

A MULTICRITERIA ANALYSIS FOR PLANNING REGULATORY DECISIONS

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ABSTRACT

This paper proposes the application of a mathematical multicriteria model Analytic Hierarchy Process (AHP) to prioritize issues of ANTT Regulatory Agenda, in order to reduce the subjectivity present. The study provides a proposal for the implementation of the tool on one of the main themes of the Agenda, the Road Freight Transportation, on the basis of international references.

Keywords: Multicritéria, AHP, Regulatory Agenda, Decision Process.

INTRODUCTION

The process of creating Regulatory Agencies in Brazil began from the second half of the 90s, which, according to Grotti (2006), gave greater autonomy and specialization for governmental institutions, in order to prevent political influence on regulation. They started to make a clear distinction between the functions of formulating public policy focused on the economic sector assigned to the corresponding sectorial Ministry and regulatory functions of the economic activity of private agents operating the sector.

The National Land Transportation Agency (*Agência Nacional de Transportes Terrestres - ANTT*) was established in 2001 by federal law 10.233, bound to the Ministry of Transport. Among its duties is the preparation and editing of rules and regulations. The Regulatory Agenda is one of the instruments used to indicate what subjects will demand a performance priority action for the agency in a given period and aims effectiveness in applying the rules,

the predictability of actions and directing efforts to fulfill the mission and institutional goals of ANTT. However, the process of prioritizing regulatory matters is complex due to the interests of various classes and the degree of interdependence among decisions (ANTT, 2012).

This complexity leaves to inevitable degree of subjectivity based on the Analytic Hierarchy Process (AHP) for modeling the decision in a way that mitigates such subjectivity.

To illustrate the use of the method in the field of transportation an application for the prioritization of subthemes of thematic area Road Freight Transportation of the ANTT is presented. A set of criteria such as safety, environmental impact, economic development, accessibility, investment, cost-benefit, preservation of the existing transportation system, revision of old regulations (over 10 years) and simplification of regulatory language is also taking into account. The article also presents a brief review of the literature of the AHP method regarding Transportation and public agencies, and an explanation of the method in question.

REGULATORY AGENDA OF THE ANTT

The first Regulatory Agenda was prepared for the biennium 2011/2012 and was done by surveying internal priorities for the regulatory activity of the ANTT.

To facilitate the prioritization of regulations Agenda is divided into eight thematic areas, namely: general topics, exploitation of the federal highway infrastructure, interstate and international road transportation of passengers, rail transportation of passengers, rail freight transportation, exploitation of the railway infrastructure and leasing of operating assets, road freight transportation and intermodal transportation.

After approval, the themes of the Regulatory Agenda enter into the implementation phase, and will be discussed and worked in order to give rise to normative acts deemed necessary for its regulation in the market. Each subject is treated as a project and its implementation follows the best practices of project management, referenced in the PMBOK guide of 2008 (PMI, 2008).

The implementation of the Regulatory Agenda is performed by the areas responsible for themes and accompanied by SUREG (Superintendence of Regulatory Acts). New demands identified during implementation or during other activities of the Agency, may result in a review of Agenda (ANTT, 2012).

To improve the efficiency of regulation many countries of the OECD (Organization for Economic Cooperation and Development) adopt the Regulatory Impact Analysis (RIA). RIA is a document created before a regulation is introduced to evaluate the possible effects, helping decision makers with theirs decisions. Improving the quality of regulation is one of the main goals of the ANTT. Among the most commonly used methodologies to perform RIA are cost-benefit analysis, cost-effectiveness analysis, multicriteria analysis, and standard cost model (Pro-Reg, 2012).

A partnership between ANTT and IPEA (Institute of Applied Economic Research) developed a methodology for the Regulatory Agenda 2011/2012, AIR, based on the method GUT (Gravity, Urgency and Trend) of quality used for prioritizing actions that generate data that will support decision making. The result of this study could reduce the items of the Agenda from 175 subjects to 69 subjects (Kohlsdorf, 2011).

REGULATION ON THE INTERNATIONAL TRANSPORTATION SECTOR

American Department of Transportation (DOT)

According to the Department of Transportation (DOT or USDOT) the Interstate Commerce Commission was the first American regulatory agency created in 1887 with the main objective of regulating the railroad industry, protecting small carriers, discriminated by price policy applied by the railroads. The regulation has gained strength in the 50s and 60s in many sectors, in the transportation area was established DOT, the first federal government agency with responsibility for development and administration of policies and programs to protect and enhance the safety, adequacy and efficiency of the transportation system and services.

The Department of Transportation (DOT) consists of 10 operating administrations and the central office, each of which has the legal responsibility of a wide range of settings. The DOT develops and implements a wide range of regulations that govern internal programs, such as purchases and subsidies, accessibility, environmental protection, energy conservation, information technology, occupational health and safety, asset management, seismic safety, and operation aircraft and vehicles.

According to DOT (2011) one of the major its goals is the continuous improvement of its regulations, which must be clear, simple, convenient, fair, reasonable and necessary. They should not be issued without adequate participation by the public and, once issued must be regularly analyzed and revised, as needed, to ensure that they remain effective. This philosophy combined with studies and data from national and international sources and general factors are considered principles in determining the need for revisions of the regulations.

As general factors:

1. The nature and scope of public complaints and suggestions (for example, applications for a regulation)
2. The need to simplify or clarify regulatory language for example, based on requests for interpretation)
3. The need to eliminate overlapping and duplication of regulations.
4. The need to eliminate contradictions or conflicts with other regulations.
5. The length of time since the last review.
6. The importance or relevance of the problem.
7. The degree to which technology, economic conditions or other factors involved have changed.

8. The number of applications for exemption and the number granted.

According to Executive Order 12866 of 1993, the process of creating a new regulation in the United States, regulatory agencies must consider the following steps (OMB, 2012).

1. Identification of the problem - each agency shall identify the problem it seeks to solve, and assess the importance of the problem.
2. Analysis of other regulations (or laws) - Each agency must consider whether existing regulations (or laws) have created or contributed to the problem that the new regulation proposes to correct and whether those regulations (or other law) should be modified to achieve the intended goal of regulation more effective.
3. Analysis and identification of alternatives - the agency must identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.
4. Risk analysis - that being to establish regulatory priorities, each agency must consider in a reasonable way, the degree and nature of the risks posed by various substances or activities within its jurisdiction.
5. Elaboration of regulation cost effectively - whereas when an agency determines that a regulation is the best available method to achieve the goal regulatory, must draw its regulations in the most cost effective to achieve the goal regulator. Thus, each agency shall consider incentives for innovation, consistency, predictability, the costs of enforcement and compliance (to the government, regulators, and the public), flexibility, distributive impacts, and equity.
6. Creation of regulations which benefit justifies the costs - recognizing that some benefits and costs are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of regulation justify its costs.
7. Use of all possible rational information for creating a regulation - basing decisions more rational way possible with informations as scientific, technical, economic, or other information on the need, and the consequences of regulation desired.
8. Specification of performance objectives - must identify and assess alternative forms of regulation and, whenever possible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt.
9. Alignment at the federal, state, regional and local levels.
10. Analysis of the relevance and consistency - avoiding duplication or incompatibility with other settings or other federal agencies.
11. Analysis of impact on society - in order to impose the least burden on society, including individuals, businesses of differing sizes, and other entities (including small communities and governmental entities), according to the achievement of the objectives of regulation, taking into account among other things, the extent possible, the costs of cumulative regulations.
12. Elaboration of regulation in a simple and clear understanding enabling easy, with the goal of minimizing the potential for uncertainty and proceedings arising from such uncertainty.

The priorities in the regulation respond to the challenges and opportunities that confront any department. The main focus of the DOT is the welfare of the population, economic growth, stability and national security that require policy development in the transportation area and programs that contribute to providing fast transport, secure, efficient and convenient at the lowest cost including the efficient use and conservation of American resources (DOT, 2012).

A U.S. regulatory agency has five strategic objectives and priorities for regulatory criteria. The five goals are security, good repair, economic competitiveness, livable communities, environmental sustainability. The criteria used in the prioritization settings are seven, namely: relative risk to be addressed; requirements imposed by law; action on the National Transportation Safety "Most Wanted List"; costs and benefits of regulations, the benefits of non-regulatory alternatives; opportunities for non-regulatory actions; applicability of any law, including the effects of the agency's resources (DOT, 2012).

English Department for Transportation (DFT)

According to the English Department for Transportation (DFT) (2012) one of its priorities is to reduce the number of regulations. The bureaucracy has become a major problem and the Government is determined to deal with it, encouraging sustainable economic growth, increasing personal freedom and justice.

To rid society of unnecessary laws, the Government intends to create a better balance of responsibilities between the state, business, society and individuals, and encourage people to take greater responsibility for their actions (DFT, 2012).

The government strategies are: to remove and simplify regulations that may impede growth; introduce regulation only as a last resort; to improve the quality of any new regulations and migrate to the enforcement regimes less costly and less bureaucratic in which inspections are objective and risk-based (DFT, 2012).

According to the Regulatory Policy Committee (2009) to create a new British regulation there an assessment composed by seven recommendations:

Recommendation 1: Don't presume regulation is the answer

- ✓ Has a market failure been clearly identified and is it demonstrated that government intervention is warranted?
- ✓ Have non-regulatory alternatives been fully considered and, if not, has sufficient justification been provided to explain why not?

Recommendation 2: Take time and effort to consider all the options

- ✓ Have a sufficiently wide range of options been taken forward for detailed appraisal?
- ✓ Has any viable option been ruled out of detailed appraisal without good reason?

Recommendation 3: Make sure you have substantive evidence

- ✓ Is there evidence explaining how the market currently works and how any market failure identified is causing the observed behaviour in the market?
- ✓ Have the outcomes and responses of public consultation (where appropriate) been used as evidence to inform the estimates of costs and benefits presented?
- ✓ Is there evidence that other relevant Departments or other public bodies (where appropriate) have been involved in forming the estimates of impacts presented?

Recommendation 4: Produce reliable estimates of costs and benefits

- ✓ Have all the potential impacts of the regulatory proposal been identified, including any unintended consequences?
- ✓ Have all costs been valued at their opportunity costs?
- ✓ Is the time period for calculation long enough to encompass all important costs and benefits, and has the appropriate discount rate been used?
- ✓ Is it easy to see what are the most important risks and uncertainties?

Recommendation 5: Assess non-monetary impacts thoroughly

- ✓ Has the quantification and/or valuation of non-monetized impacts been undertaken in accordance with established techniques?
- ✓ Are the non-monetized impacts presented in a way that enables them to be compared across the different options in a systematic manner?

Recommendation 6: Explain and present results clearly

- ✓ Is it clear who will benefit and who will bear the cost under each option, when these costs will be incurred, and by how much?
- ✓ Does the IA reference the source of data, research and evidence used and is the robustness of each of these clearly demonstrated?

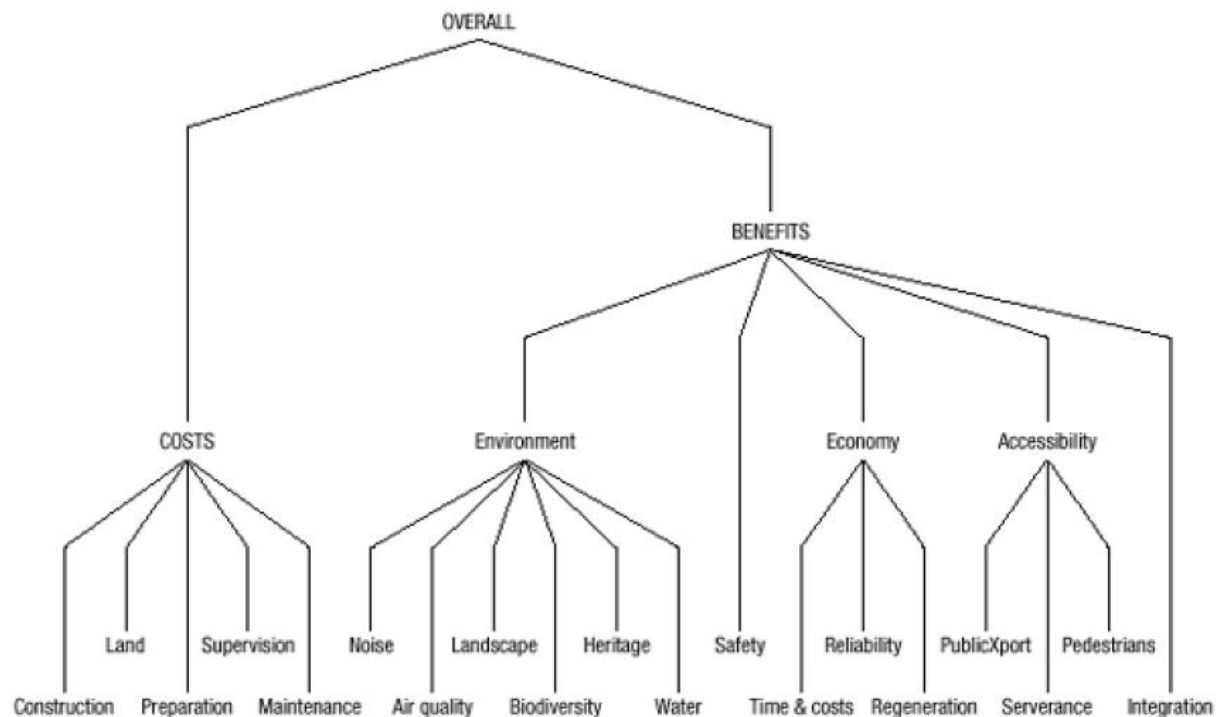
Recommendation 7: Understand the real cost to business of regulation

- ✓ Is the policy in scope of the 'One in, one out' policy?
- ✓ Has the Equivalent Annual Net Cost to Business been calculated and is it robust?

The DETR (Department of the Environment, Transport and Regions) for evaluating investments in transportation specifies five key objectives for the sector, namely: to protect and improve the infrastructure and the environment, improve safety for users; contribute to an efficient economy, and support sustainable economic growth, promote accessibility to facilities, especially for individuals who do not have cars and promote integration of all modes of planning and better use of resources, leading to a more efficient transport system (Regulatory Policy Committee, 2009).

These goals are divided into criteria, some of which may be measurable, including monetary valuation, classification for other purposes, and others are just qualitative factors. Figure 1 shows an outline of how the objectives and criteria for the DETR new approach for evaluation of transport investments can be represented (Regulatory Policy Committee, 2009).

Figure 1: A value tree for objectives



Source: Department for Communities and Local Government, 2009

The five objectives have been grouped under the objective 'BENEFITS', the costs has been separated out of the 'Economy' objective and represents a separate objective, with its sub-costs represented beneath as criteria. That separation facilitates the display of benefits versus costs for schemes being appraised. There are no sub-objectives for 'Safety' and 'Integration', so those objectives also serve as criteria. This representation is an illustration only; it might need modification if MCDA (Department for Communities and Local Government, 2009).

LITERATURE REVIEW

According to Saaty and Shang (2011), the individual progress depends on the ability that people have to make effective decisions. The science or art of decision is a subject that has been studied extensively through various multicriteria methods. Evaluating a set of possible alternatives in the light of different criteria is always a more justifiable to make decisions.

A multicriteria analysis evaluates the performance of the alternatives according to selected criteria and also the importance of the criteria in accordance with the general objective of the decision. Because they are applicable to any situation, multicriteria methods can be used for research on different topics, including decisions in the transportation sector and in the area of public policy.

Nassi and Costa (2010) presented the use of AHP method in ranking cities with the best transport tariff system. Metropolitan areas in North America, South America, Europe, Asia and Oceania were analyzed. The criteria considered were: complexity, impact on revenue, passenger control, difficulty in implementation, long trips, payment methods, fair price, implementation cost, and number of trips. On the other hand, the alternatives were judged on the type prevailing rate: rate per zone or distance-based service system, market-based system, a system based on the system time and rate constant. Each of the three groups of experts involved (transport operators, teachers and government officials) judged different alternatives priority. At the end of the paper the authors suggested a union of the judgments, resulting in a unique model.

Casal and Araújo (2011) used AHP method for studying changes in technology monitoring system for the urban transportation in Porto Alegre. An old system was due to be changed for a new technological alternative. To apply the AHP method the criteria considered were: cost and deployment, operating cost, technological mastery by the company, reliability of data transmission, infrastructure complexity and contribution to the control of the managing agency. These criteria were used to try four alternative systems: identification of passing vehicle with embedded radio stations and fixed detection passage radiofrequency tracking vehicle location with GPS and GPRS communications, vehicle tracking with GPS location and communication by GPRS and RFID vehicle tracking and location with GPS and GPRS communication and embedded computer board. The method was judged by experts and the first alternative was chosen, with 39% of priority.

Saaty (2007) developed a methodology for prioritization of public entities, whose problems involve the diversity of people affected by the decisions, the political matters, time and agenda. According to the author the Multi-Decisions-Decision-Making (MDDM) uses the Multicriteria AHP method and the Analytic Network Process (ANP) together to measure the alternative or courses of actions in tangible and intangible criteria and thus arrive at a decision.

In MDDM, the problems are more general and more complex because decisions influence each other and have interdependencies that are related to the selection criteria. Furthermore, the author states that the problems Multi-Decisions regard as main object human values and contribution of each decision for these values. To solve the problems MDDM, issues such as uncertainty, necessity, urgency and in general the benefits, opportunities, costs and risks has great significance in the hierarchical organization of decisions for implementation. As application examples, the author explains how the decisions of Congress and the U.S. Senate are taken in accordance with the methodology in question, which puts the criteria and factors affecting the choices and mentions how decisions affect the parties involved (Saaty, 2007).

THE AHP MULTICRITERIA METHOD

The AHP is a multicriteria decision method developed by Thomas L. Saaty (1990) that takes into account a combination of factors that are structured hierarchically following levels: the overall goal, criteria and sub-criteria considered and selected alternatives.

According to Saaty (1990), structuring objectives, attributes, issues and stakeholders serve two purposes: 1. provides an overview of the complex relationships inherent in situations, and, 2. support the decision maker to assess whether the questions of each level are of the same order of magnitude so that it can compare elements homogeneous accurately.

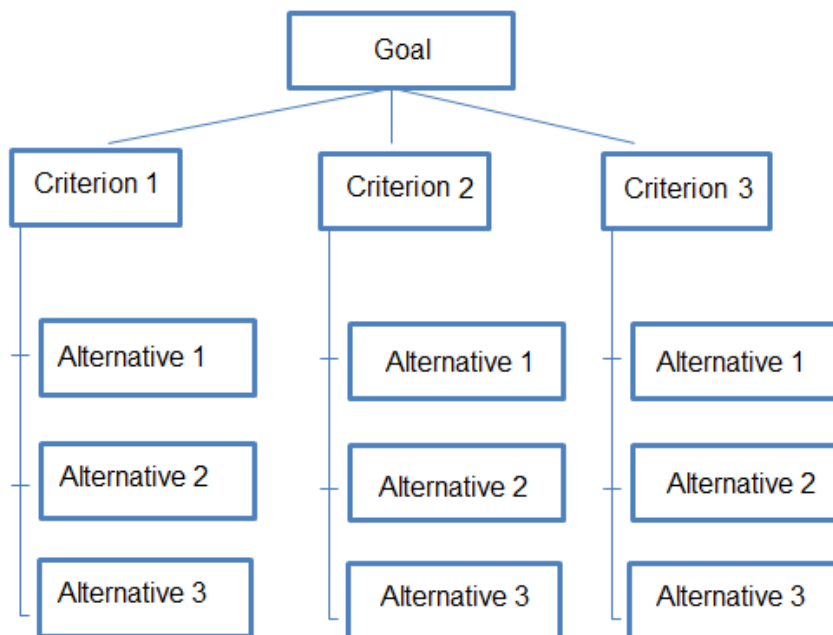
Costa (2002) explains that the AHP is based on three principles of analytical thinking:

- Construction of hierarchies: the problem is structured into hierarchical levels, in order to get a better understanding and evaluation. In exercising this activity identifies the key elements for decision making, grouping them in related clusters, which are allocated to specific layers.
- Setting priorities: setting priorities based on the ability of humans to perceive relationships between objects and situations observed by comparing pairs to light a certain focus or criterion (parity judgment).
- Logical consistency: it is possible to evaluate the prioritization model built as its consistency.

According to Costa (2002) the following steps compose the modeling process:

- I. Construction of Hierarchy: identifies the elements that form the structure of the hierarchy: the main focus, criteria, sub-criteria (if any) and the alternatives.
 - i. Setting Main focus - is the overall goal
 - ii. Identification of criteria - is the set of properties, attributes, questions or points of view in the light of which to evaluate the performance of the alternatives. The criteria should be established by experts for the model to closely match reality. Thus, if the experts see fit, may establish sub for each proposed criterion.
 - iii. Identification of alternatives - is the set of feasible alternatives that satisfy some conditions to be decision making.
 - iv. Structuring the hierarchy - draw up the design hierarchy, according to the figure below, in order to seek illustrate how members of the same elements relate.

Figure 02- Structuring model of hierarchies



- II. Value judgments: this step is taken three central questions: What judge? How to judge? Who is to judge?
- i. What judge - the assessment should be carried out equally between the elements of a layer in the light of each of the elements of the previous layer.
 - ii. How to Judge - Saaty (1990) puts the Analytic Hierarchy Process is strictly concerned with the problem of scale and what kind of numbers should be used and how to combine them properly resulting priorities. A measuring scale consists of three elements: a set of objects, a set of numbers, and a mapping of objects relative numbers. Thus, Saaty has developed a standardized scale (Table 01) that can be used to measure objects or events in respect of the properties for which the scoring is designed to measure.
 - iii. Who should judge - the evaluators who perform the trials should have as much knowledge on the subject on trial, should be experts on the subject.

Table 01 – Saaty`s Scale Standardization

Verbal Scale	Numeric Scale
Equal preference	1
Moderate preference	3
Strong preference	5
Very Strong Preference	7
Absolute preference	9

- III. Calculation of Priorities: prioritization is done in four stages, obtaining the "Table of Judgments," obtaining "Standardized Framework Trials", obtaining Local Medium Priorities and Global Medium Priorities.
 - i. Table of Trials - conducted after the trials of parity elements, these are converted to a Table of Judgments built according to Saaty`s scale patterning. Should be constructed so many frames as there are parity judgment, namely a framework for alternative to the criterion 1, the Criterion 2, 3 and so on.
 - ii. Table of Normalized Trials - Added to the judgments of each column, then divides each element by the sum of the corresponding column.
 - iii. Medium Local Priority - are the averages of columns of standard tables.
 - iv. Medium Global priority - it is a global priority vector that stores the priority associated with each alternative in relation to the main focus, to calculate the priority Global, is necessary to combine the priorities of each alternative places in the light of various criteria. The alternative that has the highest priority will be the alternative.
- IV. Consistency Analysis: for a joint trial is consistent it should not contradict itself. To evaluate the consistency, Saaty proposes the Consistency Index (CI), which evaluates how the matrix of judgments is inconsistent.

$$IC = (\lambda_{max} - N)/(N - 1)$$

Where N and λ_{max} represent, respectively, the order and the largest eigenvalue of the parity matrix of judgments.

Calculated IC, Saaty proposes the use of Reason Consistency (RC) to evaluate the inconsistency in the order in the matrix of judgments. For the model is consistent The CR value should be less than 0.1.

PROPOSAL FOR APPLICATION

The application of the method explained above is suggested to be applied in one of the central thematic area of the ANTT Regulatory Agenda of the biennium 2011/2012. The thematic area chosen was Road Freight Transportation, because it is a very important service provided by the Agency and has a few alternatives, which will facilitate global understanding.

The five alternatives presented are the issues outlined in Agenda, as detailed in Table 02.

Table 02 - Alternatives: Road Freight Transportation

Alternatives	Description
Road Freight Transportation	Legal instrument establishing the National Registry of Road Transporters Own Load, regardless of record in RNTRC.
Electronic Freight Payment	Regulating electronic freight payment
Transportation of Dangerous Goods	Upgrade Instructions Supplementary Regulation of Land Transportation of Dangerous Goods
Review of the Regulation of the National Register of Road Freight Carriers - RNTRC	Regulatory law dealing Road Transport Loads for third parties and remuneration.
Review of the Regulation of International Freight Road transport	Review of procedures for issuance of license Originally, Authorization Character Occasional, for national trucking companies charge authorized to operate in international road transport between the countries of South America, and Supplemental License in case of foreign companies

Source: National Land Transportation Agency (ANTT), 2012

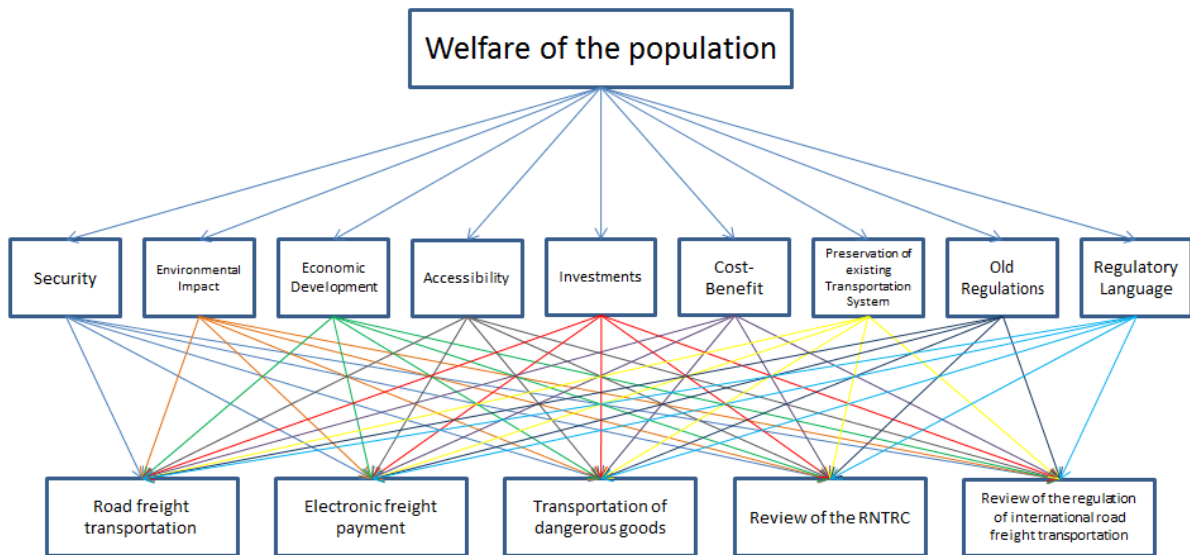
The criteria to be used in the method were selected from benchmarks made with international agencies. For the use of the method, selection criteria may vary for each subject evaluated. The relevance of the criteria used should be indicated by experts. Table 03 below shows the selected criteria and their descriptions for this example.

Table 03 - Criteria and their descriptions

Criteria	Description
Security	Greater impact on safety for the population.
Environmental Impact	Greater impact on the environment for the population.
Economic Development	Compare the alternatives which will bring more economic development to the region affected.
Accessibility	Greater accessibility to the population considering all users.
Investment	Greater need for financial investment.
Cost-Benefit	In general, better cost / benefit ratio for the population involved.
Preservation of existing Transportation System	Greater preservation of existing transportation system.
Old Regulations	Reviewing old regulations.

Regulatory Language	Greater ease in understanding the regulations for the population, easier access to information.
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Figure 03 - Hierarchical structure of the problem



After setting the criteria are applied questionnaires to experts in the field of transport, as shown in Table 04, so that they could judge equally, according to the scale of Saaty, the preferred alternative for each criterion and the degree of preferably between concepts: equal, moderate, strong, very strong and absolute.

Table 04 – A model of questionnaire judgment

Criteria	Alternatives	Road Freight Transportation	Judgement	Electronic freight payment
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Security		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Environmental Impact		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Economic Development		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Accessibility		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Investment		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Cost-Benefit		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Preservation of the existing Transportation System		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Review of old Regulations (over 10 years)		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference
Simplification of the regulatory language		() Preference		
			() Iqual () Moderated () Strong () Very Strong () Absolute	() Preference

The results of applied questionnaires are used according to the steps of AHP multicriteria methodology, as described in the previous section. The trial parity and the remaining steps must be performed for each subject indicated to obtain the ranking topics indicated. Importantly, the choice of judges is very important to reach the main focus, since the method depends on the judgment and their experience.

The results for thematic area being modeled to obtain the prioritization of alternatives are due to be concluded and it will be presented to ANTT shortly.

CONCLUSION

The paper aims to contribute to improving regulatory quality in ANTT, since the method of multicriteria decision aid Analytic Hierarchy Process (AHP) reduces the subjectivity of the alternatives present in the Regulatory Agenda.

The study of international institutions is critical reference to assist in the development of mechanisms for management and decision making of national regulators. Thus, the use of international benchmarks for choosing the selection criteria of regulatory issues is a way to search for this development and thereby prepare a Regulatory Agenda efficient, giving priority to issues more necessary to the country, taking into account the cost-benefit and risk-return ratio of each proposal.

Therefore, the article merely suggest the AHP methodology considering the criteria selected, demonstrated through an example using one of the themes of the ANTT Regulatory Agenda. For future work, it is suggested the development of a Regulatory Agenda with regulatory proposals and criteria selected by experts.

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