

Management And Handling Of Documented Information In Transportation Organizations, According To Ecuadorian Legal Provisions, An Analysis Of The Planning System.

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ABSTRACT

An intervention model for a tariff-based rotational parking system is proposed, tailored to the contexts and best practices in cantonal head cities within the Andean region of Colombia, Ecuador, and Peru. Mechanisms and solutions are adopted that, on a smaller scale, cater to the need for vehicular organization in the critical historical zones or centers of cantonal head cities. This model addresses the knowledge gap resulting from the absence of specific experiences and studies that reflect the characteristics of cantonal head cities from an Andean perspective. It provides a flexible intervention proposal that allows each Cantonal Transport Directorate to apply it, considering the local context. The research uses a non-experimental, cross-sectional, and descriptive design, encompassing both explanatory and exploratory research types, in addition to case studies. The conclusion is drawn to disseminate this intervention model to the rest of the cantons in the Andean region, contributing to the positive development of local governance in each city.

Keywords: Rotating parking system with tariffed parking, sustainability, vehicular congestion, parking zones, municipal ordinance.

INTRODUCTION

Rotating pay-and-display parking systems (SEROT) in urban settings are emerging as solutions to problems of traffic congestion, urban space management, rural population migration to cities, the slow modernization and transformation of road network structures, the absence of technical road studies, the excessive increase in the vehicle fleet, and are posing challenges to urban mobility, with a lack of public policy and a lack of alignment with the 2020 Sustainable Development Goals. Therefore, "SEROTs are a sustainable, innovative solution that promotes the rational use of public space and contributes to reducing traffic congestion" (Pérez, 2020).

Several studies have highlighted the benefits of SEROT, including improvements in the efficient use of urban space and decreases in climate-changing CO₂ emissions; however, research in the Latin American context remains limited. Rodríguez and Martínez (2021) analyzed the impact of these systems in Bogotá, finding a notable improvement in vehicular traffic, but they point out the need to investigate their economic, social, and environmental feasibility in other cities in the region. Among the theoretical assumptions that support this research, the following are cited: Borovskoy and Yakovleva (2017) and parking space simulation models; the approaches of Carpio et al. (2014), urban integration and mobility planning in the design of urban transport interchanges at the regional and city level; urban mobility policies and urban transport infrastructure (Lupano and Sánchez, 2009); price tariffs for a sustainable transport system and the expert system in the selection of mobility management strategies aimed at implementing active transport (Mibliore et al., 2014; Salleha et al., 2015).

Similarly, in Peru, accelerated urban growth and an increase in the vehicle fleet exacerbate traffic problems and a shortage of parking spaces. Implementing SEROTS emerges as a strategy to optimize the use of urban space and mitigate traffic congestion, thus contributing to improving citizens' quality of life within the framework of SDG 11: Sustainable Cities and Communities (García and López, 2019). A preliminary study in Lima (Fernández, 2022) is added, suggesting a positive correlation between the implementation of these systems and a decrease in parking search

times. However, the author himself emphasizes the need to investigate their economic, social, and environmental impact in various cities across the country.

In Colombia, the increasing vehicle fleet and limited road infrastructure have intensified congestion problems. Therefore, in the face of this challenge, SEROT systems are emerging as a sustainable alternative for urban mobility (Ramírez and Torres, 2018). Analyzing the impact of these systems in Medellín, they report improvements in traffic flow; however, they emphasized the importance of conducting feasibility studies that comprehensively consider economic, social, and environmental aspects (Gómez and Castro, 2020).

In Ecuador, Álvarez (2021) warns that the accelerated growth of the vehicle fleet, coupled with the increase in traffic problems and a notable shortage of parking in urban areas, where SEROTS emerge as a viable alternative to face these challenges, by increasing the efficiency of use of public space and improving vehicular circulation, through the implementation of public policies of the Decentralized Autonomous Governments (García, 2019; Hernández, 2020).

Ecuadorian researchers, such as (Martínez, 2022; López, 2023), emphasize the need to adapt these systems to local specificities (small cantonal capitals), while others highlight the importance of considering social acceptance and environmental impact in their implementation (Zambrano, 2021; Torres, 2022). On the other hand, Aguacallo (2022) adopts a developmental approach when evaluating a financial study in which the main financial indicators were analyzed.

There are contrasts in the approaches to SEROT in the provincial capitals of the inter-Andean region in the countries of Colombia, Ecuador, and Peru. Thus, in the Ecuadorian Andean case of the capital city of Riobamba, a sustained effort is being made to optimize the congestion-ridden historic center. The modernization of the SEROT ordinance is analyzed and suggested from the perspective of citizen rights, where the knowledge gap "can be enriched and contextualized according to the socioeconomic environment" (Flores, 2022).

Of the sources that nourish and shape the proposal, from the legal (Machicato, 2012; Flores, 2022) regarding the approach of Municipal Ordinances. Of technical approaches and feasibility proposals (Yupa, 2016; Mayor et al, 2020; Illescas, 2016; Fierro, 2011), of the accounting, administrative and financial approaches (Aguacallo, 2022; Obregón, 2023; Valdivieso, 2008; Aldaz, 2016). The Ecuadorian standards INEM (2012) and INEM (2004) are studied; Colombian standards (POT Bogotá, 2022; Bogotá Planning Secretariat, 2021); of the Peruvian standard (National Society of Industries, 2021), referring to the status of technical regulations.

The approaches of Tamayo (2016) and the proposal to expand SEROT in the urban area and the manifestation of surveyed users that their activities are affected due to the time it takes to find parking space, along with other negative aspects that arise from the lack of parking, are added. The approach of Santamaria-Tipantasig (2022), and the application of the SEROT already implemented by updating the approach of the Decentralized Autonomous Municipal Government, GADM, Salcedo canton, preventing congestion, air pollution and health problems in users, is highlighted. The research of Obregón (2023) is added by analyzing the influencing factors when implementing SEROT in cantons. The consequences and impact of lack of order, such as the high concentration of traffic given the traffic agglomeration, are revealed and analyzed.

It is worth noting the contribution of Yupa (2016), which carried out a cantonal market study, determining the existence of an unsatisfied demand for parking and, above all, the acceptance of the proposal for regulated parking in the city center, which allows us to assert that the project is commercially viable.

Furthermore, the contributions of Jarrin and Pomaquiza (2022); (Cuadrado, 2018), address the feasibility study for the implementation of the cantonal SEROT, these authors conclude that the urban area is inadequately signposted, and through the capacity measurements it is evident that they have an occupancy rate higher than 50%, which indicates that there is a high demand for parking in the study area.

The problem persists in the inter-Andean cantonal capital cities: the excessive increase in traffic congestion. This issue has already been reported: "the absence of SEROT (Security and Urban Traffic Control System) in cantonal capital cities has been linked to an increase in traffic

congestion, exacerbating urban mobility problems" (Mafla et al., 2021). Furthermore, there is a deterioration in air quality, where "the prolonged search for parking, resulting from the lack of rotating parking systems, contributes significantly to the deterioration of air quality in urban areas" (Mura and Reyes, 2015).

Added to this is the impact on the local economy, especially in cantons with tourist destinations where bus parking is almost impossible, and as Salinas and Troya (2020) rightly point out, "the difficulty in finding parking in urban centers without rotating fare systems deters potential consumers, adversely affecting the local economy." Last but not least, is the negative perception among citizens of the absence of innovative solutions that impact the satisfaction of residents and visitors expressed by Sánchez (2015) "citizen perception of parking management is negatively impacted by the lack of rotating systems, contributing to a deteriorated image of municipal management.

The overall objective is to propose a sustainable administrative intervention for SEROTs in cantonal capital cities in the inter-Andean region of Ecuador, utilizing innovative best practices from urban centers to provide a flexible SEROT intervention proposal for transportation management, tailored to the local context.

METHODOLOGY

The design of the non-experimental, descriptive and qualitative research is declared (Mata, 2019), proposing a holistic and comprehensive action analysis by taking the best practices and contributions of SEROT interventions in countries such as Colombia, Peru and Ecuador and in the specific proposals to the current challenges of SEROT management in small cantonal capitals in the inter-Andean region without the "deliberate manipulation of variables and in which the phenomena are only observed in their natural environment and then analyzed" (Hernández et al, 2014).

Cross-sectional design (Rodríguez and Mendivelso, 2018) since data are analyzed and studied from variables studied or a predefined set, that is, at the time of initiating the research. The qualitative aspect is expressed in the characterization and analysis of information gathering, such as the characteristics of the challenges and dimensions inherent to vehicular traffic and its multidimensional impact, characterizing and suggesting an intervention approach.

Among the research types, exploratory research (Abreu, 2012) is cited, addressing a little-studied problem of SEROT intervention in inter-Andean capital cities with complex spatial configuration and specific socioeconomic characteristics; descriptive and explanatory research, in terms of the description and characteristics inherent in each phase or dimension of SEROT intervention. Among the scientific methods, the following are cited: analysis and synthesis of bibliographic sources, modeling method in the integrative SEROT approach, inductive and analytical methods, corresponding to the dimensions specified in the Ecuadorian context.

RESULTS AND DISCUSSION

The SEROT approach in cantonal capital cities in the Ecuadorian inter-Andean region is due to the economic, social, environmental, historical, legal, cultural, road, and access characteristics that differentiate them from other cities in various cantons across the country. It cannot be claimed that they are industrialized or close to national roads or highways. A public instrument is needed to support decision-making associated with developing and intervening in municipal ordinances (the SEROT) with a participatory and citizen-led approach. All of this is based on the Organic Code of Territorial Planning (COOTAD).

The SEROT proposal is structured in eight phases that allow for proper interpretation and a fluid logical sequence, emphasizing the participatory nature of citizens. Figure 1 shows its approach, which uses a systemic focus to interrelate each underlying dimension and create a coherent SEROT product tailored to local needs.

Figure 1. Systematic approach to a SEROT product



1. Characterization and analysis of the environment

It is necessary to identify, based on the geographic location, the characteristic social, cultural, environmental, legal, technological, and economic aspects that could directly or indirectly influence the municipal planning of the City of Riobamba (SEROT), in addition to updating the current public and local legal bases. The analysis of the environment refers to transportation and roads, studying the percentages of asphalt coverage, road direction, sidewalks and curbs, road projection, and road signage. Practical and applicable examples (Yupa, 2016; Obregón, 2023)

From a technical perspective, the routes and frequencies of intercantonal and interprovincial transport (if it exists) are specified, including urban transport cooperatives, the transport mode is added and the vehicles used are classified (Yupa, 2016, p. 38).

A SWOT analysis is then developed, which focuses on the participation of pedestrians, the floating population, and the criteria of transportation specialists from the Decentralized Autonomous Government of Riobamba (GADMR). It is erroneous to stereotype each SWOT exercise; however, there are indicators to assess, as shown in Table 1. It is suggested that the environment be analyzed and new indicators suggested. The SWOT matrix must contribute to the strategic matrix that allows for appropriate strategies for sound decision-making. (Yupa, 2016; Obregón, 2023; Aldaz, 2016)

Size 1. Participatory SWOT

STRENGTHS	OPPORTUNITIES
Citizen acceptance through socializing and learning about the SEROT Ordinance Generation of income for the public coffers Job creation Development of the tertiary services sector	The proposed SEROT intervention model Citizen participation
WEAKNESSES	THREATS
Non-existence and/or outdated SEROT ordinance Incorrect application of SEROT ordinance Traffic congestion	Lack of control and appropriation of sidewalks, parking by neighbors Floating population invading public spaces

2. *Market analysis*

It is questioning the purpose of making the decision to intervene in the SEROT municipal ordinance. By optimizing this phase, the sample size of the study area is calculated and the research is designed in addition to the instruments to be applied.

Citizen feedback is key, and indicators are proposed for developing items such as perceptions of parking problems; average parking delay; impact of not finding parking; reasons for parking; parking consistency; degree of agreement with implementing SEROT; and willingness to pay the parking fee. A Likert-type survey is suggested for analysis using a statistical package available at universities and public institutions.

3. *Demand-supply-participation study*

Based on the concept of supply (Morales and Morales, 2009), there is little competition for SEROT service. However, field observation is useful to verify private spaces designated for parking, where this type of activity is not registered in the area where it will be implemented.

In addition, vehicle registration is accounted for, estimating projected demand based on the annual vehicle inflow, with ranges from 0.2 to 0.9 (Fierro 2011; Aldaz, 2016). For a better understanding, see (Yuta, 2016) and parking calculations with an annual increase index of 0.95.

Regarding participation and its indices, it is the value of demand and supply in the period analyzed, considering the demand for spaces required by the cantonal capital city with the percentage of participation, according to the established table (Yupa, 2016)

4. *Price calculation*

It is based on cost analysis and national comparisons in each country, but the criterion lies in the correct calculation of costs, and this sensitive aspect must be understood by the citizen as to why prices are set. Jarrín and Pomaquiza (2022) suggest setting prices based on cost studies.

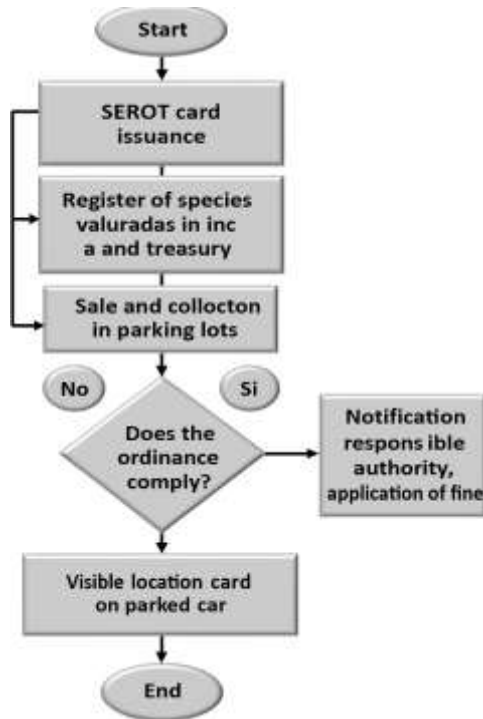
5. *Technical study and signaling*

It encompasses everything related to the operation and functionality of the project, verifying the technical feasibility of providing the service and determining the size, location, equipment, facilities, and organization required to carry out production. It requires a description of the macro and micro locations, taking development as a reference (Yuta, 2016).

When referring to the term "production process," it refers to a set of dynamically interrelated actions aimed at transforming certain elements. Thus, input elements or factors become output elements (services in this case) after a process in which their value increases.

Thus, conceptualizing SEROT from a process perspective arises from the imperative to generate parking spaces in areas of the city where there is significant demand for them, where the supply of spaces is limited, and where the city's road network is not designed to accommodate the demand of vehicles that use these centers. The process, in a simplified form, is shown in Figure 2, subject to changes and criteria from the authorities.

Figure 2.Sustainable SEROT process



Signage refers to signs, signals, or markings made on the road surface, such as lines, symbols, legends, words, numbers, or other indications known as horizontal and vertical signage. In some situations, they are the only and/or most effective means of communicating instructions to drivers. (INEM-004, 2016; POT Bogotá, 2022).

The objectives of signage are to prevent, guide, and direct road users; delineate lanes and prohibited areas; and complement and reinforce the meaning of vertical signs. For sign selection and adaptation to the local context (Obregón, 2023; POT Bogotá, 2022).

6. Cost, administrative and legal analysis

The cost proposal analysis contains the dimensions or elements that structure the SEROT intervention. Quantities, unit values, total values, and annual totals associated with Fixed Assets; Information Technology; Signage Materials; Operating Expenses; Administrative Expenses; Office Supplies; Cleaning Supplies; Utility Expenses; and Selling Expenses are calculated.

For details on table formats and explanations, (Yupa. 2016; Obregón, 2023; Fierro, 2011; Illescas, 2016). For its part, the administrative study is based on the five "E" approach (Londoño-Cardoza and Vásquez, 2021), as expressed in Figure 3.

Economy: Associated with the cost of executing the processes contained in SEROT, assuming the adequate quality of the products obtained.

Efficiency: Increases as the expected results are obtained using appropriate wood resources.

Effectiveness: Relationship between the objectives and goals programmed during the SEROT service.

Ecology: Conditions, operation and practices associated with environmental requirements, evaluation and impact on the SEROT program.

Ethics: Expressed in the morals, individual and group behavior of the SEROT institution officials, regarding their duties, laws, constitutional norms, education.

In addition, the organizational structure, control functions and interrelation with the municipal police must be discussed and designed (Yupa, 2016; Obregón, 2023), all at the discretion of the responsible GAD administration and the local public governance context.

Figure 3. SEROT sustainable administrative model



7. Financial evaluation

The SEROT financial analysis is the analytical process used to evaluate the financial situation of a project or investment. The analysis details the economic and monetary aspects that influence its success. This will allow decisions to be made regarding its viability in terms of economic profitability.

The financial evaluation will be carried out by determining the Net Present Value, the Internal Rate of Return, the Break-Even Point, and a Sensitivity Analysis; this information will be used by the investor to make decisions regarding the project's investment and its proper functioning.

Financing for the SEROT Project, led by cantonal governments, must reflect the benefits this project generates in terms of order and security, the minimal investment, and its payback period over the life of the project. Calculations are based on the supply-demand study, the established price, and occupancy projections. This study also includes a citizen survey and acceptance of the price established based on the cost study.

Once the estimated revenue, costs, and expenses have been determined, the profit and loss statement can be calculated. The purpose of analyzing the income statement is to calculate the project's net income and cash flows, which are generally the actual operating profit. Only then can the cash flow be determined, thereby determining the company's actual needs in a given period by comparing actual revenue received with actual expenses paid.

Now, it is possible to carry out a financial evaluation of the project and determine the degree of profitability of the SEROT project by comparing the project's revenues and costs. Sapag (2011) warns of the risks incurred when making an investment, so forecasting techniques are established based on reliable and current information about the factors that will influence the project, to evaluate the results and make relevant decisions.

For the SEROT project, the Net Present Value (NPV) is analyzed as the sum of the present values of the net cash flows less the initial investment. This determines the current value of the money the company will receive from its parking service. The Internal Rate of Return (IRR) is the value of the cash flows generated by the project that exactly equals the net investment made. The break-even point, expressed as a percentage or value, determines the point at which sales will exactly cover costs. It is shown in terms of profits or losses for SEROT when parking rentals exceed or fall below this point. Thus, it is a reference point from which an increase in sales volumes will generate profits, but a decrease will also cause losses.

Finally, sensitivity analysis (Biblia, 2018) determines the impact, that is, how sensitive the IRR or NPV is to changes in certain investment variables, all other variables remaining constant. The importance of this analysis becomes apparent when changing the values used to evaluate the project due to unforeseen deviations.

8. *SEROT Ordinance*

Flores' (2022) study is suggested, given the inadequate approaches to promulgating SEROT Ordinances, the impact on citizen user perceptions regarding their rights and the service received, based on the Ecuadorian experience. This author adds a final proposal, the design of the Ordinance based on the results of the designed model or procedure. This research demonstrates its feasibility of being legitimized, socialized, and applied in the rest of the cantons of the inter-Andean region, always adapted to the local context.

CONCLUSION

The proposed SEROT intervention model in cantonal capital cities in the inter-Andean region of Ecuador responds to the adaptation of SEROT municipal ordinances to the context of the city of Riobamba, taking into account the best practices and experiences in countries such as Colombia, Peru and Ecuador, highlighting the diversity of studies and proposals, but there are no local approaches that allow for a logical, simple and orderly decision-making for a project of this nature. It is feasible to socialize the SEROT intervention proposal in cantonal cities of the Inter-Andean region, emphasizing the need to group together a multidisciplinary team with the appropriate skills to undertake a project of this nature, emphasizing, reorganizing and simplifying those aspects that allow providing an intervention proposal.

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