

Chapter 2

Quality of Life in Latin America: A Proposal for a Synthetic Indicator

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2.1 Introduction

Measuring quality of life poses a major challenge that is not without its problems, particularly when dealing with a region such as Latin America, which embraces such vastly differing countries.

As set out in its 35th session report “Compacts for Equality: Towards a Sustainable Future,” the Economic Commission for Latin America and the Caribbean (ECLAC) (2014) states that Latin America and the Caribbean have reached a crossroads, despite having made huge strides in recent years towards reducing poverty and consolidating democratic states. However, this group of countries is facing major problems, such as undiversified productive structures, gaps in welfare, difficulties in labour markets, increased violence and crime to name but a few.

Despite this scenario, Latin Americans reported high levels of subjective well-being in relation to their income levels compared to other countries in the world: hence, the importance of investigating which factors prove most important when measuring their quality of life (Rojas and Martinez 2012).

Research into quality of life in Latin America faces an enormous dilemma given that in many instances the effects which certain factors (income, inequality, education,...) have on quality of life differ from those reflected in the traditional literature on the topic.

The main goal of this chapter is to provide an approach to measure quality of life in Latin America from a territorial perspective by creating a Synthetic Quality of Life Indicator (SQLI) using the P_2 distance method and adopting the social indicator

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approach. Amongst other objectives, the chapter seeks to obtain a robust synthetic measure of quality-of-life levels based on the most recently available information and to analyse inter-country disparities.

By adopting the social indicator approach, the synthetic indicators provide the ideal tool for measuring multi-dimensional concepts such as quality of life, as they enable information from the various indicators to be aggregated into a single synthetic measure, thereby facilitating research thereof. The indicators have mainly been chosen depending on the availability of data for the group of countries analysed and to ensure comparability at an international scale.

The chapter is structured as follows. Firstly, Introduction is Sect. 2.1, then in Sect. 2.2 a brief overview is provided of the concept of quality of life, and its investigation in Latin America. In Sect. 2.3, the system of indicators used to create the SQLI is described. Sect. 2.4 sets out the method chosen to process the information. Section 2.5 provides the results and findings to emerge as well as an analysis thereof. Adopting a spatial approach, we then apply our SQLI to measure quality of life in Latin American countries, exploring which factors have the greatest explanatory and discriminant power when accounting for disparities amongst countries. Finally, Sect. 2.6 presents the main conclusions to emerge from the research.

2.2 Quality of Life and Its Research in Latin America

2.2.1 *Some Studies*

Defining quality of life is both complex and abstract. Yet, given its implications in such diverse areas as the political, social, and economic spheres, measuring and analysing it are essential, particularly with a view to devising public policies. Interest in research into quality of life has increased in a region like Latin America, which has significant variations between countries and comprises societies suffering deep inequalities. The combination of poorly diversified structures and inefficient institutions that are often controlled by powerful economic and political interests leads to enormous inequality in distribution of resources. This means that inequality is not confined to means and resources, but also includes various dimensions of well-being and individual capacities and permeates the relationships that individuals forge.

One of the first studies to investigate quality of life and happiness from an international perspective, and in particular for all the countries in Latin America, was Graham and Pettinato (2002). These authors provide a new conceptual framework for analysing the relationship between subjective well-being and the political sustainability of market-oriented economic growth in 17 Latin American countries and Russia.

Other examples of studies that measure the quality of life for a sample of Latin American countries from a comparative perspective are: the study carried out by Graham and Sukhtankar (2004) based on the Latin barometer surveys from 2000 to 2002. This latter work reports some unexpected positive trends as well as notable

differences between countries that suffered from crises and those that did not. Satisfaction with market policies and with the way democracy is working has decreased amongst all groups except the very wealthy. The Graham and Felton's (2006) work examines the effects of several variables, including wealth, status, and reference group size, on the link between inequality and happiness in Latin America. Graham (2008) conducted an excellent review of quality-of-life measurement in Latin America, addressing the challenges and contributions that come from taking a broader quality-of-life-based approach rather than a simpler income-based approach to assessing well-being. The aforementioned study uses the tools provided by the economics of happiness and relies on large-scale surveys as well as more in-depth field research in Latin America.

Considering 18 countries, Melgar and Rossi (2011) study happiness in Latin America, based on the information provided by the Latin barometer databases for 2008. In another more recent study, based on the information revealed by the Gallup survey of 2007, Rojas (2012) also provided a clear image of the region. The analysis considered 16 Latin American countries and provided a quantitative view of the main quality-of-life problems in the region, exploring the factors that structurally threaten quality of life in the region.

Other examples of works that investigate quality of life and well-being in some countries of Latin America are: the work entitled *Quality of Life in Argentina* by Tonon (2012), describing the results of several research projects carried out by the author, studying changes in the level of life satisfaction in Argentina; the study conducted by Florenzano and Dussailant (2011) for the Chilean population; measurement of subjective well-being by Rossi et al. (2008), this measurement being devised for their study in Argentina and Uruguay; and the work of Fuentes and Rojas (2001) on subjective well-being and income based on a representative sample of two urban areas in Mexico.

These documents are a small sample of some of the numerous works that aim to measure quality of life in Latin America, either for the region as a whole or for any of the individual countries, and which highlight the importance of the topic.

2.2.2 The Concept of Quality of Life

Awakened interest in the concept dates back to ancient times. Since its early days, mankind has sought to satisfy its needs and to secure a "good life" for itself. Early Greek philosophers strove to provide an answer to the essence of concepts such as well-being and happiness and how mankind could achieve them. Yet, during many periods of history, the question was not, in itself, the subject of scientific enquiry and appeared under the guise of a number of concepts such as well-being, happiness, and satisfaction. The very nature of the concept of quality of life is what causes us such difficulties when we seek to define it, since it is a concept that is vague, complex, hard to measure, dynamic, multi-disciplinary, and disperse (see Setién 1993):

1. It is a vague concept given that its content is open to debate. This usually leads us to resort to other synonyms or analogous concepts, which only confuses the matter further. Use of the term quality of life is commonplace as a synonym of well-being, happiness, subjective well-being, health, etc., depending on the particular discipline we are involved in. Examples abound and highlight the semantic confusion the term encompasses, for example Ostroot et al. (1982).
2. A further characteristic of this concept is that it is complex or multi-dimensional, given that it embraces multiple facets or dimensions. Authors such as Solomon et al. (1980) and Slottje et al. (1991) reflect the multi-dimensional nature of the notion and other similar concepts such as human needs, standard of living, etc., *"The quality of life is an inclusive concept that encompasses all aspects of life, as they are experienced by individuals,"* Solomon et al. (1980, p. 224). *"The notion of the quality of life comprises a set of measurable attributes that can be weighted by some metric, the quality of life may be measured through individuals, places and countries and through time,"* Slottje et al. (1991, p. 1).
3. It is a concept which is indirectly measurable. As a result, social indicators are used to approach the concept. As Zarzosa points out (1996, p. 15): *"Measuring well-being is an impossible task."* It is the components of quality of life which provide substance to the concept and are those which, by using social indicators, allow us to approach the question of how it may be measured.

Given this complexity, prior to engaging in any research, a definition of the conceptual outline in which the work is to be framed needs to be defined, justifying the chosen components and indicators through which we address the concept. One restriction limiting research into the notion is that its very nature curbs our ambitions, forcing us to make do with only an approximation for measuring it. Despite this limitation, such an approach proves both necessary and valuable vis-à-vis decision-making aimed at enhancing quality of life for individuals as well as society at large.

4. A further characteristic is that it is a dynamic concept. This particular feature of the concept has been evidenced by authors such as Campbell et al. (1976), Brickman et al. (1978), with other authors such as Allison et al. (1997), positing a dynamic construction of the notion of quality of life.
5. Being a multi-disciplinary concept means that multiple perspectives emerge when exploring it, thus enriching our research. Quality of life has been and still is subject matter for such diverse disciplines as economics, sociology, medicine, psychology, philosophy, and so on. This has today led to an exchange of knowledge, such that different sciences have mutually benefitted, interchanging concepts and theories.
6. It is a universal concept such that a wide range of possible approaches exists. Depending on characteristics like culture, religion, or the general nature of the society in question, quality of life may give rise to a variety of proposals. Yet, it is a universal concept which societies, through time and space, have always sought to maximise.
7. Finally, it is a heterogeneous concept in the sense that it draws on various kinds of information.

Economists have usually addressed the study of quality of life from an objective standpoint using indicators such as income and consumption. Exchange of knowledge amongst various sciences, particularly ranging from sociology and psychology to economics, has led us to consider whether the concept should be analysed using objective or subjective information or a combination of both. Varying opinions have been expressed on the matter, and the debate goes on.

In our case, we feel that quality of life should be studied not only drawing on information of an objective nature but also embracing information provided by individuals' own perception of their life. "Classical" economic indicators (especially income) have proven insufficient to measure persons' well-being, and there is clear evidence that the relationship between economic performance and well-being is much weaker than assumed (Rojas 2011).

The year 1998 witnessed a lively debate surrounding the definition of quality of life and gave rise to an exchange of opinions amongst members of the International Society for Quality of Life Studies [ISQOL] which was published by Cummins (1998). The aforementioned work evidences the wide range of interpretations and positions concerning the definition of our subject matter and the clash between the objective and subjective approaches. One conclusion to emerge from the work is that in order to maintain quality of life as a viable concept, both objective and subjective elements need to be included.

Outside this debate, many other authors have raised concerns as to whether the notion of quality of life should embrace subjective dimensions – Erikson (1974, 1993), Erikson and Uusitalo (1987) – or only subjective elements – Campbell et al. (1976) – or at the other end of the scale only objective elements – Slotte et al. (1991) to name but a few.

As evidenced throughout this section, the literature addressing quality of life encompasses a wide range of definitions which correspond to the various lines and approaches that exist when conducting enquiry into the concept.

In this vein, and as a result of previous research carried out by the authors of the present work, we adopt the following definition:

Quality of life is the result of complex interactions of a set of objective and subjective factors: objective factors refer to external conditions of an economic, socio-political, environmental, and cultural nature, while subjective factors refer to individuals' perception of their own life and the satisfaction reached in its various dimensions (Somarriba (2008, p. 15)).

This definition refers to both objective and subjective factors as essential parts of the concept under study. Choosing such a definition in a work which seeks to measure the concept entails the need to determine which factors are mentioned so as to measure them, selecting and constructing a system of indicators which serve to quality of life in the various Latin American countries.

The link between using objective versus subjective information when measuring quality of life has been the focus of many studies in the literature. The debate surrounding the inclusion of subjective indicators, when measuring quality of life or a similar notion, is as old as the social indicator approach itself. Pena (1977) and, more briefly, Zarzosa (1996) offer information concerning both the origin and the

development of the debate, within the framework of the early programmes carried out by leading international agencies such as the UN (1975) and the OECD (1976).

In general, it is usually agreed that any measurement of quality of life which fails to embrace subjective indicators will be incomplete. Indicators of perception are, by definition, subjective. It is not possible to obtain objective measures of subjective experiences (Pena, 1977, p. 41). Yet, whilst facilitating the task of measuring quality of life, removing such qualitative features renders the actual task itself pointless (Schumacher, 1978, p. 41).

There are numerous examples which highlight the importance of merging objective and subjective information when measuring quality of life:

In Hagerty et al. (2001), the authors reviewed 22 of the most widely used QOL indices around the world. In this work, the authors take, for example, the work of Erik Allardt on level of living and quality of life (Allardt 1978). According to this work, QOL can and should be assessed through subjective indicators, although level of living has to be assessed using objective indicators. Thus, both subjective and objective indicators are required if the whole concept of QOL is to be captured.

In this sense, others propose the index called the “Happy Life-Expectancy” (HLE). This can be interpreted as the number of years the average citizen in a country lives happily at a certain time. This conception is operationalised by combining registration-based estimates of length-of-life, with survey data on subjective appreciation-of-life. Life expectancy in years is multiplied by average happiness on a 0–1 scale. This “apparent” QOL can be measured by the degree to which citizens live long and happily, and it merges objective and subjective information.

A further example is the Social Progress Index, which measures the extent to which countries satisfy the non-financial needs of their citizens. It includes indicators of perception, such as perceived crime levels, satisfaction with one’s dwelling, and indicators related to freedom and tolerance.

Diener (1995) proposes the so-called Advanced QOL Index that includes seven variables, amongst which there are objective variables like physicians per capita, savings rate, per capita income, as well as subjective variables like well-being.

Subjective indicators do not necessarily move along the same lines as objective indicators related to the same phenomenon (UN 1975, p. 30; Zapf 1987, p. 17; Maggino and Zumbo 2012, p. 212). In the area of Latin America, numerous studies have explored the link between the two types of indicator, objective and subjective, in various countries. See Rubalcava (2011), Rojas (2003), Arita et al. (2005), Restrepo and Ardila (2012), amongst others.

The impossibility of reaching a conclusion concerning the correlations between objective and subjective indicators, and which proves valid for any moment and any place, means that generally speaking, one should not be replaced by the other. Both types of indicators are necessary and it is worth trying to include them in the synthetic measurement and analysing the role which each indicator plays in the set indicator information.

Once the need to embrace individuals’ perception when measuring quality of life has been accepted, an extremely thorny methodological problem immediately

arises, namely, how to synthesise objective and subjective information in a single measure. Some research has posited practical proposals in an effort to overcome the problem in the best possible manner. In this regard, see Maggino and Zumbo (2012, p. 218–219).

One solution may be to define subjective partial indicators, interpretation of which would be ordinal and not cardinal, in other words indicators which allocate a numerical value to the various levels identified in individuals' responses, valuing their perception. Subsequently, an aggregation method may be applied using statistical measures that are appropriate for ordinal data.

In the specific case of the present research, we apply a method for obtaining the synthetic indicator which allows for a cardinal interpretation of the results. As a result, although subjective ordinal indicators were initially chosen, said ordinal indicators were subsequently transformed into cardinal ones. For instance, the partial indicator which measures individuals' confidence in the national government has been transformed into another partial indicator which reflects the percentage of people who trust the government. In other words, perception indicators are used, although these are reconverted into indicators which have a cardinal interpretation. This means that the method used to obtain the synthetic indicator is appropriate.

2.3 Selecting Indicators

As noted earlier, our definition of quality of life refers to both objective and subjective factors as integral parts of the concept under scrutiny. Chart 2.1 sets out the 51 partial indicators used, information for which is taken mainly from international statistical sources such as the World Bank, United Nations, and Latin barometer, amongst others. As is commonplace when adopting the technique of social indicators, simple indicators are grouped into various dimensions. This approach has been adopted in works such as Pena (1977), Zarzosa (1996, 2012), Somarriba (2008), Somarriba and Pena (2009), and Zarzosa and Somarriba (2013), amongst others.

In the current paper, the following components have been chosen: income, home, work, health, society, physical environment, safety, education, and happiness. These components or domains concur to a large extent with those used in most works addressing topics such as the one in hand (for instance, Somarriba et al. 2015).

The indicators have mainly been chosen depending on the availability of data in all instances, and an effort has been made to ensure comparability at an international scale. Moreover, the choice of indicators has sought to reflect the concerns of citizens today. As a result, amongst others, the chosen indicators cover such issues as perceived level of corruption, low labour intensity rates, and trust in the government.

For the indicators chosen, data generally correspond to 2014. In the few cases in which information was still not available for said year, we chose the closest year for which information was available.

INCOME AND WEALTH	HEALTH	PHYSICAL ENVIRONMENT	EDUCATION	HOME
SATISFACTION WITH STANDARD OF LIVING	MALE ADULT MORTALITY RATIO	SATISFACTION WITH ACTIONS TO PRESERVE THE ENVIRONMENT	ADULT LITERACY	INTERNET USERS
GINI COEFFICIENT	FEMALE ADULT MORTALITY RATIO	CARBON DIOXIDE EMISSIONS PER CAPITA	YOUTH LITERACY	FACILITIES AND GOODS IN THE HOME
GROSS NATIONAL INCOME PER CAPITA	LIFE EXPECTANCY AT AGE 60	DEATHS DUE TO OUTDOOR AIR POLLUTION	AL LEAST SOME SECONDARY EDUCATION	SATISFACTION WITH AVAILABILITY OF GREEN AREAS AND PUBLIC SPACES IN YOUR LOCALITY.
QUINTILE RATIO	MALE LIFE EXPECTANCY HEALTH-ADJUSTED YEARS	DEATHS DUE TO UNSAFE WATER, UNIMPROVED SANITATION OR POOR HYGIENE	MEAN YEARS OF SCHOOLING	SATISFACTION WITH MUNICIPAL SERVICES
	FEMALE LIFE EXPECTANCY HEALTH-ADJUSTED YEARS	POPULATION LIVING ON DEGRADED LAND	EXPECTED YEARS OF SCHOOLING	SATISFACTION WITH ROADS AND PAVING
	HEALTH EXPENDITURE	DEATHS DUE TO NATURAL DISASTERS	SATISFACTION WITH QUALITY OF EDUCATION	SATISFACTION WITH PUBLIC TRANSPORT
	SATISFACTION WITH HEALTH CARE QUALITY	POPULATION AFFECTED BY NATURAL DISASTERS	EXPENDITURE ON EDUCATION	
	INFANT MORTALITY	DEATHS DUE TO INDOOR AIR POLLUTION		
	MATERNAL MORTALITY RATIO			
	DEPTH OF FOOD DEFICIT			
JOB	COMMUNITY	SAFETY	HAPPINESS	
SATISFACTION WITH JOB	TRUST IN OTHER PEOPLE	HOMELESS PERSONS	OVERALL SATISFACTION WITH LIFE	
EMPLOYMENT	SATISFACTION WITH THE COMMUNITY	PRISON POPULATION		
YOUTH UNEMPLOYMENT	TRUST IN NATIONAL GOVERNMENT	HOMICIDE		
SATISFACTION WITH LOCAL LABOUR MARKET	SATISFACTION WITH FREEDOM OF CHOICE	PERCEPTION OF SAFETY		
CHILD LABOUR	CORRUPTION PERCEPTION INDEX			
FEMALE LABOUR FORCE PARTICIPATION				

Chart 2.1 Variables chosen to calculate the DP₂ Synthetic Quality of Life Indicator organised by components (Source: Own)

By using this system of indicators, we seek to provide a general measure of quality of life, leaving aside any specific aims and objectives of a political nature or any detailed analysis of components such as health or education. Nevertheless, although our measure may prove useful for such goals, this is not the goal it pursues.

Chart 2.1 sets out the 51 partial indicators used in the research.

Annex 2.1 sets out the definitions and data sources.

In the present research, the happiness component comprises a single indicator: The Satisfaction Index. Specifically, we use the indicator “Overall life satisfaction” (Chart 2.1), to evaluate the happiness dimension.

The literature provides many definitions and uses of these notions. Veenhoven (2012) conducts a conceptual analysis both of a number of more or less equivalent terms and of the relations between them.

The term “overall happiness” may well be denoted using other words. It may be defined explicitly, or it may be deduced from the indicators through which we aim to measure the happiness dimension. On occasions, the term “life satisfaction” is used to refer solely to the affective appraisal of life; in other words, in this context, happiness is identified as the “hedonic level of affect.” On other occasions, the term “life satisfaction” is used in a wider sense, to refer to the individual’s appraisal of the overall quality of his/her own life as a whole (Veenhoven, 2012, p. 66). In this other context, happiness is a subjective enjoyment of life as a whole. This latter meaning is the one used in the current research.

2.4 Methodology

The instance [Pena (1977)] has been widely used to measure quality of life (welfare) and other similar concepts such as poverty or welfare [Rivera (2004); Zarzosa (1996); Somarriba (2008); Somarriba and Pena (2009); Cuenca-García and Rodríguez-Martín (2010); Zarzosa (1994), (2012); Cuenca-García et al. (2010), Rodríguez-Martín (2012), Rodríguez-Martín and Salinas (2012), amongst others)]. Recent examples of the use of this methodology in prestigious journals in this field of research, such as Social Indicators Research or Applied Research in Quality of Life, are Zarzosa and Somarriba (2013), and Somarriba et al. (2015), Ray (2014), Rodríguez-Martín et al. (2013, 2014), amongst others.

Somarriba and Pena in 2009 published a paper to measure quality of life in the European Union and reviewed different methods for designing synthetic indicators: Principal Components Analysis (PCA), Data Envelopment Analysis (DEA), and distance indicators (stance). In this work, the use of the instance is 0 since it is a distance-based method that allows a hierarchical comparison, whatever the heterogeneity of the input variables. An excellent review of the methodologies for constructing composite indicators, including indicators of distance, can be found in OECD (2008).

The synthetic distance DP_2 indicator, defined in Pena (1977), from j th country, is defined as follows:

$$DP_2(j) = \sum_{i=1}^n \left\{ \left(\frac{d_{ij}}{\sigma_i} \right) \left(1 - R_{i,i-1,\dots,1}^2 \right) \right\} \text{ with } d_{ij} = |x_{ij} - x_{i*}|; i = 1, 2, \dots, n; j = 1, 2, \dots, m$$

The reference base $X_* = (x_{*1}, x_{*2}, \dots, x_{*n})$
where

- n is the number of variables
- x_{ij} is the value of the i th variable in the j th country.

- σ_i is the standard deviation of variable i th variable.
- $R_{i,i-1,\dots,i}^2$ is the coefficient of determination in the regression of X_i over $X_{i-1}, X_{i-2}, \dots, X_i$, already included. And $R_1^2 = 0$

Thus defined, the synthetic indicator measures the distance, with regard to the object studied, between each country and a fictitious base reference. In this instance, the base reference comprises the results from an imaginary country, which reflects the worst possible scenario for all the simple indicators and would therefore be attributed a value of zero in the synthetic welfare indicator.

By dividing it by a standard deviation, the problem of heterogeneity of the measuring units of the variables is dealt with, such that all the partial indicators (quotients involved in the expression) are expressed in abstract units.

The coefficient of determination, $R_{i,i-1,\dots,i}^2$, measures the part of the variance of each variable explained by the linear regression estimated using the preceding variables. As a result, the factor $(1 - R_{i,i-1,\dots,i}^2)$, referred to as the *correction factor* by Pena, prevents redundancy by removing from the partial indicators the information already contained in the preceding indicators. In this way, the synthetic indicator only includes the new information from each variable.

In order to gauge the discriminant power of each simple indicator on the results in terms of international disparities in Latin America, we obtained the Ivanovic (1974) Discrimination Coefficient (DC):

$$DC_i = \frac{2}{m(m-1)} \sum_{k_i}^{j,l > j} m_{ij} m_{il} \left| \frac{x_{ij} - x_{il}}{\bar{X}_i} \right|$$

where m is the number of countries.

This measure, analysed by Zarzosa (1996), ranges between 0 and 2, and these values corresponding to the two extreme theoretical cases as regards discriminant power. If a variable takes the same value for all countries, DC equals zero, indicating that this variable holds zero discriminant power. By contrast, if a variable only has a value other than zero for one country (and in the remainder, $m-1$ is equal to zero), DC is equal to two and the variable has full discriminant power.

The properties established by the P_2 distance synthetic indicator make it the ideal measure for the purpose set out in the current research. A brief description of these is provided below (Zarzosa and Somarriba (2013)). Any interested readers who wish to delve deeper into these properties may consult the previously cited references.

Below, we briefly describe the procedure for obtaining the DP_2 synthetic distance indicator. This iterative procedure for calculating the DP_2 synthetic indicator was devised by Pena (1977) and implemented by Zarzosa and Zarzosa (1994), as reported in Zarzosa (2005). The procedure involves the following stages:

1. Obtaining the data matrix $X = \{x_{ij}\}_{m \times n}$, where x_{ij} is the value of the i th variable in the j th territorial unit. Variables whose increase leads to a worsening in quality of life should have a negative sign.

2. Choosing the reference base, X^* , such that comparisons between the territorial units r and k , obtained from $|DP_2(r, *) - DP_2(k, *)|$, do not depend on this base. For each variable, the reference value must be greater than or equal to or less than or equal to the maximum or minimum values, respectively, of the succession of values observed in the group of territories as a whole.
3. Calculating the D distance matrix between each territory and the reference base:

$$D = \{d_{ij}\}_{m \times n} \text{ where } d_{ij} = |x_{ij} - x_{i*}|$$

4. Calculating the standard deviations of the variables, σ_i .
5. Obtaining partial indicator matrix I :

$$I = \{I_{ij}\}_{m \times n} \text{ where } I_{ij} = \frac{d_{ij}}{\sigma_i}$$

6. Obtaining the F vector of the Frechet Distance indicators:

$$F = \{F_j\}_{m \times 1} \text{ where } F_j = \sum_{i=1}^n I_{ij}$$

7. Calculating the n simple correlation coefficients between each variable and the Frechet Distance:

$$r(F, X_i) = r(F, I_i), \quad \forall i = 1, \dots, n$$

8. Ordering the variables, according to the absolute values of the simple correlation coefficients obtained in the previous stage.
9. Calculating the DP_2 indicator, entering the variables in the order obtained in stage 8. This DP_2 vector of results, obtained in the first iteration, is referred to as $DP_2^{(1)}$.
10. Calculating the simple correlation coefficients between each variable and $DP_2^{(1)}$.
11. The variables are ordered again, following the absolute correlation between each of them and $DP_2^{(1)}$.
12. Calculating DP_2 , inputting the variables following the order obtained in the previous stage. This DP_2 vector, obtained in the second iteration, is referred to as $DP_2^{(2)}$.
13. The iterative procedure continues until convergence is reached, in other words until the outcomes of the successive iterations stabilise.
14. When the same DP_2 vector is obtained in two successive iterations, that is, the final results vector.¹

¹If no strict convergence is achieved, the results of the successive iterations must be analysed so that the semi-conforming vectors are identified. One of these or its arithmetic mean may be chosen as a solution, since the differences would be insignificant.

As indicated in steps 9 and 12, each iteration concludes by calculating a DP_2 m -dimensional vector, whose j th element has the following expression:

$$DP_2(j) = \sum_{i=1}^n \frac{d_{ij}}{\sigma_i} (1 - R_{ii-1, \dots, 1}^2), \text{ with } j = 1, 2, \dots, m$$

In order to obtain the corresponding corrector factors, $(1 - R_{ii-1, \dots, 1}^2)$, an estimation must be made of $(n - 1)$ linear regression models in each iteration. An alternative approach is outlined below.

First, steps 1 to 8 inclusive are performed. The following steps are then carried out:

- 9(a). Calculating X_0 , the typified X matrix, which is obtained by subtracting the mean from all the values of each variable and dividing the result by the standard deviation.
- 10(a). Obtaining $X_0^{(1)}$, which is the reordered X_0 matrix, following the order determined by the results of step 8. The first column of the $X_0^{(1)}$ matrix will reflect the (typified) variable which was at the top of the ranking in step 8. And so on.
- 11(a). Obtaining $R^{(1)}$, the correlation matrix amongst the reordered variables according to 8. This is obtained from $X_0^{(1)}$.
- 12(a). Calculating the principal minors of $R^{(1)}$.
- 13(a). Obtaining the correcting factor vector:

$$(1 - R^2) = [(1 - R_1^2) \quad (1 - R_{2,1}^2) \quad (1 - R_{3,1,2}^2) \quad \dots \quad (1 - R_{n,1,2, \dots, n-1}^2)]'$$

Where the symbol that appears at the end of the expression indicates it is the transpose of the vector. The elements of the correcting factor vector are calculated by dividing each principal minor obtained in step 12(a) by the one immediately before it. By definition $R_1^2 = 0$.

- 14(a). Obtaining $I^{(1)}$, the reordered partial indicator matrix following step 8. The order of the variables in this matrix will therefore be the same as in $X_0^{(1)}$.
- 15(a). Calculating vector DP_2 obtained in the first iteration:

$$DP_2^{(1)} = [DP_2^{(1)}(1) \quad DP_2^{(1)}(2) \quad \dots \quad DP_2^{(1)}(m)]'$$

in which $DP_2^{(1)}(j)$, with $j = 1, 2, \dots, m$, is the value of the synthetic indicator, obtained in the first iteration, for territory j . The previous vector is obtained as follows:

$$DP_2^{(1)} = I^{(1)}(1 - R^2)$$

The first iteration will have finished. The second would then commence, repeating the steps after step 7, replacing the Frechet vector, F , with the Pena vector obtained in the first iteration, $DP_2^{(1)}$. The procedure continues until convergence is achieved, as specified in point 13.

From the above measure, it is possible to calculate the DP_2 for the various components (domains or areas of life). From these new resulting indicators, a total synthetic indicator, referred to in our case study as the Synthetic Quality of Life Indicator (SQLI), is calculated. This facilitates and simplifies the calculation process enormously and also allows us to obtain detailed information for the different components.

The logic of this approach is as follows: if the goal is to decompose into several dimensions (health, education...) and if we have a suitable measure for each domain, the synthetic indicator can be obtained by applying the methodology to establish measures in each domain. This process is called DP_2 by stages. The current research aims to analyse the explanatory factors of quality of life in Latin America. In order to do this, we have obtained a Synthetic Quality of Life Indicator and a synthetic indicator for each selected component.

2.5 The Structure of the Synthetic Quality of Life Indicator in Latin America

Applying the DP_2 method to the simple indicators in Chart 2.1,² the results shown in Tables 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, and 2.8 and the Annex 2.2 were obtained for the countries covered in the study.

The current research aims to analyse the explanatory factors of quality of life in Latin America. To do this, we have obtained a Synthetic Quality of Life Indicator and a synthetic indicator for each selected component.

The statistical technique used in the present research to analyse quality of life allows us to explore the impact which each component, and each simple indicator, has on determining the outcomes compared to the rest. As a result, it is possible to draw conclusions concerning which aspects emerge as the most relevant when explaining spatial disparities in quality of life in Latin American countries, applying the technique used.

This section analyses the relative importance of each component, and each simple indicator, in constructing the synthetic indicator and in the results obtained, applying three statistical criteria: absolute linear correlation ($|r|$) with the resulting synthetic indicator, the correction factor ($1 - R^2$), and the discrimination coefficient (DC):

The absolute value of the linear correlation coefficient is the measure used to order the simple indicators into the various iterations of the synthetic indicator calculations. In the Annex 2.2, the simple indicators are listed in the order they are ranked according to their degree of absolute correlation with the resulting synthetic indicator. In other words, the first simple indicator evidences the highest linear cor-

²Through software P2 distance: Well-being's Synthetic Indicator. R package version 1.0.1 (Pérez-Luque et al. (2012)).

Table 2.1 Structure of the Synthetic Quality of Life Indicator (SQLI)

	$(1 - R^2)$	$ r $	DC
Income	1.00	0.84	0.42
Education	0.66	0.76	0.36
Happiness	0.42	0.74	0.14
Environment	0.36	0.68	0.24
Health	0.40	0.64	0.37
Society	0.74	0.59	0.34
Home	0.70	0.55	0.42
Safety	0.48	0.46	0.21
Job	0.64	0.27	0.36

Source: Own

relation, in absolute value terms, with the final indicator, and the last simple indicator evidencing the lowest absolute correlation.

As explained in the definition of the synthetic indicator, the correction factor, $(1 - R^2_{ii-1, \dots, 1})$, indicates the amount of fresh information attributable to each simple indicator.

The discrimination coefficient (DC) ranges between 0 and 2. If a variable takes the same value for all countries, DC equals zero, indicating that this variable holds zero discriminant power. By contrast, if a variable only has a value other than zero for one country (and in the remainder, $m - 1$ is equal to zero), DC is equal to two and the variable has full discriminant power.

We now interpret the results corresponding to the three measures, for the Synthetic Quality of Life Indicator (SQLI): The complete structure of the synthetics indicator of each component can be consulted in the Annex 2.2.

The correction factors shown in Table 2.1 were obtained from the order defined by the linear correlation coefficients corresponding to the final iteration,³ these coefficients also being included in this table. This results evidence a good selection of dimensions of quality of life. For all the dimensions analysed, significant correlations with quality-of-life synthetic indicator were obtained. Likewise, all the components have a significant capacity to discriminate between countries in Latin America. In addition, the non-redundant information provided by each dimension is considerably high.

A person's overall well-being can be understood from their welfare in different facets of their life. A person's life embraces a number of aspects, and their satisfaction in each helps to explain their general well-being. By way of an example, below we discuss dimensions that have greater weight in determining quality-of-life synthetic indicator for Latin America. Interested readers may consult detailed results concerning all the components in the Annex 2.1. The results also reveal that, according to the data and the three statistical criteria, the income component is the most impor-

³As explained in the methodology, an iterative algorithm is used to solve this issue and to determine the weights of each variable.

tant in explaining disparities in quality of life amongst Latin American countries. This result is consistent with works such as Melgar and Rossi (2011). In their study for Latin America, they find that per capita income and income distribution affect the happiness of Latin Americans. A more equal income distribution increases happiness.

Regarding the structure of the income synthetic indicator (Annex 2.2, Table 2.9), the most important simple indicator is a measure of inequality, the quintile ratio. Since this simple indicator is the one which most correlates with the income indicator, it includes all of its information. That is why its corresponding correcting factor is the unit. Gross National Income (GNI) per capita is the second partial indicator involved in calculating the synthetic indicator of income, given its absolute correlation. It incorporates 80 % of its information, since the remaining 20 % proves redundant with regard to the information contained in the quintile ratio indicator. Furthermore, in the income component, Gross National Income per capita is also the most discriminant simple indicator amongst Latin American countries. Satisfaction with standard of living, the third simple indicator most correlated with the synthetic indicator of this component, shows the second highest correction factor after the quintile ratio. It provides 85 % of its information, such that the quintile ratio and Gross National Income per capita are the simple indicators that incorporate the highest percentage of information to obtain the synthetic indicator of the income component in Latin American countries. Finally, the Gini coefficient incorporates only 18 % of its information, since the remaining 82 % is reported in the previous partial indicators, particularly in the measure of inequality, quintile ratio. Furthermore, the Gini coefficient has less discriminant power amongst Latin American countries than the first measure of inequality, the quintile ratio.

As established by Graham and Felton (2005), Latin America is the region displaying the highest inequality in the world. We find that relative income differences have major and consistent effects on well-being in the region. Inequality makes those in the highest quintiles roughly 5 % happier than the average and those in the poorest quintile 3 % less happy, regardless of differences in wealth levels within and across these groups.

As regards the second indicator, Gross National Income per capita, indicators such as national income or gross domestic product have traditionally been considered as indicators of a country's economic development and well-being. However, in the mid-60s, the identity between growth, development, and welfare began to be questioned. And the concept of development was redesigned, saying it is not an end in itself, but above all a means to create better living conditions.

Income plays an important role in analysing individuals' quality of life, as a means of meeting both their own needs and those of society as a whole. Its importance is not so much due to its monetary nature but more as a resource that can satisfy a range of different needs: material, safety and security, prestige, etc., hence the importance of the subjective indicator of satisfaction with standard of living as an indicator of whether those needs are met. This feature of income as a resource that satisfies needs entails the existence of strong connections between income and other areas of life such as housing, employment, and education, amongst others.

The structure of the income synthetic indicator, discussed above, determines the following ranking of countries (Table 2.2).

It should be remembered that bearing in mind how the reference base was defined, higher synthetic indicator values mean a higher standard of quality of life in the Income component. A fictitious country which reflected the worst situation for all the simple indicators would have a null synthetic indicator value. In this case, the fictitious country coincides with a real country: Honduras, which has the worst values of all the simple indicators of the income component.

Due to the properties of the DP_2 synthetic indicator, it is possible to offer a cardinal interpretation of the distances between each two countries. Thus, Uruguay, which is the best situated country, is 8.68 units away from Honduras. Likewise, all the international distances can be measured.

When considering statistical correlation criteria, the second most important dimension to explain disparities in quality of life in Latin America is education, followed closely by happiness. Education is one area that plays an important role in individuals' quality of life and sense of well-being, as recognised by authors like Campbell et al. (1976, p. 347).

In the education component (Annex 2.2), the adult literacy partial indicator plays a key role when gauging quality of life in Latin American countries. Since this simple indicator is the one which most correlates with education, it includes all of its information (100 %). However, this simple indicator has little power of discrimination amongst Latin American countries. The most discriminant simple indicator is expenditure on education (% GDP).

Table 2.2 Results of the income synthetic indicator

Ranking	Country	Income
1	Uruguay	8.68
2	Venezuela (Bolivarian Republic of)	8.32
3	Mexico	8.06
4	Chile	7.49
5	Argentina	7.02
6	Panama	6.97
7	Costa Rica	6.47
8	Paraguay	6.32
9	Nicaragua	6.19
10	Brazil	5.7
11	Ecuador	5.7
12	Dominican Republic	5.43
13	El Salvador	5.33
14	Colombia	5.07
15	Peru	4.74
16	Guatemala	3.37
17	Bolivia (Plurinational State of)	2.31
18	Honduras	0

Source: Own

The education synthetic indicator determines the following ranking of countries (Table 2.3).

Guatemala, which has the lowest value in the education synthetic indicator, is 2.31 units away from the undesirable fictitious country (null value in the synthetic indicator) and 8.25 from the best situated country, which is Argentina.

The linear correlation coefficient between the education synthetic indicator and the income synthetic indicator is 0.58, whilst the Spearman correlation coefficient is 0.83, indicating there are cardinal differences between the two indicators, although the two are closer to one another when establishing the ranking of countries. As in other areas of the world, there are certainly clear connections between education and income.

Rojas (2007) finds a positive effect of years of schooling on life satisfaction and, specifically, on satisfaction in domains such as the relationship with children, leisure, and health. The net effects of changes in education on subjective well-being have been studied using econometric models in which control variables such as income and other personal socio-demographic features are employed. These studies have evidenced that subjective well-being responds to changes in education. It has been found that education is a variable correlated with happiness (Rojas and Martinez (2012)). Likewise, as stated by Graham (2008), income has a strong and consistent relationship with happiness in the case of Latin America.

In sum, the findings from the present study concur with those of other researchers. Agreement is first reflected vis-à-vis the relevance of the three dimensions which, in our work, top the list as explanatory factors describing quality of life in

Table 2.3 Results of the education synthetic indicator

Ranking	Country	Education
1	Argentina	10.56
2	Costa Rica	10.11
3	Bolivia (Plurinational State of)	9.59
4	Chile	9.4
5	Venezuela (Bolivarian Republic of)	8.74
6	Uruguay	8.55
7	Mexico	8.39
8	Panama	8.32
9	Brazil	7.86
10	Colombia	7.86
11	Ecuador	7.85
12	Paraguay	7.61
13	Peru	6.39
14	Dominican Republic	6.27
15	El Salvador	5.5
16	Nicaragua	4.16
17	Honduras	2.87
18	Guatemala	2.31

Source: Own

Latin America. Second, results coincide with regard to the strong links between these dimensions, interaction amongst which is in turn an explanatory factor of quality of life and its disparities in Latin America.

As regards the happiness index, it should be remembered that this component comprises a single indicator: the satisfaction index. This component is also highly correlated with quality-of-life synthetic indicator and determines the following ranking of countries (Table 2.4).

The linear correlation coefficient between the happiness indicator and the income synthetic indicator is 0.66, like the Spearman correlation coefficient. For happiness and education, the value is 0.71, whilst the Spearman correlation coefficient is 0.84. As a result, the education indicator ranks the countries in a way which is more similar to the happiness and income indicator than these latter two indicators are able to do between one another.

A similar study can be carried out for each component. The Annex 2.2 contains the structure of the synthetic indicator of each dimension, and Table 2.5 shows the results for all synthetic indicators.

The most important simple indicators within the remaining dimensions are: deaths due to natural disasters, in environment; life expectancy at age 60, in health; trust in national government, in society; satisfaction in municipal services, in home; homeless persons, in safety; and satisfaction with local labour market, in job.

It should be noted that the last component in forming quality-of-life synthetic indicator, job, also has great relevance, since quality-of-life synthetic indicator

Table 2.4 Results of the happiness synthetic indicator

Ranking	Country	Satisfaction index
1	Costa Rica	7.3
2	Mexico	7.3
3	Venezuela (Bolivarian Republic of)	7.1
4	Brazil	6.9
5	Panama	6.9
6	Chile	6.6
7	Argentina	6.5
8	Colombia	6.4
9	Uruguay	6.4
10	Bolivia (Plurinational State of)	6
11	Ecuador	6
12	El Salvador	5.9
13	Guatemala	5.9
14	Paraguay	5.8
15	Peru	5.8
16	Nicaragua	5.4
17	Dominican Republic	4.8
18	Honduras	4.6

Source: Own

Table 2.5 Results, by country, of synthetic indicators by components

Country	Income	Home	Job	Health	Society	Environment	Safety	Education	Happiness	P ₂ Distance	Ranking
Argentina	7.02	11.63	4.94	10.02	8.82	14.53	12.27	10.56	6.5	16.08	2
Bolivia (Plurinational State of)	2.31	6.77	10.899	1.84	8.64	11.78	10.96	9.59	6	11.53	12
Brazil	5.7	4.87	8.68	7	6.53	13.53	10.59	7.86	6.9	12.36	11
Chile	7.49	9.03	7.856	10.93	4.29	12.01	12.41	9.4	6.6	15.14	4
Colombia	5.07	6.2	6.305	7.45	7.79	13.02	8.03	7.86	6.4	10.69	13
Costa Rica	6.47	5.17	5.185	13	7.6	17.05	9.86	10.11	7.3	13.92	6
Dominican Republic	5.43	5.21	0.975	5.6	8.69	12.32	7.97	6.27	4.8	7.33	17
Ecuador	5.7	7.75	8.221	8.69	9.95	16.18	11.17	7.85	6	13.08	10
El Salvador	5.33	5.96	5.781	7.1	6.7	11.3	8.44	5.5	5.9	9.28	14
Guatemala	3.37	4.73	7.276	3.93	10.83	5.39	12.96	2.31	5.9	8.77	16
Honduras	0	3.06	6.373	7.4	6.14	9.85	8.25	2.87	4.6	4.27	18
Mexico	8.06	6.04	6.179	10.6	8.98	12.64	10.56	8.39	7.3	14.31	5
Nicaragua	6.19	12	7.045	8.23	11.28	11.38	11.35	4.16	5.4	13.41	9
Panama	6.97	8.89	10.234	10.27	8.79	13.78	9.19	8.32	6.9	15.21	3
Paraguay	6.32	4.74	10.703	7.5	8.92	12.18	12.5	7.61	5.8	13.66	8
Peru	4.74	6.09	8.209	7.42	2.77	10.31	8.3	6.39	5.8	9.11	15
Uruguay	8.68	7.92	7.701	11.35	9.69	15.46	11.7	8.55	6.4	16.27	1
Venezuela (Bolivarian Republic of)	8.32	3.67	9.333	8.6	9.64	15.17	7.47	8.74	7.1	13.68	7
Mean	5.73	6.65	7.33	8.16	8.11	12.66	10.22	7.35	6.20	12.12	
Variance	4.45	5.82	5.38	6.92	4.47	6.82	3.12	5.25	0.57	10.13	

Source: Own

incorporates much of its information, 64 %. Only 36 % of the information is reflected in the preceding components. As a result, although the work dimension is ranked last in quality-of-life synthetic indicator, it does play a key role in determining quality-of-life disparities found between Latin American countries.

Table 2.5 reflects the results by country for all components.

2.6 International Disparities in Quality of Life in Latin America

2.6.1 *Distribution of the Synthetic Quality of Life Indicator in Latin America*

Figure 2.1 illustrates the overall behaviour of the DP_2 synthetic indicator for the 18 countries in the study. The graphic shows the distribution of the indicator through a frequency histogram reflecting the values of quality-of-life synthetic indicator on the x axis, grouped into intervals of equal size. On the right are the main descriptive statistics of certain features of the distribution, together with some information which enables us to perform a normality test, which we will go on to discuss later.

As can be seen, the mean, median, and mode values (or most frequent) are close to one another. Moreover, there is no statistical evidence to rule out the possibility that the actual distribution of quality-of-life synthetic indicator follows a normal symmetrical distribution compared to the mean and in which the mean, mode, and median coincide, since the Jarque and Bera normality test does not lead to any rejection of the null hypothesis of normal distribution.

Although the normality hypothesis is not rejected, the frequency histogram presents negative asymmetry, or to the left, because the number of countries displaying unusually low quality-of-life synthetic indicator values is greater than the number of countries with unusually high synthetic indicator values. Specifically, there are eight countries showing values to the left of the modal interval (which ranges between 12.5 and 15), whereas there are four countries to the right. In other words, the number of badly situated countries is twice the number of well-situated ones.

There is considerable dispersion in quality-of-life synthetic indicator values around the mean in relative terms (the variation coefficient is 0.3). This reveals that, according to the results of this research, there is a significant degree of disparity amongst Latin American countries with regard to quality of life.

Table 2.6 contains the Synthetic Quality of Life Indicator values. Countries in Latin America are ranked in order of their indicator value.

Given the properties of the DP_2 synthetic indicator, it is possible to interpret these values in cardinal terms. Honduras, for instance, which has the lowest synthetic indicator value, is therefore 4.27 units away from the undesired imaginary country (zero synthetic indicator value) and 12 units away from the best country, which is Uruguay. All the remaining international distances may be determined likewise.

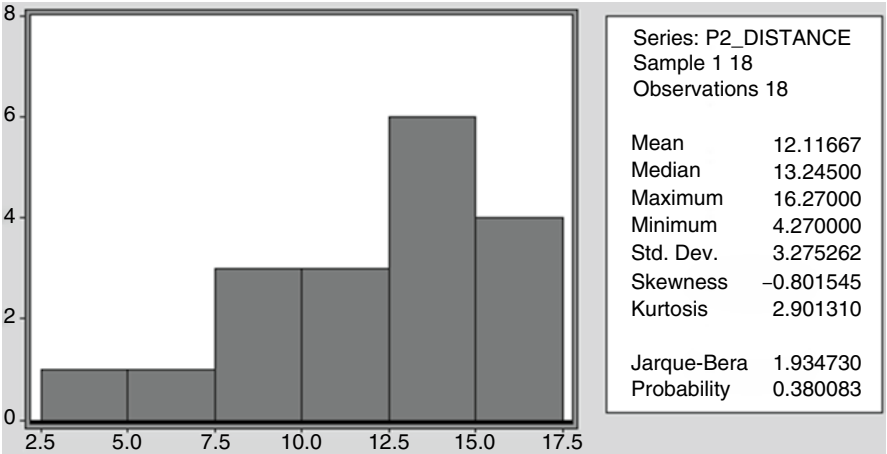


Fig. 2.1 Distribution of the Synthetic Quality of Life Indicator (SQLI) for Latin America (Source: Own)

Figure 2.2 shows a cartogram with the geographical distribution of the Synthetic Quality of Life Indicator.

The darker colour represents the lower level of quality of life in Latin America. Figure 2.2 reveals a clear geographical pattern in which countries located in the Southern Cone, on the one hand, and the North, on the other, enjoy a higher quality of life. These are joined by countries on the Isthmus of Panama and its neighbour, Costa Rica.

2.6.2 Classification of Latin American Countries Following the Synthetic Quality of Life Indicator

Bearing in mind the characteristics of the distribution of the synthetic indicator, mentioned earlier, we have initially classified the countries into three groups, depending on this indicator’s value. These groups correspond, respectively, to high, medium, and low indicator values. To establish the limits between one group and another, we use distribution tertiles.

The shaded colours indicate quality-of-life group to which the countries belong: un-shaded countries belong to the high quality-of-life group (Group T1), those shaded in light grey belong to the intermediate quality-of-life group (Group T2), and those shaded in dark grey to the poorest quality-of-life group (Group T3).

A series of descriptive measures has been estimated for each of the groups to facilitate analysis (Table 2.7).

According to the results, quality of life differs substantially in the three groups of countries. The group with the poorest quality of life has a much lower mean quality

Table 2.6 Ranking of countries, applying the DP₂ Synthetic Quality of Life Indicator

Ranking	Countries	Ordered synthetic indicator
1	Uruguay	16.27
2	Argentina	16.08
3	Panama	15.21
4	Chile	15.14
5	Mexico	14.31
6	Costa Rica	13.92
7	Venezuela (Bolivarian Republic of)	13.68
8	Paraguay	13.66
9	Nicaragua	13.41
10	Ecuador	13.08
11	Brazil	12.36
12	Bolivia (Plurinational State of)	11.53
13	Colombia	10.69
14	El Salvador	9.28
15	Peru	9.11
16	Guatemala	8.77
17	Dominican Republic	7.33
18	Honduras	4.27

Source: Own



Fig. 2.2 Classification of Latin American countries, following the DP₂ Synthetic Quality of Life Indicator (Source: Own)

Table 2.7 Descriptive measures of the DP₂ Synthetic Quality of Life Indicator for Latin America. Countries grouped in terms of the synthetic indicator distribution, by tertiles

Countries	Number of countries	Distance	Mean	Standard deviation	Variation coefficient
Group T1 [High quality of life]	6	2.35	15.16	0.93	0.06
Group T2 [Medium quality of life]	6	2.15	12.95	0.85	0.07
Group T3 [Low quality of life]	6	6.42	8.24	2.22	0.27

Source: Own

Intragroup ranking	Group T1	Group T2	Group T3
1	Uruguay	Venezuela (Bolivarian Republic of)	Colombia
2	Argentina	Paraguay	El Salvador
3	Panama	Nicaragua	Peru
4	Chile	Ecuador	Guatemala
5	Mexico	Brazil	Dominican Republic
6	Costa Rica	Bolivia (Plurinational State of)	Honduras

Chart 2.2 Countries grouped into three quality-of-life groups according to the DP₂ Synthetic Quality of Life Indicator, by tertiles (Source: Own)

of life than the two other groups. The means difference between the two final groups is extremely large, and indeed even higher than the value of quality-of-life synthetic indicator for Honduras, the country with the lowest quality of life.

Moreover, the third group displays the largest absolute dispersion. With a total distribution spread of 12, over half of this spread corresponds to the group with the lowest quality of life. This group also displays the largest dispersion compared to the mean group value (Standard Deviation). Finally, the group with the lowest quality of life also contains the largest relative dispersion compared to the mean group value (Variation Coefficient).

In sum, countries with a low quality of life also evidence the greatest international disparities in terms of quality of life. By contrast, there are no major disparities within the high and medium quality-of-life groups. Quality of life in group 2 is clearly lower than in group 1, although the international disparities within these two groups are very similar, according to all statistical criteria.

Additionally, a cartogram has been created showing the geographic location of the various countries, grouped in terms of the synthetic indicator distribution tertiles.

The darker shade of colour becomes, the lower the level of quality of life in Latin America. Figure 2.3 once again reveals that the highest quality of life corresponds to the Southern Cone of Latin America, together with Mexico and two countries in Central America. The lowest quality of life corresponds to the remaining Central-American countries (except Nicaragua, which has a medium quality of life), in addition to the Dominican Republic and two neighbouring countries in the north-west of South America, Peru, and Colombia.



Fig. 2.3 Classification of Latin American countries, following the DP₂ Synthetic Quality of Life Indicator (Source: Own)

The analysis conducted previously is conditioned by the countries being grouped into three groups of equal size. To verify the robustness of the conclusions, a totally different grouping was performed. Specifically, countries were grouped into three categories in terms of the synthetic indicator values, dividing the spread of the distribution into three equal parts. Results in this case are shown in Chart 2.3, Table 2.8, and Fig. 2.4.

As can be seen in Table 2.8, even though the high quality-of-life group contains most of the observations, it is the group displaying the lowest relative dispersion compared to the mean group value (Variation Coefficient). This confirms that quality of life in Latin American countries is characterised by a situation in which countries with the highest quality of life present minor disparities with one another. By contrast, amongst the countries displaying the lowest quality of life, there are major disparities, both in absolute and relative terms. In fact, this latter group comprises only two countries, the Dominican Republic and Honduras, which have an extremely low mean quality of life. The medium quality-of-life group shows the smallest absolute dispersion as well as an intermediate relative disparity, which is nearly low.

Intragroup ranking	Group S1	Group S2	Group S3
1	Uruguay	Bolivia (Plurinational State of)	Dominican Republic
2	Argentina	Colombia	Honduras
3	Panama	El Salvador	
4	Chile	Peru	
5	Mexico	Guatemala	
6	Costa Rica		
7	Venezuela (Bolivarian Republic of)		
8	Paraguay		
9	Nicaragua		
10	Ecuador		
11	Brazil		

Chart 2.3 Countries grouped into three quality of life groups, according to the DP₂ Synthetic Quality of Life Indicator dividing the Spread of the distribution into three equal parts ([4.27–8.27], [8.27–12.27], and [12.27–16.27]) (Source: Own)

Table 2.8 Descriptive measures of the DP₂ Synthetic Quality of Life Indicator for Latin American countries grouped according to the spread

Countries	Number of countries	Distance	Mean	Standard deviation	Variation coefficient
Group S1 [High quality of life]	11	3.91	14.28	1.25	0.09
Group S2 [Medium quality of life]	5	2.76	9.88	1.18	0.12
Group S3 [Low quality of life]	2	3.06	5.8	2.16	0.37

Source: Own

The darker the shade of colour becomes the lower quality of life in Latin America. Figure 2.4 underpins the low quality of life of certain countries located in three geographical areas: the north-west of South America, Central America, and the Caribbean

In sum, conclusions concerning the geographical distribution of quality of life in Latin America are extremely robust. Regardless of the criteria used to order the countries in terms of quality of life, particularly worthy of note is the distance between poles comprising the Southern Cone, Mexico, and certain Central-American countries, which enjoy a better quality of life, and other countries in the north-west of South America, Central America, and the Caribbean, which enjoy a poorer quality of life.

2.7 Conclusions

The present research offers both a theoretical and empirical approach to measuring quality of life in Latin America. The study’s findings are grounded on a specific set of simple indicators taken from recently available information (2011–2014) for Latin American countries. These indicators have been selected and filtered, providing us with a database of 51 objective and subjective quality-of-life indicators.



Fig. 2.4 Classification of Latin American countries, following the DP₂ Synthetic Quality of Life Indicator dividing the spread of the distribution into three equal parts (Source: Own)

Using this set of indicators, we calculate a territorial Synthetic Quality of Life Indicator (SQLI) using DP₂ distance, the methodology for which is briefly explained in the chapter. Based on the results to emerge from this indicator, the following conclusions may be drawn.

The most important aspects involved when accounting for disparities in quality of life amongst Latin American countries are income, education, and happiness. Furthermore, these three facets display important inter-connections, which also constitute an explanatory factor of quality of life and its disparities in Latin America.

Of the various dimensions of quality of life, the most relevant simple indicators are: a measure of inequality (the quintile ratio), in income; adult literacy, in education; happiness (single indicator); deaths due to natural disasters, in environment; life expectancy at age 60, in health; trust in national government, in society; satisfaction in municipal services, in home; homeless persons, in safety; and satisfaction with local labour market, in job.

The statistical distribution of the Synthetic Quality of Life Indicator displays negative asymmetry, or to the left, since the number of countries showing unusually low quality-of-life synthetic indicator values is greater than the number of countries

with unusually high synthetic indicator values. Indeed, there are twice as many badly situated countries as there are well-situated ones.

The results also reveal considerable dispersion in quality-of-life synthetic indicator values around the mean in relative terms. In other words, there is a significant degree of disparity amongst Latin American countries with regard to quality of life.

Countries with a low quality of life also evidence the greatest international disparities in terms of quality of life, whilst countries with the highest quality of life display small international disparities.

Latin American countries have been classified using quality-of-life indicator, following two different classification criteria, and the geographical distribution of quality of life has been analysed. The results to emerge are extremely robust, since they do not depend on the classification criterion used.

As regards geographical distribution, a clear geographical pattern emerges in which countries located in the Southern Cone and in the North enjoy a higher quality of life, as do countries on the Isthmus of Panama and its neighbour, Costa Rica. At the other end of the scale, countries which have a low quality of life include some of those in the north-west part of South America, Central America, and the Caribbean.

This approach to measuring quality of life in Latin America should be seen as a contribution to research aimed at providing a basis for improving quality of life in Latin America.

2.8 Annex 2.1

2.8.1 *Income*

Satisfaction with standard of living: Percentage of respondents answering “satisfied” to the Gallup World Poll question, “Are you satisfied or dissatisfied with your standard of living, all the things you can buy and do?” Gallup (2013).

Gross National Income (GNI) per capita: Aggregate income of an economy generated by its production and its ownership of factors of production, less the incomes paid for the use of factors of production owned by the rest of the world, converted to international dollars using PPP rates, divided by midyear population. HDRO calculations based on data from World Bank (2014), IMF (2014), and UN Statistics Division (2014).

Quintile ratio: Ratio of the average income of the richest 20 % of the population to the average income of the poorest 20 % of the population. HDRO calculations based on data from World Bank (2014).

Gini coefficient: Measure of the deviation of the distribution of income amongst individuals or households within a country from a perfectly equal distribution. A value of 0 represents absolute equality, a value of 100 absolute inequality. HDRO calculations based on data from World Bank (2014).

2.8.2 *Home*

Internet users: People with access to the worldwide network, expressed per 100 people. World Bank (2014).

Percentage of goods and facilities in the home: Do you or any member of your family have any of the following goods? (House in which the parents have a separate bedroom from the children, Refrigerator/icebox/freezer, Own home, Computer, Washing machine, Fixed telephone, Mobile phone, Car, Running water, Hot running water, Sewage system, Bathroom with shower) Latin barometer (2011).

Satisfaction with availability of green areas and public spaces in your locality: Median of respondents to the question: Would you say you are very satisfied (1), fairly satisfied (2), not very satisfied (3), or not satisfied at all (4) with...? Latin barometer (2011).

Satisfaction with municipal services: Median of respondents to the question: Would you say you are very satisfied (1), fairly satisfied (2), not very satisfied (3), or not satisfied at all (4) with...? Latin barometer (2011).

Satisfaction with roads and paving: Median of respondents to the question: Would you say you are very satisfied (1), fairly satisfied (2), not very satisfied (3), or not satisfied at all (4) with...? Latin barometer (2011).

Satisfaction with public transport: Median of respondents to the question: Would you say you are very satisfied (1), fairly satisfied (2), not very satisfied (3), or not satisfied at all (4) with...? Latin barometer (2011).

2.8.3 *Job*

Satisfaction with job: Percentage of respondents answering “satisfied” to the Gallup World Poll question, “Are you satisfied or dissatisfied with your job?” Gallup (2013).

Employment to population ratio: Percentage of the population aged 25 years or older that is employed. ILO (2013).

Youth unemployment ratio: Percentage of the labour force population aged 15–24 that is not in paid employment or self-employed but is available for work and has taken steps to seek paid employment or self-employment. ILO (2014).

Child labour: Percentage of children aged 5–11 who, during the reference week, did at least one hour of economic activity or at least 28 h of household chores, or children ages 12–14 who, during the reference week, did at least 14 h of economic activity or at least 28 h of household chores. UNICEF (2014).

Satisfaction with local labour market: Percentage of respondents answering “good” to Gallup World Poll question, “Thinking about the job situation in the city or area where you live today, would you say that it is now a good time or a bad time to find a job?” Gallup (2013).

Labour force participation rate by sex: Proportion of a country's working-age population (aged 15 and older) that engages in the labour market, either by working or actively looking for work, expressed as a percentage of the working-age population. ILO (2013).

2.8.4 Health

Adult mortality rate by sex: Probability that a 15-year-old will die before reaching age 60, expressed per 1,000 people. WHO (2013).

Life expectancy at age 60: Additional number of years that a 60-year-old could expect to live if prevailing patterns of age-specific mortality rates stay the same throughout the rest of his or her life. WHO (2013).

Health-adjusted life expectancy by sex: Average number of years that a person can expect to live in full health, taking into account years lived in less than full health due to disease and injury. WHO (2013).

Health expenditure, total: Current and capital spending on health from government (central and local) budgets, external borrowing and grants (including donations from international agencies and non-governmental organisations), and social (or compulsory) health insurance funds, expressed as a percentage of GDP WHO (2014).

Satisfaction with health care quality: Percentage of respondents who answered "satisfied" to the Gallup World Poll question, "Are you satisfied or dissatisfied with the availability of quality health care?" Gallup (2013).

Infant mortality rate: Probability of dying between birth and exactly age 1, expressed per 1,000 live births. Inter-agency Group for Child Mortality Estimation (2013).

Maternal mortality ratio: Number of deaths due to pregnancy-related causes per 100,000 live births. UN Maternal Mortality Estimation Group (2013).

Depth of food deficit: Number of kilocalories needed to lift the undernourished from their status, holding all other factors constant. FAO (2013).

2.8.5 Physical Environment

Satisfaction with actions to preserve the environment: Percentage of respondents answering "satisfied" to Gallup World Poll question: "In this country, are you satisfied or dissatisfied with the efforts to preserve the environment?" Gallup (2013).

Carbon dioxide emissions per capita: Human-originated carbon dioxide emissions stemming from the burning of fossil fuels, gas flaring, and the production of cement, divided by midyear population include carbon dioxide emitted by forest biomass through depletion of forest areas. World Bank (2014).

Deaths due to outdoor air pollution: Deaths of children under age 5 due to respiratory infections and diseases, lung cancer, and selected cardiovascular diseases attributable to outdoor air pollution. HDRO calculations based on World Bank (2014).

Deaths due to indoor air pollution: Deaths of children of age under 5 due to acute respiratory infections attributable to indoor smoke from solid fuels. HDRO calculations based on World Bank (2014).

Deaths due to unsafe water, unimproved sanitation, or poor hygiene: Deaths of children under age 5 due to diarrhoea attributable to poor water, sanitation, or hygiene. WHO (2013).

Population living on degraded land: Percentage of the population living on severely or very severely degraded land. Land degradation estimates consider biomass, soil health, water quantity, and biodiversity. FAO (2013).

Number of deaths due to natural disaster: Number of people confirmed as dead and missing and presumed dead as a result of a natural disaster, expressed per million people. Natural disasters are classified as climatological, hydrological, and meteorological disasters and include drought, extreme temperature, flood, mass movement, wet storm, and wildfire. CRED EM-DAT (2013) and UNDESA (2013).

Population affected by natural disasters: People requiring immediate assistance during a period of emergency as a result of a natural disaster, including displaced, evacuated, homeless and injured people, expressed per million people. CRED EM-DAT (2013) and UNDESA (2013).

2.8.6 Safety

Homeless people: People who lack a shelter for living quarters as a result of natural disasters, who carry their few possessions with them and who sleep in the streets, in doorways or on piers, or in any other space, on a more or less random basis, expressed as a percentage of the total population. United Nations Statistics Division (2014).

Prison population: Number of adult and juvenile prisoners (including pre-trial detainees, unless otherwise noted), expressed per 100,000 people. International Centre for Prison Studies (2013).

Homicide rate: Number of unlawful deaths purposefully inflicted on a person by another person, expressed per 100,000 people. FAO (2013).

Perception of safety: Percentage of respondents answering “yes” to the Gallup World Poll question, “Do you feel safe walking alone at night in the city or area where you live?” Gallup (2013).

2.8.7 Education

Adult literacy rate: Percentage of the population ages 15 and older who can, with understanding, both read and write a short simple statement on their everyday life. UNESCO (2013).

Youth literacy rate: Percentage of the population ages 15–24 who can, with understanding, both read and write a short simple statement on their everyday life. UNESCO (2013).

Population with at least some secondary education: Percentage of the population ages 25 and older that reached at least a secondary level of education. UNESCO (2013).

Mean years of schooling: Average number of years of education received by people ages 25 and older, converted from education attainment levels using official durations of each level. UNESCO (2013).

Expected years of schooling: Number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life. UNESCO (2013).

Satisfaction with education quality: Percentage of respondents who answered "satisfied" to the Gallup World Poll question, "Are you satisfied or dissatisfied with the education system?" Gallup (2013).

Education expenditure: Total public expenditure (current and capital) on education, expressed as a percentage of GDP. World Bank (2014).

2.8.8 Community, Politics, and Institutions

Satisfaction with community: Percentage of respondents answering "yes" to the Gallup World Poll question, "Are you satisfied or dissatisfied with the city or area where you live?" Gallup (2013).

Trust in national government: Percentage of respondents answering "yes" to the Gallup World Poll question, "In this country, do you have confidence in the national government?" Gallup (2013).

Satisfaction with freedom of choice: Percentage of respondents answering "satisfied" to the Gallup World Poll question, "In this country, are you satisfied or dissatisfied with your freedom to choose what you do with your life?" Gallup (2013).

Trust in other people: Percentage of respondents answering "can be trusted" to the Gallup World Poll question, "Generally speaking, would you say that most people can be trusted or that you have to be careful in dealing with people?" Gallup (2013).

Corruption Perception Index (CPI): scale of zero to 10, with zero indicating high levels of corruption and 10 indicating low levels. Transparency International (2014).

2.8.9 *Happiness or Subjective Welfare*

Overall life satisfaction index: Average response to the Gallup World Poll question: “Please imagine a ladder, with steps numbered from zero at the bottom to ten at the top. Suppose we say that the top of the ladder represents the best possible life for you, and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time, assuming that the higher the step the better you feel about your life, and the lower the step the worse you feel about it? Which step comes closest to the way you feel?” Gallup (2013).

2.9 **Annex 2.2**

2.9.1 *Structure of the Components (Table 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, and 2.16)*

Table 2.9 Structure of the synthetic indicator of income

	$(1 - R^2)$	$ r $	DC
Quintile ratio	1	0.8163648	0.4178298
Gross National Income per capita	0.795392	0.7675336	0.5126381
Satisfaction with standard of living	0.8478926	0.6690963	0.1210993
Gini coefficient	0.1768425	0.6453066	0.1114393

Source: Own

Table 2.10 Structure of the synthetic indicator of home

	$(1 - R^2)$	$ r $	DC
Satisfaction with municipal services	1	0.8786285	0.022071
Satisfaction with roads and paving	0.4033778	0.7634929	0.02518012
Satisfaction with public transport	0.3923586	0.7178496	0.02523648
Satisfaction with availability of green areas and public spaces in your locality.	0.6666679	0.5395644	0.02983122
Internet users	0.8096397	0.2792254	0.42529725
Percentage of goods having home	0.1508967	0.1982649	0.260988

Source: Own

Table 2.11 Structure of the synthetic indicator of job

	$(1 - R^2)$	$ r $	DC
Satisfaction with local labour market	1	0.8099177	0.06738544
Satisfaction with job	0.72729134	0.713589	0.32804554
Employment ratio	0.90470163	0.659378	0.07624329
Youth unemployment	0.62427821	0.6465722	0.47086746
Female labour force participation	0.09650481	0.4398092	0.14427324
Child labour	0.28051059	0.1858187	0.72129601

Source: Own

Table 2.12 Structure of the synthetic indicator of health

	$(1 - R^2)$	$ r $	DC
Life expectancy at age 60	1	0.9401236	0.04683208
Female adult mortality rate	0.3244464	0.8631322	0.33971383
Satisfaction with health care quality	0.2663408	0.8599155	0.45593187
Life expectancy health-adjusted years male	0.227777	0.8585963	0.04394801
Life expectancy health-adjusted years female	0.1945799	0.8512857	0.04811063
Maternal mortality rate	0.101425	0.8344322	0.53095283
Depth of food deficit	0.3248304	0.6721157	0.8050288
Male adult mortality rate	0.160578	0.6227991	0.31145762
Health expenditure % GDP	0.458173	0.4328489	0.29632906
Infant mortality rate	0.6043382	0.3615668	0.28065062

Source: Own

Table 2.13 Structure of the synthetic indicator of environment

	$(1 - R^2)$	$ r $	DC
Number of deaths due to natural disaster	1	0.8657016	1.0163399
Population affected by natural disasters	0.6539031	0.6634242	0.9222554
Deaths due to outdoor air pollutions	0.758494	0.6443454	1.2543846
Deaths due to indoor air pollutions	0.4643413	0.6297513	1.1312217
Deaths due unsafe water unimproved sanitation or poor hygiene	0.1281509	0.5107592	0.982751
Population living on degrade land	0.6180147	0.4659057	0.9668695
Satisfaction with actions to preserve the environment	0.9133881	0.4557078	0.2171755
Carbon dioxide emissions per capita	0.5234368	0.4376323	0.6484268

Source: Own

Table 2.14 Structure of the synthetic indicator of safety

	$(1 - R^2)$	$ r $	DC
Homeless persons	1	0.5563988	0.9115531
Homicide rate	0.9829879	0.5291577	0.9596355
Prison population	0.9103187	0.3838439	0.4758059
Overall perception safety	0.9400514	0.518949	0.1692903

Source: Own

Table 2.15 Structure of the synthetic indicator of education

	$(1 - R^2)$	$ r $	DC
Adult literacy	1	0.8999035	0.07847208
At least some secondary	0.3210792	0.8654939	0.20582008
Expenditure on education (% GDP)	0.1991092	0.7892218	0.03301462
Satisfaction with education quality	0.2722142	0.7628560	0.28993146
Expected years of schooling	0.3737685	0.7571686	0.14396810
Youth literacy	0.7884148	0.6799636	0.48031373
Mean years of schooling	0.3679674	0.1930103	0.17397969

Source: Own

Table 2.16 Structure of the synthetic indicator of society

	$(1 - R^2)$	$ r $	DC
Trust in national Government	1	0.6895359	0.32884097
Satisfaction with freedom of choice	0.7542056	0.5996988	0.10592422
Satisfaction with the community	0.9420311	0.5919788	0.06472951
Corruption Perception Index	0.8972059	0.3470709	0.38578079
Trust in other people	0.8431276	0.1223114	0.38338132

Source: Own

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