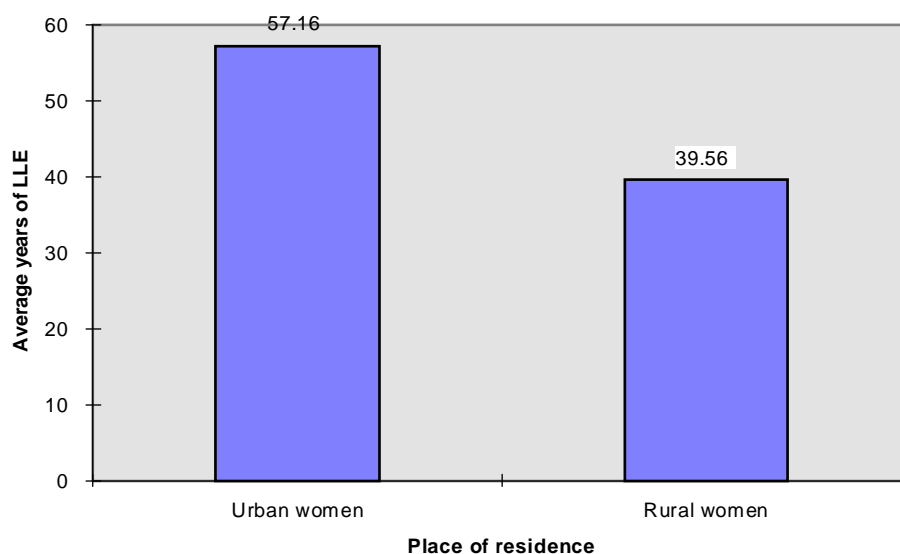
While women have the highest LLE at birth in the most urbanized area of Mexico--the Federal District--they have the lowest LLE at birth in the mainly rural state of Chiapas. In 1990, 99.7 percent of the women in the Federal District were living in urban areas and 58.5 percent of the women in Chiapas were residing in rural areas.[31] The conditions of social development between urban and rural women are less evenly distributed than for men.

The state-level analysis triggers many other relevant results which are peculiar to each state. For example, besides the cases of Chiapas, Oaxaca, and Guerrero, the states of Hidalgo, Puebla, Veracruz, Michoacan, and Guanajuato are in need of immediate attention. These states have very significant low levels of social development. Importantly, a general trend of the state-level analysis was that while the most urban states resulted in the highest levels of LLE, the most rural states appeared to have the lowest levels of LLE.

There are four states which appear to escape this general positive correlation between urbanization and higher levels of LLE at birth: Baja California Sur, Durango, and Zacatecas, which do not have high levels of urbanization but still rank above the national average in social development; and the state of Mexico, which stands a little above the national LLE average, although almost 72 percent of its population live in urban areas. In the state of Mexico, the continuous migratory waves might explain this inconsistency, especially since large portions of the immigrants come from rural areas.[32]

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[30] In 1990, the Federal District had a population of 8,235,744; the state of Nuevo Leon had 3,098,736 inhabitants; the state of Baja California had 1,660,855 inhabitants. See Appendix 1 for the states' total population (INEGI 1992a).

[31] Appendix 5 shows a full urban and rural population distribution for men and women at the state level.

[32] For instance, Unikel (1978, p. 213) explains that in Mexico, 4.5 million people from rural areas moved to urban areas in only 20 years (1950-1970). The central region of Mexico, which includes the state of Mexico, was the main center of attraction, if not the principal.

Both exceptions need to be evaluated closely to find alternative explanations to these two cases. In summary, we believe that the LLE approach to measure social development does indeed pay attention to issues of equity, poverty, and gender. Moreover, further analysis is required at the state level to gather important pieces of information for each state in areas such as environment, crime, health services, and questions of equity within the states in particular. In Table 8, we have ranked the states of Mexico by their level of social development and their urbanization conditions.

Table 8. Average levels of LLE of men and women at birth, and urbanization percentage at the state level in Mexico in 1990. Source: Calculations by the author.

State	Average years of LLE at birth of men and women	Percentage of population living in urban areas	Ranking of urbanization percentage
1. Federal District	61.26	98.26	1
2. Nuevo Leon	60.06	87.15	2
3. Baja California	59.95	82.47	3
4. Baja California Sur	59.11	59.28	13
5. Coahuila	58.60	79.69	4
6. Sonora	58.39	67.23	10
7. Chihuahua	58.08	69.30	7
8. Tamaulipas	57.45	73.37	5
9. Durango	56.52	43.71	20
10. Aguascalientes	56.52	68.41	8
11. Jalisco	54.90	67.41	9
12. Colima	54.24	66.87	11
13. Sinaloa	53.82	47.77	18
14. State of Mexico	53.49	71.29	6
15. Nayarit	53.09	38.47	25
16. Zacatecas	53.07	25.80	29
17. Morelos	52.11	55.41	15
18. Tlaxcala	51.81	35.19	27
19. Quintana Roo	50.58	59.96	12
20. Yucatan	50.38	55.71	14
21. Tabasco	49.97	31.68	28
22. Campeche	49.51	51.04	17
23. San Luis Potosi	49.18	43.22	21
24. Guanajuato	47.41	53.65	16
25. Queretaro	46.96	46.55	19
26. Veracruz	46.79	39.15	24
27. Michoacan	46.78	40.56	22
28. Puebla	45.16	40.31	23
29. Hidalgo	44.52	25.71	30
30. Guerrero	39.30	35.64	26
31. Oaxaca	38.76	19.93	32
32. Chiapas	36.70	23.46	31

6. Conclusions

The use of the Literate Life Expectancy (LLE) approach proved to be an innovative systems analysis tool for measuring social development. The implementation of this new empirical method demonstrated significant social differences in Mexico based on age group, sex, residential locality, and geographical location. At the national level, the study highlighted the need for more education and health services for rural men and women. In 1990, the average LLE at birth in Mexico was 52.91 years. Particular attention must be given to the rural areas which are the most in need. In 1990, 42.5 percent of the population of Mexico, or 34,547,235 rural dwellers, comprised the group in immediate need of the basic social services of education and health. Rural inhabitants had 42.23 years of LLE at birth. Importantly, 46,675,410 urban inhabitants of Mexico, or 57.2 percent of its total population, achieved higher levels of social development with 56.95 years of LLE at birth. Simultaneously, women seem to be both the leading and the lagging group. While urban women had the highest LLE at birth (57.16 years), rural women obtained the lowest level (39.56 years) of social development. Their difference accounts for almost 20 years of LLE at birth. Compared with the existing gap of LLE between urban and rural women, the LLE difference between urban and rural men is less dramatic. Urban men have 11.84 years more of LLE at birth than rural men. However, this difference is still very significant.

Applying the LLE indicator by regions in Mexico, our study demonstrates the importance of the northern regions, in particular, the leading role of the North West region for both men and women. The three northern regions obtained the three highest LLE years at birth. There might be important aspects to be learned from the northern regions in order to foster social development nationwide. Furthermore, we distinguished less social inequities between men and women in the central regions of Mexico. On the contrary, the largest gap between men and women was detected in the South Pacific region--the region with the lowest LLE at birth for both sexes. In sum, the empirical use of LLE pointed to the urgent need of providing more attention to the southern part of Mexico. The three regions of the southern part of the nation require extensive investment in social services.

At the state level, we draw other relevant and more accurate conclusions. On the one hand, the study showed the preeminent role of urban localities as more efficient centers in the distribution of health and education services. The leading role of the Federal District and the states of Nuevo Leon, Baja California, and Baja California Sur demonstrate this argument. On the other hand, the study underlines the unfortunate living conditions of the urban and rural population of Chiapas, Oaxaca, and Guerrero. These three states have the lowest LLE at birth in both men and women. Particularly relevant is the finding of rural women who are the more neglected group. Further analysis is required to find out more about the states of Baja California Sur, Zacatecas, Durango, and the state of Mexico, which do not have an obvious positive correlation of urbanization and levels of social development.

The national, regional, and state conclusions direct our attention to some other relevant issues in which further empirical analysis is needed. Social development is interrelated with a set of other important factors which involve the daily activities of human beings. Urban dwellers appear to be taking advantage of education, health and other social services.

Almost 8 out of every 10 Mexicans will live in urban areas in the year 2000 (UN 1995b, p. 83). Cities embody the hope of social and economic development. As Eugene Lieden describes it:

> ...cities are the prism of the genius of civilizations...where entrepreneurs hatch their schemes and find the markets and financing to bring them to fruition, where the elites of technology, industry, and the arts meet to brainstorm, and where deep shifts in culture and politics might begin with an unexpected encounter... (Lieden 1996, p. 61).

Although statistically urban areas depict a promising future for humanity, they can also be a nightmare for our future well-being. Urban environments have many dysfunctional social, economic, and environmental consequences which make our economic and social development more difficult. The urban environment is intrinsically related to the social, economic, political, and also institutional and physical characteristics of the ecosystems that surround and influence our everyday lives.[33]

Although we appreciate the important progress in urban areas, there are many social, health, and environmental threats that urban dwellers have to face daily: lack of access to clean drinking water, air pollution, greenhouse emissions, psychological stress, and most importantly, urban poverty and family disintegration. Historically, poverty has been nurtured in rural areas, but as Mexico becomes more urban, poverty is becoming an urban phenomenon. Explosive urban growth tends to perpetuate and extend social inequities. As the quality of life of the urban poor has been declining (Laquian 1994, p. 192), the concern over social and welfare impact of urban areas increases.

In summary, Mexico's twofold agenda for nurturing social and economic growth and promoting sustainable development strategies in the rural and urban areas presents the opportunity to promote a more equitable, just, and

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[33] For further advancement of this idea, see Bartone (1990).

fair society; this might be achieved by giving emphasis to health and education. The urban environment is not the future of Mexico; it is today's reality.

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Appendix 1. Political division of the United Mexican States and its population and density distribution by state in 1990

U N I T E D   S T A T E S

2

26

Rio Grande

8

5

GULF OF CALIFORNIA

25

3

10

19

GULF OF MEXICO

32

28

24

18

1

PACIFIC
OCEAN

11

22

13

29

BAY OF
CAMPECHE

31

14

6

16

15

4

23

Gulf of Honduras

17

21

30

27

9

12

20

7

CENTRAL
AMERICA

Gulf of Tehuantepec

1. Aquascalientes	9. Federal District	17. Morelos	25. Sinaloa
2. Baja California	10. Durango	18. Nayarit	26. Sonora
3. Baja California Sur	11. Guanajuato	19. Nuevo León	27. Tabasco
4. Campeche	12. Guerrero	20. Oaxaca	28. Tamaulipas
5. Coahuila	13. Hidalgo	21. Puebla	29. Tlaxcala
6. Colima	14. Jalisco	22. Querétaro	30. Veracruz
7. Chiapas	15. State of Mexico	23. Quintana Roo	31. Yucatán
8. Chihuahua	16. Michoacán	24. San Luis Potosi	32. Zacatecas

Population and density by state in 1990. Source: INEGI 1992a.

Federal Entity	Population 1990	Density (Inhabitants per km^2)
United Mexican States	81 249 645	41
1. Federal District	8 235 744	5 494
2. State of Mexico	9 815 795	457
3. Morelos	1 195 059	242
4. Tlaxcala	761 277	195
5. Guanajuato	3 982 593	130
6. Aguascalientes	719 659	129
7. Puebla	4 126 101	122
8. Hidalgo	1 888 366	90
9. Queretaro	1 051 235	89
10. Veracruz	6 228 239	86
11. Colima	428 510	79
12. Jalisco	5 302 689	66
13. Tabasco	1 501 744	61
14. Michoacan	3 548 199	59
15. Nuevo Leon	3 098 376	48
16. Chiapas	3 210 496	43
17. Guerrero	2 620 637	41
18. Sinaloa	2 204 054	38
19. Yucatan	1 362 940	35
20. Oaxaca	3 019 560	32
21. San Luis Potosi	2 003 187	32
22. Nayarit	824 643	30
23. Tamaulipas	2 249 581	28
24. Baja California	1 660 855	24
25. Zacatecas	1 276 323	17
26. Coahuila	1 972 340	13
27. Durango	1 349 378	11
28. Quintana Roo	493 277	10
29. Sonora	1 823 606	10
30. Chihuahua	2 441 873	10
31. Campeche	535 185	10
32. Baja California Sur	317 764	4

Appendix 2. Estimates of Age-Specific Death Rates (ASDR) of men and women from rural and urban areas of Mexico in 1990

Age group	<1 year	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	45-49 years	50-54 years	55-59 years	60-64 years	65-69 years	70-74 years	75 + years
	37.7	2.5	0.7	0.6	1.4	2.3	2.9	3.3	4.1	5.1	7	9.2	13.8	18	27.2	37.5	89.126675
Urban male	35.587021	2.359882	0.660767	0.5663717	1.3215339	2.1710914	2.7374631	3.1150442	3.8702065	4.8141593	6.6076696	8.6843658	13.026549	16.99115	25.675516	35.39823	84.131375
Rural male	41.70354	2.7654867	0.7743363	0.6637168	1.5486726	2.5442478	3.2079646	3.6504425	4.5353982	5.6415929	7.7433628	10.176991	15.265487	19.911504	30.088496	41.482301	98.591455
	29.8	2.3	0.5	0.4	0.6	0.8	0.9	1.2	1.8	2.5	3.6	5.4	8.9	12.5	20.1	29.3	81.555085
Urban female	28.326996	2.1863118	0.4752852	0.3802281	0.5703422	0.7604563	0.8555133	1.1406844	1.7110266	2.3764259	3.4220532	5.1330798	8.460076	11.882129	19.106464	27.851711	77.523845
Rural female	32.859316	2.5361217	0.5513308	0.4410646	0.661597	0.8821293	0.9923954	1.3231939	1.9847909	2.756654	3.9695817	5.9543726	9.8136882	13.78327	22.163498	32.307985	89.92766

Projected adjustment of the Demographic Yearbook 1988 (UN 1990, p. 490). Mexico Rural and urban population of 1979.

Total male death rates in 1990 6.0; adjusted urban male for 1990 5.66 and adjusted rural males for 1990 6.64.

Total female death rates in 1990 4.4; adjusted urban female for 1990 4.18 and adjusted rural female for 1990 4.85.

Calculating the urban male formula: 6.0(6.4/6.78) and the rural male formula: 6.0(7.5/6.78).

Calculating the urban female formula: 4.4(5.0/5.26) and the rural female formula: 4.4(5.8/5.26).

Appendix 3. Literate Life Tables for Mexico

Male urban 1990.

Age	m(x)	q(x)	P(x)	I(x)	L(x)	T(x)	e(x)	PLx	LLx	LTx	Le(x)
<1	35.58702065	0.035	0.965	100000	97545	6990189	69.90	0	0	5673716	56.74
1-4	2.36	0.009	0.991	96504	383830	6892643	71.42	0	0	5673716	58.79
5-9	0.66	0.003	0.997	95597	477117	6508813	68.09	0.655999	312988	5673716	59.35
10-14	0.57	0.003	0.997	95282	475761	6031696	63.30	0.976521	464591	5360728	56.26
15-19	1.32	0.007	0.993	95012	473559	5555935	58.48	0.979772	463980	4896137	51.53
20-24	2.17	0.011	0.989	94386	469486	5082376	53.85	0.976298	458358	4432158	46.96
25-29	2.74	0.014	0.986	93367	463790	4612890	49.41	0.970619	450164	3973800	42.56
30-34	3.12	0.015	0.985	92098	457074	4149100	45.05	0.966091	441575	3523636	38.26
35-39	3.87	0.019	0.981	90675	449202	3692026	40.72	0.953525	428326	3082061	33.99
40-44	4.81	0.024	0.976	88937	439607	3242824	36.46	0.938321	412493	2653735	29.84
45-49	6.61	0.033	0.967	86821	427335	2803217	32.29	0.915118	391062	2241243	25.81
50-54	8.68	0.042	0.958	84000	411431	2375881	28.28	0.897476	369249	1850181	22.03
55-59	13.03	0.063	0.937	80430	389973	1964451	24.42	0.874677	341100	1480932	18.41
60-64	16.99	0.081	0.919	75356	362043	1574478	20.89	0.844316	305679	1139832	15.13
65-69	25.68	0.121	0.879	69215	326037	1212435	17.52	0.804101	262167	834153	12.05
70-74	35.40	0.163	0.837	60866	280575	886398	14.56	0.721231	202360	571986	9.40
75+	84.13	0.348	0.652	50969	605823	605823	11.89	0.610123	369626	369626	7.25

Female urban 1990.

Age	m(x)	q(x)	P(x)	I(x)	L(x)	T(x)	e(x)	PLx	LLx	LTx	Le(x)
<1	28.3269962	0.028	0.972	100000	97972	7580406	75.80	0	0	5715554	57.16
1-4	2.19	0.009	0.991	97207	386806	7482434	76.97	0	0	5715554	58.80

Age	m(x)	q(x)	P(x)	I(x)	L(x)	T(x)	e(x)	PLx	LLx	LTx	Le(x)
5-9	0.48	0.002	0.998	96360	481173	7095628	73.64	0.662522	318788	5715554	59.31
10-14	0.38	0.002	0.998	96132	480221	6614455	68.81	0.978098	469703	5396766	56.14
15-19	0.57	0.003	0.997	95949	479090	6134234	63.93	0.978624	468849	4927063	51.35
20-24	0.76	0.004	0.996	95676	477508	5655144	59.11	0.96657	461545	4458214	46.60
25-29	0.86	0.004	0.996	95313	475588	5177636	54.32	0.952261	452884	3996669	41.93
30-34	1.14	0.006	0.994	94906	473235	4702048	49.54	0.938953	444345	3543785	37.34
35-39	1.71	0.009	0.991	94366	469902	4228814	44.81	0.908942	427114	3099440	32.84
40-44	2.38	0.012	0.988	93562	465159	3758912	40.18	0.876195	407570	2672327	28.56
45-49	3.42	0.017	0.983	92457	458522	3293752	35.62	0.832078	381526	2264756	24.50
50-54	5.13	0.025	0.975	90889	448916	2835231	31.19	0.806839	362203	1883230	20.72
55-59	8.46	0.041	0.959	88586	434121	2386315	26.94	0.768109	333452	1521028	17.17
60-64	11.88	0.058	0.942	84916	412821	1952194	22.99	0.724767	299199	1187576	13.99
65-69	19.11	0.091	0.909	80017	382573	1539373	19.24	0.682312	261034	888377	11.10
70-74	27.85	0.130	0.870	72721	340882	1156800	15.91	0.641132	218550	627342	8.63
75+	77.52	0.325	0.675	63253	815918	815918	12.90	0.501021	408792	408792	6.46

Male rural 1990.

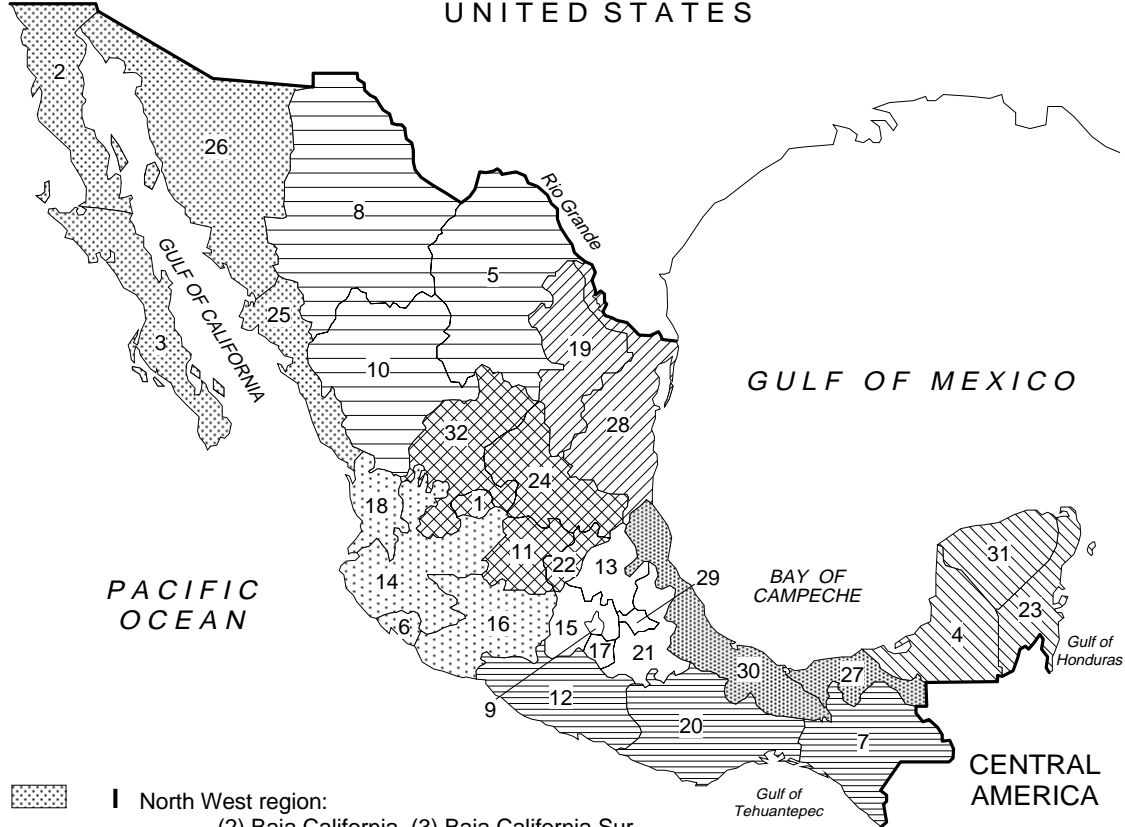| Age	m(x)	q(x)	P(x)	I(x)	L(x)	T(x)	e(x)	PLx	LLx	LTx	Le(x)
<1	41.70353982	0.041	0.959	100000	97251	6683468	66.83	0	0	4489597	44.90
0-4	2.77	0.011	0.989	95915	381086	6586218	68.67	0	0	4489597	46.81
5-9	0.77	0.004	0.996	94860	473290	6205132	65.41	0.53289	252212	4489597	47.33
10-14	0.66	0.003	0.997	94493	471714	5731842	60.66	0.91902	433515	4237385	44.84
15-19	1.55	0.008	0.992	94180	469157	5260128	55.85	0.91851	430925	3803870	40.39
20-24	2.54	0.013	0.987	93454	464433	4790971	51.27	0.895083	415706	3372945	36.09
25-29	3.21	0.016	0.984	92272	457837	4326538	46.89	0.862039	394674	2957239	32.05
30-34	3.65	0.018	0.982	90804	450078	3868701	42.60	0.842005	378968	2562566	28.22

age	m(x)	q(x)	P(x)	I(x)	L(x)	T(x)	e(x)	PLx	LLx	LTx	Le(x)
35-39	4.54	0.022	0.978	89162	441010	3418623	38.34	0.793173	349797	2183597	24.49
40-44	5.64	0.028	0.972	87162	429993	2977613	34.16	0.747283	321327	1833800	21.04
45-49	7.74	0.038	0.962	84738	415965	2547620	30.06	0.701509	291803	1512474	17.85
50-54	10.18	0.050	0.950	81519	397889	2131655	26.15	0.67295	267759	1220671	14.97
55-59	15.27	0.074	0.926	77474	373701	1733766	22.38	0.654541	244602	952911	12.30
60-64	19.91	0.095	0.905	71778	342554	1360065	18.95	0.596696	204400	708309	9.87
65-69	30.09	0.140	0.860	64971	303038	1017512	15.66	0.54321	164613	503909	7.76
70-74	41.48	0.188	0.812	55880	254199	714474	12.79	0.50123	127412	339296	6.07
75+	98.59	0.395	0.605	45379	460275	460275	10.14	0.460341	211884	211884	4.67

Female rural 1990.

age	m(x)	q(x)	P(x)	I(x)	L(x)	T(x)	e(x)	PLx	LLx	LTx	Le(x)
<1	32.85931559	0.032	0.968	100000	97881	7312879	73.13	0	0	3956109	39.56
0-4	2.54	0.010	0.990	96767	384649	7214999	74.56	0	0	3956109	40.88
5-9	0.55	0.003	0.997	95790	478227	6830349	71.31	0.539232	257875	3956109	41.30
10-14	0.44	0.002	0.998	95527	477129	6352122	66.50	0.916604	437338	3698233	38.71
15-19	0.66	0.003	0.997	95316	475826	5874993	61.64	0.903225	429778	3260895	34.21
20-24	0.88	0.004	0.996	95002	474004	5399167	56.83	0.847334	401640	2831117	29.80
25-29	0.99	0.005	0.995	94583	471794	4925162	52.07	0.779884	367944	2429477	25.69
30-34	1.32	0.007	0.993	94115	469087	4453369	47.32	0.742058	348090	2061532	21.90
35-39	1.98	0.010	0.990	93495	465258	3984282	42.62	0.655424	304941	1713442	18.33
40-44	2.76	0.014	0.986	92571	459816	3519024	38.01	0.594252	273247	1408501	15.22
45-49	3.97	0.020	0.980	91304	452215	3059208	33.51	0.53473	241813	1135255	12.43
50-54	5.95	0.029	0.971	89510	441247	2606993	29.13	0.503639	222229	893442	9.98
55-59	9.81	0.048	0.952	86884	424433	2165746	24.93	0.468127	198689	671213	7.73
60-64	13.78	0.067	0.933	82723	400388	1741312	21.05	0.395538	158369	472524	5.71

65-69	22.16	0.105	0.895	77212	366602	1340925	17.37	0.33213	121759	314155	4.07
70-74	32.31	0.149	0.851	69105	320734	974323	14.10	0.24013	77018	192396	2.78
75+	89.93	0.367	0.633	58776	653589	653589	11.12	0.17653	115378	115378	1.96

Appendix 4. The United Mexican States by region and Literate Life Expectancy by age group for each region
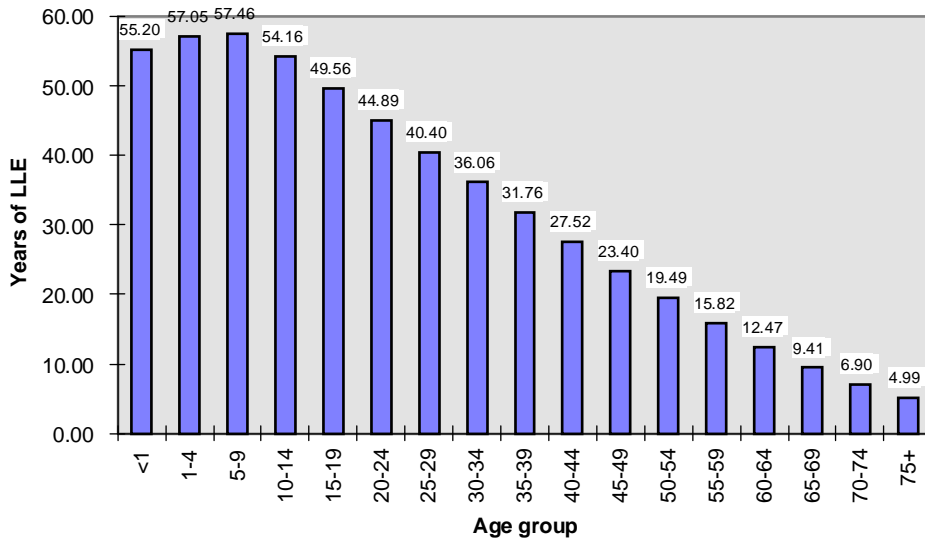

Literate Life Expectancy of men and women of Mexico by region in 1990.

I) <u>North West Region</u>

Literate Life Expectancy of men from the North West region of Mexico in 1990.

Literate Life Expectancy of women from the North West region of Mexico in 1990.
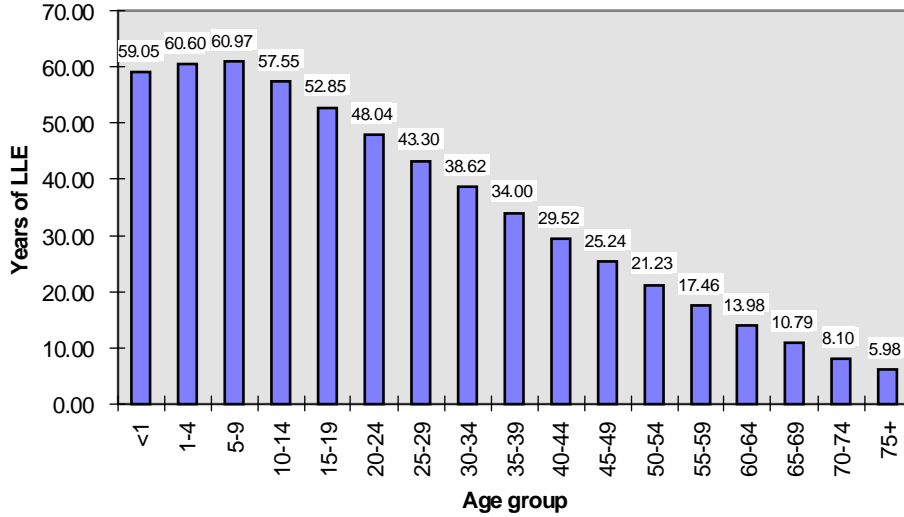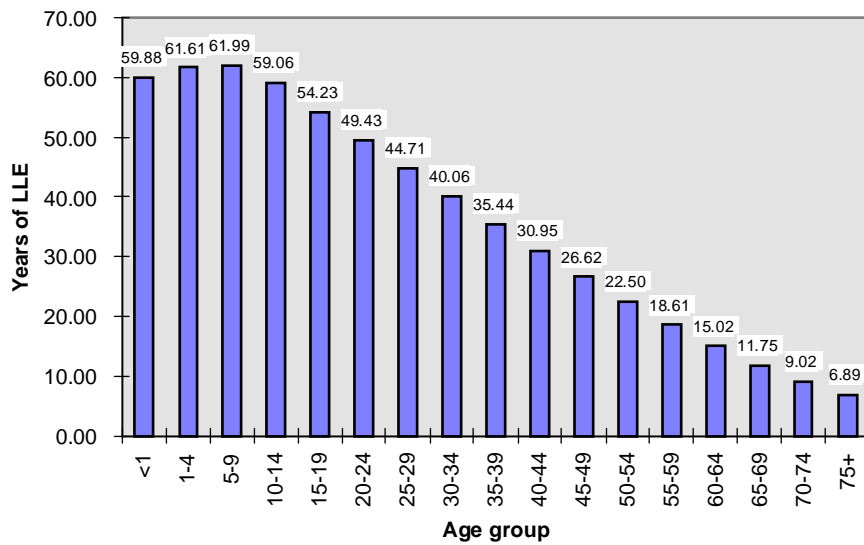

II) <u>North Region</u>

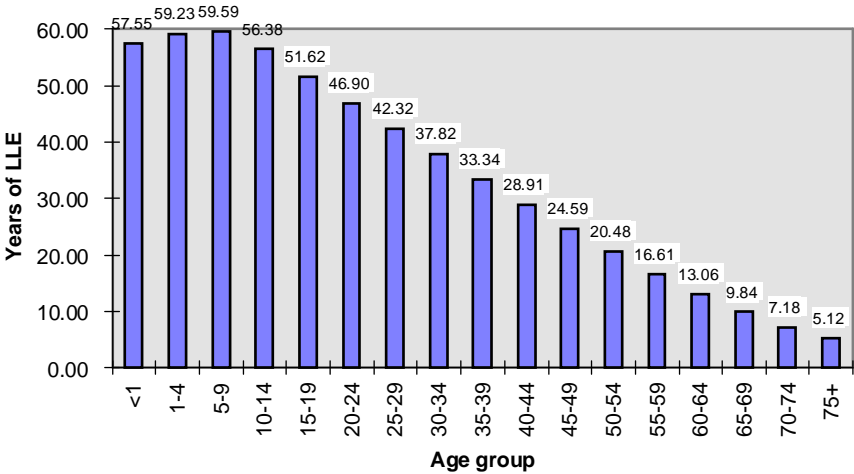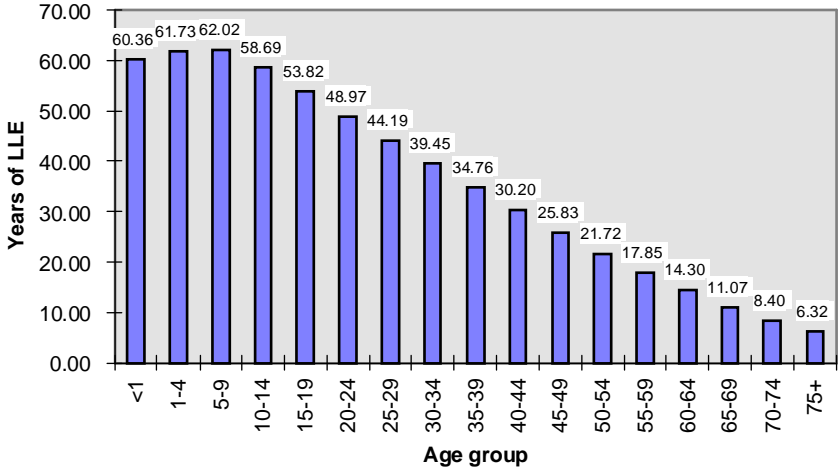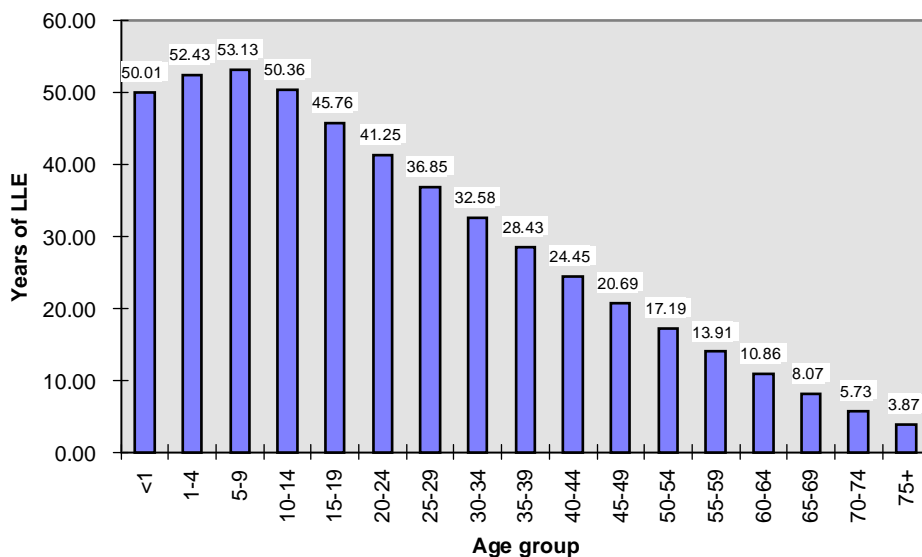## Literate Life Expectancy for men from the North region of Mexico in 1990.
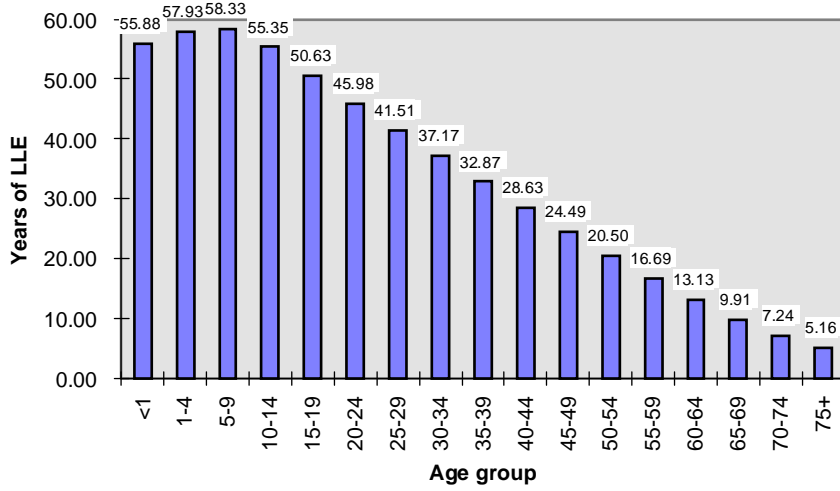
Years of LLE (y-axis)

Age group	Years of LLE
<1	55.88
1-4	57.93
5-9	58.33
10-14	55.35
15-19	50.63
20-24	45.98
25-29	41.51
30-34	37.17
35-39	32.87
40-44	28.63
45-49	24.49
50-54	20.50
55-59	16.69
60-64	13.13
65-69	9.91
70-74	7.24
75+	5.16

Age group (x-axis)

Literate Life Expectancy of women from the North region of Mexico in 1990.

Years of LLE (y-axis)

Age group	Years of LLE
<1	59.88
1-4	61.61
5-9	61.99
10-14	59.06
15-19	54.23
20-24	49.43
25-29	44.71
30-34	40.06
35-39	35.44
40-44	30.95
45-49	26.62
50-54	22.50
55-59	18.61
60-64	15.02
65-69	11.75
70-74	9.02
75+	6.89

Age group (x-axis)

III) <u>North East Region</u>

Literate Life Expectancy of men from the North East region of Mexico in 1990.

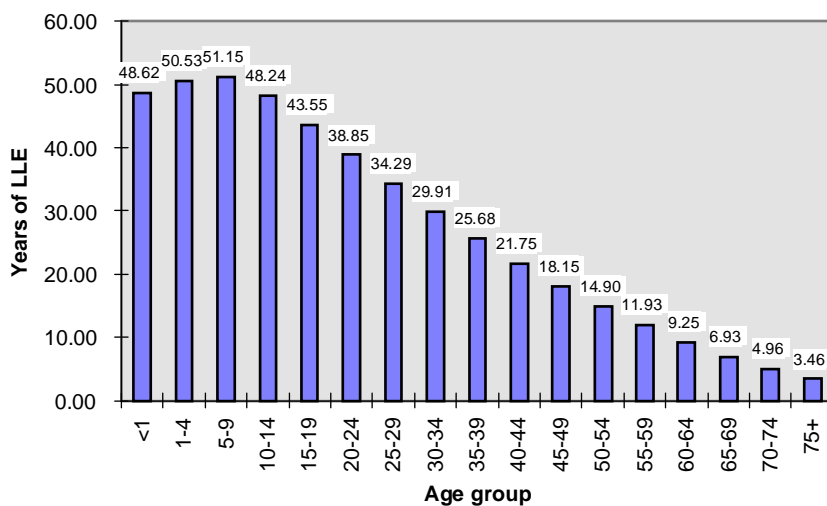**Literate Life Expectancy of women from the North East region of Mexico in 1990.**

IV) <u>North Center Region</u>

**Literate Life Expectancy of men from the
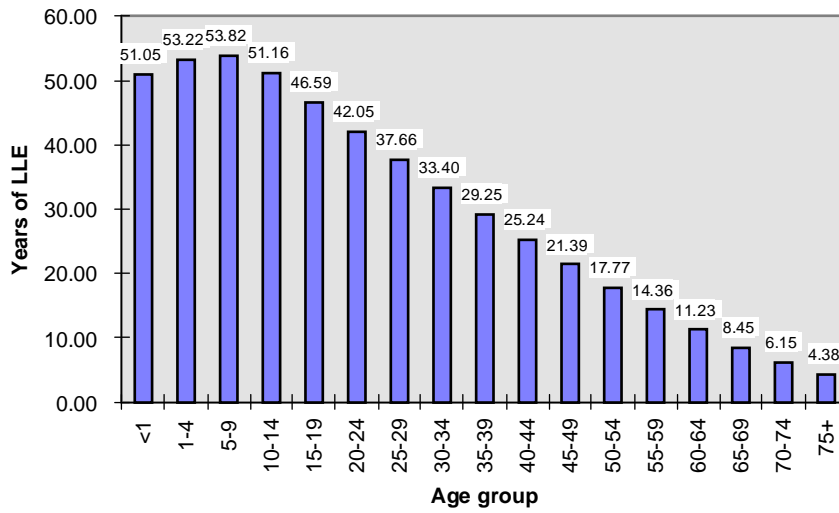North Center region of Mexico in 1990.**

**Literate Life Expectancy of women from the
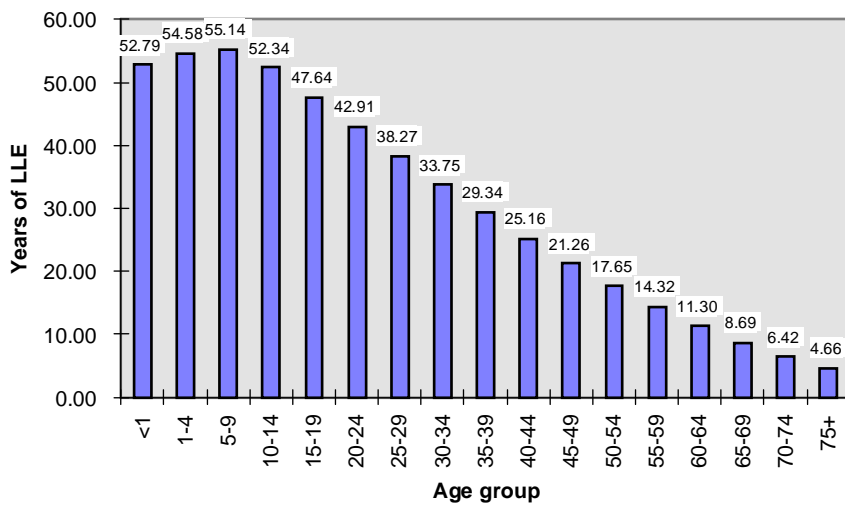North Center region of Mexico in 1990.**

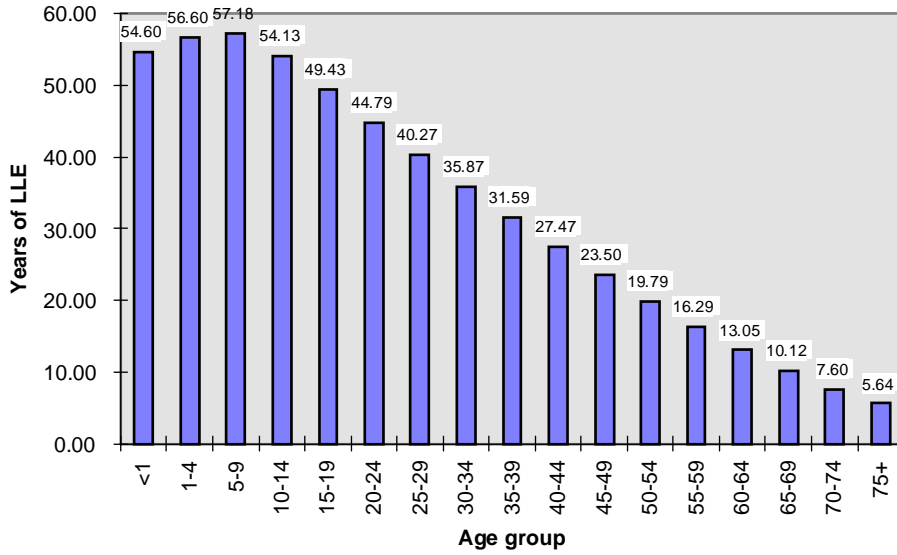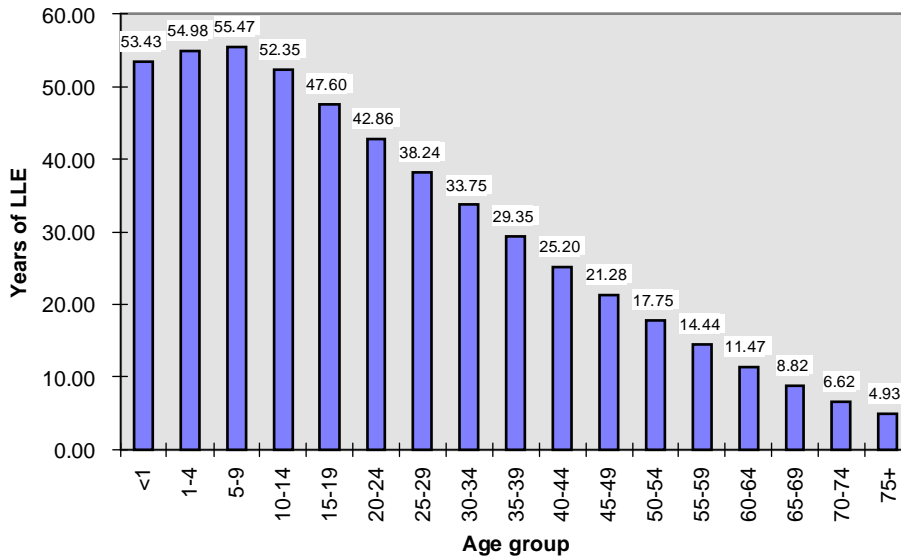**Literate Life Expectancy of men from the Occident region of Mexico in 1990.**

Values (Years of LLE) by Age group:
- <1: 51.05
- 1-4: 53.22
- 5-9: 53.82
- 10-14: 51.16
- 15-19: 46.59
- 20-24: 42.05
- 25-29: 37.66
- 30-34: 33.40
- 35-39: 29.25
- 40-44: 25.24
- 45-49: 21.39
- 50-54: 17.77
- 55-59: 14.36
- 60-64: 11.23
- 65-69: 8.45
- 70-74: 6.15
- 75+: 4.38

Literate Life Expectancy of women from the Occident region of Mexico in 1990.

Values (Years of LLE) by Age group:
- <1: 52.79
- 1-4: 54.58
- 5-9: 55.14
- 10-14: 52.34
- 15-19: 47.64
- 20-24: 42.91
- 25-29: 38.27
- 30-34: 33.75
- 35-39: 29.34
- 40-44: 25.16
- 45-49: 21.26
- 50-54: 17.65
- 55-59: 14.32
- 60-64: 11.30
- 65-69: 8.69
- 70-74: 6.42
- 75+: 4.66

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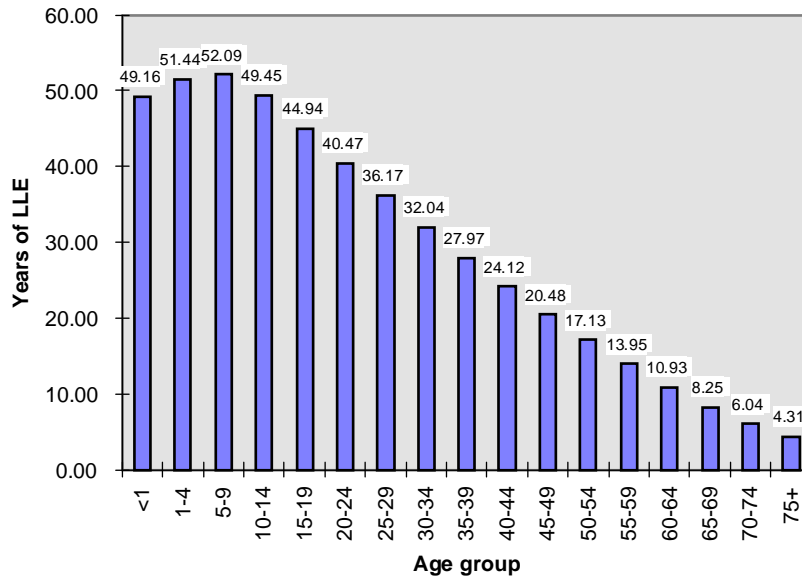**Literate Life Expectancy of men from the Center region of Mexico in 1990.**

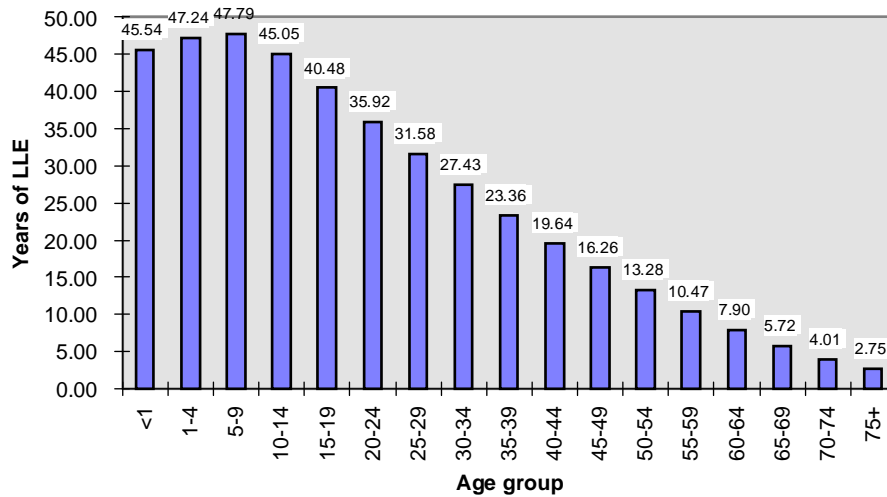**Literate Life Expectancy of women from the Center region of Mexico in 1990.**

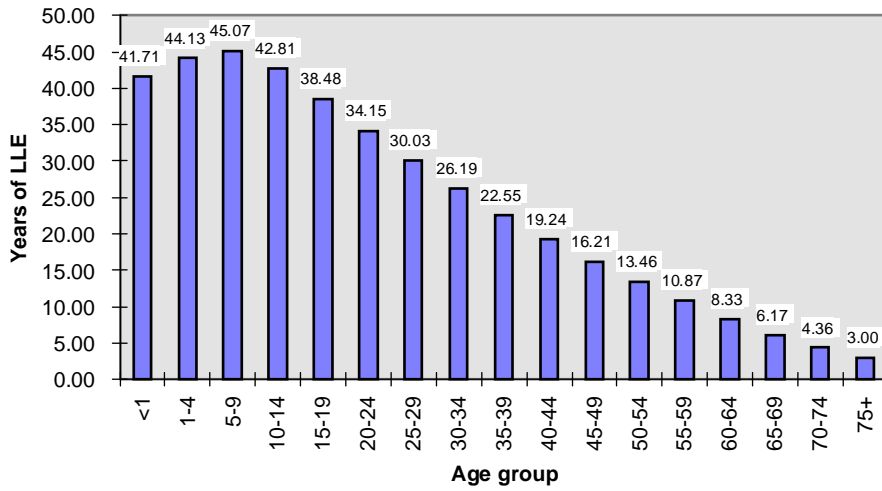**Literate Life Expectancy of men from the Gulf Coast region of Mexico in 1990.**

Literate Life Expectancy of women from the Gulf Coast region of Mexico in 1990.
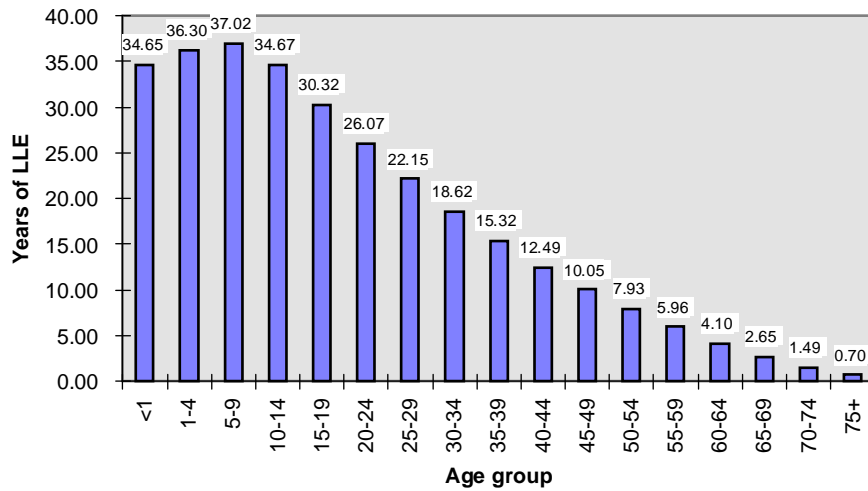
Literate Life Expectancy of men from the South Pacific region of Mexico in 1990.
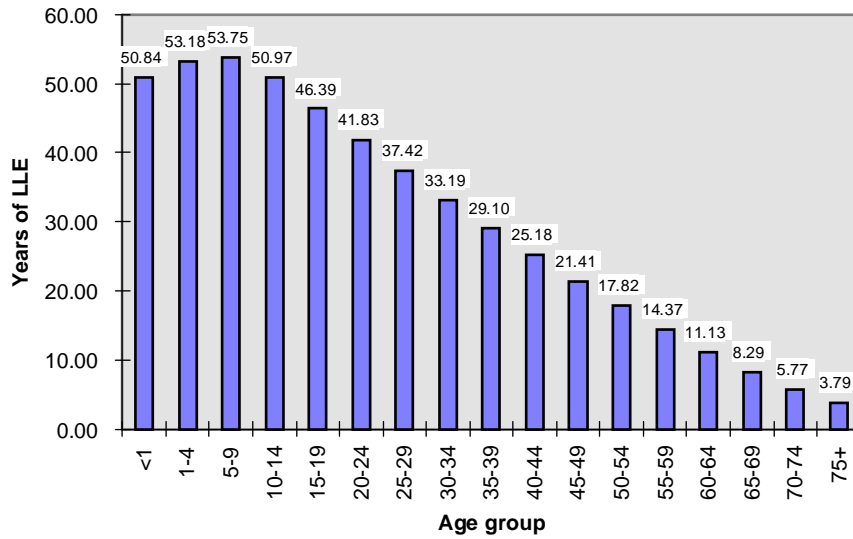

Literate Life Expectancy of women from the South Pacific region of Mexico in 1990.
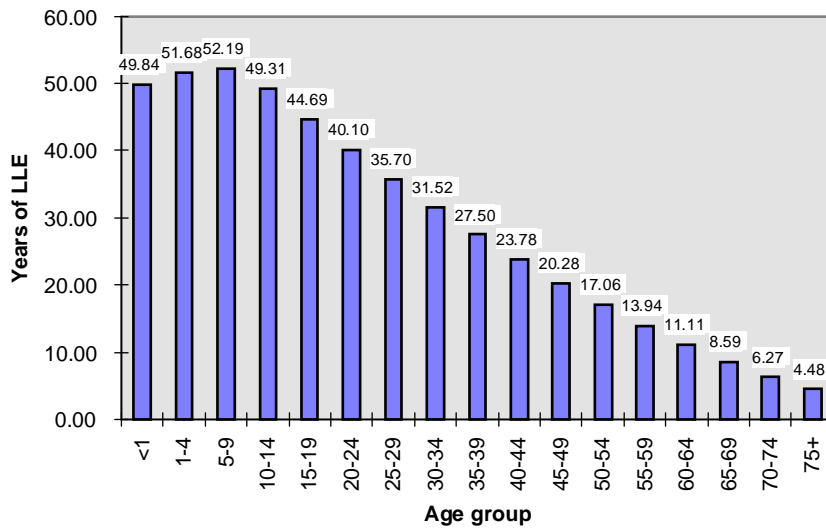
IX) <u>Yucatan Peninsula Region</u>

Literate Life Expectancy of men from the Yucatan Peninsula region of Mexico in 1990.

Literate Life Expectancy of women from the Yucatan Peninsula region of Mexico in 1990.

Appendix 5. Mexico's urban and rural population distribution at the state level by sex in 1990

	State				Men				Women			
	Total urban	Total %	Total rural	Total %	Urban portion	%	Rural portion	%	Urban portion	%	Rural portion	%
Aguascalientes	492378	68.4182	227281	31.5818	237450	67.8006	112768	32.1994	254928	69.0037	114513	30.9963
Baja California	1369862	82.4793	290993	17.5207	682199	81.9862	149891	18.0138	687663	82.9744	141102	17.0256
B. California S.	188392	59.2868	129372	40.7132	94578	58.4417	67255	41.5583	93814	60.1638	62117	39.8362
Campeche	273161	51.0405	262024	48.9595	133436	49.6465	135336	50.3535	139725	52.4468	126688	47.5532
Coahuila de Z.	1571801	79.6922	400539	20.3078	772762	78.926	206335	21.074	799039	80.4475	194204	19.5525
Colima	286583	66.879	141927	33.121	140466	66.0883	72077	33.9117	146117	67.6571	69850	32.3429
Chiapas	753290	23.4634	2457206	76.5366	362104	22.5642	1242669	77.4358	391186	24.362	1214537	75.638
Chihuahua	1692226	69.3003	749647	30.6997	830114	68.4178	383188	31.5822	862112	70.1719	366459	29.8281
Distrito Federal	8092449	98.2601	143295	1.7399	3868596	98.1899	71315	1.8101	4223853	98.3244	71980	1.6756
Durango	589839	43.7119	759539	56.2881	285461	42.9416	379305	57.0584	304378	44.4599	380234	55.5401
Guanajuato	2136806	53.6536	1845787	46.3464	1031399	53.5309	895336	46.4691	1105407	53.7686	950451	46.2314
Guerrero	934028	35.6413	1686609	64.3587	449825	35.0817	832395	64.9183	484203	36.1773	854214	63.8227
Hidalgo	485566	25.7136	1402800	74.2864	232471	25.0201	696667	74.9799	253095	26.3853	706133	73.6147
Jalisco	3574731	67.4136	1727958	32.5864	1722798	67.1684	842094	32.8316	1851933	67.6432	885864	32.3568
Edo. de Mexico	6997723	71.2904	2818072	28.7096	3436305	71.0781	1398244	28.9219	3561418	71.4965	1419828	28.5035
Michoacan	1439243	40.5626	2108956	59.4374	1027173	59.7623	1718763	48.4404	1081783	59.132	1829436	51.5596
Morelos	662297	55.4196	532762	44.5804	319185	54.6751	264600	45.3249	343112	56.1306	268162	43.8694
Nayarit	317257	38.472	507386	61.528	152577	37.1182	258480	62.8818	164680	39.8176	248906	60.1824
Nuevo Leon	2700590	87.1513	398146	12.8487	1338414	86.7599	204250	13.2401	1362176	87.5394	193896	12.4606
Oaxaca	601978	19.936	2417582	80.064	288395	19.5199	1189043	80.4801	313583	20.3345	1228539	79.6655
Puebla	1663404	40.3142	2462697	59.6858	797152	39.6883	1211379	60.3117	866252	40.9078	1251318	59.0922
Queretaro	489408	46.5555	561827	53.4445	236110	45.7429	280058	54.2571	253298	47.3395	281769	52.6605
Quintana Roo	295772	59.9606	197505	40.0394	150980	59.2292	103928	40.7708	144792	60.7428	93577	39.2572
San Luis Potosi	865814	43.2218	1137373	56.7782	415720	42.1061	571595	57.8939	450094	44.3062	565778	55.6938
Sinaloa	1052975	47.7745	1151079	52.2255	513459	46.6094	588162	53.3906	539516	48.9387	562917	51.0613
Sonora	1226035	67.2314	597571	32.7686	606411	66.2681	308677	33.7319	619624	68.2016	288894	31.7984
Tabasco	475753	31.68	1025991	68.3199	231206	30.8282	518776	69.1718	244547	32.5298	507215	67.4702
Tamaulipas	1650722	73.3791	598859	26.6209	803415	72.2692	308283	27.7308	847307	74.4635	290576	25.5365
Tlaxcala	267947	35.197	493330	64.803	130369	34.753	244761	65.247	137578	35.6284	248569	64.3716
Veracruz	2438671	39.1551	3789568	60.8449	1165409	37.8696	1912018	62.1304	1273262	40.4106	1877550	59.5894
Yucatan	759407	55.7183	603533	44.2817	367587	54.5469	306305	45.4531	391820	56.864	297228	43.136
Zacatecas	329302	25.8008	947021	74.1192	158923	25.4822	464740	74.5178	170379	26.1053	482281	73.8947

Source: Calculated by the author.