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Indicator system for monitoring the sustainability of historic centers associated with transportation

Sistema de indicadores para el control de la sostenibilidad de los centros históricos asociada al transporte

Elayne Tápanes Suárez[1], Omar Bosch Nuñez[2], Yasniel Sánchez Suárez[3], Maylín Marqués León[3], Orlando Santos Pérez[4]

ABSTRACT

The study focused on the management control of sustainability related to transportation in historic centers, given its influence on the social development of these areas. The primary purpose was to establish a system of indicators to monitor transportation sustainability in such centers. Techniques such as literature review, surveys, direct observation, expert consultations, and brainstorming were employed to achieve this. Various thematic models were analyzed, supported by software tools such as Microsoft Office Excel 2010, Microsoft Office Visio 2010, and EndNote X7. As a result of this research, twenty indicators were identified, meticulously described, and categorized under three sustainability perspectives: social, economic, and environmental. These indicators, derived from strategic objectives, are essential to assess the effects of transportation in historic centers and to facilitate prompt interventions that mitigate negative impacts, thereby improving the quality of life and urban sustainability.

Keywords: historical center, indicators, sustainability, transport.

JEL classification: Q56; L92; P25.

RESUMEN

El estudio se centró en el control de gestión de la sostenibilidad vinculada al transporte en centros históricos, dada su influencia en el desarrollo social de estas áreas. El propósito principal fue establecer un sistema de indicadores para monitorizar la sostenibilidad del transporte en dichos centros. Para ello, se recurrió a técnicas como la revisión literaria, encuestas, observación directa, consultas a expertos y brainstorming. Se analizaron diversos modelos temáticos, apoyados por herramientas informáticas como Microsoft Office Excel 2010, Microsoft Office Visio 2010 y EndNote X7. A raíz de esta investigación, se identificaron veinte indicadores detalladamente descritos y categorizados bajo tres perspectivas de sostenibilidad: social, económica y medioambiental. Estos indicadores, derivados de objetivos estratégicos, son esenciales para evaluar los efectos del transporte en los centros históricos y facilitar intervenciones rápidas que mitiguen impactos negativos, mejorando así la calidad de vida y la sostenibilidad urbana.

Palabras clave: centros históricos, indicadores, sostenibilidad, transporte.

Clasificación JEL: Q56; L92; P25.

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[1]Central Termoeléctrica Antonio Guiteras. Matanzas, Cuba.

[2]Sucursal Islazul Varadero. Matanzas, Cuba.

[3]Universidad de Matanzas. Matanzas, Cuba.

[4]Empresa de Proyectos de Arquitectura e Ingeniería de Matanzas. Matanzas, Cuba

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INTRODUCTION

Research on sustainability is growing and diversifying to a great extent in many scientific fields (Clark & Harley, 2020; Subercaseaux et al., 2021), basically because the difficulties related to this science have structures of great complexity

that relate elements of the economy, community, environment, political, cultural and technical, among others. Sustainability is the linkage between the population and the environment that favors improving and developing the quality of life while protecting the need for transportation-related policies associated with the population's quality of life, capacity, and sustainability (Torres, 2018).

Cities have a significant environmental impact; therefore, achieving sustainability through preventive actions at the urban level is essential (Lafuente, 2022). The accelerated expansion of urban centers has led to the creating of urban centers that lack the resources to meet the population's mobility, equipment, and service demands (Almeida et al., 2020). Transportation serves as a means of movement for inhabitants and acts as a catalyst for the socioeconomic development of nations (Sangroni et al., 2021). This sector represents a strategically crucial piece in the economy, as it boosts urban efficiency and supports activities in various fields, including industry, marketing, and tourism, which are fundamental in the economic productive structure (Handley et al., 2019).

Transportation management is defined as a dynamic process of dialogue and decision-making involving various stakeholders, including the social, economic, and governmental sectors, to shape its future (Arévalo, 2021). This area presents an intrinsic complexity, encompassing strategies, actions, and tools essential for the city's proper functioning. However, despite its crucial importance, transportation brings with it negative impacts. Among the most prominent and significant concerns are the environmental effects, such as noise, air pollution, and waste derived from urban transport. This is why prioritizing sustainable development and the environmental capacity of an area becomes imperative (Viana, 2017).

Another negative impact of the transportation system is the damage it causes to buildings. It is recognized that the values of the built heritage and the natural heritage support the conservation and improvement of the human condition and, therefore, the sustainability of the historic center. However, there are limitations to the quality of the natural and built environment services that humans receive. Today, to achieve objectivity in the conservation of buildings, the knowledge of technicians and experts on the effects that these structures have on land, water, air, and man is paramount (Costa, 2018; Chaos, 2018; Ramirez et al., 2020; Reyes, 2021).

Models proposed by Guerrero (2017), Ermagun et al. (2018), Aguirre et al. (2019), Boscán de Pacheco (2019), Martínez (2019), Vicuña et al. (2019), and Beriguete et al. (2022) were examined. These studies address perceptions of sustainability and urban quality of life but present gaps about the impact of transportation in urban areas. In the context of sustainable management, the use of management control documents is essential. These provide valuable reports and insights, outlining mechanisms and delineating new objectives that facilitate informed decisions, enabling more effective and efficient management (Tápanes et al., 2022).

On the other hand, Martinez (2019) states that indicators that measure how management proceeds are of great relevance to assess the sustainability of historic centers and integrate management into the decision-making process. In previous research, these indicators are directed from the study of mobility to sustainable approaches to transportation aimed at achieving a higher quality of life for urban dwellers, including environmental and social participation aspects (Santos, 2020). The business world had the idea of conceptualizing indicators only in the form of mathematical equations. However, over the years, many authors have offered additional definitions to this theory, as it is not only with this experience that essential data can be found to monitor different situations.

Therefore, indicators are, according to Vavrek et al. (2021), a way of knowing the magnitude of the conceptualization of a situation at a given time; accordingly, Zorn et al. (2018), Báez and Puentes (2018), and Martínez et al. (2020), define indicators as a numerical tool that favors appropriate decision making through data analysis and estimation. Based on what has been discussed above, it can be concluded that indicators provide meaningful feedback on timely business processes for management; in the first place, they are relevant by assisting in decision-making and providing essential and decisive data to estimate what is likely to happen.

Thus, Cordero (2017) states that a system of indicators is a collection of data collected at crucial intervals, which helps assess the level of realization and performance of a specific space in terms of planning. Due to the topic's relevance, the present research aims to identify indicators for monitoring the sustainability of historic centers associated with transportation.

METHODS

The study adopted a mixed approach, incorporating both theoretical and empirical methods. The theoretical methods employed included analysis and synthesis of information based on specialized literature, consultation

with experts, interviews with officials involved, and comparative, logical, and systemic analysis. In addition, the empirical methods were related to scientific-technical research tools such as the EndNote® bibliographic manager, the selection of experts using the Delphi method, and expert advice through surveys.

For identifying sustainability indicators in historic centers associated with transportation, procedures applied in previous research were reviewed, such as Pérez and Hernández (2015) and Márquez et al. (2019), which allowed the identification of sustainable development indicators. In addition, the contributions of Medina et al. (2014), Alfaro and Gómez (2016), Tonolli (2018), Lafaurié et al. (2022), and Rico et al. (2022) were considered to reach a consensus on the procedure adopted in the present study, which consists of the following steps:

Step 1. Application of information gathering techniques such as interview, observation, survey, and document review.

Step 2. The Delphi method will reduce the list to a reasonable and manageable amount of information for management.

Step 3. Identification of the system of indicators and their description.

RESULTS AND DISCUSSION

For the initial compilation of a set of indicators that historic centers should take into account for their sustainable development, taking into account the impact of transportation on them, the questionnaire shown in table 1 was applied to a group of 15 experts, specialists with expertise in areas closely related to the management and achievement of sustainability.

Table 1.
Questionnaire applied to the group of experts

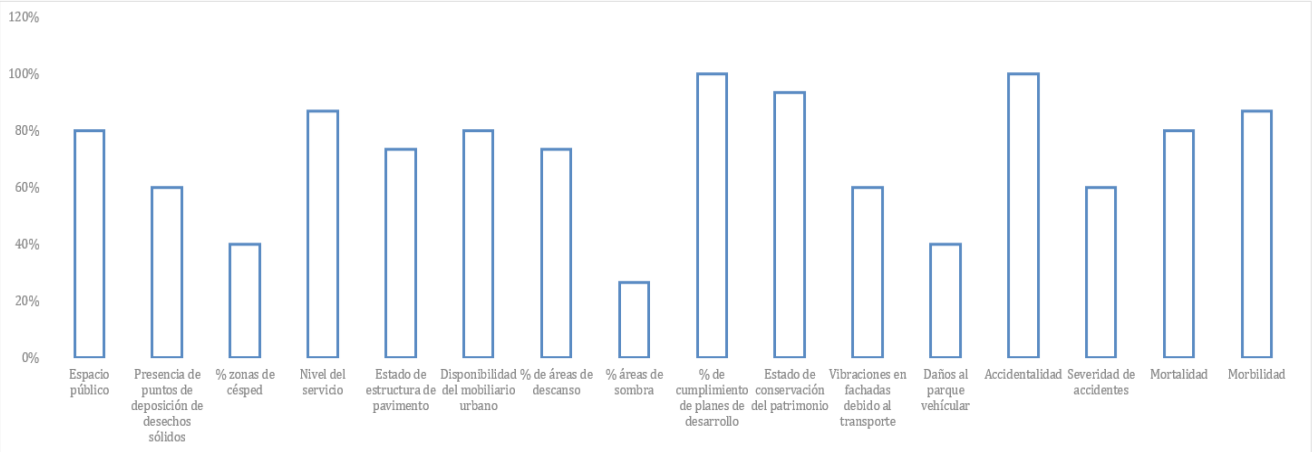
Dear expert: Due to your knowledge of the management and achievement of sustainability, you have been selected to point out indicators that significantly impact the sustainability of historic centers associated with transportation.			
Name and Surname			
Years of experience		**Activity performed**	
Evaluate the indicators presented here, taking into account their impact on the sustainability of historic centers associated with transportation, and select with an (x) those that, in your opinion, should be taken into account to measure, according to the strategic objectives divided into three dimensions: social, economic, environmental.			
Social dimension			
Objective: Implement policies for adequate accessibility in the historic center.			
Indicators presented		**Others as deemed necessary**	
Public space			
Presence of solid waste disposal points			
% grassy areas			
Level of service			
Condition of pavement structure			
Availability of street furniture			
% rest areas			
% shaded areas			
% compliance with development plans			
Heritage conservation status			
Vibrations in facades due to transportation			
Objective: Reduce the number and severity of traffic accidents.			
Indicators presented		**Others as deemed necessary**	

Damage to vehicles		
Accident rate		
Accident severity		
Mortality		
Morbidity		
Economic dimension		
Economic dimension		
Objective: Maximize the use of the budget allocated to the sustainability of the historic center.		
Indicators presented		**Others as deemed necessary**
Investment feasibility		
Incurrence of additional execution costs		
% budget compliance		
% compliance with investments		
Profitability of investments		
Environmental dimension		
Objective: Reduce environmental impact		
Indicators presented		**Others as deemed necessary**
Waste generation.		
pollution index		
Noise.		
Air quality		
Modification of the visual landscape		
Suspended particles		
Loss of biodiversity		
Soil contamination		
Sulfur dioxide concentration		
Thank you for your collaboration with the study. Thank you very much.		

Source: own elaboration.

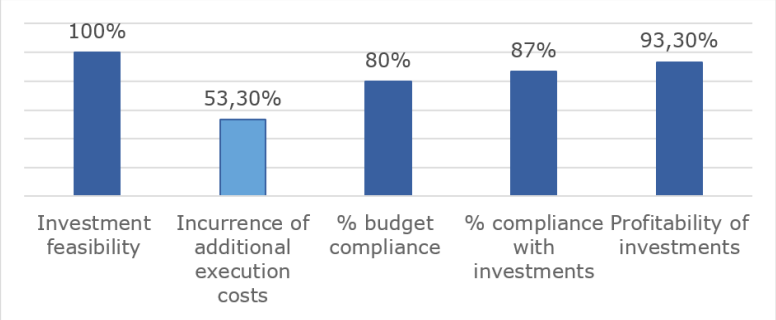
With the Delphi method applied to the indicators of the social dimension (Figure 1), to the indicators of the economic dimension (figure 2), and to the indicators of the environmental dimension (figure 3), the list of the proposed indicators was reduced and those that reached a percentage higher than 70% were taken as a result. For their analysis, they are divided according to their dimension and strategic objectives.

Figure 1.
Results of the Delphi method: indicators of the social dimension



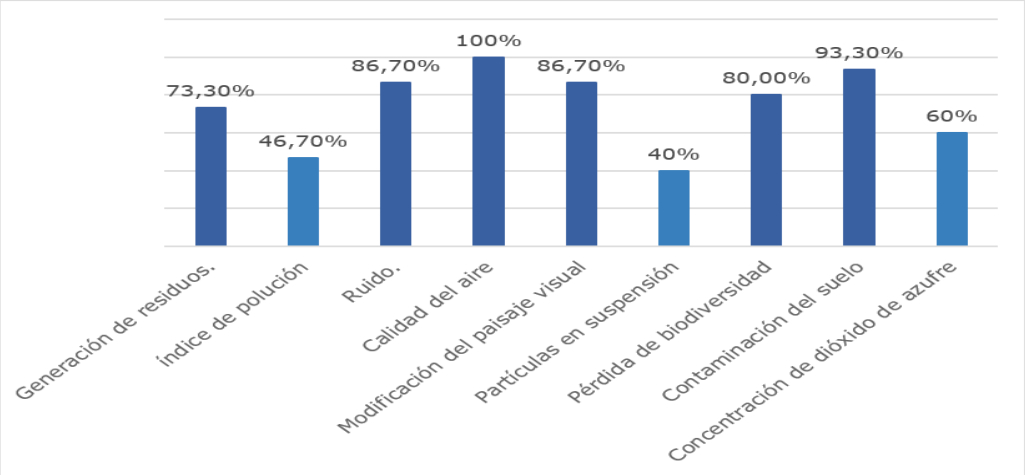
Source: own elaboration.
Note: the figure appears in its original language

Figure 2.
Results of the Delphi method: indicators of the economic dimension



Source: own elaboration.

Figure 3.
Results of the Delphi method: indicators of the environmental dimension



Source: own elaboration.

The most relevant indicators for measuring the scope of each dimension are shown in table 2.

Table 2.
Key indicators for monitoring sustainability associated with transportation in historic centers

Dimension	Strategic Objectives	Indicators for management control
Social	Implement policies for adequate accessibility in the historic center.	Public space
		Level of service
		Pavement structure condition
		Availability of street furniture
		% of rest areas
		State of conservation of heritage
		% compliance with development plans
	Decrease the number and severity of traffic accidents.	Accident rate
		Mortality
		Morbidity
Economic	Maximize the budget allocated to the sustainability of the historic center.	Investment feasibility.
		Profitability of investments.
		% compliance with investments.
		% compliance with budget.

Environmental	Reduce environmental impact	Waste generation. Noise. Air quality. Modification of the visual landscape. Loss of biodiversity. Soil contamination

The following is a detailed description of the system of indicators in terms of its usefulness in managing the sustainability of historic centers associated with transportation, expression of calculation, unit of measurement and frequency of measurement (table 3).

Table 3.
Detailed description of the proposed indicators

Indicators	Usefulness in management	Calculation expression	Unit of measure	Frequency of measurement
Public space	Contemplate many public policy objectives: safety, health, recreation, social cohesion, etc.	Participatory designs	Adimensional	When conducting public service level surveys
Level of service	Indicate the different degrees of comfort of pedestrian traffic in a subjective way.	It is closely linked to the number of service and service readiness of pedestrian infrastructure	unidimensional	monthly
Pavement structure condition	Characterize the state of preservation of the pavement structure	Infrastructure in good condition = (LIP - LIP in poor condition) / LIP *100	%	Semiannually
Availability of street furniture	Determine the width of a section of pedestrian infrastructure occupied by street furniture	Direct measurement	meters	When conducting corridor capacity and pedestrian level of service studies
% of rest areas	Identify the presence of rest areas in pedestrian infrastructure and public spaces	% of rest areas = (Rest area / Pedestrian circulation area) * 100	%	Semiannually
State of conservation of heritage	Weigh the proportion of heritage buildings in good condition	State of conservation = (Number of buildings in good condition) / (total number of devices) * 100	%	Annual
% compliance with development plans	Recognize the fulfillment of pedestrian infrastructure advancement purposes.	Growth % = (% planned - % implemented) / % planned	%	Annual
Accident rate	Monitor traffic accidents for preventive actions.	I= No. of accidents in the year *100000/No.of inhabitants	unidimensional	Monthly
Mortality	Monitor the number of fatalities in road crashes	I= No.of deaths in the year * 100000/No.inhabitants	unidimensional	Monthly
Morbidity	Determine the number of injured	I= No.of injured in the year * 100000/ No.of inhabitants	unidimensional	Monthly
Investment feasibility	to know how feasible the investments made are	depends on the investments made.	unidimensional	Annual
Profitability of investments	to know how profitable the investments made are	depends on the investments made	unidimensional	Annual

% compliance with investments	Identify the proportion of investments executed according to schedule	% fulfillment of investments = (% I programmed - % I executed) / % I programmed (Where I are the investments)	%	Annual
% compliance with budget	Measure compliance in the execution of the budget allocated to social investments in the historic center.	% budget fulfillment = (% planned - % executed) / % planned	%	Annual
Waste generation	Determine an estimate of the percentage of waste generated in the historic center	Estimation of top management	%	Monthly
Noise	Determine noise levels caused by traffic, which are detrimental to the quality of life of citizens in the historic center	Direct measurement	decibels	Monthly
Air quality	Evaluate the environmental quality of life of residents in the historic center	Air quality index = Pollutant concentrations / Maximum Allowable Concentrations	%	Monthly
Modification of visual landscape	Determine the extent to which the landscape of the historic center has been transformed	Estimate	%	Annual
Loss of biodiversity	Define the extent to which biological diversity is diminishing or disappearing	Estimate	%	Annual
Soil contamination	Determine the extent of surface degradation or destruction	Estimate	%	Annual

Source: own elaboration.

The consolidated indicators compose a cohesive system thanks to their interconnections and relationships. This network of indicators provides a holistic view of the environment. In this context, each indicator provides individual information and contributes to a comprehensive understanding of the system. If one of these components is missing or fails, it can destabilize the balance of the whole, directly affecting the ability to achieve sustainability in historic centers. Therefore, monitoring and maintaining all of these indicators is essential to ensure effective and sustainable management of historic centers.

CONCLUSIONS

The research consulted not only underlines the importance of management control in multiple economic sectors but also emphasizes how these tools and methods can be crucial in the adaptation and evolution of various areas. Applying these lessons to sustainability in historic centers, especially regarding transportation-related issues, we find an unprecedented opportunity to ensure its relevance and effectiveness in the contemporary context.

Through meticulous consultation with experts, several essential elements were distilled. These elements shaped a comprehensive framework, delineated by specific perspectives and clearly defined indicators, all derived from the operationalization of the dependent variable addressed in the study. Thus, the theoretical contribution of the research revolves around the battery of indicators constructed.

The depth of analysis on each indicator provided a clear understanding of their uniqueness and how each contributes to the overall picture. In their totality, these indicators provide a robust and cohesive system for monitoring and assessing the current and future state of historic downtowns about sustainability. Given transportation's influence and impact on these environments, this framework is precious, underscoring the need for ongoing monitoring and data-driven adaptations to balance historic preservation and modern demands.

REFERENCES

Aguirre, J., De Santiago, N. y Verdugo, A. (2019). *Aproximación al impacto de los espacios públicos en los centros históricos desde un enfoque del transporte, la calidad de vida y el bienestar social. Comparativa Guadalajara-Medellín*. http://hdl.handle.net/2117/185538

Alfaro, C., y Gómez, J. (2016). Un sistema de indicadores para la medición, evaluación, innovación y participación orientado a la Administración Pública. *Methaodos. Revista de Ciencias Sociales*, 4(2), 274-290. https://doi.org/10.17502/m.rcs.v4i2.124.

Almeida, M., Zúñiga, L. y Gómez, L. (2020). Protección de vistas relevantes del centro histórico de Camagüey: instrumento de gestión urbana para la toma de decisiones. *Retos de la Dirección*, *14*(2), 225-248. https://journals.reduc.edu.cu/index.php/retos/article/view/3277

Arévalo, F. (2021). Gestión de la red vial Morales-san Roque y su efecto en la calidad de vida del poblador beneficiado [Tesis de maestría, Universidad Científica del Perú]. Repositorio UCP. http://repositorio.ucp.edu.pe/handle/UCP/1861

Báez, P., y Puentes, A. (2018). Parámetros financieros para la toma de decisiones en pequeñas y medianas empresas del municipio Duitama, Colombia. *Revista de Ciencias Sociales (Ve)*, 24(1), 67-84. https://dialnet.unirioja.es/servlet/articulo?codigo=7024153.

Beriguete, F., Rodríguez, I. y Palumbo, M. (2022). Cómo medir el impacto de las iniciativas ciudadanas en la sostenibilidad urbana? *ACE: Architecture, City and Environment*, 17(49), 10413. https://doi.org/10.5821/ace.17.49.10413.

Boscán de Pacheco, G. (2019). LA GESTIÓN URBANA SOSTENIBLE: Perspectivas para una ciudad posible en el marco de la teoría institucional. *Reviste Científica Compendium*, *22(43)*. https://www.redalyc.org/journal/880/88063978003/html/

Cordero, J. (2017). Propuesta de un sistema de indicadores de sostenibilidad turística para destinos urbanos. *ARA: Revista de Investigación en Turismo*, 7(1), 41-51. https://revistes.ub.edu/index.php/ara/article/view/20025.

Costa, E. (2018). Riesgos y potenciales de preservación patrimonial en América Latina y el Caribe. *Investigaciones Geográficas* (96), 1-26. https://doi.org/10.14350/rig.59593

Clark, W. y Harley, A. (2020). Sustainability Science: Toward a Synthesis. *Annual Review of Environment and Resources*, *45*(1), 331-386. https://doi.org/10.1146/annurev-environ-012420-043621.

Chaos, M. (2018). Usos y apropiaciones del patrimonio urbano VS identidad perdida o conservada. *PatryTer*, *1*(1), 22-33. https://www.redalyc.org/journal/6040/604065686004/604065686.

Ermagun, A., Lindsey, G. y Hadden, T. (2018). Bicycle, pedestrian, and mixed-mode trail traffic: A performance assessment of demands models. *Landscape an Urban Planning*, 117, 92-102. https://doi.org/10.1016/j.landurbplan.2018.05.006

Guerrero, A. (2017). *Estudio preliminar de demanda para ciclovías como un sistema de transporte no motorizado: caso de estudio parroquia Cayambe* [Tesis de pregado, Pontificia Universidad Católica del Ecuador]. Repositorio PUCE. http://repositorio.puce.edu.ec/handle/22000/14129.

Handley, J., Fu, L. y Tupper, L. (2019). A case study in spatial-temporal accessibility for a transit system. *Journal of Transport Geography*, *75*, 25-36. https://doi.org/10.1016/j.jtrangeo.2019.01.005

Lafaurié, Y., Carvajal, C. y Ramírez, E. (2022). Sistema de indicadores para el estudio de la evaluación del componente educativo en la facultad de ciencias médicas Salvador Allende. VARONA, 4. https://www.redalyc.org/articulo.oa?id=360672204006.

LaFuente, J. (2022). *Accesibilidad a la edificacion como indicador urbano en los procesos de regeneración urbana integrada en centros históricos de ciudades patrimoniales* [Tesis doctoral, Universidad de Granada].

Repositorio Granada. http://hdl.handle.net/10481/75961.

Martínez, H., Cazallo, A., Meñaca, I. y Uribe, C. (2020). Desempeño financiero de las empresas minoristas de alimentos y bebidas en Barranquilla– Colombia. *Revista de Ciencias Sociales (Ve)*, 26(1), 144- 160. https://doi.org/10.31876/rcs.v26i1.31316.

Martínez, A. (2019). *Calidad de vida en las ciudades en Colombia ¿Qué debemos mejorar?* [Tesis de pregrado, Universidad del Tolima] Repositorio UT. https://doi.org/10.1046/j.1365-2133.2002.04692.x.

Martínez, C. (2019). Indicadores urbanos y su influencia en el desarrollo sostenible urbano de Huancayo metropolitano-Perú. Ingeniare.Revista Chilena de Ingeniería 27(3). http://dx.doi.org/10.4067/S0718-33052019000300465

Márquez, L., Vasallo, Y., Cuétara, L. y Sablón, N. (2019). Sistema de indicadores para la sostenibilidad en comunidades rurales del ecuador en el marco de la Agenda 21 Local. *Revista Espacios,* 40(18), 28. https://www.revistaespacios.com/a19v40n18/a19v40n18p28.pdf

Medina, A., Ricardo, A., Piloto-Fleitas, N., Nogueira, D., Hernández, A. y Cuétara Sánchez, L. (2014). Índices integrales para el control de gestión: consideraciones y fundamentación teórica. *Ingeniería Industrial*, *35(1), 94-104.* https://rii.cujae.edu.cu/index.php/revistaind/article/view/424

Pérez, A. y Hernández, M. (2015). Medición de indicadores de desarrollo sostenible en Venezuela: Propuesta metodológica. *Revibec: revista iberoamericana de economía ecológica*, 24, 1-19. https://dialnet.unirioja.es/servlet/articulo?codigo=5200393.

Ramírez, N., González, J. y Reyes, J. (2020). Estrategias de Preservación del Patrimonio Cultural de los Centros Históricos de Puebla. *Revista de Estudios Andaluces*, *39*, 45-65. https://dx.doi.org/10.12795/rea.2020.i39.03.

Reyes, R. (2021). Lucha por la preservación de la riqueza identitaria, natural, arqueológica y arquitectónica de los pueblos. *Maya Administración y Turismo*, *3*, 13-28. https://doi.org/10.33996/maya.v3i1.2.

Rico, J., Galviz, D., Jiménez, A., y Aristizábal, L. (2022). Sistema de indicadores de eficiencia financiera para las pymes del sector textil de Medellín-Colombia. *Revista de Ciencias Sociales (Ve),* 28(6), 441-460. https://dialnet.unirioja.es/servlet/articulo?codigo=8598068.

Sangroni, N., Medina, Y., Tápanes, E., Santos, O., Pérez, J. y Sánchez, Y. (2021). Principales modelos de gestión de calidad de vida urbana asociada al transporte. *Ingeniería Industrial*, *62(3)*. https://rii.cujae.edu.cu/index.php/revistaind/article/view/1116.

Santos, O. (2020). *Instrumento metodológico para la gestión de accesibilidad y movilidad en centros históricos cubanos. Aplicación en la ciudad de Matanzas* [Tesis de Doctorado, Universidad de Matanzas]. Repositorio UMCC. http://rein.umcc.cu/handle/123456789/10.

Subercaseaux, D., Moreno-Calles, A., Astier, M. y de Jesús Hernández, L. (2021). Emerging Agro-Rural Complexities in Occident Mexico: Approach from Sustainability Science and Transdisciplinarity. *Sustainability*, *13*(6), 3257. https://doi.org/10.3390/su13063257

Tápanes, E., Santos, O., Yenisey, L. y Marqués, M. (2022). Contribución al control de gestión de accesibilidad y movilidad en centros históricos. *Confin Habana*, *16(1).* http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2073-60612022000100007.

Tonolli, A. (2018). Propuesta metodológica para la obtención de indicadores de sustentabilidad de agroecosistemas desde un enfoque multidimensional y sistémico. *Revista FCA UNCUYO,* 51(2), 381-399. http://www.scielo.org.ar/pdf/refca/v51n2/v51n2a30.pdf

Torres, A. (2018). *Servicio del transporte público de la ciudad de Puebla: propuesta de mejora de la calidad de vida de los usuarios en relación con su experiencia de viaje* [Tesis de Maestría, Universidad Iberoamericana Puebla]. Repositorio Iberopuebla. http://repositorio.iberopuebla.mx/licencia.pdf.

Vavrek, R., Bečica, J., Papcunová, V., Gundová, P. y Mitríková, J. (2021). Number of financial indicators as a factor of multi-criteria analysis via the topsis technique: A municipal case study. *Algorithms*, 14(2), 64. https://doi.org/10.3390/a14020064.

Viana, E. (2017). Ciudad y transporte: transformación urbanística e impacto ambiental. *Revista Bibliográfica de Geografía y Ciencias Sociales, 22*(1.189), 1-18. http://www.ub.es/geocrit/b3w-1189.pdf

Vicuña, M., Orellana, A., Truffello, R. y Moreno, D. (2019). Integración urbana y calidad de vida: Disyuntivas en contextos metropolitanos. *Revista INVI, 34*(97), 17-47. https://revistainvi.uchile.cl/index.php/INVI/article/view/63210

Zorn, A., Esteves, M., Baur, I. y Lips, M. (2018). Financial ratios as indicators of economic sustainability: A quantitative analysis for Swiss dairy farms. *Sustainability*, 10(8), 2942. https://doi.org/10.3390/su10082942

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AUTHORSHIP CONTRIBUTION
Conceptualization: Elayne Tápanes Suárez, Omar Bosch Nuñez.
Data curation: Omar Bosch Nuñez, Maylín Marqués León, Orlando Santos Pérez.
Formal analysis: Elayne Tápanes Suárez, Yasniel Sánchez Suárez.
Research: Elayne Tápanes Suárez, Omar Bosch Nuñez, Yasniel Sánchez Suárez.
Methodology: Elayne Tápanes Suárez, Omar Bosch Nuñez.
Project administration: Elayne Tápanes Suárez, Orlando Santos Pérez.
Supervision: Yasniel Sánchez Suárez, Maylín Marqués León.
Validation: Elayne Tápanes Suárez, Omar Bosch Nuñez, Yasniel Sánchez Suárez.
Writing - original draft: Elayne Tápanes Suárez.
Writing - revision and editing: Maylín Marqués León, Orlando Santos Pérez.