

TRANSPORT ECONOMIC AS A FUNCTION OF PLANNING SUSTAINABLE DEVELOPMENT OF SPORTS-SCHOOL AIRPORT

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<https://doi.org/10.37602/IJSSMR.2025.8535>

ABSTRACT

Modeling a traffic system involves a meticulous, multi-phase process starting with defining problems, objectives, and current conditions, which is crucial due to data scarcity and complexity. It includes collecting extensive statistical, socio-economic, and field data, forecasting future demand based on socio-economic trends, and creating demand and impact assessments to evaluate the feasibility and effectiveness of proposed solutions. The process emphasizes the interdependence of spatial and movement phenomena, ensuring that goals align with social and economic development while respecting limitations such as budgetary, environmental, and spatial constraints. Decision-making integrates these insights to select optimal transportation solutions that balance costs, benefits, and environmental impacts, ultimately guiding policy and infrastructure development for efficient, sustainable urban mobility.

1.0 INTRODUCTORY PART

Transport economics in air traffic involves applying a comprehensive blend of knowledge, principles, and skills across various disciplines to optimize the use of resources, ensure sustainable growth, and meet user demands effectively, while also considering technical, organizational, and environmental factors. Planning in this context is a meticulous process that employs engineering and complex methodologies to assess future needs, analyze current traffic systems, and propose improvements based on extensive data collection, aiming to create a detailed understanding of the existing situation and develop strategies for efficient and effective air traffic management and development. It underscores that modern, efficient airport infrastructure serves as a backbone for economic growth, international trade, and societal development, especially in transition countries like Macedonia where scientific studies on these topics are limited. Addressing this gap involves applying a systematic approach of diagnosis, prognosis, and therapy to develop sustainable, well-regulated air traffic systems aligned with international standards, ensuring optimal utilization of resources, and supporting broader economic and social progress within the framework of sustainable development goals. The research focuses on a complex analysis of transport economics and sustainable development, in order to prove the four hypotheses through scientific responses to current topics such as the importance and characteristics of transport economics, infrastructure sustainability, environmental impact, international trade and economic development, with a special emphasis on air traffic. The research also includes modeling of universal optimization models, evaluation of cost-benefit analyses and benchmarking to determine the possibilities for the development of airport infrastructure and its suitability in the international framework, in order to ensure a

sustainable and competitive transport system that is in line with global standards for sustainable development.

The article stands out as a novel contribution in the field of aviation, scientific research methodologies, and economic analysis, particularly within the Macedonian and European context, by addressing a gap in the existing literature. Unlike typical bibliographic units that often provide encyclopedic explanations of aviation phenomena, this work uniquely integrates resource-based approaches with sustainable development principles to evaluate airport infrastructure development, exemplified through the Gevgelija airport project. It challenges previous research paradigms by demonstrating that traditional resource-based cost-benefit analyses may not be effective in the Macedonian aviation industry and emphasizes the importance of balancing infrastructure growth with environmental sustainability. This research not only advances theoretical understanding but also offers practical insights for developing competitive advantages in the air transport sector without compromising ecological integrity, filling a significant gap in both domestic and international scientific literature.

2.0 METHODOLOGICAL SETTING

Transport planning and design are activities that consist of a formalized procedure with the aim of developing a view of the future with sufficient security and confidence to make the necessary decisions and to take appropriate measures to improve the current situation, positive realization and to minimize the negative effects on development. With the development of civilizations, it is increasingly moving away from the method of objective assessment by parties relying on reliable information and the application of scientifically verified planning methods, which become a prerequisite for efficient and rational development. Planning and design essentially help to improve in anticipation of the most likely outcome of decisions and measures and complete security of the process depending on the size, visibility and credibility of the information and accuracy in the application of the method and procedure.

The individual ability of planners and/or designers to think and synthesize the results of analysis, creative forms of possible solutions and an objective and impartial assessment of their total value and to propose an optimal solution based on the prerequisites for the successful implementation of the planning/design process. The text underscores the importance of a comprehensive and systematic approach to traffic planning, emphasizing the need to gather diverse data—including demographic, socio-economic, geographical, and infrastructural information—to inform effective decision-making. It highlights the significance of organized information processing, strategic planning, and clear goal-setting in ensuring long-term sustainability and efficiency, especially within the context of regional development and airspace management. The focus on defining precise objectives aims to enhance European airspace efficiency and support sustainable regional development, aligning transportation systems with broader economic and environmental goals for future resilience and viability.

Passing through a comprehensive array of twenty-two scientific methods, including the "mosaic" method which integrates content from seminar papers and projects; mathematical models to conceptualize infrastructure design; statistical methods for analyzing phenomena; descriptive methods to decompose complex concepts; compilation methods for literature collection; modeling methods based on air traffic control knowledge; analysis and synthesis

techniques for evaluating and structuring knowledge; deductive and inductive reasoning for logical inference; abstraction and concretization for case-specific research; generalization and specialization to refine findings; and proof methods to validate optimal location decisions. These methods collectively facilitate a multidimensional exploration of the topic, integrating theoretical, empirical, and practical approaches to develop sustainable transport solutions for a sports-school airport. The classification methods outlined encompass a diverse range of approaches used in scientific and practical research, including classification according to ICAO Annexes, theoretical systems for modeling and representing balance, and comparative methods for analyzing development parameters of locations. Historical methods draw inspiration from Leonardo da Vinci's analytical work, while empirical methods focus on qualitative and quantitative research. Axiomatic methods provide foundational hypotheses, case study methods analyze specific phenomena such as the airport near Gevgelija, and ideal type methods consider perfect conditions in equilibrium theory. Programming methods facilitate 3D terrain visualization, observation methods involve field data collection, and forecasting methods are crucial for wind rose analysis in construction planning.

3.0 ANALYSIS OF THE TRAFFIC AND TRANSPORTATION SITUATION

The purpose of the analysis of the situations is to assess the degree to which the existing transport system satisfies the needs for the quality of the transport service and from the aspect of capacity, speed, safety, price and consequences for the environment. The process of state analysis requires the collection and processing of a significant amount of information related to the geographical location of the traffic, socioeconomic characteristics of the area, activities (area), characteristics of the traffic network, characteristics of the movement of the population and cargo, parameters of the movement of the population and cargo, mass transport and overall assessment of situations.

3.1 Traffic - Geographical Features

In this part of the analysis, it is necessary to describe the natural and created values that should be preserved, as well as the possibility of further development of the area.

It is very important to present the development of the transport system and the road network, which explains the reason for the existing structure and layout of the network, as well as how it is used. Traffic-geographic features are an important element of the analysis that explains the historical-geographical conditions that influence the formation of surface features and its connection with the environment.

3.2 Population and socio-economic indicators

From the analysis of these indicators, we find an absolute and relative measure of the population and its characteristics, social and social organization of the area, economy, economic potential of the area, economic development, plans and their realization. In this way, the possibilities for socio-economic development, as well as limiting factors, are considered. The following parameters are usually treated: the population in the next 20 years, as well as the migration of the population, the percentage of the economically active population and the assessment of the work potential in relation to the gender structure, the employment of the population by sectors, the qualification structure of the population and the level of education.

Which parameters will be used also depends on the level of planning. Indicators of the social and economic condition of the population are analyzed by transferring data from the economy with population indicators and are reduced to one resident in the family. As an example, the following data can be given: the gross national product, the net personal income (salary), the total income of the household, the degree of motorization, the surface of the living space per family, the number of television or radio receivers, the number of doctors per thousand households and others.

3.3 Economy

Economic growth rates by branches, craft and fixed assets, level of indebtedness, number of employees, employment rates, productivity, economy, gross income per employee, as well as other specific indicators show the development of a certain economic area and its dynamics. Investments in communal infrastructure or roads are particularly important. Activity is compared by grouping into primary (agriculture, mining), secondary (industry), tertiary (trade, hospitality, services) and activities (education, arts, etc.). At the level of the entire area, the economic potential of traffic zones is prohibited. Thus, for each spatial unit it is necessary to determine at least two data. It is the number of employees and shipping and freight.

3.4 Spatial arrangement of activities

The lines of desire for movement, as well as the extent and timing of space travel, depend on the appearance and density of activities in the observation area.

The purpose of the area, depending on the activity, can be: collective housing (high density of housing), individual housing (low density), work zones, central facilities (banks, shops, administration), traffic areas, recreational and green areas, and the mixed use zone. For the purposes of traffic analysis, the characteristics of the city are identified by individual spatial units and this serves as the basis for the formation of traffic zones. Zones should be homogeneous in order to easily determine attractions and productions. Information on spatial arrangement of the activities can be obtained from urban planners.

3.5 Characteristics of traffic networks

In most cases, a detailed analysis of the traffic network is performed, for example, roads and street networks, networks, roads and ports, airport facilities, etc. Special attention must be paid to the road traffic network. The reason for this is the lack of good coordination of drivers of individual vehicles, which can cause congestion. In the analysis the entire network was divided into homogeneous shares. The profile and condition of the pavement, as well as the traffic regime, can be taken as criteria. Data for each element of the road network (shares, nodes, etc.) are the network cadastre. These are the following data: technical characteristics of shares (category of roads which shares the length shares, width and organization of the traffic profile, the type and condition of August, the organization of the work of the section (parking, to stop mass public transit), the traffic mode of the section and at the customers who comes to the shares, equipment for regulating the traffic of nodes, the position of the shares in relation to the characteristic parts of the city, to a certain content that serves the shares (stadium, hospitals, ports, schools, state August and underground installations) and the characteristics of the traffic

flow (flow, traffic speed, flow, density and flow structure in certain time periods, variations over time and the volume of traffic structure and safety).

In addition to these characteristics, special details such as public bus transport, bicycle movements, etc. can be given when describing the network. From what follows, each analysis requires a separate data list and computer processing program. The analysis should include the level of service and traffic flow in terms of barriers between motorized and non-motorized traffic.

3.6 Characteristics of passenger movement

The analysis of passenger movement characteristics aims to determine both the volume and distribution of movement in space, to temporally distribute the movements, the distribution according to the mode of movement and the reasons for the movements undertaken. Spatial movement characteristics are an important factor for analyzing traffic conditions, which include the definition of movement depending on the source and destination. Thus, the trends of origin and destination are in the observed area, and such movements are called local and movements in which one end or in the observed area (external). Analysis of spatial characteristics determines transit, target movements (external distribution), local movements, internal distribution from the terminal. The results of such an analysis can be given in multidimensional matrices, which complicates the processing, but shows the trends in the areas much more clearly. over time, the analysis can be performed at intervals from 5 minutes to weeks and seasonal oscillations. When analyzing, it is necessary to take into account the relevance of the application, ie. movement demands should be intense for a sufficiently long time.

3.7 Nature of traffic - spatial planning

Within the general framework for traffic planning, there are several types of traffic planning depending on the time span of the observation, the spatial coverage, the degree of aggregation of the planning and so on. According to one of the possible and more common divisions, there are three types of traffic planning:

- A) Sectoral traffic planning, which includes traffic planning as a separate economic area or some of its branches,
- B) Spatial traffic planning, which includes planning the traffic network and associated phenomena in a specific area,
- b) Traffic planning, which includes the design, evaluation and selection of individual transport facilities.

Spatial-traffic planning aims to increase the rational organization of space and increase the spatially important effects of socio-economic development. That is why the main attention of the spatial planning is aimed at monitoring the relationship between the traffic and the given space and at establishing mutual relations and influences. Because the content of spatial economy is closely related to the meaning and different forms of space, and only spatial planning has an extremely strong spatial character. Given such a feature, spatial planning and

traffic planning have become very important in recent times. There are four specific reasons for this:

A) increasing the significance and value of spatial and spatial factors in the complex relationships and processes of modern life, work and development,

B) increased impact of traffic on the environment and vice versa,

C) increasing urbanization and demand for transport in a relatively narrow space and

D) increase in inter-city and inter-regional movement of people and goods and increase in congestion on the main directions of traffic movement. Therefore, in some countries, the obligation of traffic planning is legalized in areas that have reached a certain degree of urbanization.

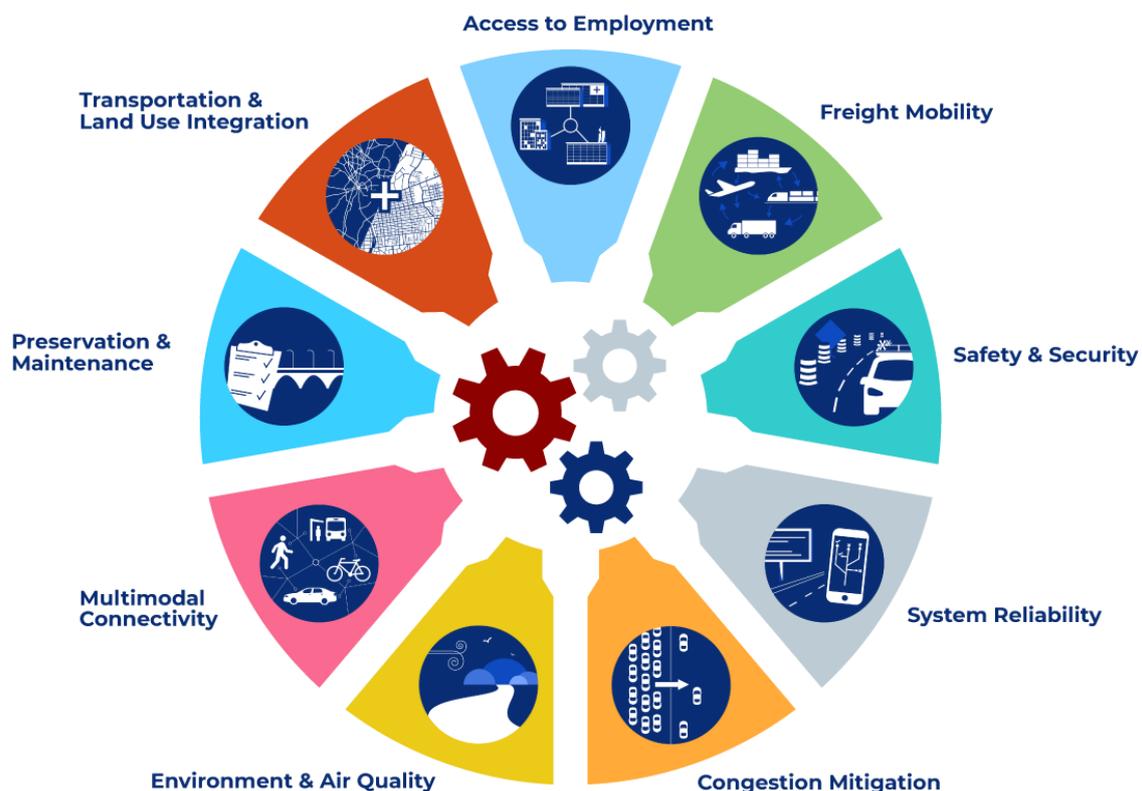


Figure 1, Type of traffic planning

4.0 ECONOMIC VIEW FOR FUNDAMENTALS OF THE PLANNING PROCESS

From the very beginning of modern systems of transportation of people and goods (at the end of the 19th century) to the middle of the 20th century, the methodological approach included a linear sequence of a structure consisting of four steps, although the feedback effects of the implementation of measures (realization of supply) the current state of demand for transport services.

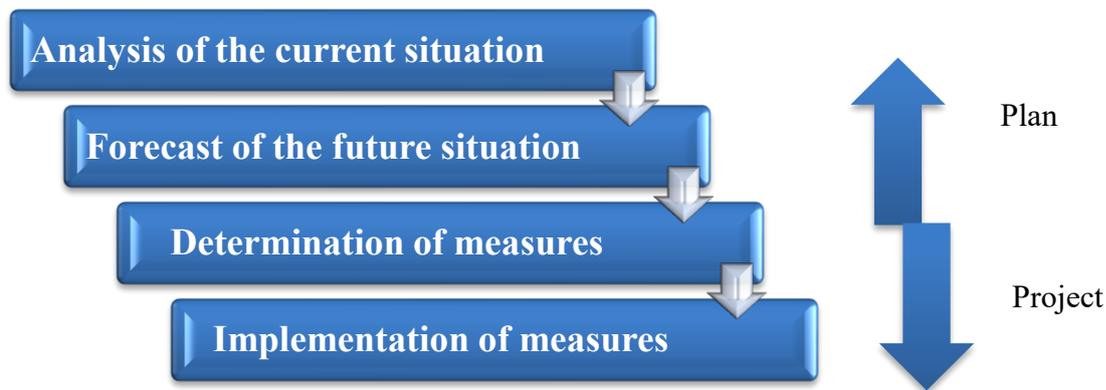


Figure 2, Basis in the planning process

One of the main reasons for this is the impossibility of multiple iterative testing of many varieties due to the lack of appropriate planning methodology and technology. This approach to the process led to a relatively strict separation of the planning and design processes, that is, the overall planning process resulted in future demand as a programming requirement for the design process.

Objectively, it is about adjusting the supply to the future demand through the procedures for dimensioning the elements of the traffic networks and actions. Further elaboration of the basic planning process highlights four steps:

1. **PROBLEM ANALYSIS** in which the desired state is defined through the development goals, and the defects are based primarily on the results of the analysis of the current situation. The diagnosis is established through direct and feedback connections, that is, iterative conclusions.
2. **MEASUREMENT OF THE PROJECT** implies a detailed definition of possible measures, such as political, organizational, management, construction, exploitation, etc. The final result of this step should be a documented proposal of measures.
3. **SECURITY OF DECISION** implies a process of consideration and adoption of optimal measures, as defined by the planning team.
4. **THE IMPLEMENTATION PROCESS** is the last step in the continuous process and consists of constantly monitoring whether the consequences of the application are in accordance with the defined measures in the design process.

5.0 TRANSPORT ECONOMIC LEVELS OF PLANNING FOR AERODROME INFRASTRUCTURE

In transport economics, the hierarchical levels of planning—strategic, tactical, and operational—are essential for creating efficient, sustainable, and cost-effective transportation systems; strategic planning sets long-term goals based on comprehensive diagnostics and evaluates potential measures for their long-term impact, thereby defining an optimal combination of policies, while tactical planning translates these strategic objectives into medium-term infrastructure and service decisions, and operational planning focuses on short-

term scheduling and day-to-day management to implement strategic commitments effectively. Therefore, two basic types of planning are distinguished:

- a) strategic planning (broadest long-term plans)
- b) operational planning (by separate sectors or subsystems representing the traffic basis).

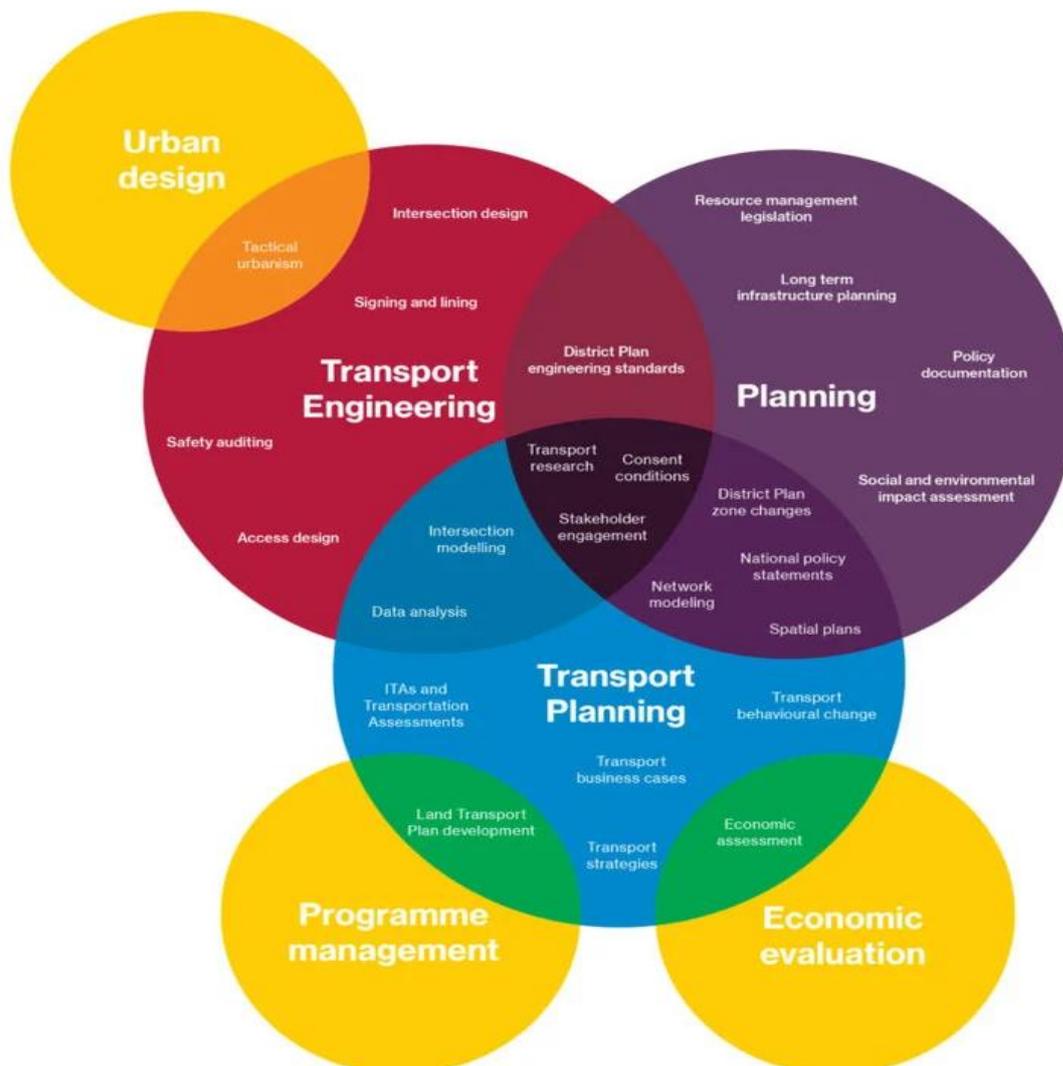


Figure 3, Levels of planning

By combining the basic concept of planning and the previous one (strategic and operational planning) a complex process of traffic planning can be formed. It is important that the strategic goals and measures represent a single system and that the projected operational measures are always evaluated at two levels:

- subsystem and
- complete system.

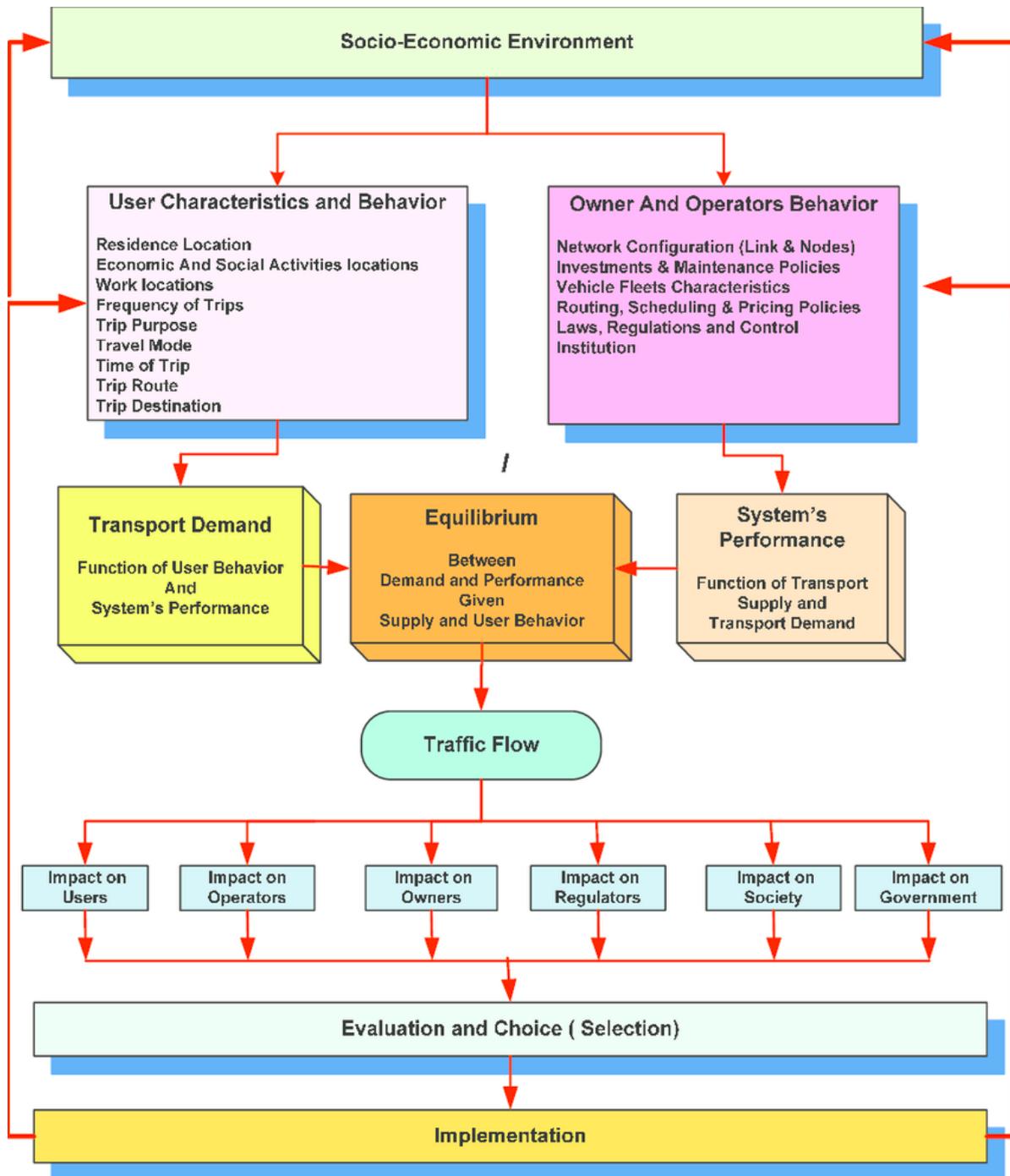


Figure 4, Diagram for economic planning process

6.0 TRANSPORT ECONOMIC BASIS FOR PLANNING TRAFFIC SYSTEMS

Traffic systems planning should be integrated into broader traffic planning, aligning with the objectives of other sectors while supporting decision-making across multiple levels through a structured process that emphasizes clear goals, reliable data, and understanding of social influences. This involves assessing costs and benefits, optimizing resource use, and considering

factors like travel time, costs, environmental impacts, and social costs to maximize societal welfare, ensuring that transportation infrastructure is developed efficiently, sustainably, and in a manner that balances technical feasibility with social acceptability.

6.1 Transport economic for planning process

Transportation economics is crucial for the planning process because it helps evaluate the costs, benefits, and efficiency of different transportation options, ensuring optimal allocation of resources, improved infrastructure development, and enhanced mobility. By analyzing factors such as infrastructure investment, demand forecasts, and pricing strategies, planners can make informed decisions that promote sustainable growth, reduce congestion, and improve overall transportation systems. The general scheme of planning and the time spiral of state change as part of the process that improves and improves (or) preserves the state is given in Fig.5.

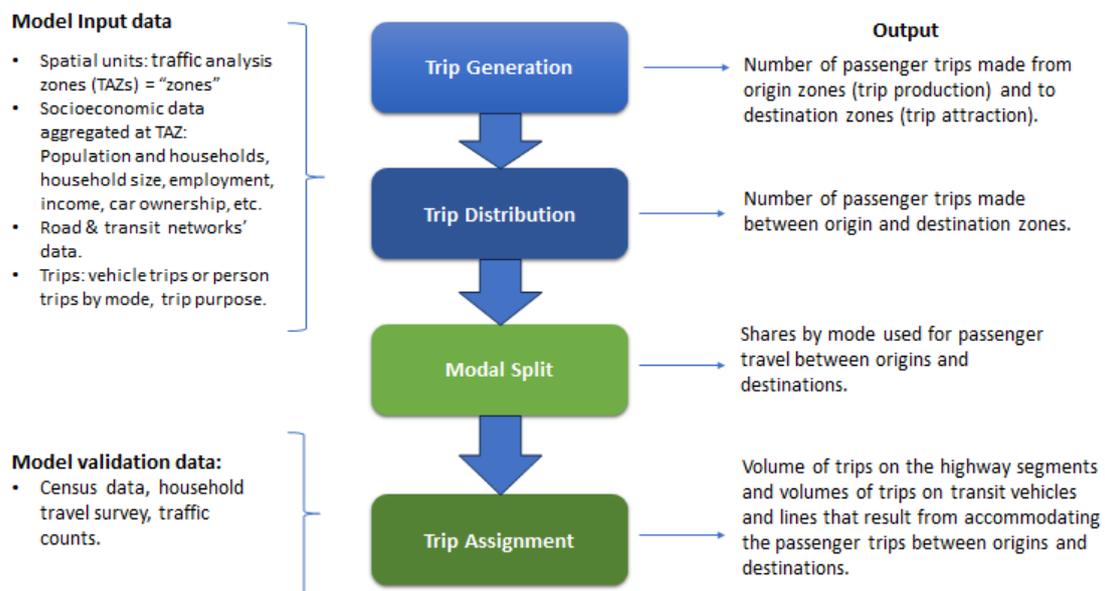


Figure 5, Transportation Modeling

In the traffic planning process, there are time intervals (mountain horizon), according to the spatial coverage or from the element planning activity.

Transportation and transportation planning is a specific process that determines the necessary facilities to meet the future transportation needs of the planned area.

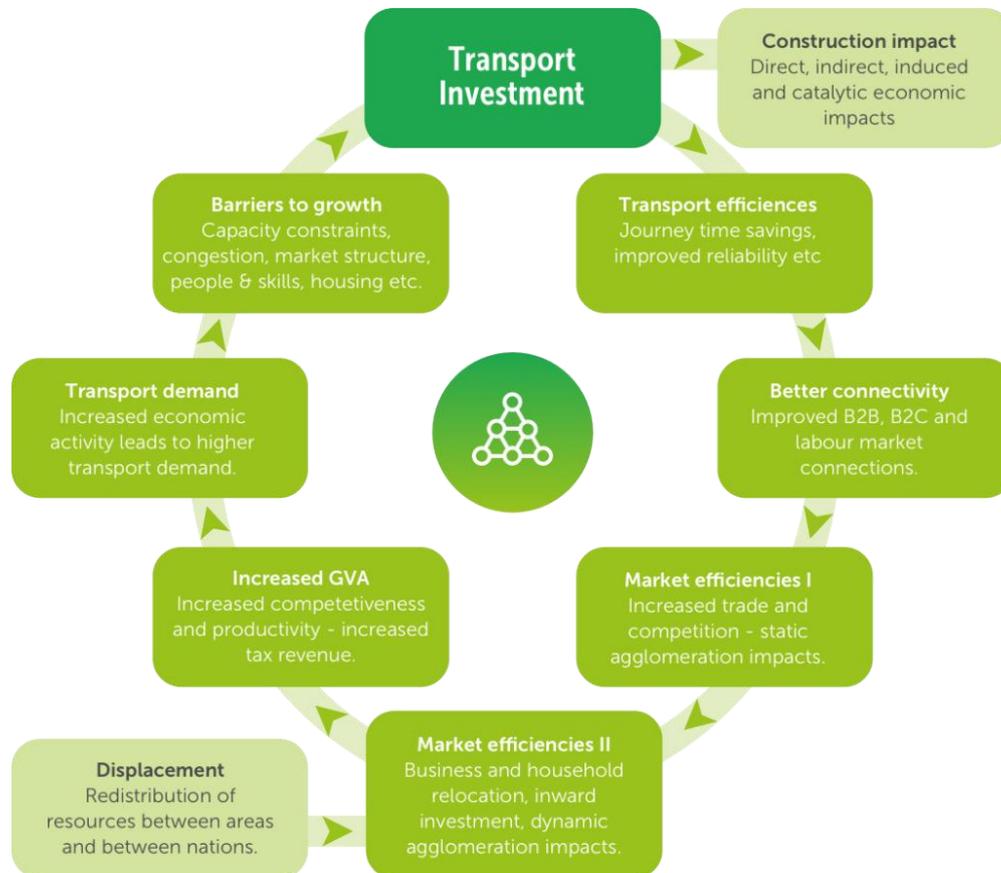


Figure 6, Basic diagram for the traffic planning process

In planning a traffic system, it basically starts with transit needs and the ways in which these transportation needs are addressed. And the flows of goods and passengers distributed in a certain area in time and converted into flows of propulsion units are the task that the traffic system has to overcome.

6.2 Basic steps in traffic planning

The first step in the planning process is analysis of traffic problems and disease diagnosis, and objective perception of the situation and definition of defects.

The second step involves defining goals based on the objective impact of broader aspects such as the economy, society and policy development, as well as the goals of preserving and improving the environment. This step is not independent of the influence of the current situation, and as a result they should define the future status in accordance with the specific needs and opportunities for development.

The third step, variants of the design, of the creative process to explore possible solutions in which indicators of future service traffic to comply with opportunities offered for each of the variants. For each of the variants, all the consequences are defined and based on their perception, the initial variant solutions are modified.

The main purpose of having feedback is that each variant is internally optimized. After the completion of the process of internal variants optimization, they are compared with objective indicators of positive and negative consequences, that is, they settled on the degree of fulfillment of the adopted goals (the criteria established on the basis of the goals), in order to document the optimal variant.

Strategic planning usually relies on the application of optimization criteria, and operational planning mainly refers to economic valuation methods.

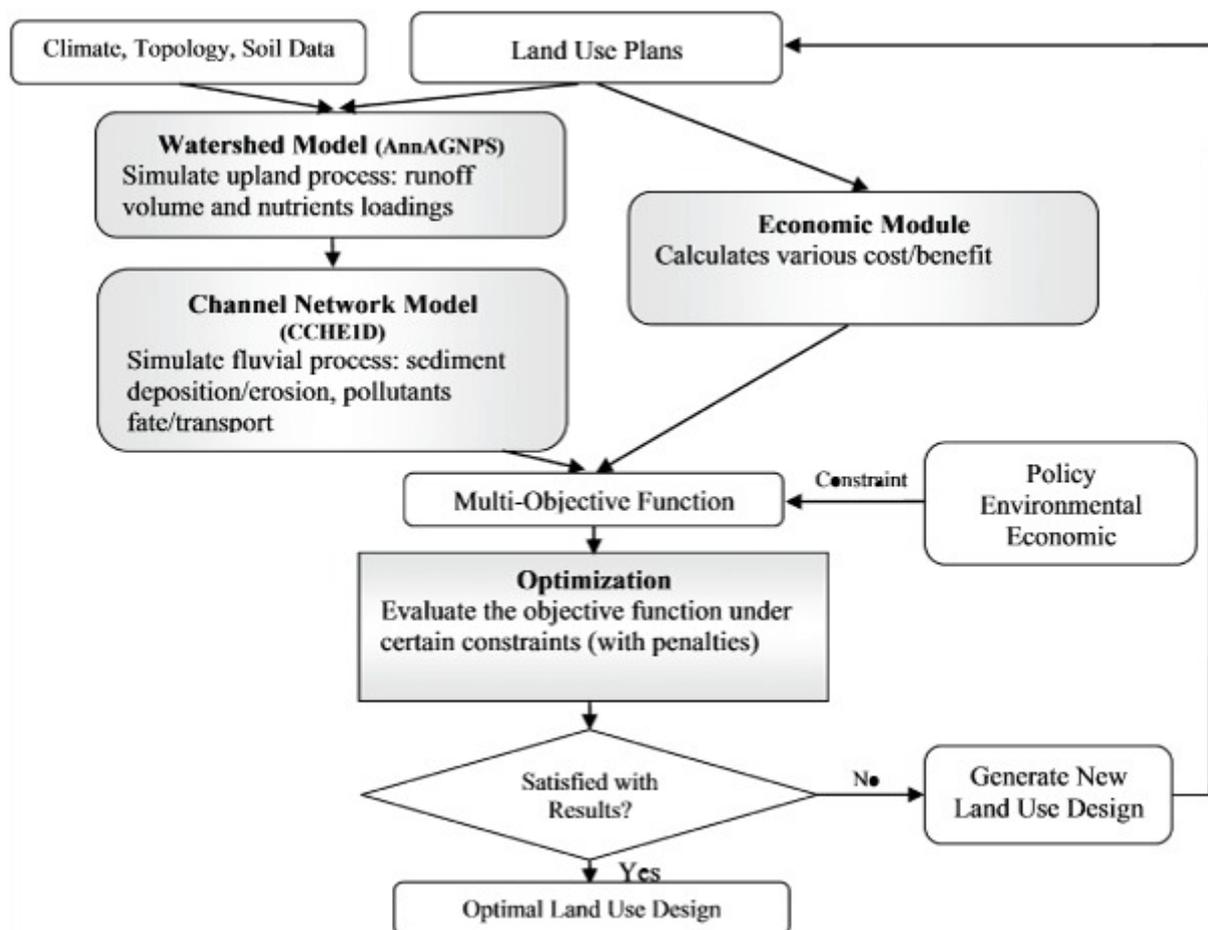


Figure 7, Method of multipurpose optimization for transport economic evaluation

7.0 GOALS AND PROCEDURES IN ECONOMIC TRANSPORTATION FOR TRAFFIC PLANNING

Traffic planning emerged as a specialized discipline in the 1950s, particularly in developed Western countries, to address the complex transportation challenges arising from rapid urban growth and increased movement of people and goods. As cities became focal points of congestion and inefficiency, traffic planning evolved to analyze current problems, forecast future needs, and develop transportation systems that optimize the movement of people, goods, and information, aiming to reduce costs, improve safety, and enhance overall traffic flow.

Although the process of traffic planning can be divided into several interrelated steps, it is common to group them into several main groups of activities related to:

- determining the goals that the planning process seeks to achieve
- analysis of existing traffic problems
- assessment of future traffic problems
- researching potential solutions in order to meet the set goals
- evaluation of individual solutions and combination of solutions that should
- achieving better traffic effects
- selection of the best solution (combination of solutions)
- defining the stage realization of the most favorable solution.

The objectives of the traffic plans were initially purely functional in nature and mainly included the improvement of the transport infrastructure, with the aim of reducing congestion and waiting vehicles, the negative effects of traffic accidents, overloading of public transport vehicles and the like. Such an approach to traffic planning can be called traditional or functional, and although it later received some criticism, it has remained in many traffic studies to this day. The evolution of traffic studies from the 1950s through the 1960s highlights a shift from traditional, functionally focused planning to a more holistic understanding of urban mobility, recognizing that transportation infrastructure should integrate with broader social, economic, and environmental activities; critics argued that earlier approaches overlooked these interconnected aspects, emphasizing the importance of considering the entire urban surface system rather than isolating traffic issues. In previous considerations, attention was not paid to the feedback from the traffic system to the environment, the greater influence was only one-way - the activities and purpose of the surfaces were determined by the traffic system. The development of the system analysis approach in transport planning during the late 1960s marked a significant shift from traditional methods by emphasizing a holistic view of the traffic system as interconnected elements, including infrastructure, transportation means, and organizational structures, all working together to facilitate accessibility and connectivity. This approach considers the system's interactions with its environment and underscores the importance of setting goals, standards, and restrictions that are aligned with the broader development of the area, rather than focusing solely on individual transport elements. Consequently, it promotes a more integrated and sustainable strategy for managing traffic problems, ensuring that transportation planning supports overall regional growth and development objectives.

8.0 ECONOMIC SIGNIFICANCE IN INTERCONNECTION OF PROCESSES IN TRAFFIC PLANNING

The planning process includes transportation of traffic demand and supply is considered within a broad causal relationship with the social, economic areas of urban development. An essential

step in the planning process is to analyze the problems that include the purpose of determining development goals and defining measures, because it is objectively impossible to determine the boundary between these concepts. The terms planning and design have become synonymous in our practice, and essentially their interpretation is a matter of convention. It is common that the term means planning activities, mainly in the area of demand, as well as the term design activities mainly in the area of turnover of transport services. However, considering the cause/effect effect in traffic, the development of relations on the one hand, and physical, economic and social development, on the other hand, the problem can be limited only to the issue of demand and supply of transport services, but to spatial planning development and design of transport networks must be considered as conditional processes.

The basic methodological approach to planning is defined on the basis of the division according to the levels of geographic planning and design and the corresponding functional classification of the actions of the road network. A hierarchical series of planning and design studies is necessary when dealing with the primary intercity road network (for example, a section of highway or in our case an airport).

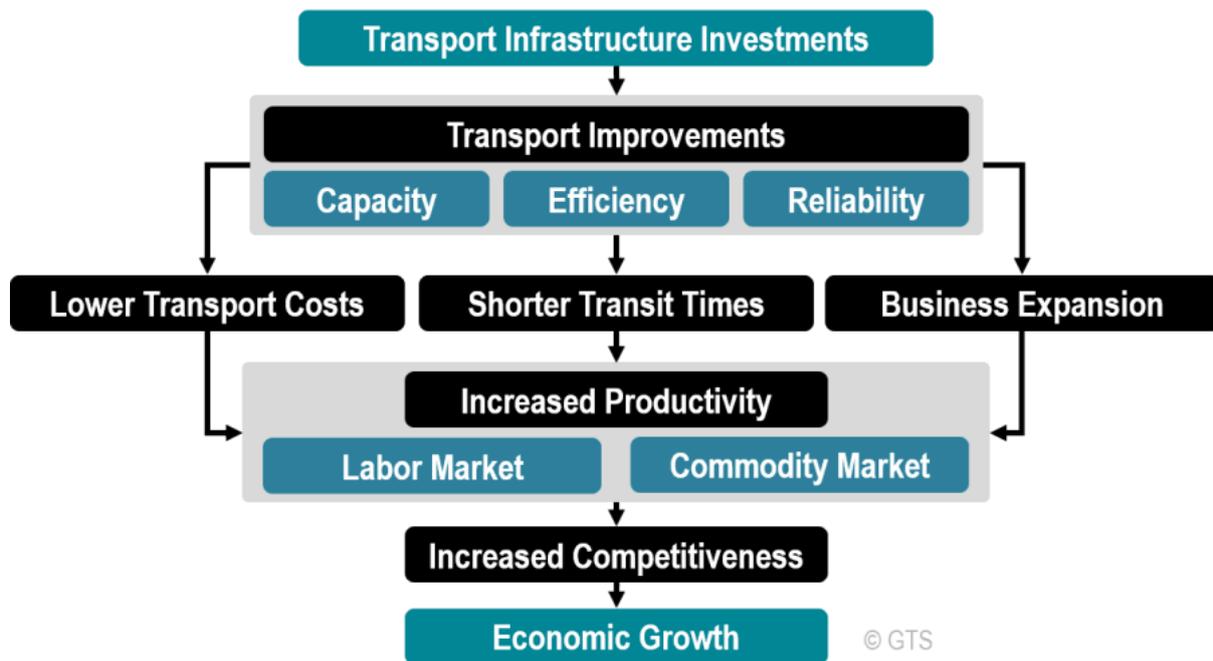


Figure 8, Basic methodological approach to traffic planning

9.0 CONCLUSION

Transport economics modeling for a traffic system begins with a critical and complex initial phase of defining problems, setting goals, and gathering current data, which is essential for guiding subsequent steps. This phase involves extensive data collection, testing, and documentation, often hindered by data availability issues, making it the most challenging part of the process. Once a comprehensive statistical and documentary database is established,

along with clearly defined research zones, detailed modeling can proceed, relying on the accumulated data to develop accurate representations of the traffic system.

When defining the problem and planning the framework, the key problems are defined, the goals and limitations are defined, the decision-making process of input and output data, value criteria and selection criteria are determined. This work is carried out according to a certain methodology and includes the following elements:

The goal is a general framework for developing a proposal for a variant. The goal must faithfully reflect what people need for profitability in accordance with the goals of social and economic development, and is determined based on past achievements and development trend of future development.

Limitations - The determination of limitations aims to ensure the reality of the planned prediction and realization of the selected solutions. Constraints can be monetary, environmental, spatial, etc.

The transportation system planning process relies on comprehensive data collection—including demand for goods and passenger movement, socio-economic factors, land use, and infrastructure—to develop spatial transport models and forecast future demand based on socio-economic development, population distribution, and motorization levels. This foundational data, gathered through field surveys and statistical analysis, informs decision-criteria that integrate system performance metrics like travel time, quality, and costs to facilitate optimal system selection. Demand forecasting aligns previous planning phases by estimating future transportation needs, assuming a causal relationship between socio-economic characteristics and demand, thus enabling planners to assess total transportation needs, modes, and spatial distribution over the planning horizon. Creation and evaluation of a demand plan for forecasting a phase that has acquired the distribution of traffic flow on the access to the transport network of development and evaluation of alternative plans for testing and evaluation of proposed solutions. The study should determine whether the proposed transportation system meets transportation demand in terms of capacity, reliability, and service levels, and assess potential impacts on the environment and land use. The evaluation evaluates to what extent the solution is economically and socially justified and feasible. This is achieved by comparing the costs and benefits of the options and adopting the one that achieves the greatest benefits.

Decision making and achievements Policy making is a phase that includes a wide set of economic, financial, legislative, administrative activities that need to be implemented to ensure the execution of the plan.

The basic principle of planning is the interdependence of the phenomenon. With traffic planning, interdependence is related to the purpose of space and the occurrence of movement. This interdependence is fundamental to traffic planning.

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