Article

A Model for Determination of Life Quality Differences among Municipalities

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ABSTRACT

Aim: To design a model for determination of life quality differences among municipalities, which allows for guiding decision-making during land-use planning.
Methods: Expert opinion along with techniques of multivariate statistics.
Main results: Conception and integration of uni- and multi-dimensional indexes of quantitative and perceived life quality; the evaluation of inequality levels; the position of every municipality within the territorial context; and the identification of distinguishing characteristics of each cluster, which calls for actions based on territorial planning, toward reducing such inequalities.
Conclusions: The implementation of a designed model validates different analytical moments of its structure. Accordingly, its capacity to measure, classify and evaluate the differences among municipalities in terms of life quality and its determining factors through established criteria, is demonstrated. It also ranks and associates municipalities based on the results.
Key words: Life quality; unidimensional and multidimensional indexes; inter-municipal inequalities; territorial planning.

RESUMEN

Objetivo: Diseñar un modelo para la determinación de las desigualdades intermunicipales de la calidad de vida, que permita guiar la toma de decisiones en el proceso de planificación territorial.

Métodos: Método de criterio de expertos combinado con técnicas de la estadística multivariada.

Principales resultados: La concepción e integración de los índices unidimensionales y multidimensionales de la calidad de vida cuantitativa y la calidad de vida percibida; la evaluación de los niveles de desigualdad; la posición de cada municipio dentro del contexto territorial, y la identificación de las características diferenciadoras de cada conglomerado, lo que permite proponer acciones desde la planificación territorial, encaminadas a la disminución de dichas desigualdades.

Conclusiones: La implementación del modelo diseñado valida los distintos momentos analíticos contenidos en la estructura de este; de esta manera se demuestra su capacidad para medir, clasificar y evaluar con criterios fundamentados, las desigualdades intermunicipales de la calidad de vida y sus factores determinantes, a la vez que posiciona y relaciona los municipios en correspondencia con los resultados obtenidos.

Palabras clave: calidad de vida; índices unidimensionales y multidimensionales; desigualdades intermunicipales; planificación territorial.

Received: 03/03/2018
Accepted: 29/11/2019

INTRODUCTION

The local development index in Cuba (Méndez, 2013) _calculated from selected indicators for the 1985-2013 period_, showed a higher concentration in provinces in the low level, with little presence of territories in the high categories, and a disadvantage for those with lags and unequal starting conditions to overcome their situation.

According to Íñiguez and Pérez (2004), determining the space-territories with the biggest depression or lag (opaque), or the most attractive or advanced (bright), allows for priority state-sponsored actions that promote compensation or minimization of spatial unbalances and social distances.

In that sense, one of the driving principles to design the National Plan of Economic and Social Development 2030 for Cuba claims that "to achieve an adequate local distribution of the productive forces, combining the national and sectoral dimensions with the local one, and the development of prosperous, ordered, and sustainable modern cities, rural areas and mountains (Communist Party of Cuba [PCC], 2016, p.18).

Accordingly, the process of identification of intermunicipal life quality inequalities is a starting point to design new local distribution balances that go along with the update policy of the Cuban economic and social model, especially, the necessary equity in spatial material distribution that offers the possibility of qualifying and focusing social inequalities.

However, it is important to say note that the aspects related to identification of life quality inequalities are not being materialized and determined, when designing and implementing the experimental Plan of Local Development in Municipalities in some territories, which is based on a methodological procedure for updating the General Plan for Territorial Arrangement, designed by the Institute of Physical Planning (Duverger and Castro, 2011), and the indications to design the Plan of the Economy for 2018. On the contrary, at times, the situation of human settlements is insufficiently described.

Hence, the general aim of this research is to design a model allowing for the determination on intermunicipal inequalities in terms of life quality, so the outcome may guide decision-making during the planning process.

DEVELOPMENT

Life quality is a category used by several disciplines and serves various purposes, which adds more complexity to its definition. That is why, advancing in the design of a life quality definition in the municipality will be the first task of this work. Three main basic components stood out from the conceptual analysis performed. First, its

geographical, dynamic, and multidimensional character; second, the result from objective and subjective factors; and third, the social character of its design.

In the Cuban case, the municipality, in correspondence with the political-administrative structure, is a space that can be planned, and it is functional. It is a social construct, whose configuration depends of factors inherent to society and the political system involved. Hence, according to the authors of this paper, it is the proper scenario to conduct analysis on life quality, by ensuring public life, management, and integrated development planning, articulation, and people participation, and the possibility to intervene in decision-making.

Municipal life quality in Cuba is a dynamic, progressive, and multidimensional process, which expresses the level of realization of social production relations in a given context. It reflects the degree in which needs are met at a certain historical moment, in terms of its objective expression (quantitative and qualitative), and perceived as the achievement of continuous improvement, a goal and motivation for integrated and full development of society, and all its members (Aguilera, Perón, and Hormía, 2014).

Within the local Cuban context, measuring perceived life quality as suggested by the authors, emerges as the need to consider the relation that should exist between the objective conditions of life, evaluated according to indicators produced by local statistics, which are assumed by planners to design prospective and comprehensive annual development plans, and the perception of life quality by a particular social group.

The term inequality of municipal life quality is used in this research to name inequities originated toward the interior of municipalities and among them. It shows the objectivity of a complex reality in which several different dimensions and indicators are interrelated, and show the existence of unequal spatial distribution of life quality. Accordingly, there are some significant and systematic differences, though in theory, inequalities do not have a negative denotation *per se*, it is part of natural diversity and human differences.

The review of national literature promoted interest in this kind of analysis. Authors converge at stating that intermunicipal economic inequalities hinder sustained and continued growth (Becerra, 2004), and therefore, socioeconomic development has essentially been an unbalanced process in the territories. To provide further grounds, recent studies have focused on measuring territorial development; the

characterization of geographical spaces; the search for causes that lead to inequalities; and the evaluation of their impact on society.

Although it has been an explicit topic expressed within the objective of territorial planning by the Ministry of Economy and Planning, work has been done from a sociological perspective (Ferriol, 1998; Íñiguez and Pérez, 2004; Añé, 2007; González, 2013; Espina, 2008). Likewise, measurements have also included municipal development and the living standard in order to rank territories.

However, at this point, it is necessary to state that the term determination of intermunicipal inequalities of life quality not only involves measurements, but also typification, classification, and evaluation, including the identification of intermunicipal inequalities of life quality, which considers distances, dimensions, and indicators with a high discrimination power, that can support decision-making processes to design actions that can be implemented through planning.

From that perspective, having elements that ensure decision-making, in order to attenuate inequalities of life quality, it is important to identify causal factors that contribute to broader gaps, since their knowledge leads to more attention from the government and different actors, about fundamental priority aspects.

A review of the national literature evidenced the existence of several studies linked to determining factors of territorial inequalities in general, where municipalities are influenced by a number of factors which are potentialities or limitations in reducing the existing gaps. These can have an economic, human, institutional, and cultural character, among others, which can determine inequalities associated to life quality in a concrete historical context, in reference to the dimensions taken for measurement.

It is necessary to highlight that the analysis of intermunicipal inequalities not only is included in the municipal process of development planning, but also in that of the province. At this level, more coherent and differentiating policies can be established in groups of municipalities, depending on the type of inequality of life quality identified, which is combined with the actions of the municipality, based on the nature and behavior of determining factors of such inequalities.

The critical evaluation made on this topic has allowed the investigators of this paper to consider the theoretical rationale for the design of a model that permits determination of intermunicipal irregularities of life quality as follows:

1. Definition of life quality has a multidimensional nature, manifested at the local level; its measurement comprises the objective approach (based on quantitative and qualitative indicators), and perceived (perceived life quality).
2. Operationalization of life quality at a global scale in dimensions and indicators, which is a basic requisite for measurement, typification, and evaluation of intra- and intermunicipal inequalities.
3. Identification of intermunicipal inequalities in every dimension, through descriptive and analytical evaluation of indicators with a discriminatory power, validated by statistical techniques and methods that help explain the differentiation of life quality among municipalities, and their local behavior in time.
4. The integration of objective life quality analysis (CVOM), and the quality of perceived life quality is the logical rationale for identification of more integrated typologies of inequalities, to plan generic and specific actions.
5. Measurement, typification, classification, and evaluation of intermunicipal inequalities corresponding to a given model. Hence, when a model is designed to achieve that aim, the fact that dimensions and indicators are not permanent, and vary depending on the historical-concrete conditions of its application, should be considered.

The method of modeling and systemic approach was used to argument this process, from the conception as a unit, the integration of elements, but not as a simple sum of its parts, where each has an impact on the others.

The criteria stated by Ferriol (1998) were included to determine the components of the model suggested, which coincide in that all models are structured within a set of essential components and relations, such as principles and stages.

It was assumed that principles are permanent starting and returning points, which are mandatory to achieve efficient measurement of inequalities in life quality at a local scale. In order to define them, information was obtained through qualitative research instruments, like surveys to experts and specialists in planning, and document review, which included reports and other documents from the Ministry of Economy and Planning, and the National Office of Statistics (ONEI).

According to the authors, seven starting principles must be fulfilled for identification of intermunicipal inequalities of life quality, which were finally kept, though their declaration and explanation were modified according to opinions from specialists, who demonstrated their expertise in this topic. Below are the resulting principles:

1- Pertinence: Identification of intermunicipal inequalities of life quality has to describe the local necessity and reality within a context, based on a systematic diagnosis of its behavior, expressed through planning actions that include the real capacity of the municipality in order to mitigate or reduce them, based on the needs of the population and the local government.
2- Parsimony: The design of the procedure must consider that results are achieved with minimum information use, no redundancy, and relevance, to measure the dimensions in a way that permits simplification of comprehension and implementation.
3- Flexibility: It refers to the capacity the identification process has in terms of intermunicipal inequalities of life quality, to adapt to different contexts and measurement techniques.
4- Participation: The planning authorities and the municipal and provincial governments take part in the identification of intermunicipal inequalities of life quality, as experts/users, to contribute to the formulation of actions leading to its reduction and insertion in planning actions.
5- Systemacity: It has to do with maintaining control and surveillance over the behavior of local life quality, which can reveal the existence of intermunicipal inequalities in quantitative and qualitative aspects of life quality and its dynamic.
6- Confidentiality: It relies, largely, in the application of methods and techniques of scientific research that contribute to the veracity and objectivity of results.
7- Communication of results: It refers to the need to publish the results, so they can be known and used by planning authorities and specialists, as well as for design and implementation of policies.

These principles are present across the model, though the stages and steps in it favor the action of some in relation to the rest, depending on their objectives.

Along with it, based on the literature review and the implementation of the method of opinion of experts, the authors established the following fundamental premises:

1. Municipal life quality may be evaluated from nine dimensions: education, health, employment, and social assistance; housing; food-nutrition; environment; recreation and leisure; transportation and communications; economic situation.

They include areas of essential needs in terms of municipal life quality, adjusted to the Cuban context, from diagnosis to the proposal of planning actions, which contributes to government performance, in keeping with its functions at different levels, and the control and follow up of actions to take.

2. The dimensions do not have the same importance concerning life quality at the local scale in a province; hence, they must be arranged by order of importance.

3. A set of indicators is defined for every dimension, as shown in Table 1, as the result of the implementation of qualitative techniques (opinion of experts), and quantitative (analysis of principal components, combined with analysis of hierarchical clusters), considering that life quality in the municipality is a multidimensional construct.

Table 1. Indicators of every dimension of objective municipal life quality

Dimensions	Indicators	Acronyms	UM	Source
Education	Expenditure in education x population (+ 6 years)	EE x Inhab	PESOS	ONEI
	Average educational level	AEL	UNO	ONEI
	Teachers x inhabitants (+ 6 years)	T x inhab	UNO	ONEI
	Professionals x economically active population %	P x AP %	UNO	ONEI
Health care	Infant survival rate x 1000 born live	STx1000BL	UNO	ONEI
	Mortality rate x 10 000 inhabitants	MRx10thoulnhab	UNO	ONEI
	Community doctor office x 1 000 inhabitants	Inhab x CDO	UNO	ONEI
	Expenditure in health care x inhabitant	EH x Inhab	PESOS	ONEI
Employment, security, and social assistance	Economically active population working %	EAPW	UNO	ONEI
	Protected households in the municipality %	PHM	UNO	ONEI
	Employed population insured %	EPI	UNO	ESEN
	Per capita expenditure in social assistance	PcESA	PESOS	ONEI
Housing	Home rate per inhabitant	HR x inhab	UNO	HOUSING OFFICE
	Homes in proper conditions %	HPC %	UNO	HOUSING OFFICE
	Homes with current water %	HCW %	UNO	ONEI
	Homes with sewing system %	HS %	UNO	ONEI
	Homes with garbage collection %	HGC %	UNO	ONEI
	homes with street lights %	HSL %	UNO	ONEI
Food-nutrition	*Per capita* public food sales	PcPFS	PESOS	ONEI
	Per capita sales in farmers' market	PcSFM	PESOS	ONEI
	Per capita prepared food sales	PcPFS	PESOS	ONEI
	Consumption of kcal by inhabitant	Ckcal x inhab	UNO	DPPE
Environment	Population with access to residual water treatment %	PARW %	UNO	CENSUS
	Volume of solid waste collected per inhabitant	VWC x inhab	UNO	ONEI
	Per capita of green areas %	PcGA %	UNO	ONEI
	Per capita of swept streets	PcSS	UNO	ONEI
Recreation and leisure	Number of libraries	NL	UNO	ONEI
	Number of museums	NM	UNO	ONEI
	Inhabitants per sports facilities	Inhab x SF	UNO	ONEI
	Per capita Expenditure in culture and sports	PcECS|	PESOS	ONEI
Transportation and communications	Coefficient of public transportation services	PTS	UNO	ONEI
	Telephone density per inhabitant	TD	UNO	ETECSA
	Municipal road density	MRD	UNO	DPT
	Highway index per km^2	HIK^2	UNO	DPT
Economic situation	Gross value added	GVA x inhab	PESOS	ONEI
	Hard currency sales per inhabitant	HCS x inhab	PESOS	ONEI
	Total income per inhabitant	TI x inhab	PESOS	ONEI

Source Based on SPSS output 19.0

4. Perceived municipal life quality measurement (PMLQ) requires the application of a survey based on defined dimensions and indicators, as shown in Table 1.

Table 2. Survey applied to evaluate perceived life quality

Dimensions	Item	1	2	3	4
Education	V01-Confidence in the municipal education system				
	V02-Perception of the efficacy of the educational service in the municipality				
	V03-Assessment of the educational level of the municipal population				
	VO4-Assessment of the quality of the educational infrastructure in the municipality				
Health care	V05-Assessment of the quality of health care services in the municipality				
	V06-Perception of the people's health status				
	V07-Perception of health education of the municipal population				
	V08-Confidence in the health care system in the municipality				
Employment, security, and social assistance	V09-Satisfaction with public policy on employment in the municipality				
	V10-Assessment of work conditions in the municipality				
	V11-Assessment of social security, amount of pensions and subsidies				
Housing	V12-Satisfaction with the housing conditions in the municipality				
	V13-Quality of service rendered by housing institutions				
	V14-Assessment of public service quality in homes (power, water, telephone, etc.)				
	V15-Assessment of home safety				
Food-nutrition	V16-Perception of the nutritional situation in the municipality				
	V17-Assessment of food access by the population				
	V18-Satisfaction with food services offered by food businesses				
Environment	V19-Satisfaction with the environmental conditions in the municipality				
	V20-Perceptionof public safety in face of environmental risks (hurricanes, floods, etc.)				
	V21-Satisfaction with them municipal solid waste collection				
Recreation and leisure	V22-Satisfaction with the amount and quality of recreational activities in the municipality				
	V23-Satisfaction with the cultural and entertainment infrastructure				
	V24-Satisfaction of leisure use in the municipality				
Transportation and communications	V25-Assessment of the conditions of sidewalks, zebras, and parks				
	V26-Assessment of municipal transportation services				
	V27-Satisfaction with the quality of post office, telephone, press deliver, transportation, and other services				
Economic situation	V28-Assessment of the economic situation in the municipality				
	V29-Satisfaction with the supply and prices of goods and services				
	V30-Satisfaction with economic safety				

The greatest theoretical and methodological contributions of this research are found in the principles and premises defined, which are elements to consider in all the stages that make up the model designed, as shown in Fig.1

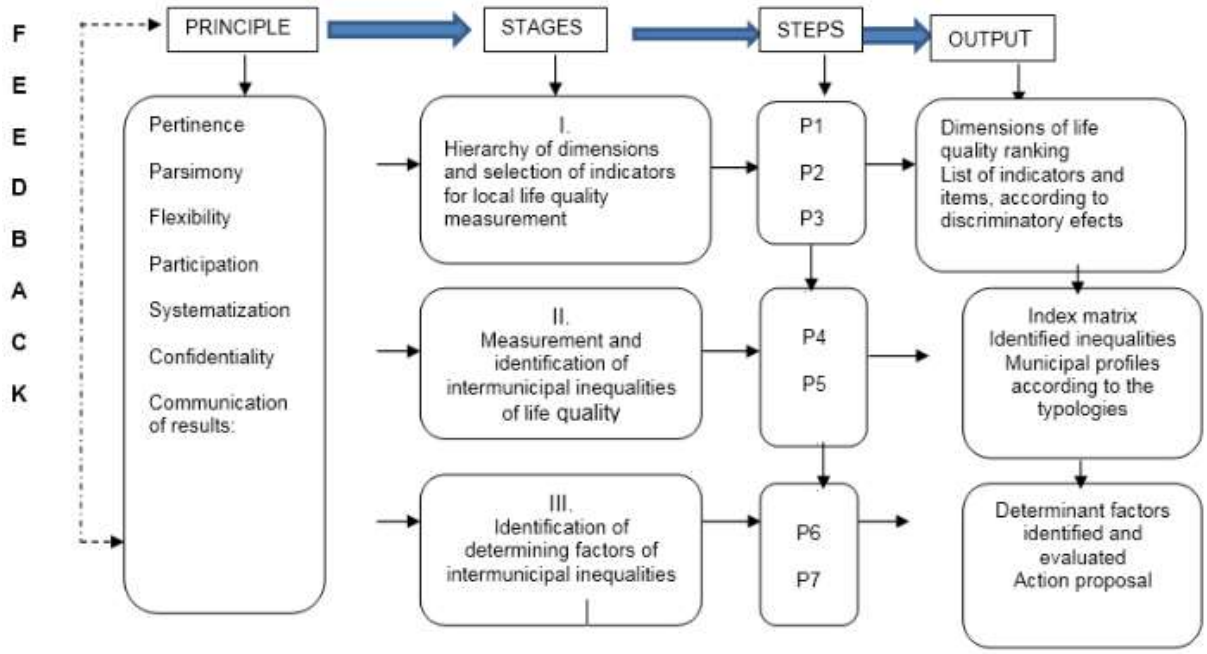

Fig. 1 A model for determination of intermunicipal inequalities of life quality

The model presented assumes that development is differential, and that the inequalities generated by a deformation of the economic structure will not be eliminated. It is fundamental to seek a reduction of gaps with the proactive participation of all the actors, not excluding the role played by the distributive factor. The objectives per stage and an explanation of the steps that make them are presented below:

Stage I. Hierarchy of dimensions and selection of indicators for local life quality measurement

The objective of this stage is to rank defined dimensions to evaluate life quality, and indicators with discriminatory effects at a local scale, according to the concrete situation of the municipalities. It is made of three steps.

Step 1. Determination of the importance of ranking dimensions and in a hierarchical order.

The importance of ranking every dimension is determined by expert judgment, and is done by the Territorial Commission of Planning and Local Development (CTPD), with

the participation of the *ad hoc* group, so their opinions and appreciations are discussed, which is important for hierarchic arrangement of dimensions (Table 2), according to a survey containing a list of dimensions.

The evaluations given by each expert will be recorded through a 1-10 scale, where the top limit (10 points) represents the highest impact or possible contribution to the dimension, and vice versa.

In this case, it is recommended to use Kendall W concordance coefficient to verify the degree of expert coincidence in the arrangement of dimensions, according to the degree of importance attributed.

Step 2. Selection of indicators by dimensions to measure CVOM

Upon considering the complexity of life quality, and that the aim of the model is to identify intermunicipal inequalities, it is important to determine the discriminating indicators in the municipalities to study. Hence, analysis of variance (ANOVA) is suggested to determine if there are statistically significant differences between two groups of individuals or more (municipalities), as to the mean and variance of the indicator, so all indicators in Table 2 may not be considered.

When the groups to be formed are defined, a K mean hierarchical analysis is performed, which will show an analysis of variance (ANOVA output) explaining the indicators that introduce modifications among groups (discriminants), for a significance level below or equal to 0.05.

The output of this step is the matrix of indicators for all CVOM dimensions, after checking reliability, validity, and discriminating power, using statistical methods.

Step 3. Application of a survey to measure CVPM and data arrangement

The application of this survey in Table 2 requires the type of sampling that is most convenient, according to the context of the study, in order to obtain a representative sample. When applied, it is important to use methods and techniques to collect and process information, such as factorial analysis.

Before application, the reliability of the questionnaire and the scale to be used, should be validated. Reliability consists a scale utilization to produce similar results when different people use it, with different manners of conducting a test. It is done through the Alpha Cronbach analysis coefficient.

The output of the stage is the dimensions of life quality, and the indicators and items, validated according to their discriminating effects, arranged hierarchically.

Stage II. Measurement and identification of intermunicipal inequalities of life quality

The aim of this stage is to measure perceived and CVOM The input constist of the data matrix by dimensions, and it has two steps:

Step 4. Creation of data matrices, calculation of indexes and identification of intermunicipal inequalities of life quality.

This step is made by specialists of the team created by CTPD. The information is organized in the matrices of perceived and CVOM, to calculate the unidimensional indexes of life quality, as input to identify inequalities.

Based on the standardized matrix value of indicators, and items corresponding to all the dimensions of life quantitative and perceived quality, two types of analyses are recommended: unidimensional and multidimensional. One of them is explained below.

Unidimensional analysis

The indicators inside each dimension are assumed to have the same weighted importance, so assuming the proposal made by Fernández and Leva (2004), the value of a dimension will correspond to the equation:

Where:

$$D_x=\sum_{x=1}^{n}\frac{ind_{xj}}{n}$$

D_x: Value of the index corresponding to the dimension j

ind_{xj} : Value of the indicator or items x the dimension j

n: Number of indicators and items that make up the dimension j.

The contribution of these indexes to measurement and identification of intermunicipal inequalities from a unidimensional approach, lies in the possibility of showing the direct effect of each indicator and item on such differences, by looking at the ones with the highest discriminating power, and therefore, threby contributing largely to distance increases or nearness between municipalities.

Upon calculating the unidimensional indexes of all the dimensions and municipalities, two types of analyses are suggested. A descriptive analysis, which pursues characterization of a territorial distribution characterization of the index values achieved in the different municipalities, and a second type of analysis, which explains the exiting gaps among municipalities, and requires the application of variance

coefficient (percentage), since it is a relative dispersion measure that is not bound to problems to the measure unit. The criteria of Fuenzalida and Moreno (2009) concerning intra-regional inequalities was assumed.

- If it does not exceed 25%, a small dispersion will be considered (large intermunicipal equality).
- Between 25 and 50%, a large dispersion will be considered (large intermunicipal inequality).
- If it exceeds 50%, it will be regarded as excessive dispersion (extreme intermunicipal inequality).

Multidimensional analysis

The multidimensional analysis enables simultaneous analysis of two or more dimensions, which permits a whole vision of problems, and uncovers the complex interaction of factors that take place in regional phenomena, by evaluating not only differences in relation to other municipalities, but also their similarities.

This analysis is necessary, and is methodologically viable, since the dimension for very heterogeneous municipalities must be weighted, as the basis to guide decision-making during the planning process not only in the municipality, but also to focus on the priority dimensions from planning processes. To achieve that, it is important to regard unidimensional indexes based on their weighted importance, which would indicate that the significance of each dimension is distinct, and it is calculated according to Fernández and Leva (2004), with the equation:

$$\mathrm{ICVM} = \sum_{D1}^{Dm} (D_1 * \text{weight}_{D1} + D_2 * \text{weight}_{D2} + \ldots + D_m * \text{weight}_{Dm}) / m, \ \forall \ \text{weight}_{Di} \neq 0$$

ICVM: Index value of multidimensional life quality

D_m: Dimension life quality, where m is the number of dimensions considered.

weighted_{Dm}: Weighted index of the dimension.

Where the weight factors must fulfill this restriction:

$$\sum_{i=1}^{m} \text{weight}_{Di} + \mathrm{K} + \text{weight}_{Dm} = 1 \ \forall \ 0 \leq \text{weight}_{D1} \leq 1$$

That is, the sum of weight factors of the dimensions will have a value of 1. Obtaining weighted dimensions necessarily implies the incorporation of subjective analysis to

municipal life quality, to strengthen the vision of the importance and influence of each dimension.

Both perceived and objective ICVM of each municipality, permit the establishment of a ranking that indicates the location of municipalities in all the different intervals calculated from the expression of “c”, suggested by Spiegel (1966), to typify the results of indexes, because it is a simple method which is commonly used by investigators. The formula for calculation is,

$$c = \frac{1}{3}\left[\text{Max}\ (\text{ICVUP}\ ) - \ \text{Min}\ (\text{ICVUP}\ )\right]$$

Three levels or stages are suggested for municipal typification, considering the values taken by the indexes: low, mid, and high life quality, based on international and Cuban references.

This pool of municipalities was made according to their typologies of similar life quality; it allows governments and engaged entities to make decisions in order to set up more coherent and less homogeneous policies, strategies, and actions to tackle inequalities, depending on which dimensions and indicators case groups should be prioritized.

Step 5 Analysis and level of correspondence between quantitative and perceived life quality. Classification of global multidimensional municipal life quality (CVGMM)

The purpose is to determine the possible existence of an important relation between CVOM and perceived (CVPM), and identify cluster profiles based on the dimensions involved, which is important to measure and identify inequalities, and proposals of possible actions for attenuation.

This step has two moments: The first one is important to determine if there is a linear ratio between CVOM, and considered variables, not at random. That is, this ratio is not statistically significant. Accordingly, the Pearson correlation analysis is performed, since the constant amplitude of the scale ensures treatment at intervals (Hernández, 2017).

A second moment is used to identified the global life quality typologies that pools municipalities based on the behavior of their dimensions. consequently, simple correspondence analysis is performed to identify basic dimensions through analysis of contingency tables or correspondences achieved by crossing qualitative variable categories (nominal and ordinal scales), observed in a sample.

The Gamma correlation coefficient is calculated to verify the ratio, helping determine the ratio between the two ordinal variables (González, 2011; Madruga, 2012). The output of this stage is the municipality profiles according to their typologies.

Stage III. Identification of determining factors of intermunicipal inequalities

The objective is to identify the determining factors of inequalities and suggest actions toward reduction, by means of their insertion in planning. It will be conducted by the specialists from the team created by CTPD.

Step 6. Identification of determining factors of intermunicipal inequalities of life quality

The determining factors of inequalities have a multidimensional character, with the coexistence of physico-environmental, human, economic-financial, sociocultural, technological, and other factors. Opinion of experts is the method used for identification of these factors, with the Delphi technique, based on the application of a questionnaire linked to the Likert scale, with nodal values (1-5) above 4.

The determination of power influences of these values on intermunicipal inequalities is done with the MIC-MAC method, since it allows for identification of driving and dependent factors (key variables), from a matrix of direct influences (crossed impact matrix), to find the influence level of some factors on others. The value scale suggested by Godet was used, by which influences are scored 0-3, and offers a possibility of signaling potential influences.

Thus, zero means that the factor exerts no influence; one indicates that the influence is weak; two can be classified as mid; and three shows a strong influence. A maximum P value means that the factor exerts a potential influence.

Similarly, the analysis of the influence and dependence plane permits determining the final treatment for each factor of the system, based on the following decision criteria.

Quadrant 1: input variables, highly motile, little dependent factors are found. These are the most explicative ones, conditioning the others that influence on the formation of intermunicipal inequalities of life quality.

Quadrant 2: linking variables that groups highly motile, and very dependent factors. Hence, any action exerted on them will have repercussions on the others, causing a boomerang effect. These types of factors may be considered dependent and explicative simultaneously.

Quadrant 3: identifying little motile and very dependent variables of factors. They are the resulting factors, whose evolution is explained by the action of input and linking factors.

Quadrant 4: placing the variables excluded or little motile and little dependent factors, which are relatively autonomous and can be excluded from the analysis.

Step 7. Design of planning actions, according to their typologies

The objective of this step is to suggest planning actions based on identified profiles. It is conducted by the group of experts through process consulting, which allows for the design of action programs, and suggests changes to improve certain decisions.

The output of this stage is identification and evaluation of determining factors, as well as planning action proposals.

The model for determination of intermunicipal inequalities of life quality was validated in the municipalities of Holguin, Cuba. The outputs obtained in each stage are summarized below:

Stage I. Hierarchy of dimensions and selection of indicators for local life quality measurement

To cope with the different stages, a group of specialists was chosen, of which 16 proved their expertise to apply the model. To arrange the dimensions according to their weighted importance, they were asked to answer a questionnaire, and the responses were submitted to concordance tests through Kendall W coefficient, and reliability, using Cronbach Alpha coefficient, through SPSS, for Windows (version 20.0). The results achieved in both cases were favorable.

Based on the values given to the dimensions, the highest ranking position was for health care (HTH-13.5%), education (EDU-12.6%); housing (HOU-12.3%); food and nutrition (F-11.7%; economic situation (EZ-11.1%; employment, social security, and social assistance (ESSA-10.8%); environment (EV-10.6%); recreation and leisure (RLT-8.9%; and transport and communications (TC-8.5%).

The evaluation of the list of indicators in Table 1 was made according to the open structured interview consulting to specialists at the provincial and municipal offices of ONEI, who worked on the models of primary information in the system, specialists of institutions and bodies which the dimensions belong to, and specialists from the statistical departments of the bodies from the Central Administration of the State.

Based on the proposals, there was a first evaluation of information availability, in relation to the time period analyzed, with the necessary territorial disaggregation

(municipal scale). Secondly, the indicators with a relevant significance for life quality evaluation were selected following multidimensional and unidimensional approaches. Then, the indicators with a capacity to set differences or matrices among municipalities were chosen from that previous set. Finally as a fourth step, considering the posible existence of information redundancy in the proposals, the highly correlated indicators in each dimension were removed, thus avoiding co-linearity problems.

Out of 38 chosen indicators distributed in nine dimensions at the end, only 22 (57.8 %) showed discriminatory effects to measure inequalities of CVOM, as shown in Table 3.

Table 3. Selected indicators

Dimensions	Indicators	Sig.
Health care	Mortality rate x 10 000 inhabitants	.000
	Community doctor office x 1 000 inhabitants	.001
	Expenditure in health care x inhabitant	.000
Education	Expenditure in education x population (+6 years)	.000
Housing	Homes in proper conditions %	.016
	Homes with current water %	.001
	Homes with sewing system %	.012
	Homes with garbage collection %	.000
Food-nutrition	Consumption of kcal by inhabitant	.000
Economic situation	Gross value added	.000
	Hard currency sales per inhabitant	.000
	Total income per inhabitant	.000
	Mean monthly salary in the municipality	.013
Employment, security, and social assistance	Economically active population working %	.001
	Households protected by municipal social assistance %	.021
	Employed population insured %	.004
Environment	Population with access to residual water treatment %	.000
	Green areas *per capita*	.001
Recreation and leisure	Number of museums	.000
	Inhabitants per sports facilities	.000
	Per capita expenditure in culture and sports	.000
Transport and communication	Highway index per km^2	.001

To obtain the items with discriminating indexes in relation to perceived life quality inequalities, when the surveyed was applied (Table 2), an intentional 545 individual sample including different strata, sexs, ages, and residence areas, was considered, for the 14 municipalities of the province in the study.

The results of the analysis of variance (ANOVA) to each dimension, based on the mid scoring of items (95% confidence), showed the 24 items with discriminating effects to measure inequalities, which were related to perceived life quality (Table 4).

Table 4. Results of analysis of variance

Dimensions	Items	Sig.
Health care	5. Assessment of the quality of health care services in the municipality	.001
	7. Perception of health education of the municipal population	.000
	8. Confidence in the health care system in the municipality	.000
Education Housing	4. Assessment of the quality of the educational infrastructure in the municipality	.003
	13. Quality of service rendered by housing institutions	.000
	14. Assessment of public service quality in homes (power, water, telephone, etc.)	.016
	15. Assessment of home safety	.012
Food nutrition	16. Perception of the nutritional situation in the municipality	.001
	17 Assessment of food access by the population	.000
Economic situation	28. Assessment of the economic situation in the municipality	.000
	29. Satisfaction with the supply and prices of goods and services	.000
	30. Satisfaction with economic safety	.002
Employment, security, and social assistance social	9. Satisfaction with public policy on employment in the municipality	.001
	10. Assessment of work conditions in the municipality	.003
	11 Assessment of social security, amount of pensions and subsidies	.000
Environment	19. Satisfaction with the environmental conditions in the municipality	.004
	20. Perception of public safety in face of environmental risks (hurricanes, floods, etc.)	.005
	21. Satisfaction with them municipal solid waste collection	.004
Recreation and	22. Satisfaction with the amount and quality of recreational activities in the municipality	.007

Stage II. Measurement and identification of intermunicipal inequalities of life quality Identified inequalities

Municipal profiles according to the typologies

Table 5 shows the CVOM indexes for the municipalities of Holguin province, in 2015, as well as its classification and ranking, indicating the municipalities with the highest achievements, which are apparently vulnerable. It is important to highlight municipalities Holguin and Moa, with dimensions of quantitative life quality. Overall, 61.1% of the municipal/dimension values ranked in the low typology, and 34.1% in the mid. The worst municipalities were Cacocum, with 88.8% of dimensions within the low typology. Gibara, Calixto Garcia, Cueto, and Sagua accounted for 77.7%.

Concerning perceived life quality (Table 6), the following conclusions have been drawn: the highest rankings are for Holguin and Mayari, with 77.7% of their dimensions within the high category, seven of them in the first three places. The positions of Cueto, Rafael Freyre, and Sagua are contrasting, with more than 50% of their dimensions in the low typology (66.6%), ranking 10-14 in the hierarchical arrangement of all the municipalities. In short, 34.9% of the values belong to the low category; 46.8% to the mid category; and 18.2% are in the high category. The distribution of results among municipalities is unequal.

According to these results, and the corresponding analysis, the municipalities were classified as follows:

I. Municipalities with global multidimensional life quality (CVGMM), with high vulnerability: characterized by a low CVOM, and low and mid perceived life quality. It comprises 78.6% of municipalities (Gibara, Rafael Freyre, Banes, Antilla, Baguano, Calixto Garcia, Urbano Noris, Cueto, Frank Pais, Sagua, and Cacocum).

II. Municipalities with global multidimensional life quality (CVGMM), with low vulnerability: identified by a mid CVOM, whereas the perceived CVOM may be high or mid. Municipalities Moa and Mayari are within this group, accounting for 14.3%.

III. Most favored global multidimensional life quality (CVGMM): high objective and perceived life quality. The municipality of Holguin, accounting for 7.1%.

Table 5 Weighted results of objective life quality indexes and hierarchies

Education		Health care			Security and social assistance			Housing			Food-nutrition			Environment			Recreation and leisure			Transport and communication			Economic situation	
**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**
6	II	0.06	11	II	0.04	12	I	0.05	8	I	0.03	10	I	0.03	8	I	0.03	4	I	0.02	11	I	0.00	7
13	I	0.08	4	II	0.03	13	I	0.03	14	I	0.16	6	II	0.06	1	II	0.01	7	I	0.03	5	I	0.01	4
7	I	0.07	8	II	0.08	2	II	0.05	6	II	0.05	7	II	0.04	4	I	0.04	3	I	0.04	3	I	0.01	8
3	II	0.07	9	II	0.04	11	I	0.07	4	II	0.06	4	II	0.03	11	I	0.00	14	I	0.02	9	I	0.00	13
11	I	0.10	1	II	0.06	6	II	0.04	12	I	0.03	11	I	0.04	7	I	0.00	13	I	0.03	6	I	0.03	9
1	III	0.09	3	II	0.07	3	II	0.11	2	III	0.10	1	III	0.03	12	I	0.06	1	II	0.08	1	II	0.04	2
8	I	0.10	2	II	0.09	1	II	0.05	9	I	0.03	12	I	0.04	5	I	0.01	10	I	0.02	7	I	0.00	11
14	I	0.08	5	II	0.05	8	I	0.04	10	I	0.04	8	I	0.3	9	I	0.01	8	I	0.02	14	I	0.00	14
9	I	0.07	6	II	0.07	4	II	0.06	5	II	0.07	3	II	0.04	6	I	0.01	11	I	0.02	13	I	0.00	12
12	I	0.06	10	II	0.05	9	I	0.05	7	II	0.03	13	I	0.03	10	I	0.01	9	I	0.04	2	I	0.00	8
5	II	0.05	13	II	0.03	14	I	0.08	3	II	0.04	9	I	0.04	3	I	0.05	2	I	0.03	4	I	0.03	3
4	II	0.04	14	II	0.05	7	II	0.04	13	I	0.06	5	II	0.05	2	II	0.00	12	I	0.03	7	I	0.01	5
10	I	0.07	7	II	0.07	5	II	0.04	11	I	0.03	14	I	0.02	14	I	0.01	6	I	0.02	8	I	0.00	10
2	III	0.05	12	II	0.04	10	I	0.12	1	III	0.07	2	II	0.03	13	I	0.01	5	I	0.02	12	I	0.11	1
		0.07			0.06			0.06			0.05			0.04			0.02			0.03			0.02	

Value calculated on the arithmetic mean of weighted indexes

** Provincial ranking by dimensions

*** Life quality typologies reached by the municipalities according to the dimension

****Number of dimensions per municipalities, classified depending to the objective life quality

Table 6 Results of weighted perceived life quality indexes, and hierarchy

	Education			Health care			Security and social assistance			Housing			Food-nutrition			Environment			Recreation and leisure			Transport and communi on	
Municipalities	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**
Gibara	0.04	12	II	0.04	11	II	0.06	4	II	0.05	8	II	0.04	9	I	0.06	5	II	0.05	7	II	0.04	9
R. Freyre	0.02	14	I	0.01	14	I	0.02	10	I	0.07	4	II	0.02	14	I	0.04	12	I	0.04	8	II	0.05	5
Banes	0.05	10	II	0.04	12	I	0.02	11	I	0.03	12	I	0.04	8	II	0.05	8	II	0.05	6	II	0.02	11
Antilla	0.07	7	II	0.06	8	II	0.01	12	I	0.05	7	II	0.05	6	II	0.07	4	II	0.07	4	II	0.04	8
Báguano	0.09	2	III	0.08	5	III	0.01	14	I	0.05	9	II	0.06	5	II	0.06	7	II	0.03	10	I	0.02	12
Holguín	0.07	6	II	0.08	2	III	0.11	1	III	0.11	1	III	0.10	2	III	0.10	1	III	0.05	5	II	0.08	1
C García	0.05	11	II	0.03	13	I	0.01	13	I	0.04	11	II	0.03	11	I	0.06	6	II	0.06	3	II	0.05	7
Cacocúm	0.06	9	II	0.08	6	III	0.03	7	I	0.04	10	II	0.07	3	II	0.04	11	II	0.04	9	II	0.05	6
U. Noris	0.08	4	III	0.07	7	II	0.02	9	I	0.03	13	I	0.05	7	II	0.07	3	II	0.07	1	II	0.04	10
Cueto	0.07	5	II	0.08	4	I	0.05	5	II	0.01	14	I	0.03	12	I	0.01	14	I	0.03	12	I	0.00	14
Mayarí	0.09	3	III	0.10	1	III	0.09	2	III	0.09	2	III	0.10	1	III	0.09	2	III	0.06	3	II	0.06	4
F. País	0.06	8	II	0.06	8	II	0.08	3	II	0.06	5	II	0.02	13	I	0.05	9	II	0.03	13	I	0.06	3
Sagua de T.	0.04	13	I	0.06	10	II	0.04	6	II	0.05	6	II	0.04	10	I	0.05	10	II	0.02	14	I	0.01	13
Moa	0.10	1	III	0.08	13	III	0.03	8	I	0.09	3	III	0.06	4	II	0.02	13	I	0.03	11	I	0.07	2
Mid	0.06			0.05			0.05			0.06			0.05			0.05			0.06			0.05	

* Value calculated depending on the arithmetic mean of weighted indexes

** Provincial ranking by dimensions

*** Life quality typologies reached by the municipalities according to the dimension

**** Number of dimensions per municipalities, classified depending to the objective life quality

Stage III. Identification of determining factors of intermunicipal inequalities

According to the methods applied, and the model explanation, the motricity plan produced that the very motile and little dependent factors are key for evaluation of life quality in the municipalities, because they had an effect on the rest. The most influential are employment, and municipal investment. Factor distribution and quality of social services, situation of the socio-economic infrastructure in the municipality, the internal market, and municipal currency circulation, are less dependent, so action planning is made possible.

CONCLUSIONS

Since increasing life quality is the end objective of local development processes, its planning requires a theoretical and methodological basis. The starting point to achieve this lies in the proper conception of life quality at a local scale, adjusted to the Cuban scenario, which implies the definition of dimensions and indicators that ensure measurement, classification, and identification of intermunicipal inequalities and its determining factors.

The implementation of the model designed validates the different analytical moments comprised in its structure. Hence, the capacity to measure, classify, and evaluate intermunicipal inequalities of life quality and its determining factors, based on sound arguments, was demonstrated. Additionally, it ranks and relates municipalities in keeping with their results.

The model designed is a methodological tool proved its feasibility and practical usefulness to the Territorial Commission for Planning and Development, as well as the Local Bodies of the People's Power engaged in the process of local development planning, by orienting decisions to elaborate strategies, programs, and actions seeking to reduce the gaps among municipalities, and to enhance local life quality.

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Conflicts of interest and conflict of ethics statement

The authors declare that this manuscript is original, and it has not been submitted to another journal. The authors are responsible for the contents of this article, adding that it contains no plagiarism, conflicts of interest or conflicts of ethics.

Autor contribution statement

Jorge Luis Aguilera Molina: Theoretical background, development of procedure and tools for local development project management.
Zoila Madiu Quiroga Gómez: Measurements, analysis of results, conclusions.
Eva Catalina Perón Delgado: Design of the manuscript, redaction of the results and abstract, review of all the manuscript.