International Journal of Research in Commerce and Management Studies

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

To cite this article: Ana Lazarovska, Verica Dancevska and Violeta Manevska (2022). IMPROVING THE GEVGELIJA AERODROME PROJECT METHODOLOGY THROUGH THE EYE OF LOGIC OPTIMIZATION, International Journal of Research in Commerce and Management Studies (IJRCMS) 4 (4): 46-75

IMPROVING THE GEVGELIJA AERODROME PROJECT METHODOLOGY THROUGH THE EYE OF LOGIC OPTIMIZATION

Ana Lazarovska[1], Verica Dancevska[2] and Violeta Manevska[3]

[1]University St Kliment Ohridski Bitola, Faculty of Technical Sciences,
Makedonska falanga 33, 7000 Bitola,

[2]University St Kliment Ohridski Bitola, Faculty of Technical Sciences,
Makedonska falanga 33, 7000 Bitola,

[3]University St Kliment Ohridski Bitola, Faculty of Information and Communication Technologies,
Partizanska bb, 7000 Bitola,

DOI: http://dx.doi.org/10.38193/IJRCMS.2022.4405

ABSTRACT

The term equilibrium and the emergence of new technologies intended for aerodrome infrastructure development puts increasing pressure on the field of optimized traffic networks as crucial criteria for location selection. There is a constant need to improve optimization processes as one of the needed solutions for an equalized system. However, finding and implementing an optimization model is a potential requirement for traffic capacity for planned aerodromes where the intended capacity has the decision rule. In this paper, the authors show how the optimization model may be recast as a decision factor. We then take advantage of the recent advantage of recent advantages in Single European Sky ATM Research- SESAR reinforcement learning to build a project methodology that learns how the new aerodrome infrastructure can be born. Our design for the Gevgelija aerodrome has a number of desirable locations and it is decisional for one that generalizes many decision factors. Additionally, this methodology natively supports problems like this one, without the need to handle special cases. Finally, it is the same methodology that can be used to achieve different optimization objectives, e.g. aerodrome category and aerodrome development.

KEYWORDS: project, equilibrium, aerodrome infrastructure, optimization, logic representation

1. INTRODUCTION

The project concept is defined by many authors and literature in which different aspects are emphasized in different ways. "A project represents a temporary effort or effort that is undertaken to achieve a specific product, service, or any other deliverable defined by the scope and purpose of the project. Elaborated in this way, it determines that the project is carried out only once, with a defined

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

beginning and end, budget and scope of work to be performed."[1] The project, as a problem that requires a solution, should avoid definition in the literal sense of the word, but it's meaning should it is considered as an interest or objective aimed at improving either through the development of new airport infrastructure or any service in aviation that will ultimately have a positive effect on the stakeholders of the project. "A project is a set of related activities determined by the purpose, specifications, and technical conditions that must be carried out using resources in a given time with a limited budget." [2]"A project is a specific and limited task to be completed and has a goal, duration, and connection with other projects." [3] "A project is a planned set of interrelated tasks that will be performed within a certain period of time and within certain costs and other constraints." [4]

In this paper, the equilibrium quadrant shows the correlation between the four constraints and how changing one causes the quadrant to be unbalanced. Increasing project scope affects project time, cost, and quality with every project decision that can affect these four aspects of the project. Cost is a function of coverage, time, and quality, and defining or changing some of these variables can potentially affect the projected costs, i.e. the budget.

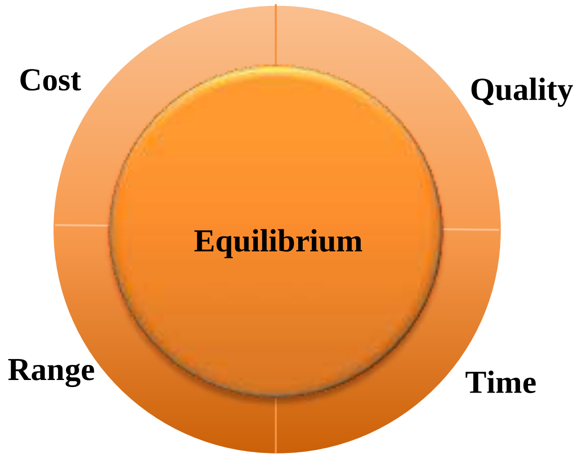


Figure 1: Equilibrium quadrant [5]

Equilibrium between transportation requirements and the ability of the supply system to plan and predict the flow of aircraft and passengers in transportation systems by modelling transportation systems on two subsystems: supply and demand. The supply system describes the availability of transportation systems and airport infrastructure, while the demand system includes models that determine the demand for transportation, based on socio-economic characteristics from the beginning to the end of the flight using static models.

Taking this in mind can be done by writing an optimization model for traffic capacity. The building and validation of the model were supported by the Library of the Economic Faculty in Zagreb, using data from the European Union Publications Office by the European Union. Using the optimization model, the planned aerodrome in the vicinity of the city of Gevgelija is illustrated by analyzing the planned capacity. The special accent of this study is on the sustainable development after-effects taken as the main goal. The content is represented in 5 chapters: at the beginning is the introduction part and then follows the second part presents the background. The third part presents the model and calculation for optimization, the other part of the discussion of the effects and result, and the final conclusion are in the fifth part.

2. Literature for project point of view review

Having in mind the article's published already about this project

1. Gevgelija aerodrome location selection- Opatija conference
2. Stages of aerodrome sustainable category evaluation in the vicinity of the Gevgelija city through Nash`s theories of equilibrium- International Journal of Business and Management in Prague,
3. Improving Gevgelija aerodrome of the most favorable location for Runway with risk point of view- International Journal of Business and Management in Prague, for complete evaluation will be published the following methodology.

2.2 Project Review

The time aspect through which the project is observed and displayed as a function of the project triangle, according to research and practice, the obtained quality is always a function of time, budget, and cost. Constraints defined by time, scope, and cost have long defined project success criteria for an organization. Completing the project on time and within budget raises the question of whether the coverage defined by the contract is always achieved, ensuring satisfaction with the outcome. A project that is aligned with the business strategy, a fully developed business case, and a well-defined scope is often underestimated key elements that guarantee success, replaced by the complete completion of the project. The standard triple constraints, time, cost, and coverage, do not guarantee delivery if the basic assumptions and analyses of the project are not consistent with the business strategy. The probability of project success increases when success criteria are defined that more accurately reflect projects as business investments. The business strategy and the realization of the expected business goals are achieved with successful deliveries that are carefully planned, apply the required methodologies and manage and control. Project management first relies on the fact that it is really important that the project is based on real needs with a legitimate business goal to achieve while implementing the project in the right way means proper planning and execution.

The project life cycle in the aerospace world consists of phases that are time-bound, with start and end control points that can be divided according to functional or sub-objectives, specific milestones within the scope of the project, or financial opportunities such as the delivery of equipment to the required location to implement a specific product, deliver a business solution or detailed documentation required for product configuration. Phased projects are a set of logically related activities that are carried out one after the other overlapping to a certain extent depending on the nature of the project, aimed at completing the defined deliverables in the project in order to facilitate the management, planning, and controlling of the project itself:

- each phase has a specific goal for manifestation, as a description of the solution,
- in order to achieve each of the stages, it is necessary to ensure control over certain processes and activities,
- the completion of work from a certain stage can be transferred to the next stage, called a control point in the project.

The project's general life cycle consists of four phases: [6]
• Beginning (opening),
• Organization and preparation,
• Implementation,
• Closure.

Characteristics of the general structure of the life cycle are the following: [6]
- Costs and requirements increase during the implementation phase and fall sharply near the end of the project.
- Each project is special and unique which may mean that the amount of resources varies individually.
- Risk and uncertainty are greatest at the beginning of the project, and decrease during implementation and near the end of the project.
- The possibility of influencing the final characteristics and success is greatest at the beginning and gradually decreases until the end of the project.

There is no ideal project structure that can be fully applied to all activities and therefore it varies depending on the area of work and application. For the construction of airport infrastructure, a specific structure is precisely defined that should be followed during the planning of all projects, regardless of the nature of the project, with an individual approach that best suits the nature of the project being allowed. Project phases are a sequential process to control the quality of the project in order to achieve

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

the desired goal.

In situations where the project may benefit or simply need to overlap phases, i.e. simultaneous phases, we distinguish two basic types of relationships between project phases: [6]

- a sequential relationship starts only when the previous phase is completed, it reduces uncertainty and improves quality, reducing the possibility of reducing the total duration.
- an overlap ratio that starts before the end of the previous one, is used to reduce the duration for additional resources so that the activities can be performed in parallel, which often leads to the risk of repeating the work with changes to the result of the previous stage.

When choosing the method of operation, various factors are taken into account, such as the level of control, efficiency, and the degree of uncertainty. It is possible to apply both approaches in one project for the best efficiency of the project considering the defined scope of the project, the required quality, the plan, the budget, the resources, and the risks in the project.

The life cycle of the project is generically reduced to the stages of opening, organization, and preparation, i.e. planning, realization, and closing. Each project starts with a clear and specific concept, which is observed in practice with the implementation of the project to formalize the mission and vision of the project that can lead to problems in the implementation of the project, that is, what and how to do it.

The project life cycle is divided into phases: [6]

1. Conceptualization and definition are the first phase of the project, defined as the necessary undertaking of the preliminary goals and the possible means to achieve their goals.
2. Planning involves establishing more formal plans to achieve the initially developed goals by preparing a time frame, and budget and defining the task and required resources.
3. Implementation represents the actual "work" of procurement of materials and resources, performance, and quality control.
4. Project closure includes the final activities that typically involve "releasing" resources from the project and redeploying project team personnel.

The organizational effort is measured as a number of hours worked, the thumbprint of expenses, funds invested, or other measures of the use of organizational resources. The effort involved varies during the early stages of conceptualization, definition, and planning when it is minimal and increases rapidly during the later planning and execution of the project.

It is common to think that the phases that take the longest are usually the most important in the life cycle, while the emphasis and planning time is placed on the implementation and control phase, on opening, planning, and closing so that they can determine the success or failure of the project.

In aerospace, project management, and, leadership service, project success is defined by carefully achieving expected business value. The transparent definition and planning of the project according to the business objectives of the clients, the establishment of a project organization with real leadership and competencies, the application of the necessary methodology, and strict management and control for consistent compliance with the expected results lead to the success of the project. The process brings together all aspects, from planning to contract to close and moving to delivery, solution walkthrough, solution architecture design, cost estimation, risk analysis, delivery model definition, product selection, partnerships, and more to prepare a complete offer with all the necessary contents of the agreed contract. [7]

This process is aligned with the XLPM methodology for managing and controlling tasks, projects, programs and portfolios where it integrates a comprehensive methodology for project-oriented operations that differ: [8]

- development projects.
- project management for clients/clients.
- management of internal projects within the organization.
- Management methodology for construction and installation.

2.2 Specificities for project management with XLPM- defined methodology

The XLPM Methodology provides an overview of the definition of portfolios, programs, and tasks according to the XLPM methodology with a detailed presentation of project management for clients/customers.

XLPM (a world-class methodology for managing and controlling Projects, Programs, and Project Portfolios) is based on PROPS originally developed by Ericsson, aligned with PMBok, and developed in partnership with SEMICON. Basics of the PROPS process, templates, methodology, roles, governance, etc. are the basis and integral part of XLPM consisting of several tools in a defined phase model and a single reporting structure. The phases were divided by decision points called "toll roads" (for decisions made outside the project) and "turning points" (for decisions made within the project). In three different sections, PROPS distinguishes between the project management function and the executive function which are related to the characteristics of individual projects.

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

XLPM is a methodology for managing and controlling tasks, projects, programs, and portfolios to fully support project portfolios of organizations with a comprehensive methodology for project-oriented operations. The goal of XLPM is to enable and support the successful management of project activities for overall business objectives. The methodology enables management in the framework of operations and corresponding tasks, projects and programs, of plans and reports in order to make correct decisions.

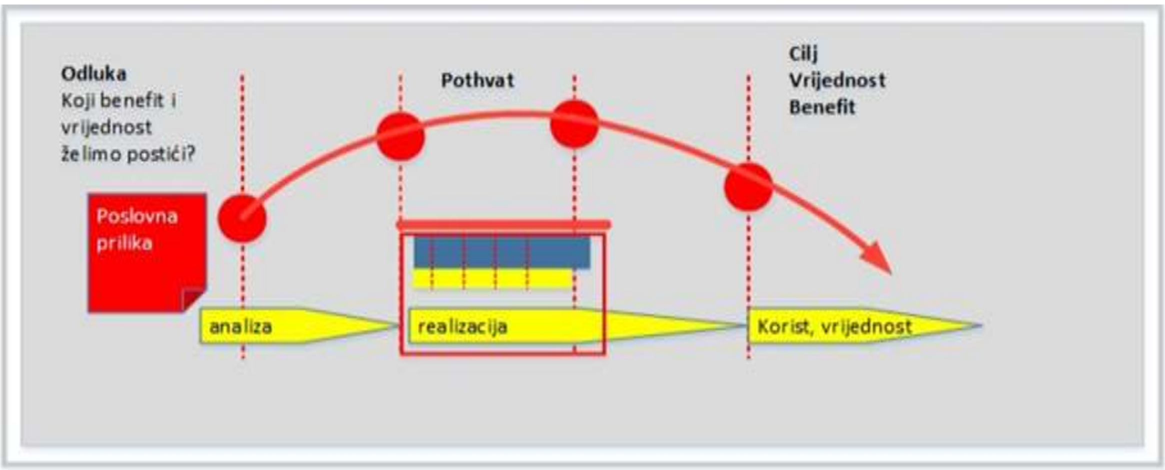


Figure 2: Business opportunity/need according to XLPM), Source:[8]

XLPM is also based on the human factors perspective to emphasize the individual, team, leadership, and shared project culture. For the greatest efficiency of the given methods with the XLPM methodology, all participants have the same attitude about what should be achieved in the same direction. The XLPM methodology defines the process from business idea to development and implementation. [8]

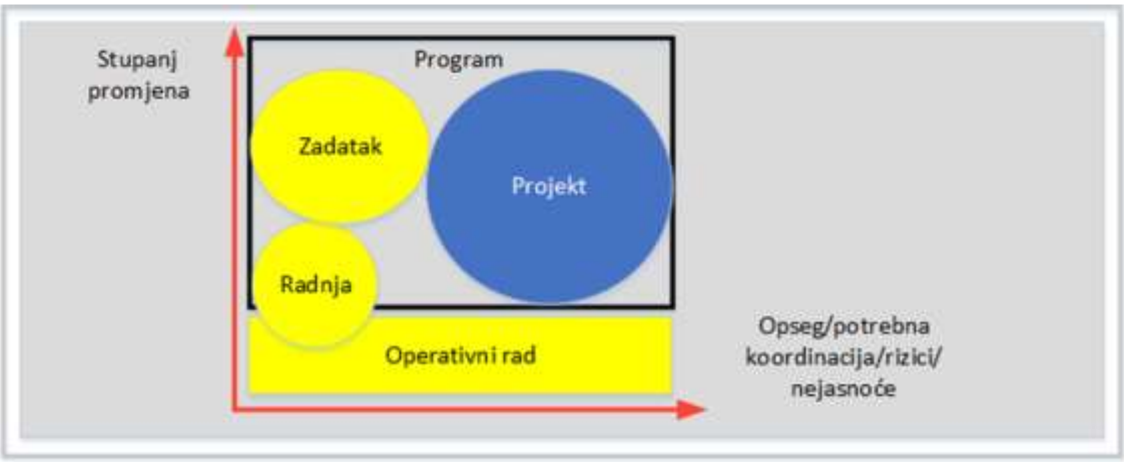


Figure 3: Division of jobs by XLPM, Source:[8]

3. Overview and projection of implementation of the Single European Sky project

The airspace of a regional control center is divided into an arbitrary number of sectors and depends on the structure of the routes. The number of operational sectors depends on demand and is limited by the number of available air traffic controllers by opening more sectors, leading to higher operational costs. Since the air navigation service provider can change the sector configurations in a short time as an internal one, the influence of military flying as an external factor prevents the optimal sectorization. The structure of the routes is determined by the demand, while its optimization corresponds to the change of the structure of the routes including: conditions and restrictions for using coordination agreements, flight level restrictions, one-way or two-way routes, the workload of the controllers... which directly affects airspace efficiency and capacity. The selection and configuration of sectors limit the structure of the route with indicators to:

1. the number of routes,
2. the number of crossed and joined points,
3. one-way or two-way flows.[9]

3.1 Structure of the airspace

Military aviation has an impact on the capacity, complexity, and workload of controllers depending on the quality of military-civilian coordination. Flexible use of airspace (FUA) is implemented in Macedonia to solve the problem of military aviation expressed due to the location in the capital and the lack of coverage by airport infrastructure in the rest of the country, where service providers agree and make decisions on the use of limited airspace zones.

Other factors affecting the complexity of the impact of military exercises are the potential bad weather and additional unforeseen traffic due to some specific events related to the number of IFR flights, especially in the Macedonian airspace. Large variations with IFR flights require optimization of resources in terms of personnel, routes, or design where under the jurisdiction of service providers is limited by its capacity and any excess has to be accommodated by applying air traffic flow control measures. [10]

3.1.1. Operational management concept

The conventional ATM concept of air traffic management is not sustainable as it cannot meet the demands of increasing capacity, safety, efficiency, and cost reduction. According to the ATM 2000+ Strategy with the projected growth rate of traffic demand at the European level for the readiness of the regulators to develop and implement a redesigned concept of the ATM system, based on automation of ATM processes and more optimal use of technological capabilities. [11]

3.1.2. ATM Strategy 2000+

A new "ATM 2000+" strategy with an increased emphasis on safety and security has been proposed at the ECAC meet resulting in a program to increase the operational efficiency of navigation systems called EATMP. The main objective for ATM 2000+ is: to provide economical, safe, fast, and regular flow through proportionate and adaptable ATM services in areas of the European airspace for national security, environmental sustainability, and uniform principles to meet the need and demands of the goal of approximating the system to equilibrium.

This new strategy is the observation of the management of a complex network of individual systems, including operators and airports interconnected in order to transmit data on overall efficiency, organization, and optimizing capacity in function of separation and arrival of aircraft "in the right location at the right time".

The main objectives of the ATM 2000+ strategy are:

1. Security,
2. Capacity,
3. National security and defense,
4. Quality,
5. Economics,
6. Environment,
7. Equality,
8. Human factor.

According to ICAO, each state is responsible for the organization, development, and performance of

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

navigation services in the respective sovereign territory with a problem mainly due to the geographical area. [11]

3.1.3. ATM Security Regulations (ESARR)

EUROCONTROL established the Security Commission as an independent body to give advice and to ensure a sustainable high level of security in the ATM system in the ECAC countries with six security regulatory requirements (in force from the third year from the date of publication) are:

1. ESARR 1 – National regulatory framework for ATM security.
2. ESARR 2 – Notification and evaluation of emergency events in ATM.
3. ESARR 3 – Use of SMS by ATM providers.
4. ESARR 4 – Risk assessment and mitigation in the ATM system.
5. ESARR 5 – ATM staff.
6. ESARR 6 – Program support of the ATM system. [12]

3.1.4. ATM and Project for Single European Sky

Flow and capacity management optimizes the ability of air traffic controllers to handle planned and existing air traffic safely and efficiently. ATFCM covers the management of network infrastructure systems and the supervision of overall network operations with the main function of maintaining the NOP of what is currently planned, divided into four main phases:

Strategic Phase: Classifies long-term flight demand data by capacity.
Pre-tactical phase: balances the next day's flights with the available capacity.
Tactical phase: manages current flights in accordance with existing capacities and develops corrective measures to resolve situations and crises.

Postoperative analysis: analyses the day of surgery.
ATFCM is an important part of ATM because it utilizes the full capacity of the system without the risk of reducing security. [11], [13]

3.2 One market, one currency, one sky

The project idea is one of the most long-lasting European institutions since the establishment of EUROCONTROL to create single European airspace.

Europe has moved its borders by opening a free and single European market without sky borders for the improvement and modernization of air transport. This finding is observed in the heterogeneous work habits and the limited airlines that are based on the organization of the states and not on the routes. The Single European Sky initiative is a major task promoted in the White Paper to address the large legislative differences between individual Member States to enable the ATM 2000+ strategy with the requirements of the future in each country. [13]

3.3 EUROCONTROL and Project for a single European sky

EUROCONTROL is a European organization for the safe operation of air navigation, with 37 member states in which both civil and military organizations are intertwined, with the aim of developing pan-European air traffic management (ATM) where development is a key element to deal with current and future challenges to increase growth, level of security, cost reduction, and environmental protection.

The main objective of EUROCONTROL is to develop, coordinate and plan the implementation of a timeless strategy and plans for the development of air traffic management in Europe, including the national institutions of the Member States, the providers of navigation services, the users of the civil and military airspace, the aerodrome, the aviation industry and other professional, and European institutions The "Single European Sky" project adopted by the EC is characterized by the following objectives:

The follow-up has all the rights and obligations, like each member state, for which expertise is needed, such as research and development policy, standardization, trans-European network, and Single European Sky. The successful implementation of the "Single European Sky" initiative is very important for the whole project by adjusting the implementation rules, adapting the European institutions to develop alternative routes, and for higher utilization and capacity for future growth rate through:

- Flexible way of using,
- Using design and classification,
- Functional bans on overflights of some of the regions,
- Uniform collection of annual expenses,
- Mutual cooperation for flow management,
- Better information about the upper airspace,
- Aeronautical Information Publication.

EUROCONTROL has sufficient expertise and knowledge that can be used and will enable the Single European Sky initiative to become a reality in the following five areas:
- Implementation of the Single European Sky project;
- Research and development;
- Global navigation systems, including the Galileo system;
- Data collection and processing and environmental protection;

International Journal of Research in Commerce and Management Studies

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

- International cooperation. [16]

4. Introduction Planning the optimal number of aircraft in the network

One of the basic tasks is the use of a complex model to determine the minimum number of aircraft to perform the tasks of the network of lines in solving a problem intended for the network of the planned sports-school airport near the city of Gevgelija. By nodes in the traffic network we mean airports connected by air routes to illustrate the planning process:

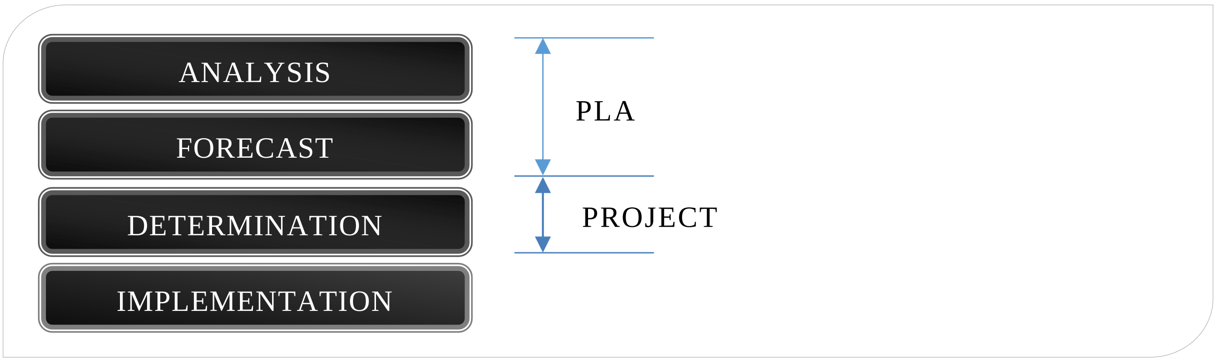


Figure 4: Basics of the planning process [17]

The planning and design of supply and future demand through the dimensioning procedures of the elements of the transport network can be presented in the following chart.

International Journal of Research in Commerce and Management Studies

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

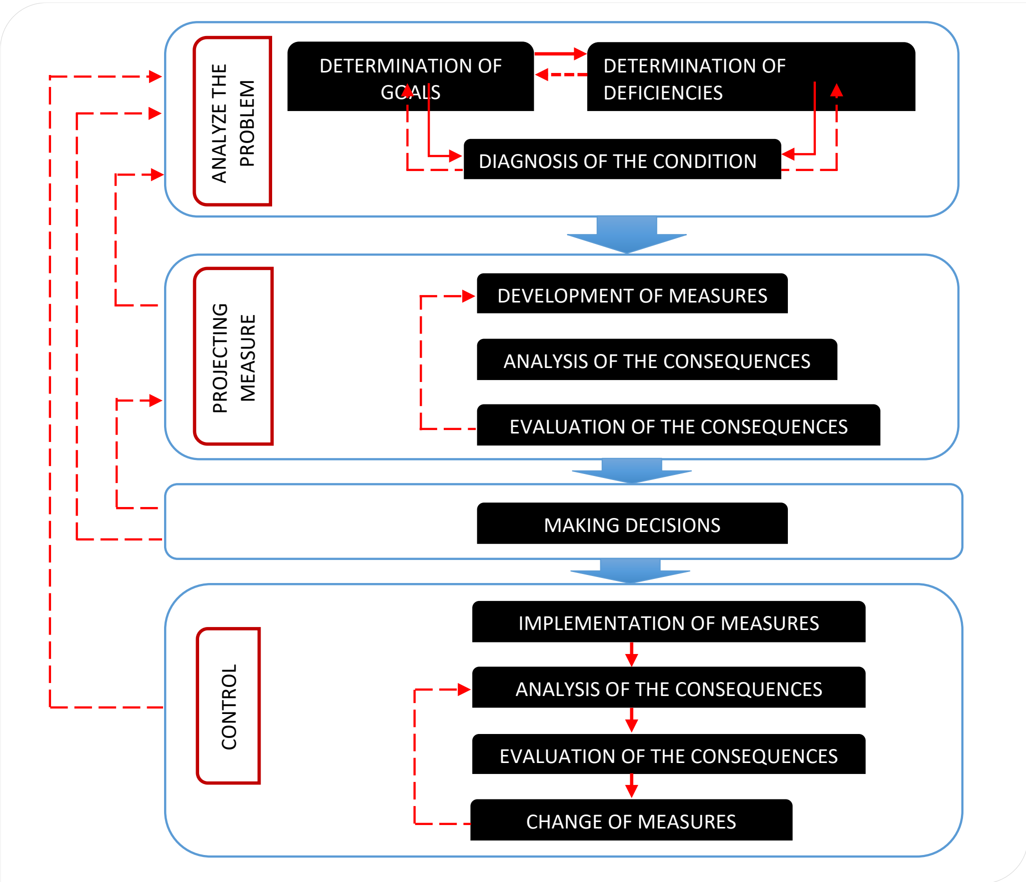


Figure 5: Planning and projecting elements of the traffic network [17]

By definition, there are two basic types of planning:

- Strategic planning long-term plans,
- Operational planning by individual sectors or subsystems.

International Journal of Research in Commerce and Management Studies

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

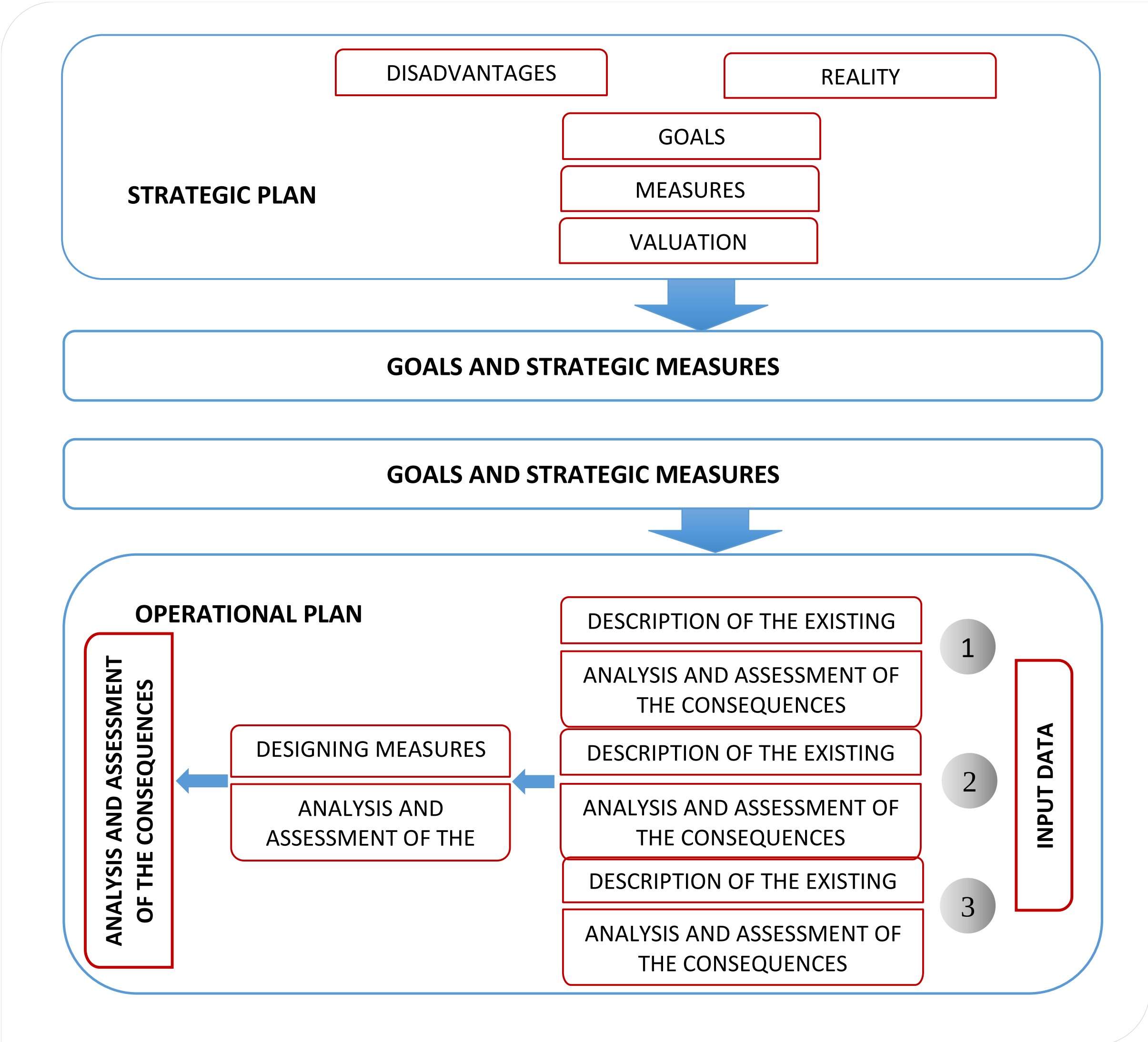


Figure 6: Operational planning by sectors or subsystems [17]

Based on the diagnosis, strategic planning objectives are defined in combination with the basic concept to form a complex air traffic planning process.

An essential step in the planning process is the analysis of the problem, which implies the objective determination of development goals and the definition of measures because it is impossible to draw a line between these activities where the terms planning and design meet as synonyms in practice. Activities in the area of demand are related to the concept of planning and the concept of designing

International Journal of Research in Commerce and Management Studies

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

activities for the supply of transport services.

Based on the diagnosis, the goals are defined and strategic planning is done by combining the basic concept as a complex air traffic planning process. An essential step in the planning process is the analysis of the problem for objective determination of development goals and definition of measures, because it is impossible to draw a line between these activities where the terms planning and design are synonymous in practice. Activities in the area of demand are related to the concept of planning and the concept of designing activities for the supply of transport services.

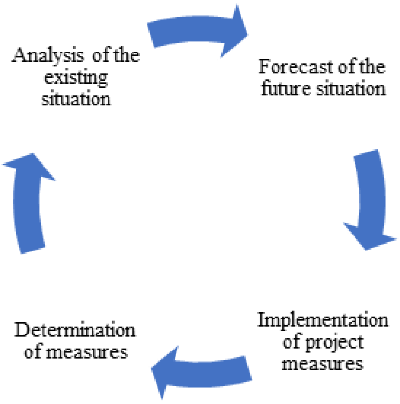


Figure 7: Strategic planning process [17]

Cause-effect relationships between transport development on the one hand, and spatial, economic, and social development on the other hand, cannot be limited to the question of supply and demand because they are considered and treated as conditional processes. [17]

International Journal of Research in Commerce and Management Studies

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

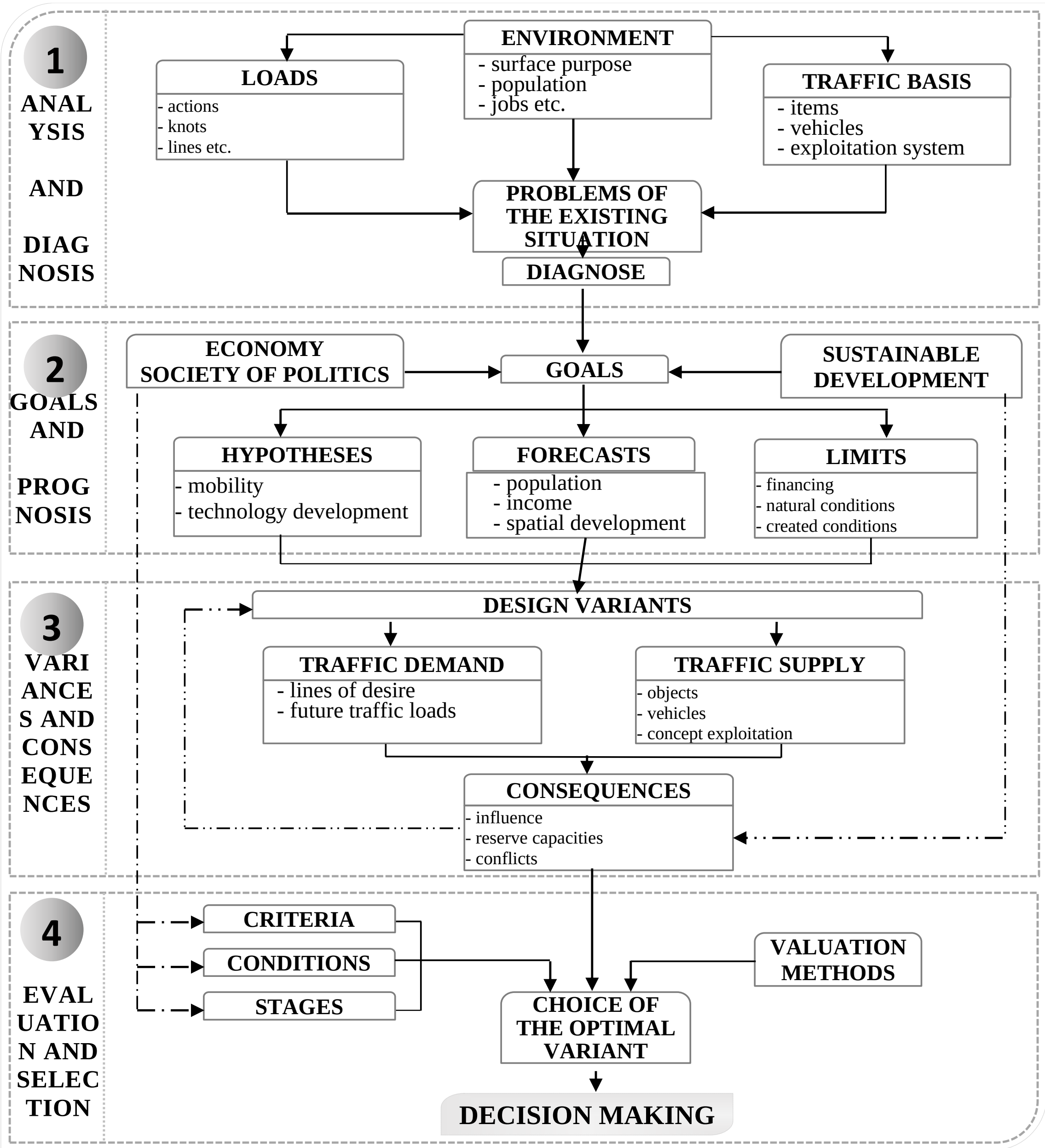


Figure 8: Basic steps in traffic planning [17]

The network of airports in the Republic of North Macedonia consists of:

Two airports for international air traffic:

- International Airport - Skopje and
- "St. Apostop Pavle" - Ohrid

Five sport airports adequate for all types of sport aviation with grass runways:

– Skopje – Stenkovec - location S
– Kumanovo - location N
– Stip- location T
– Bitola - location B
– Prilep - location L

Six airports for commercial aviation aircraft, which provide services mainly for agriculture and forestry: Logovardi Bitola, Dame Gruev Bitola, Sarandinovo Prilep, Crveni Bregovi Negotino, Karatmanovo Veles and Peshirovo St. Nicole. [18]

4.1 Optimization for the planned airport near the city of Gevgelija

For the optimization of the airport in Gevgelija, management of airport operations is necessary: Runway Management- A runway is a surface portion of a runway (concrete or asphalt) that to serve its purpose, the runway must have adequate load capacity, good drivability, and must allow safe handling of aircraft. The safe movement of aircraft requires strong levels and dry and well-maintained asphalt surfaces.

Runway operation requires regular inspection, maintenance, and repair of the runway, taxiways, and parking lots. A minimum quality standard for paved surfaces must be reached, including: a flat surface without holes, no cracks, and variations in the surface that can disturb the control direction of the aircraft. Maneuvering surfaces must be free of contamination, such as mud, dirt, and foreign objects. All objects in the vicinity of the airport: solid objects or materials on runway surfaces capable of damaging aircraft must be removed. Maneuvering areas management includes timely maintenance and reconstruction with activities such as sealing small surface cracks. The goal is to ensure that the pavement is always in good condition, by adding an additional layer of asphalt to increase the strength of the pavement. Maneuvering surfaces must be maintained to prevent further cracking of the stasis because its complete replacement is an expensive process. This includes all accessories to increase the visibility of the road for greater safety and security in the traffic.

All airports must provide rescue and fire protection services. For any incidents on the runway, the services must respond within 3 minutes and must effectively contain the fire using foam which essentially ignites the flames and cools the surrounding area to prevent further fire spread.

The Snow and Ice Control Plan are in place to ensure the safety of airport operations in the event of snow and ice conditions. Procedures to be followed are timely removal of snow and sleet control, selection and application of approved snow and ice control materials, and timely notification of aircraft when any part of the runway is threatened. Icing as an accumulation of ice on exposed aircraft surfaces or on the runway surface can cause aircraft problems, leading to an accident. Ice formation on aircraft surfaces can cause aircraft to lose directional control, reduce aircraft performance, and may even cause loss of aircraft radio communications. As the ice forms, the stasis makes a slippery surface that can cause the aircraft to lose control during takeoff or landing. Ice accumulation is potentially the most damaging weather phenomenon affecting airports. Methods for controlling ice on pavement surfaces include the application of a chemical solution (glycol) and snow removal equipment (plows, sweepers). The idea of using chemicals is that they react with the ice to produce a chemical reaction that produces heat because the heat melts the ice.

Snow removal equipment loosens and melts snow on the surface. An aerodrom snow and ice control plan is important to avoid accidents, and to be able to stop the aircraft in any emergency. Landing or taking off on a slippery surface is much more dangerous for the aircraft and in cases of danger, the flight must be delayed.

Winter weather can have a serious impact on the safe operation of airports, often resulting in conditions that can lead to incidents, accidents, or delays. For that reason, snow and ice control at an airport is extremely important, regardless of the size of the airport or the aircraft that use it. Landing or taking off on a slippery surface is much more dangerous for the aircraft. Snow and ice control on the last third of the runway is particularly critical, as this area must offer a clear runway if the pilot decides to abort the takeoff.

Security inspection programs are important to maintaining the safety of airport operations. Areas under safety inspection programs include airfield parking, highways, runways, fuel facilities, buildings, and hangars. The purpose of the inspection is to ensure that these areas are free from obstructions around the airport surfaces as well as hazards created by weather conditions (snow/ice), hazards created by erosion or broken or damaged structures (uninsulated pavements), hazards that occur during construction activity (holes or obstructions), danger from birds or wildlife. The purpose of the inspection is to ensure that these areas are free of: obstructions around airport surfaces, hazards created by weather conditions (snow/ice), hazards created by erosion, broken or damaged structures (uninsulated pavements), hazards occurring to during construction activity (holes or obstacles), danger from birds or wildlife. The goal is to increase the safety of airport operations and reduce maintenance costs by eliminating hazards from foreign objects. A foreign object on the stasis can puncture a tire that explodes and damages the fuel tank, causing a fire.

Bird and wildlife hazards, especially near an airport, have a high potential to cause serious damage to aircraft and loss of human life. Every year there are many aviation accidents reported from bird and wildlife hazards. Because of this, any associated airport must take care to manage bird and wildlife hazards. There are several control techniques available to address the bird hazard problem. Some of the techniques are: noise tools, this tool scares the birds and causes the bird to move away from the airport as well as the elimination of habitats such as trees to discourage the bird population. The crew must notify air traffic authorities of bird movements detected and any bird impacts. A NOTAM is a notice containing up-to-date information that is essential to personnel involved in flight operations, including aerodrome conditions, or a change in any component and any hazard. A NOTAM is delivered to an aviation authority to warn aircraft pilots of any hazards at a specific location. NOTAM reports on: closed runway, inoperative radio navigation aids or lights, military exercises resulting in airspace restrictions, temporary obstacles near airports (e.g. cranes), the passage of flocks of birds through the airspace, runway status notices / charging in relation to snow, ice, and standing water, reporting the operationally significant change in volcanic ash or other dust pollution, hazards such as air emissions, skydiving, kite flying, rocket launches, VIP flights, heads of state, etc. [19]

4.2 Example of the optimal number of aircraft

4.2.1. Theoretical foundations in modeling the demand of air traffic services

Equilibrium between transportation requirements and the ability of the supply system to plan and predict the flow of aircraft and passengers in transportation systems by modelling transportation systems on two subsystems:

- supply and
- demand.

The supply system describes the availability of transportation systems and airport infrastructure, while the demand system includes models that determine the demand for transportation, based on socio-economic characteristics from the beginning to the end of the flight using static models. [19]

4.2.2 Application of the model for determining demand in international passenger transport

Two lines in the international transport Location-S → Location-W with the prices of the services in regular air and land transport, while in the second case the Low-cost services for air transport and the price of the services of regular air transport with the following transport systems:

1. Location-S → Location-W plane and usage of train and bus

Selection of transport lines from Location-S → Location-W, alternatives are possible:
Alternative 1: plane, Location-S → Location -W, direct
Alternative 2: plane, Location -S → Location -Z → Location -W
Alternative 3: plane, Location -S → Location -O → Location -W [21]

4.2.3 Alternative: location-S → location-W

Capacity supply data with the number of departures from site-S per alternative is:
- Alternative 1: plane, location-S → location-W, direct, two flights per day. The duration of the flight

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

is from 0:10 to 0:25 hours, and the average duration is 1.3 (h), and in both directions, it is 2.6 (h).
- Alternative 2: plane, location-S → location-Z → location-W, two years to the day. The most likely duration of the journey is 1:30 (h), which ranges from 0:40 to 0:50 and is the result of choosing a combination, which means that the time in both directions is 3 (h).
- Alternative 3: plane, location-S → location-O → location-W, one flight per day. The departure time of departure is about 1.5 (h). On the way back it is much longer and ranges from 1:55 to 2:50 with a total time of 5.75 (h).

In conclusion from the alternatives, it follows that the advantage of the offer in terms of flight and flight schedule is the same for alternatives 1 and 2 with two departures per day, and for alternatives 3, 4 the number of departures per day is 1.

Data on the prices of transport services have been collected for the prices of purchased tickets and their statistical processing has been carried out with the statistical processing carried out in MS Excel shown:

Table 1: Results of statistical processing of ticket prices for three alternatives (statistics according to the average amount of flights)

Parameter	Alt. 1	Alt. 2	Alt. 3
Mean	198.8225	198.215	155.92
Standard Error	7.85995	3.5726	3.4818
Median	167.26	197.5	150
Mode	150.01	181	150
Standard Deviation	73.733	32.548	29.131
Sample Variance	10873.15	2118.7	1697.2
Kurtosis	2.975	6.809	3.771
Skewness	121.305	14.202	0.9445
Range	374	233.5	185.5
Minimum	138.01	151	114.5
Maximum	512.01	384.5	300
Sum	17496.4	16452	10914.5
Count	44	41.5	35
Confidence Level (95,0%)	15.62255	7.107	6.946

Statistical processing is given below.

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

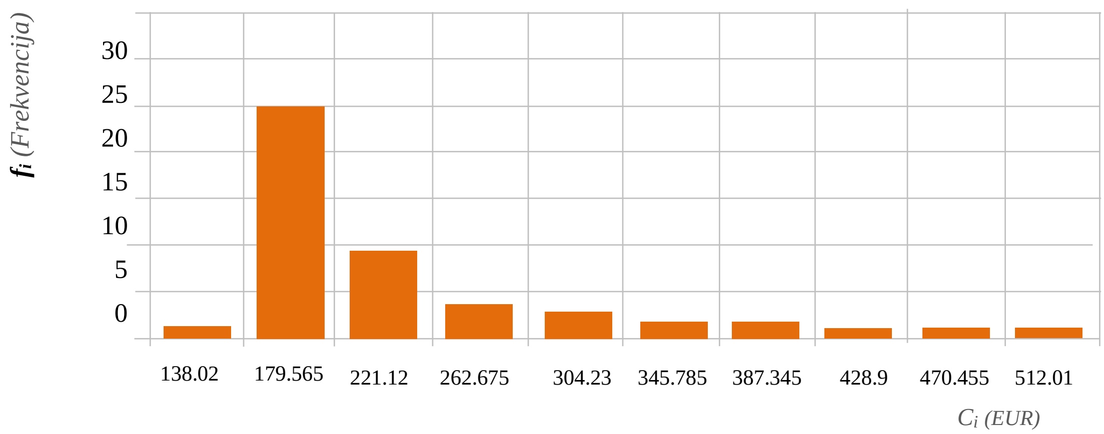
» Alternative 1, Location-S → Location-W, directly

Ticket prices are expressed in (EUR) and the distribution schedule is:

Table 2: Frequency of ticket prices by class for the line location-S → location-W

od	do	C_i [EUR]	f_i
117.23	158.79	138.01	1
158.79	200.345	179.565	25
200.345	241.9	221.12	9.5
241.9	283.455	262.675	3
283.455	325.01	304.23	1.5
325.01	366.565	345.785	1
366.565	408.12	387.345	1
408.12	449.675	428.9	1
449.675	491.23	470.455	0.5
491.23	532.785	512.01	0.5
			44

Table 3: Histogram of price of line services location-S → location-W



» Alternative 2, Location-S → Location-Z → Location-W

ISSN 2582-2292

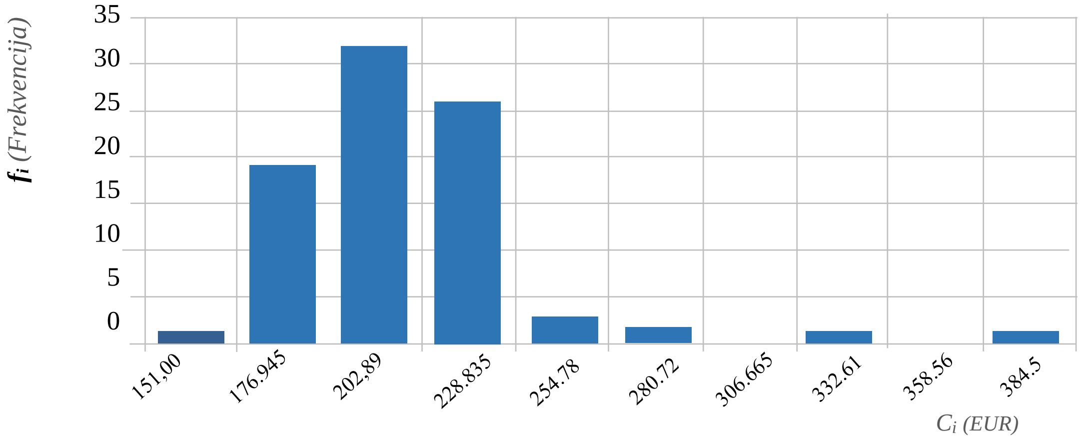
Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

The distribution schedule is:

Table 4: Frequency of ticket prices by class for the line Location-S → Location-Z → Location-W

od	*do*	C_i *[EUR]*	f_i
138.03	163.975	151	0.5
163.97	189.915	176.945	9.5
189.915	215.86	202.89	16
215.86	241.805	228.835	13
241.805	267.75	254.78	1
267.75	293.695	280.72	0.5
293.695	319.64	306.665	0
319.64	345.585	332.61	0.5
345.585	371.53	358.555	0
371.53	397.475	384.5	0.5
			41.5

Table 5: Histogram of the price of the service for the line Location-S → Location-W



» Alternative 3, Location-S → Location-O → Location-W

The distribution schedule is given:

International Journal of Research in Commerce and Management Studies

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

Table 6: Frequency of ticket prices by class for the line Location-S → Location-O → Location-W

from	to	C_i [EUR]	f_i
180.405	203.595	114.5	**2**
203.595	226.785	137.69	**5.5**
226.78	249.97	160.875	**17**
249.97	273.16	184.065	**5.5**
273.155	196.345	207.25	**4.5**
296.345	319.535	230.44	**0**
319.53	342.72	253.625	**0**
342.72	365.91	276.815	**0**
365.91	389.1	377.505	**0.5**
			35

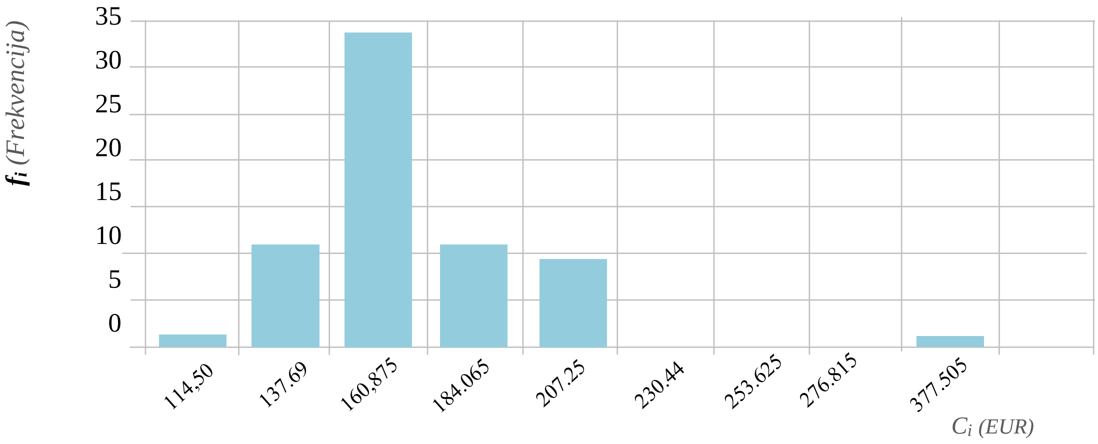


Table 12. Histogram of price of line services Location-S → Location-O → Location-W

4.2.4 Alternative: location-S → location-W data representation

The probability of choosing a transport alternative is determined by the logit model over a vector V=[-V1, -V2,-V3] which represents benefits so that negative values mean „costs“.

„Cost“ is formed from the price of the transportation, the duration of the trip, and the benefit from the aspect of the flight schedule, where in addition to these parameters it is necessary to include the meaning of the price kc, time kt, and the benefits of flying – flying schedules kr. Coefficient k can have a value of 1 to 10, with the greatest importance of the coefficient 10, and it is determined by a survey or assessment of experts with the importance of the price when choosing an alternative is kc =6,8, and the price with the coefficient of correction according to:

Table 12. Prices of transport services, correction coefficient, and corrected values of prices by alternatives

Alternative	c_i (EUR)	**Price correction coefficient** $\beta c = k^c/c_{sr}$	**Corrected value** $\beta_c \cdot c_i$
Alt. 1	198.825	0.0250	4.970625
Alt. 2	198.215	0,0250	4.955375
Alt. 3	155.92	0,0250	3.898
Srednja vrijednost C_{sr}	184.32		

The time of transport when choosing an alternative is kt =7 with the travel time in both directions with a correction factor given by:

Table 28. Time of transport services, correction coefficient, and corrected time values by alternatives

Alternative	t_i (h)	**Travel time correction factor** $\beta_t = k^t/t_{sr}$	**Corrected value** $\beta_t \cdot t_i$
Alt. 1	1,3	0,4065	0.52845
Alt. 2	3,0	0,4065	1.2195
Alt. 3	5.75	0,4065	2.3374
middle value t_{sr}	3.35		

The advantage of the flight schedule is expressed in the number of departures or flights per day where when choosing an alternative kt=8,5, and the number of flight departures with a correction coefficient is tabulated:

Table 29. Favorable schedule or flight, correction coefficient and corrected values of the number of departures - flights by alternatives

Alternative	n_i (departures - flights/week)	Coefficient correction of the number of departures-flights $\beta r = k^r/n_{sr}$	Corrected value $\beta_r \cdot n_i$
Alt. 1	2	0,4936	**0,9872**
Alt. 2	2	0,4936	**0,9872**
Alt. 3	1	0,4936	**0,4936**
middle value n_{sr}	**1.67**		

According to the expression for the cost of the ith alternative

$$V_i = \sum_k \beta_k \cdot X_{kj}^i$$

the value for the first alternative is determined

$$V_1 = 4.970625 + 0.52845 + (-0.9872)$$

The costs decrease with the benefits so that the negative value for departures (-0.4936) is greater than the number of departures that are more favorable for the user, and the value for the other two parameters is positive because the user is in a less favorable situation when the value of the price and the trip of time is higher and the values for the other alternatives.

Table 30. Normalized values of alternatives for "cost"

Alternative	$\beta_c \cdot c_i$	$\beta_t \cdot t_i$	$\beta_r \cdot n_i$	$V_i = \beta_c \cdot c_i + \beta_t \cdot t_i - \beta_r \cdot n_i$
Alt. 1	4.97965	4.970625	0.9872	**8.963075**
Alt. 2	4.96435	4.955375	0.9872	**8.932525**
Alt. 3	3.90505	3.898	0.4936	**7.30945**

By including the value of the vector V= 8.963075 + 8.932525 + 7.30945 the probability expression gives the service selection values on the line Location-S → Location-W

P= $e^{8.963075}/(e^{8.932525}e^{5.69025}e^{7.30945})$=0.4623

p=46.23%

International Journal of Research in Commerce and Management Studies

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

The check is performed according to the expression $\sum p_i = p_1+p_2+p_3=1$

Alternative	Vjerojatnoća izbora alternative *pi [%]*	
***Alt.* 1**	*p1=*	**46.23**
***Alt.* 2**	*p2=*	**44.877**
***Alt.* 3**	*p3=*	**8.853**
	∑*pi* =	**100,000**

The number of trips during the year are determined by the probable numbers of trips for each alternative presented for 100,000 trips.

Table 32. Most likely number of routes by alternatives

Alternative	Vjerovatnoća p_i	Broj putovanja
***Alt.* 1**	0.4623	46231
***Alt.* 2**	0.44877	44877
***Alt.* 3**	0.08863	8853
	UKUPNO	**100000**

4.2.5 Choice of alternate flight on the line Location-S → Location-K

The probability of a transport alternative using a profit model based on transport costs, assuming that all alternatives have the same number of departures per day without travel as a factor influencing the choice of air transport.

The vector V= [-V_1, -V_2] represents a benefit such that negative values mean "costs" in the return ticket price via a multidimensional normal distribution.

$$\begin{pmatrix} U_1 \\ U_2 : \end{pmatrix} \sim MVN\left[\begin{pmatrix} V_1 \\ V_2 \end{pmatrix}; \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix}\right]$$

$$\begin{pmatrix} U_1 \\ U_2 : \end{pmatrix} \sim MVN\left[\begin{pmatrix} -110747 \\ -94{,}5 \end{pmatrix}; \begin{pmatrix} 182{,}741 & 12{,}572 \\ 12{,}572 & 9{,}165 \end{pmatrix}\right]$$

Attributes of alternative 1 and 2:

$\sigma_{12} = \sigma_{12}\, \sigma_1\, \sigma_2 = 12{,}557$

ISSN 2582-2292

Vol. 4, No. 04 July-August; 2022 Page. No. 46-75

$Var(U_1) = \sigma_1^2 = 182.741$

$Var(U_2) = \sigma_2^2 = 0.915$

$Cov(U_1 U_2) = \sigma_{12} = 12.557$

$Corel(U_1 U_2) = \rho_{12} = 0,4851$

For the case with two alternatives (binary case) the probability e$p1 = p[U_1 > U_2]$; $p1 = p[U_2 - U_1 \leq 0]$

$$p_1 = \Phi\left(\frac{-94,5 + 110,74}{\sqrt{182,741 + 0,9165 - 2 \cdot 0,4851 \cdot 9.559 \cdot 0,677}}\right)$$

$$p_1 = \Phi(1,21966)$$

$$p_1 = 0,3869$$

with a probability of alternative 2 according to the expression

$p_1 = 1 - p_1 = 1 - 0,3869 = 0,6131$

The probability that users will benefit from the same number of departures per day of travel with the Low-Cost service is 38,69% and the airline service is 61,31%.

5. CONCLUSION

Well-organized and structured air traffic is a driver and thus an effective factor of transport inclusion in the European Union. A high-quality technical-technological and scientifically established air traffic system is a prerequisite for the transition states and the Republic of Macedonia.

Based on the above research results, the following can be concluded:

• The evaluation of investments in the aviation sector should include the financial and economic aspects of airlines and airports as well as the aspect of risk,

• The methodology places the evaluation of the investment situations "with the project" and "without the project" as very important, whereby the latter case can avoid procedures of scenarios of complete interruption of air traffic;

• The two most important indicators for the valuation of investments are the net present value and the internal rate of return;

• When evaluating from a social aspect, it is important to include all monetarily measurable components that enable a more appropriate presentation of real investment effects;

• External factors can have a significant impact on the valuation of investments, so their relative participation in the aerospace sector is significantly lower;

• The measures in developed countries internalize the external factors as an important activity that should enable the definition of an adequate general economy in the transport sector and especially an economy for certain types of transport;

• The observed levels of participation of certain types of external factors in the EU countries deserve to be taken into account more in the environment, considering the valuable natural and human potentials of Macedonia;

• Monitoring the impact of external factors is necessary to establish appropriate instruments such as collecting and processing the necessary data, the appropriate legislation in the transport sector as a whole and the system of implementing measures to protect against the negative impact of transport on the environment.

For the analyst, assessments are always a measure of the project, whether it is "good" or "bad", i.e. whether an extension is needed or there is no need for any additional investments, which increases the importance of the project for the construction of a sports-school airport.

A research project clearly presents the rules generally accepted by the aviation industry as well as their application in cost-benefit analysis. A flexible and general approach and assessment manage assumptions for final implementation decisions. Profit and cost analysis plays an important role in the analyst's limited time, research budget, available information and in making quick decisions.

Organizations, regardless of their position on the local and regional market, face problems from a situation to accurately perceive the problem that is lurking, most of the time in a chaotic state and with results that are far from predicted. The interrupted flow of information leads to inappropriate and untimely decisions that are in line with sustainable development and goals in accordance with the vision and mission of the airport. Project management of the airport allows them to control costs as well as manage in line with the challenges and development of technology. Good education of management professionals directly or indirectly related, their emotional intelligence, social culture and information technology lead to success. Successful mutual cooperation leads to lower risks of failure and disappointment, uncertainty and mistrust. As a conclusion, the project in its structure represents a complex feasible entity with a need for finishing during their implementation and upgrading for improvement, control, and the signals pointing to it are also being ignored.

Conflicts of Interest

The authors declare no conflict of interest.

REFERENCES

[1] Project Management Institute (2013.), A guide to the project management body of knowledge (PMBOK® Guide), 5. Pennsylvania, Newtown Square str. 3-6

[2] Kerzner, H. (2003.), Project Management - A systems approach to planning, scheduling, and controlling, 8. New Jersey: John Wiley & Sons, Inc, str.2
[3] Meredith, J., Mantel, S., (2009), Project Management A Managerial Approach, 7. New York: J. Wiley & Sons, Inc.
[4] WebFinance Inc. (2020.) http://www.businessdictionary.com/definition/project.html (12.1.2020.)
[5] Williams, M. (2008.), The Principles of Project Management. Australia: SitePoint Pty.Ltd
[6] Lewis, J. P. (2007.), Fundamentals of Project Management, 3. edition, New York: AMACOM, str.11
[7] Williams, M. (2008.), The Principles of Project Management. Australia: SitePoint Pty.Ltd, str.23-25.
[8] https://xlpm-online.com/en/in/x.in.index.php (9.2.2020)
[9] https://en.wikipedia.org/wiki/Airspace_class
[10] http://www.eurocontrol.int/articles/flexible-use-airspace
[11] www.icao.int/Meetings/anconf12/Document%20Archive/9854_cons_en[1].pdf
[12] www.skybrary.aero/index.php/ESARRs
[13] http://www.eurocontrol.int/articles/air-traffic-flow-and-capacity-management
[14] eurocontrol-atfcm-operations-manual-26-0-wef-20222604.pdf
[15] www.linkedin.com/pulse/basic-steps-management-planning-process-terry-mullane
[16] https://www.eurocontrol.int/care-asas/public/standard_page/Objectives.html
[17] Evaluation and decision-making in traffic design, the script, 2001
[18] https://www.caa.gov.mk/
[19] https://www.hindawi.com/journals/ddns/2022/4542299/
[20] https://en.wikipedia.org/wiki/Demand_modeling
[21] Mehanović, M.: Mreže u saobraćaju i komunikacijama, Fakultet za saobraćaj i komunikacije, Sarajevo, 2015.

Author Profile

Ana Lazarovska was born at Gevgelija, Macedonia. She is doing her Ph.D. thesis in Aviation Engineering at the University of St Kliment Ohridski Bitola, Faculty of Technical Sciences. Her first circle of education is finished at the Faculty of Transport and Traffic Sciences in Zagreb, the second circle of education at the Faculty of Traffic and Communications in Sarajevo, and currently, is a student at the Faculty of Technical Sciences in Bitola. Ana Lazarovska's field of interest includes the following: mathematics, air traffic control, navigation, and aerodromes.

Verica Dancevska is a full professor at the Faculty of Technical Sciences, University St Kliment Ohridski Bitola. She did her Ph.D. thesis in Transport Economics at the Faculty of Technical Sciences and, University St Kliment Ohridski Bitola. Her research interests are in the domain of transport economics, traffic psychology, basics of marketing. She has taught courses at all study levels (B.Sc., M.Sc., and Ph.D.).

Violeta Manevska is a full professor at the Faculty of Information and Communication Technologies, St. Kliment Ohridski University in Bitola. She did her Ph.D. thesis in -Mathematics and -Informatics Management at the Faculty of Natural Sciences and Mathematics Sciences, University of Ss. Cyril and Methodius University in Skopje. Her research interests are in the domain of applied statistics and probability, and theoretical computer science. She has taught courses at all study levels (B.Sc., M.Sc., and Ph.D.).