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Agglomeration Economies Versus Urban Diseconomies: The Case of the Greater Metropolitan Area (GMA) of Costa Rica

Arlette Pichardo-Muñiz¹ and Marco Otoyá Chavarría²

¹*The International Centre on Economic Policy (CINPE, by acronym in Spanish)*
Universidad Nacional,

The Costarrican Society of Urbanism and Land Use Planning

²*The School of Economics (ESEUNA, by acronym in Spanish)*
Universidad Nacional

Costa Rica

1. Introduction

The process of agglomeration economies proceeds in increasing manner, indirectly affecting productive activities such as education, public services, transportation and all of its linked components. Nevertheless, there is a limit to this accumulative process where the gains from economies of scales are reversed and this is related to the accumulation of decreasing costs in the areas of agglomeration. These costs include price of factors (i.e., commuting) with scarcer factors (land and labor); it also includes costs related to transportation (traffic, stress, crime, etc.) (Polèse, 1998). Generally speaking, a city, just like any other economic resource, begins to enter a phase of decreasing returns of scale and cost of essential urban services like transportation, adopting an U-shaped trend, as explained in microeconomic analysis (Camagni, 2005).

This chapter is structured as follows: The first section begins with a review of the concepts required to define and understand agglomeration economies and urban diseconomies, from the standpoint of economy as well as, from the perspective of the individuals; and includes the main focus which helps build indicators commonly used to measure diseconomies. The second section describes the area of study, including the distribution of the main economic activities and population centered in the territory. The third section explains the methodology used to assess the extent of diseconomies, indicating the conceptual framework, the dataset, variables, indicators, and methodology used. The data comes from various sources, and a statistical model was built to obtain estimates (2005-2009). The fourth section covers the results obtained and the findings of the analysis of agglomeration economies and urban diseconomies in the case of The Greater Metropolitan Area in Costa Rica. An analysis is provided of city life and its ever-growing problems demanding new styles of planning, regulations, and urban management, along with physical intervention

based on comprehensive, innovative, technical solutions. The last section presents the most significant conclusions, including their implications for design and regulation of urban planning, in the case studied, and others with similar characteristics.

2. Agglomeration economies versus urban diseconomies

From an economic point of view, Roberto Camagni (2005), reassessing the principles that govern the city, has done a spatial analysis and, in theoretical terms, has reinvented the study of the economics, from an urban perspective. To this effect, and from the premises of Marshall (static efficiency), Schumpeter (dynamic efficiency), and Marx (the conundrum of power), he introduces five basic principles to understand the city and the urban policy design: i. *Agglomeration* (or synergies), corresponding to the basic question of why the city exists; ii. *Accessibility* (or spatial competition) linked to the question of where productive and domestic activities should be located; iii. *Spatial Interaction* (or the need for mobility and contact); iv. *Hierarchy* (or city order); and, v. *Competitiveness* (or export as an economic driver).

The benefits of spatial agglomeration may be maximized, by taking advantage of economies of scale when people commute, and lessen the effects of dependency on fossil fuels; this can also reduce urban diseconomies minimizing the costs linked to public transportation systems which are a result of population growth and urbanization. Every single interrelation between city components must be taken into account; they include the agglomeration of enterprises, services, industries, and urbanization, among others. If there is a positive reaction, positive external economies such as the following can emerge: company clusters, availability and accessibility of productive inputs and workforce, generation of employment, provision of services and infrastructure, logistic of telecommunication networks, rise of virtual circles generated by closer residential zones and concentrated jobs, and anything else linked to time saving associated to people's commuting habits.

Externality is a concept introduced in economy (Smith, 1776) as amended (Marshall, 1890); and the question of who should pay the external costs is still a controversy since the origins of welfare economics (Pigou, 1920) and reexamination (Coase, 1960). By definition, it is generally used to refer to the consequences or economic side effects that the actions of one or more operators produce on other(s) that do not participate in the exchange, namely, it does not quantify the benefits and losses to externally affected individuals, families and businesses and they do not receive compensation or payment. In other words, externalities arise when there is no market for the exchange of goods or services, since there are no defined property rights over a large amount of goods and services when there is presence of public goods in the context of common resources, therefore it does not build a market around them, producing effects outside the market that are not compensated or paid for in commercial exchange. This makes the economic management of external approaches approximate to the presence of public goods and common resources.

From a practical perspective, the strategy that cities propose to tackle their growth, land expansion and public transportation infrastructure may trigger positive and negative outcomes. The first outcome is related to concentrated economic activity and maximizes the positive externalities emerging thereafter (Moomaw, 1981, 1983; Richardson, 1995). The

second outcome is a consequence of negative externalities normally increasing private and social costs, therefore considered a diseconomy.

In short, urban diseconomies, or negative externalities, are the result of raises in average total cost over time as production and the use of certain factors increases, without increasing scales. The externalities generate change in the quality of the infrastructure and provide the required services according to demand, without incurring in inefficiencies during the process and without increasing production, coordination and transaction costs due to urban inefficiencies. The cost of urban diseconomies related to transportation and public safety problems affect both external conditions contributing to quality of life (e.g.: level of income, access to services, resources and productivity) and people's subjective perspective of quality of life in various domains (e.g.: stress, time use, leisure time and so on). These deficiencies have led to the reversal of gains from concentrated economic activities and positive externalities achieved by agglomerated dwellings, thus becoming urban diseconomies.

From the perspective of the population, the people of Costa Rica, - in comparison with other countries in the region- declare low levels of dissatisfaction with the standards of living and with the city overall; however, areas associated with urban diseconomies, reveal important levels of dissatisfaction and mistrust, especially in transportation and public safety. In fact, Table 1 shows that, while in standard of living and the city overall, less than 20% of the population expresses feeling unsatisfied; in infrastructure, and public transportation system is 37% and 27% respectively; in confidence in the Judicial System is 47% and in other aspects of public safety it surpasses 50% (Gallup, 2011).

Domain	Indicator	%
General	(Dis) Satisfaction with Standard of Living	19
	Overall City (Dis) Satisfaction	16
Transportation	(Dis) Satisfaction with Roads and Highway	37
	(Dis) Satisfaction with Public Transportation	27
Public Safety	(Dis) Confidence in Judicial System	47
	(Dis) Confidence in Local Police	56
	(Un) Safety when walking alone	59

Table 1. Costa Rica: Selected indicators by domain of (dis) satisfaction with urban diseconomies; elaboration based on Gallup (2010).

With regards to diseconomies product of public insecurity, the National Public Insecurity Survey 2006 (Madrigal, 2006) reveals that one third of the population surveyed considers this issue as the country's main problem, even over issues like the state of the economy (28%) covering topics such as unemployment, poverty and high cost of living, among others. The latest Global Competitiveness Index (2011-2012), developed by the World Economic Forum, considers the insecurity and poor transport infrastructure as the main factors affecting the competitiveness of the country, resulting in Costa Rica losing five positions, from the position 56 to 61 of a total of 142 nations studied.

Nevertheless, Civil Society Organizations have not defined urban diseconomies as one priority area of interest, although some business associations and professional organizations have prepared and presented technical proposals to the national government (ACCCR, 2006; CFIA, 2010 and Costa Rican Chamber of Construction 2011). Professional training is not

geared specifically to the issue of urban diseconomies, as national research, with the exception of the International Center on Economic Policy (CINPE, by acronym in Spanish) of the *Universidad Nacional* for studies on urban diseconomies in The Greater Metropolitan Area of Costa Rica (EU/PRU-GAM / CINPE-UNA 2007c).

2.1 Description of area studied

2.1.1 The greater metropolitan area (GMA) of Costa Rica

Costa Rica is a small country (less than 50.000 km²), and The Greater Metropolitan Area (GMA) occupies less than 4% of its territory (CCP/INEC, 2002). Subsequently, in the context of giant cities (Brennan and Richardson 1989), which give rise to the megalopolis (Gottmann, 1962), world cities (Friedman, 1985) or global cities (Sassen, 1991), it could be considered a large city (according to ECLAC)¹. Although, the GMA exhibit the majority of the mega-problems seen in mega-cities with urban diseconomies: road congestion, traffic accidents, air pollution, public unsafety, and others problems associated to urban expansion and the worsening of disorderly growth which lacks adequate planning and regulation.

Costa Rica, ever since colonial times, has been characterized by concentrating its population and activities in the Central Valley Area (where the most fertile land is found). The structure of what is currently known as The Greater Metropolitan Area (GMA) - main center for the attraction of population and national economic space - began during early republican life², and was officially established in 1982, by decree of the Executive Power. Its limits are configured according to geographical factors and it's currently comprised of 31 cantons (this is the way; municipalities are called in Costa Rica). A relatively planned growth can be admitted³, it is based on one particular characteristic: the comparative advantage granted by the proximity of four of the six main localities of Costa Rica (San José, Cartago, Heredia and Alajuela, including the Juan Santamaría International Airport; until recently Costa Rica's only international hub) located within a radius of approximately 40 km, which have gained more ground and have become leading centers, both within the GMA and throughout the entire country⁴. Due to population growth and the resulting process of economic activity agglomeration, and, with the specificity acquired by that process, we have witnessed a rupture in the traditional spatial structure of the capital (San José) as the sole urban center of importance, and the emergence of a spatial organization with three additional population cores.

¹ This classification is based on socio-demographic criteria identifying three types of cities: a *metropolis*, with over 4 million people; a *large city*, with 1-4 million inhabitants, and an *intermediate city*, with 50 thousand to one million people (Rodríguez & Villa 1998).

² Indeed, in 1848, by legal mandate, the main towns of the central areas of the country were turned into cantons (roughly equivalent to municipalities or counties in other countries), which define the nation's main economic space.

³ As seen in the grid identifying historical areas, and particularly in the coverage of basic electricity and drinking water networks, as well as other urban services, as in the lattice frame for distribution of traffic in urban centers.

⁴ Four metropolitan areas have emerged, each with the name of its main city (San José Metropolitan Area, Cartago Metropolitan Area, Heredia Metropolitan Area, and Alajuela Metropolitan Area); together they compose the Greater Metropolitan Area (GMA).

By 2010, the GMA was estimated to have a population of 2.5 million, 57% of the country's total number of inhabitants. This also includes 86% of factories, stores and head offices (for control or processing) of the 50 most important export companies in Costa Rica, which as a whole generates 92% of the FOB-export value of these companies (EU/PRU-GAM/CINPE-UNA, 2007a).

General consensus shows that the current urban-regional approach is the result of poorly planned organizations; consequently, space-occupation processes, manifested in deep metamorphoses in terms of land use for multiple purposes, are constantly vindicated. The current organization is attributed to several factors, among which we can point out existing low interest in urban planning and regulation. This lack of interest caused decisions that would have contributed to deter unhealthy tendencies that were seeping, either openly or stealthily, into the GMA's urban space, to be postponed.

Simultaneously, it harbors socio-economic and spatial imbalances in its territory, which limit its own metropolitan integration, as well as its integration with the rest of the country. This leads to different levels of development and reveals mechanisms that are insufficient for activating this process. They include the design and execution of programs for sustainable urban planning in different cities, urban occupation oriented to integrate the main cities and other small towns within the metropolitan city system, the consolidation of institutional coordination mechanisms for increasing the management capacity of municipalities, the development of service infrastructures and systems, and the improvement of personal security and asset security, among other aspects to be considered in public, private and mixed policies and programs.

3. Methodology

3.1 Conceptual framework

To estimate the total cost of urban diseconomies, generally, methods of valuation analysis are utilized. In the case of diseconomies of traffic congestion, applied socio-economic valuation models to estimate, on one hand, the time lost in congestion through the use of socio-economic indicators such as labor income and, on the other, the additional consumption fuel. In the case of diseconomies generated by traffic accidents and air pollution from vehicle emissions, as a rule, comes as direct or indirect methods of assessment.

Direct methods (primarily contingent valuation or revealed preference method), focus on the willingness to pay by individuals in order to experience changes in their welfare, through the application of complex questionnaires and direct questions, that provide information on the value or cost of the resulting deadweight loss, including material costs for medical care and estimates of so-called *intangibles* costs such as loss in quality of life, pain and suffering. This has been the preferred method for economic valuation of externalities of the transportation system product in those countries with high-income levels (mainly European) (GRSP Focus 2003). It has applications, among other limitations, which depend on subjective judgment of people, as it is they, who determine the value to avoid or mitigate the direct and indirect effects of externalities, in addition to being influenced by the ability to pay of the people being interviewed. Hence, the difficulty utilizing it, because it is based on considerations of probability and statistical risk commonly known. Due to these limitations its use is ruled out in Costa Rica.

On the other hand, indirect methods of assessment are based primarily on the complementarities and substitutability relationships between good or service and market value (Azqueta, 2007). Unlike direct methods, this approach allows the inclusion of intangible costs such as suffering, pain or loss of quality of life that the person considers to be affected by when the environment varies; it is not based on subjective considerations. Principally, it is possible to assess the costs related to health care and lost labor productivity, according to market prices or observable medical costs. Generally, among these methods are: the human capital method and the method of replacement cost.

The human capital approach is a methodology used in economic evaluations known as *human costs*, measured by the value of a statistical life, that is to say, what society as a whole loses with the early death of one of its members, referring to the loss of productive capacity. Therefore, considering the loss in productivity, taking into account the age of death of the person and the maximum age for employment, according to the definition used in the economically active population (EAP), valuing life years lost as a function of income or Gross Domestic Product (GDP) per capita, thus reflecting the economic losses product of death⁵. This method can be complemented with other approaches to estimate - for example - damage to property and administrative costs and medical care to victims. Toward this end usually the method used is the cost replacement, since what it seeks is to return the asset to its original condition (Azqueta, quoted). Which is used to estimate all necessary costs to be incurred to return the asset to its initial state, the above in the case of physical damage but it also considers the costs necessary to restore health to people.

3.2 The data set

The quantitative information used for the estimation of different urban diseconomies in the present chapter, derives from diverse public institutions, producers of primary character information, mostly for the period of 2004 - 2009. Socioeconomic information comes from statistics from the National Institute of Statistics and Census (INEC, by acronym in Spanish), which is the main entity for statistical matters in Costa Rica. The investment information in urban infrastructure is from Costa Rica's General Comptroller's Office; the highway conditions and measurements were provided by the Public Works and Transportation Ministry (MOPT, by acronym in Spanish). The information regarding the flow of vehicles is from the National Public Transportation Safety Board (COSEVI, by acronym in Spanish), whereas, the vehicle count in congested traffic at specific locations was provided by the Department of Sectorial Planning. Both entities are under the umbrella of the MOPT; COSEVI also provided details on traffic accidents (deaths, material damage, and injuries). The statistics on morbidity and mortality from acute respiratory infections were obtained from the Costa Rican Social Security System (CCSS, by acronym in Spanish). The information on the total number of felonies and related costs is from the Planning Department of the Judicial Branch, and hospital costs associated to murders and suicides were obtained through the CCSS, additional information concerning material damage to

⁵ It is clear that in no way human life is valued in monetary terms; it is something besides meaningless, contrary to ethical and moral considerations. The attempt with this method is to have a rough idea of how society relinquishes in terms of income and production potential.

private property, and investment to prevent the social insecurities was provided by the insurance companies and local government. The Central Bank of Costa Rica maintains the economic data for each year.

Similarly, the additional information required for the calculation of estimations that are not generated periodically by public entities, has been taken from studies or special publications for a specific year. The population data, utilized in the period of the analysis, was taken from estimates and projections (CCP/INEC, 2002) taking as the base the year 2002. Labor income data correspond to the National Survey of Multiple Purposes (ENPM, by acronym in Spanish), and the data on transportation expenses from the National Survey on Income and Expenses (ENIG, by acronym in Spanish) conducted in 2004: however, for the purpose of the estimations, the values have been indexed by annual inflation. The fuel consumption data is from the Survey of National Energy Consumption in the transportation sector of Costa Rica 2004, conducted by the National Energy Directorate (DNE, by acronym in Spanish), Ministry of Environment, Energy and Telecommunications (MINAET, by acronym in Spanish). The statistics on percentage of emission of pollutants from the vehicle fleet with human health effects were taken from previously conducted studies (Allen, *et al* 2005).

3.3 Variables and indicators

Assessment depends on the quantity and quality of the statistics available. It also depends on reliability, accuracy, and continuity; in many cases, this represents a restraint when making estimates. In Costa Rica, the institutions responsible for record keeping do not update information continuously, and at times the data is not gathered with the purpose of measuring costs. Quantitative methods were used for the calculation of diseconomies and its expression in monetary terms in regards to GDP, considering a trailing period from 2005 to 2009, based on other information that enables, making reasonably reliable and consistent inferences regarding to:

1. *Transportation System*: a) Road Congestion (Time spent in traffic blockage and additional fuel expenses due to that); b) Traffic Accidents (cost of fatal victims with severe and minor injuries and material damage); and, c) Air pollution from motor vehicles (incidence on respiratory diseases and hospital care and Carbone Dioxide Emission - Green House-).
2. *Public Safety*: a) Murders, b) Suicides, c) Injuries, d) Vehicles Thefts and d) Expenses on public and home safety.

The methodological approach used in the quantitative estimation of urban diseconomies in the GMA and its expression in monetary terms are responsibility of the authors. In that sense, the proposed approach pretends, first of all, to discover the cause and effect relationship associated with the transportation system, land traffic and public insecurity, to determine its socioeconomic and environmental impact and its posterior expression in monetary terms; using indirect methods of economic valuation, as in the case of human capital method, avoided costs and replacement costs; which are based on the complementarity and substitutability relationships that exists between markets good and those without price. Given that the interest in the analysis of urban diseconomies in Costa Rica is recent and lack up-to-date studies, by the application of statistical models, must be taken into account the limited information available for periods greater than 10 years,

which prevent from using more sophisticated analysis models, such as econometric model, utilizing time series.

3.4 Model and estimations

Traffic Congestion can be defined as the inconvenience and increased costs that travelers impose on each other, because of the intrinsic relationship between density and speed of traffic on the road network capacity (Department of Transportation, 2011)⁶. In broader terms, congestion is the condition that prevails if the introduction of a vehicle in a traffic flow increases the circulation time of others (Thomson & Bull, 2001 as cited in ECLAC, 2002). A more precise technical definition, considers congestion as the condition that prevails if the introduction of a vehicle in a traffic flow increases the delay of others in more than $x\%$ (ECLAC, 2003). In other words, congestion can be said to be the situation that occurs when the hourly traffic demand exceeds the maximum sustainable yield of the given time limit and occurs when vehicles are stuck to each other, because of the relationship flow rate under conditions where the use of a transportation system is nearing capacity (Grand-Muller & Laird, 2007)⁷.

There are several ways to measure congestion, among the most commonly used; traffic delay is seen as a situation in which an incremental position over the status of "free flow" occurs. The latter is the uninterrupted flow condition occurred when the road has sufficient capacity so that any car that passes does not affect the travel time of another.

The approach to obtain the total cost of time lost in traffic⁸ has been developed in two stages: the first refers to the quantification of the number of vehicles circulating in congested conditions, as well as the occupancy level⁹. Subsequently, and once the total occupancy in congestion (number of persons in congestion) is known, proceed to determine the average time lost in congestion and provide an economic value through an indicator of proximity to income. What was described above, allows the inclusion of a monetary valuation of loss in productivity as a result of congestion.

The total cost of time lost in congestion is obtained by applying the following expression:

$$CTTPC = [(TDP * TDPC) * TC] * 1,4 * IL$$

Where:

$CTTPC$ = Total cost of time lost by traffic congestion (US\$/year).
 TDP = Average daily traffic measured at different points of congestion.

⁶This definition coincides with that used by Transit Authorities in countries like Scotland, and corresponds with the one applied by the Canadian Transportation Authority.

⁷Traffic congestion can be recurrent and non-recurring. The first occurs regularly in a daily cycle, weekly or monthly, allowing it to be manageable. The second is caused by traffic accidents or special events, such as construction or road closures. Traffic congestion is, therefore, a marginal phenomenon and shows how, under certain conditions, the incorporation of new vehicles has an impact on all other vehicles that are traveling at the time.

⁸The value of travel time is defined as the cost borne by society due to the fact that a person travels between two geographical points.

⁹ It is considered that on average 1.4 people travel each in personal vehicles.

$TDPC =$ Average daily traffic congestion circulating, calculated not only in terms of peak hours (6, 7, 8:30 am and 4, 5, 6, 7 pm) but also in terms of schedules which have a behavior similar or higher than the peak hour traffic.

$TC =$ Average time in congestion.

$IL =$ Average hourly labor income.

Given that Costa Rica is not systematic in its measurements and counts, current and continuing, on average daily traffic flow and in fair condition and congestion, the available data correspond to 90 points of congestion on the GMA taken in 2006, the calculation was performed taking as a base that year and estimating the number of vehicles up to 2009 by the rate of growth of vehicle fleet.

A second effect on congestion refers to the total cost for additional fuel consumption¹⁰, which is obtained by applying the following expression:

$$CTCGC = (CA_{gas} * TDPC_n) * P_{gas}$$

Where:

$CTCGC =$ Total cost of additional fuel consumption by traffic congestion (US\$/year).

$CA_{gas} =$ Additional fuel consumption (in liters).

$TDPC =$ Annual average daily traffic congestion circulating

$P_{gas} =$ Average price of liter of gas

Traffic Accidents are sudden event that cause involuntary harm to people (fatal or nonfatal), property and administrative damage. Various factors influence the amount and severity of them, including traffic congestion, climate, infrastructure, vehicle conditions, and the behavior of those who drive, among others¹¹.

The total cost of traffic accidents is determined by socio-economic cost of casualties, both fatal or nonfatal and severe and minor (cost for medical care and lost productivity costs), as well as for the cost of damage. This lost productivity is estimated not only for road fatalities, but it is also necessary to consider the lost productivity of those severe and minor injuries, which can vary from one day, to one week, or months (referred to as temporary disability), but it also must consider those permanent disabilities that involve loss of productivity for years.

¹⁰ Assumptions used in this calculation are as follows: The average performance of gasoline per vehicle (36.6 miles per gallon) (DSE, 2005). The additional fuel consumption per km increases in congestion by 25%. Likewise, it is assumed, as data marked moderate and conservative, that on average, each vehicle travels 10 km daily in congestion.

¹¹Externality valuation of traffic accidents in different countries, examined in each case in particular its adaptability to the availability of information and the situation of the country concerned. Thus, the total cost of a traffic accident varies with the methodology involved and the information available, so the amount of such external costs depends on the institutional arrangement of each country (Rizzi, 2005). For example, the European Commission has standardized a method for its member countries (COST 313), which determines the cost of road traffic accidents by victim considering medical costs, non-medical rehabilitation, and loss of productive capacity, along with other economic and human costs. However, this approach yields very different results depending on the member country in which it applies, by way of illustration, to perish in traffic accident in Norway is 15 times higher in cost than in Spain (Asociación Española de Carreteras 2005).

To calculate the total cost of traffic accidents, first, it is necessary to estimate life years lost as a consequence of a traffic accident, from the human capital approach, which results from the difference between the age of death and the economically active age according to the age range used in the definition of the Economically Active Population (EAP), which usually defines working age between 15 and 64. Since the GMA does not record data on all deaths in traffic accidents, by age range; were taken as references the number of accidents and the respective ranks of death by age in traffic accidents, for the total of the country, in order to determine the probability that a person who dies in a road accident is within a particular age range.

Along with the available information we proceeded to construct a relative frequency distribution by age group for deaths from traffic accidents, then was assigned - based on that distribution - the probability that a randomly selected person dies within a specific age range as a result of a road accident. These probabilities are used to distribute the total of accidents in the GMA by age range, so that it can better estimate the number of life years lost, and not rely solely on the average.

The total years of life lost in traffic accidents is calculated by using the following formula:

$$TAVPP = [M_n * \theta] * AVPP_i$$

Where:

$TAVPP =$	Total years of life lost due to traffic accidents.
$M_n =$	Number of deaths in n years.
$\theta =$	Probability to die within a specified age range.
$AVPP_i =$	Years of life lost according to age range i .

After obtaining the total years of productive life loss, proceed with the assignment of a monetary value to them. It uses a *proxy* to measure the loss in monetary terms. In this case, years of potential life lost are valued considering the average labor income of the central region, which belongs to the GMA; in addition to considering the rate at which the economy grew in recent years and discounting future income present value. This is so, to count the total product cost of the lost productivity traffic accidents cost yearly. The average total cost of lost productivity for road fatalities is the sum of each future productive year that is lost once the rebate is realized, estimates are as follows:

$$CTPP = \sum_{i=1}^N I \left(\frac{\left[\frac{(1 + \beta)^i}{n} - 1 \right]}{(1 + r)^i} \right)$$

Where:

$CTPP =$	Total cost of lost productivity.
$I =$	Average Labor Income.
$r =$	Discount rate.
$\beta =$	Average annual income growth.
$i =$	Years of life lost in traffic accident.

Should be clarified, that the social discount rate used is different from the market discount rate that is traditionally used, for what it is, is to determine the present value of goods or

services not necessarily tangible, or that its value increases with time or not, experience the normal process of physical capital depreciation, for example, human capital and environmental goods and services; the meaning of such fee differs, since in practice, is used as social discount rates relatively low compared with those used by the economic valuation of traditional project¹². Such differentiation is justified since high discount rates tend to punish heavily the future, while low discount rates lower the value less accelerated by providing utmost importance to its value in the future than at present, especially when dealing with resources whose expected future value will be greater than the current (Eskeland, 1994; Cifuentes, Rizzi & Vergara et al, 2004; Oliva, 2004; De Rus, Betancor and Campos, 2006).

To calculate the economic and social costs of severe and minor victims, both the cost of medical care and the cost of lost productivity are considered. In the economic assessment of severe and minor victims the procedure was to consider the information on costs incurred by traffic accidents reflected in emergency care, outpatient and hospitalization, with information from the COSEVI and the Social Security Fund. We used the average cost of care for traffic accidents reported, such as hospitalization, acute or emergency care, provided by the CCSS and in particular in the *Calderon Guardia Hospital*. For purposes of the estimate, it is assumed that every person injured by an accident has a cost for emergency care. Adding hospitalization costs by only computing people with severe injuries and costs for outpatients care only for people with minor injuries. In consequence, we proceed to estimate the total cost of care for people injured in traffic accidents using the following formula:

$$CTHAT = \sum_{i=1}^n [[(HAT_n) * Cme_{ri}AE] + [(HGAT_n) * Cme_{ri}AH] + [(HLAT_n) * Cme_{ri}AA]]$$

Where:

- CTHAT* = Total cost of hospital care for road traffic.
- HAT* = Number of persons injured in traffic accidents in the *n* year.
- Cme_iAE*= Average cost for emergency care in traffic accidents rank *i*.
- HGAT* = Number of persons seriously injured in traffic accidents in the *n* year.
- Cme_{ri}AH*= Average cost of hospital care for rank *i*.
- HLAT* = Number of people slightly injured in traffic accidents in *n* year.
- Cme_{ri}AA*= Average cost of outpatient care by rank *i*.

To medical cost is necessary to add the total costs per absence from work. Whenever an accident occurs, the person involved must stop working during the recovery period, in some cases this period may include days, weeks, months or even years. Given the lack of data on the subject, it is considered, according to the international benchmark, that the average recovery period a person with minor injury has is 3 days, and serious injury is of days.

¹² At the present time, there is no consensus on the TSD to use when assessing the loss in labor productivity or natural resources; the rule states that should be less than the discount rate the market usually utilizes. In several countries, the choice of the social discount rate is between 3% and 8%. The variability is relatively high and simultaneously, in Latin American countries with similar characteristics have coexisting rates ranging from 5% to 8% (De Rus, Betancour & Campos *et al* 2006).

$$CPPH = HLAT * DI * I + HGAT * DI * I$$

Where:

$CPPH =$	Total cost for lost productivity.
$HLAT =$	Number of people slightly injured in road accidents.
$HGAT =$	Number of people seriously injured in traffic accidents.
$DI =$	Average days of disability.
$I =$	Average labor income.

To estimate damage costs it is considered the total traffic accidents with material damage and their respective average cost as an approximation for their replacement cost. In turn, the replacement cost was estimated at consultations in different workshops in the metropolitan area, the average cost incurred by a person to repair their vehicle following a road event¹³.

Although in these cases the insurance companies should be the best reference, using the information held on compensation for these estimates with the recent opening of the insurance market in the country makes dealing with such information confidential and therefore not available to the public.

$$CTDMA = AT * CR_{me}$$

Where:

$CTDM =$	Total cost for material damage.
$AT =$	Number of traffic accidents with material damage.
$CR_{me} =$	Average cost of replacement.

From a public policy standpoint, another relevant diseconomy is air pollution, which surpasses acceptable levels and affects people's health and the atmosphere. In the case of diseconomies of air pollution from vehicle emissions, it is interesting to estimate what society least has obtained in exchange for the work of the person, if that person had not died prematurely by sickness as a result of Acute Respiratory Infectious (ARI, IRA by acronym in Spanish) due to emissions, or if he or she had not been absent to work for the same reason. Apply the same principles used in the calculation of mortality and morbidity from road traffic accidents (Equation 3 y 4) and attribute that 20.5% of morbidity and mortality from ARI due to vehicular emissions from a direct or indirect source (Allen, *quoted*).

When estimating the costs associated with morbidity due to ARI, after establishing the numbers of cases attributable to vehicle emissions, it is necessary to identify the main costs incurred by the health care system for services provided and identify the respective average costs for each type of service. In this sense, we consider the outpatient medical services, emergency consultation and hospitalization and expenses for ARI and their respective costs provided by the Social Security Fund.

The total product cost of morbidity due to ARI, and measured by the costs incurred by the public health system is given by the following equation:

¹³ The insurance companies should be the best reference, using the information held on compensation for these estimates; the recent opening of the insurance market in the country makes dealing with such information confidential and therefore not available.

$$CTMIRA = (((HIRA * \theta) * CPH) + ((CEIRA * \theta) * CCE) + ((MIRA * \theta) * CPC)$$

Where:

- CTMIRA = Total cost of morbidity due to ARI.
- θ = % ARI attributable to vehicle emissions.
- HIRA= ARI Hospitalization Cases.
- CEIRA = Emergency cases handled due to ARI.
- CCE = Average cost of an emergency consultation.
- MIRA = Morbidity from ARI cases.
- CPC = Average cost of a consultation for ARI.

The productivity costs of morbidity due to ARI are estimated as follows¹⁴:

$$CPPH = MIRA * DI * I$$

Where:

- CPPH = Total cost for lost productivity.
- MIRA = Morbidity cases due to ARI per year.
- DI= Average days of disability.
- I= Average Labor Income.

While the cost of *greenhouse* gas emissions (CO₂) is estimated considering the costs of compensation, defining the fuel consumption and emissions of greenhouse gases is associated with evaluating the establishment of such emissions at market prices.

To determine the impact of transport on the environment sector, it is necessary to consider the CO₂ emissions, as this is a major greenhouse gas. For this estimate we must determine the annual fuel consumption by type: Gasoline (Super and Regular), Diesel and Liquefied Petroleum Gas (LPG). Due to lack of information available on sale or consumption of fuel for the GMA, we proceeded to estimate the fuel used as a bridging factor to the population. To calculate the CO₂ emissions multiplied fuel consumption by type, by their respective emission factors. The method determines the expenses that would be incurred to compensate.

The total cost for the emissions of greenhouse gases (CO₂) is given by the following equation:

$$CEGEI = (CC_i * FE_i) * P_{tonCO_2}$$

Where:

- CEGEI= Total cost emissions of GEI (CO₂).
- CC_i = Total fuel consumption i.
- FE_i = Emission factor for fuel i.
- P_{tonCO₂} = Price ton of CO₂.

Public Safety is an issue that in recent decades has attracted attention worldwide and can be defined as the fear people feel to be threaten by aggression and violence from the environment, affecting the full enjoyment of life, psychological implications and socio-economic costs, both repair and prevention, which must be tolerated by families and businesses.

¹⁴ In the absence of national data on temporary disability, it is estimated that the average number of days not worked due to this cause can be between 4 to 6 days (PAHO, 2005); we use the average of 5.

The total cost for the public safety is given by the following equation:

$$CTIC = (QCDA * CMA) + (QH * CMAH + QS * CMAS) + CAPHS + CSP + CSPH$$

Where:

<i>CTIC</i> =	Total Cost of public insecurity (US\$/per year).
<i>QCDA</i> =	Number of cases of crime and aggression
<i>CMA</i> =	Average cost of care for cases of crime and aggression
<i>QH</i> =	Number of homicides
<i>QS</i> =	Number of Suicides
<i>CMAH</i> =	Average cost of medical care for homicides
<i>CMAS</i> =	Average cost of medical care for suicides
<i>CAPHS</i> =	Cost in life years lost due to homicides and suicides
<i>CSP</i> =	Cost of Public Safety
<i>CSPH</i> =	Cost of private security for homes

The estimated economic cost of lost productivity that society experiences with the deaths of its members as an anticipated product of a suicide or homicide are estimated following the methodological approach presented in equation 3 and 4 of this section. The total cost of reported cases as crimes or assaults were regarded as injuries, for which we estimated the respective health care costs, distinguishing between minor and severe injuries, and in these cases, it is also considered the result of lost productivity of temporary disability.

To calculate the cost of public safety, it is considered the country's total expenses incurred by the Ministry of Public Security, Judiciary, Ministry of Interior and Police, Ministry of Justice and Interior. Given that, this information is only available at national level for purposes of charging a cost only for the GMA, the costs were multiplied by the relative weight of crimes reported in the GMA with respect to the whole country, resulting in an average 55%.

For the estimation of expenditure made by households as a preventive measure of protection against insecurity, it is considered the information and assumptions made in the study "Economic aspects related to insecurity" (Sauma & Chacón, 2006), which, based on National Survey of Income and Expenditure (ENIG, by acronym in Spanish), which was conducted by the National Institute of Statistics and Census (INEC, by acronym in Spanish), technical governing body of the National Statistical System, estimates the minimum average cost in different areas linked to insecurity. Given that, there is no disaggregated information at the level of GMA, since it is done at the national level¹⁵, we proceeded to update the data from the cited study, considering the growth of the GMA in terms of population, the number of dwellings and vehicles, also the prices level and the assumptions made in the baseline study, using the transfer of results of 2006 to later years.

Among the items considered to estimate household spending on security are private security, installing fences, alarm and monitoring systems for homes, the installation of razor wire, the alarm system in family vehicles, the installation of locks and electric gates, construction of garages for cars and payment of car theft insurance and housing.

¹⁵ For the realization of ENIG, INEC uses a stratified sample to establish as a domain the central region Central (urban and rural), Rest of the urban country and Rest of rural country, so it is not possible to disaggregate the information in a specific way for the GMA.

4. Results and discussion

4.1 Transportation system diseconomies

Transportation system is an important diseconomy, especially in cities, like GMA, that have not given priority to investing in transportation infrastructure and networks. This disregard for investment affects city living and structure cost (socially and economically), which becomes a burden for enterprises, families, and society as a whole.

Road congestion originates from interference and friction among vehicles in comparison to the normally expected vehicle flow. This is interrelated to highway conditions and a reasonable speed required for traveling from one place to another. Additional cars make it more difficult for other vehicles to advance in traffic, and congestion becomes more evident. The stress passes on to people by means of traffic problems and longer transportation times, especially during peak hours; reduces the amount of time that could very well be spent on alternative activities (productive or leisure). This situation also leads to greater fuel consumption, and increases the probability of other costs related to human injuries and material damages due to more traffic accidents. Another apparent cost is air pollution due to toxic vehicle emissions and their effects on the atmosphere, the respiratory system (diseases) and building structures (decay). In other words, traffic congestion caused by a larger number of vehicles and a limited transportation network, unravels a series of factors that could hinder the sustainability of the urban system and affect people's quality of life, thus reducing productivity and the efficiency required in cities, with higher economic and social costs as time goes by.

Table 2 shows the results of the assessment and its expression in monetary terms of the transport system diseconomies in the GMA, for the years 2005-2009, on a cumulative basis, amounts of U.S. \$ 3,805,484,646, representing 13.5 % of GDP, being the higher cost attributed to the time lost in congestion (71.5% of total).

Costs	2005	2006	2007	2008	2009	Total
Time Loss in Traffic Congestion	504,780,388	515,082,029	531,011,376	578,212,387	590,012,639	2,719,098,818
Additional Fuel in Traffic Congestion	45,557,171	46,486,909	47,924,556	52,184,516	53,249,507	245,402,658
Traffic Accidents	85,862,252	100,653,299	106,351,163	124,704,692	122,316,355	539,887,760
Air Pollution due to Motor Vehicle Emissions	53,739,866	58,835,214	59,141,786	63,663,457	65,715,086	301,095,409
Total	689,939,676	721,057,450	744,428,880	818,765,052	831,293,587	3,805,484,646
% with respect to GDP	2.64	2.63	2.66	2.79	2.84	13.56

Table 2. Costs of the main transportation diseconomies in the GMA between 2005 and 2009 (in US\$, and as a % of GDP), own calculation based on information from COSEVI, EU/PRUGAM/CINPE-UNA, DSE, CCSS, INEC and BCCR.

4.2 Public safety diseconomies

Public insecurity is a major urban diseconomy, as manifestations of violence are a constant in the daily activities of the population, which hinders the normal development of people in daily tasks, as a consequence becoming a disincentive to private investment and individual, as the damage to people and property generates an increase in operating costs, both preventive (personal safety devices, insurance and others) and repair, involving both an opportunity cost for families and businesses, since those resources could be devoted to improvements in productivity and quality of life.

In recent decades, the GMA has shown a steady increase in all variables considered in the calculation of insecurities diseconomies, both the number of murders, suicides, injured persons and stolen vehicles, and the households and public spending on security.

Table 3 shows the results of the assessment and its expression in monetary terms of the Public Safety diseconomies in the GMA, for the years 2005-2009. On a cumulative basis, it amounts US\$ 2,020,151,841, representing 7.89 % of GDP.

Costs	2005	2006	2007	2008	2009	Total
Murders - Suicides	89,836,942	98,063,197	118,543,256	168,118,618	192,501,616	667,063,630
Severe injured	3,811,422	4,347,415	4,915,683	5,150,947	5,130,861	23,356,328
Minor injured	148,664	215,597	252,050	273,362	284,668	1,174,340
Vehicle Theft	3,725,699	4,867,152	5,472,677	6,456,835	5,587,701	26,110,063
Household Expenditure	7,161,695	7,957,439	10,193,905	11,080,951	4,978,771	41,372,760
Public expenditure	179,524,625	211,071,980	246,533,332	322,999,449	300,945,333	1,261,074,719
Total	284,209,047	326,522,780	385,910,902	514,080,162	509,428,950	2,020,151,841
% with respect to GDP	1.51	1.45	1.47	1.72	1.74	7.89

Table 3. Total costs due to public unsafety in the GMA, 2005-2009 (in US\$, and as a % of GDP); Own calculation based on UE/PRU-GAM/CINPE 2007b/ SAUMA 2006, CGR, CCSS, PJ, INS, INEC and BCCR.

4.3 Urban diseconomies versus infrastructure investment

The estimation of socio-economic and environmental costs of externalities of transportation system diseconomies and public unsafety diseconomies in the GMA, permit to have a rough idea of how they represent urban inefficiencies for Costa Rican society, though the calculations should be considered conservatives, because both the difficulties of systematic information, current and reliable, as the inability to quantify the suffering and the moral and psychological damage caused, and the distortions that they generate in the income of the families and enterprises. These deficiencies can be reduced with policies aimed at sustainable investment in urban infrastructure.

It is interesting to compare the estimated total cost diseconomies cumulative for the years 2005-2009, with the cost of some investment projects that have been estimated and proposed

during the same period, many of them still undeveloped. Subsequently, the investment options discussed, despite their cost, once compared with diseconomies generated by the current system of transit and land transportation are justified in terms of potential cost that would be saved by society and Costa Rican economy.

The assessment by the concept of diseconomies resulting from poor infrastructure and road transportation system, measured in terms of congestion and delay in the period 2005-2009 amounted to US\$ 2,964.5 million; if this is added the costs to traffic accidents and their aftermath, in a country that has a mortality rate higher than the average in Latin America, gives a total of US\$ 3,504.3 million, if they accumulate and are added to the above costs the direct and indirect effects of vehicle emissions have on human health and the environment, measured in terms of greenhouse effect gases (CO₂), the estimated cost is US\$ 3,805.4 million. The estimation for public safety diseconomies in the GMA, for the years 2005-2009, on a cumulative basis, amounts for US\$ 2,020.1 millions.

Table 4 presents a list of proposed investments for five years in analysis with a time scope until 2015 (EU/ PRU-GAM /CINPE-UNA 2007c), but the steep cost of investments should be made in the first five years. Projects identified in the present time by the relevant authorities could help reduce the costs of diseconomies concept, involving an initial investment of US\$ 1,488.9 million (for the first 5 years), the latter figure are clear benefits that could result from such investment in terms of reducing diseconomies. This is without considering the effects of linkages that such reductions could generate and its impact on the economic performance of the country through increased efficiency of urban performance of the GMA.

Diseconomies US\$ (millions) 2005-2009		2006	2007	2008	2009	2010
Time loss and fuel consumption	US\$ 2,964.5	-422,69	-216,27	-216,27	-216,27	-0,56
Traffic accidents	US\$ 539,9					
Air pollution	US\$ 301,1	-62,43	-156,19	-96,58	-100,32	-1,35
Public Safety	US\$ 2.020,1	I.N.A.	I.N.A.	I.N.A.	I.N.A.	I.N.A.
TOTAL	US\$5.825,4	-485,12	-372,46	-312,85	-316,59	-1,91

I.N.A. = Information No Available.

Table 4. Summary of diseconomies and investment projects in the GMA between 2006 and 2010 (in US\$); Own calculations based in diseconomies estimation and EU/PRU-GAM/CINPE-UNA 2007c

As for urban infrastructure investment needs, local authorities exhibit some degree of consciousness, but - not necessarily - it is reflected in the investment priorities at national level. In this regard, it is interesting the point of views of the Mayors of San Jose and Heredia, two of the biggest Municipalities in the GMA.

The Mayor of San Jose (Pichardo, 2010), states *"neither the repopulation of San Jose and the Promotion of Tourism would have any meaning if there is no improvement of public safety; henceforth, we are raising efforts at two levels: first, at the level of the Municipal Police, to strengthen it, both in number of police officers, equipment, etc., and in that I see a question about the law, but basically we have found in the alarm monitoring service, an alternative in financing growth of the municipal police; it is not only a new service that technology helps improve security in the city but also potentially a revenue for the municipality to increase public safety. I would like to have in four years, ten thousand customers of the alarm monitoring service, which would imply one billion colones a year that we'd all be investing in public safety, it would help a lot. But also another level at which we would constitute the Security Council of San Jose which was an initiative in my government's agenda and we united in a single Council all police there is: the Judicial Investigation Organization, the Ministry of Public Security with its three polices (the Migration police, Drug Control and the Police Forces and Fiscal Control) with the Municipal Police to begin working together, to plan joint operations to avoid duplication. This will help improve public safety and the safety of San José, passing through the recovery of the social framework, and the reactivation of the city, a city that is abandoned after six in the evening is not safe, even with more police officers; then, it is precisely a process that is integral. Safety is not only more police, but also more people living and walking around town."*

Another project is the tram launched by the Municipality of San Jose as part of the efforts to make the city more livable, competitive and functional¹⁶. History dates back to 1984, the date in which the first feasibility study was conducted. Political reasons linked to the need for investment, because it is a public works project that goes beyond municipal powers, have limited their development. Today the President of the Republic has made it a national priority project and the initiative is in the field of climate change facing the need to reduce CO₂ emissions as part of the country's efforts to meet demands for carbon neutral by 2021. The French government has again offered support to update the feasibility study. The initiative complements the reactivation of the rail system that propels the Instituto Costarricense de Ferrocarriles (INCOFER, by acronym in Spanish) between metropolitan areas, which must be provided of exchange nodes and build a multimodal system integrated with the urban bus routes, so that is a distribution hub and they do not enter the city center. It is expected that the tramway will have a cost of US\$ 10 million/Km for a total of 8 Km and a construction time of 30 months, and, could initiate construction in 2014, just when the concessions to public transport operators in the GMA expire. However, we need the financing scheme and a complete economic study to assess its impact on reducing negative externalities.

Similarly, the Mayor of Heredia (Pichardo, 2010) said *"Public safety is a major problem nationally and in the case of the canton of Heredia affects much more to have as part of its territory one of the largest, more precarious in the country ... This situation raises the need to increase and modernize municipal police teams ... and, most importantly, the cameras project because we know that we must avoid crime. In every school, every church, wherever people congregate cameras are being installed ... In this sense, we are also maintaining an excellent relationship and coordination with the Judicial Investigation... we have to closely coordinate to succeed in this issue of combating crime. We are also operating in and around colleges and schools to prevent drug trafficking. In*

¹⁶ The Mayor of San Jose was interviewed for these purposes, April 12th, 2011.

addition to all this a matter of vital importance is the organization of communities. In that sense, we are working with technical advice from an Israeli company in the Eyes and Ears Program, with organized communities... As for the viability of the Project Radial Heredia - San José, that was dismissed because of costs... and what is considered in coordination with the Ministry of Public Works and Transportation to the 2011 and 2012, is a tunnel at the entrance of Heredia, and the expansion to 4 lanes on the road to Alajuela and to restore Heredia's Train. "

5. Conclusion and recommendations

In conclusion, the formation of cities involves consideration of a specific geographical area where a confluence of economic, recreational, cultural and commercial, facilitated by a number of structural conditions such as infrastructure, transportation system, safety and institutional policies, among others, facilitate the development of agglomeration economies among other things, including the establishment of clusters and various production chains back and forth between various actors (companies, industries, service providers, people, etc.) allowing a better use of the available resources and lower production costs and transaction costs.

From a theoretical point of view, under appropriate urban planning cities can generate various economies product of agglomeration. Improvements in the location, whether in business or family can generate gains in terms of improved productivity, reduced transportation costs, and reduced costs of recruitment and training, also in search of suppliers and information. At the industry level, agglomeration economies even allow a divisibility and / or distribution of the costs associated with location, production, marketing and distribution.

Another important element of economies result of agglomeration is the profit of having the production and distribution of public services and infrastructure in an area that is focused on activities, which obviously reduces their cost, allowing areas to diversify the supply as diverse as telecommunications, energy, financial services and outsourcing. The population also benefits, by shortening travel time between their working and living, in addition to a variety of services concentrated and accessible, reducing travel costs and improving their material conditions of life.

However, economies of agglomeration can decrease, disappear and even become diseconomies or negative externalities due to inefficient urban systems that begin to unravel. Whenever the capacity of the city is saturated, either because they reduce or limit investment in road infrastructure and transport by land, traditional means of transportation become inefficient, creating congestion, lack of planning and other factors such as insecurity, accidents and pollution levels exceeding "tolerable" levels.

In the case of GAM of Costa Rica, this area has experienced a series of changes in structure and composition, which have generated positive benefits in terms of attracting investment, job creation, service provision and innovations in general, but have also developed a set of negative factors given the degree of saturation and the complexity of disordered use of the territory as well as insufficient capacity to invest in urban development.

As an example, in 2005, it was invested in transportation 39%, less than the average for 2000-2005. More recently a study by the Comptroller General of the Republic (2008), determined

that Costa Rica has not reached to invest more than 0.83% of GDP in transportation infrastructure in the period between 2000 and 2007.

Subsequently, the permanence and increased costs due to diseconomies of urban GAM are limited by deficiencies in proper urban investment, preventing or diminishing the use of profits generated by economies of agglomeration.

Some of the measures that could improve the territorial competitiveness, the quality of life of the people, the environmental sustainability, and the integration and social cohesion of the GMA, at the institutional level is the creation of a Managing Authority for the Great Metropolitan Area, with functions of policy formulation and management, with autonomy and authority to establish guidelines, programs and investment projects for the territory of the GAM; in order to implement a program of investment projects in urban development and enactment of a law for the reorganization of metropolitan areas.

The participation of local actors is crucial, as it will facilitate the establishment of a balanced and competitive territory (regulating the growth and expansion of urban areas) through proper strategic planning with emphasis on road infrastructure and the transportation system, appropriate location of human settlements and economic activities. Plus, prevent and correct the location of infrastructure and activities in areas of risk and vulnerability conditions.

An action to reorganization and urban regulation of GAM in the terms proposed, would allow the country to join the international Right to the City and the emerging rights derived therefrom: the right to the four basic fundamentals of life, right to mobility and free access, right to public space, housing rights, right to cleanliness, order and decoration, right to collective identity within the city and the right to security.

In this context, it is important the formulation, implementation and systematic evaluation of policy guidelines in critical areas to the economic development of the GAM, such as: (i) mobility and displacement, (ii) local economic development, (iii) urban metropolitan management, and (iv) financial sustainability.

A policy for the mobilization and movement must recognize the specialization of the territory, promote its intensive use while it is possible to correct or contain the current flooding processes to move towards a compact city, with greater capacity to exploit agglomeration economies generated by the industrial areas and major corridors and areas or corridors of commercial animation and offices that are currently observed in the GAM.

Such policy of territorial rearrangement for greater effectiveness must necessarily be able to articulate the improvement of the metropolitan road infrastructure supply (maintenance and rehabilitation of the primary road network, extension and / or expansion of the local road network), with an integrated policy for the reorganization of public transportation at the metropolitan scale of both people and goods (implementation of an intelligent traffic signal coordination system, coordination of different nodes of transportation, fare integration, improved comfort and quality of services, incentives for intensive use and information to the user in real time, building centers of charge transfers, definition of zones and roads to transport goods, among other measures).

The territorial system defined by the convergence of these two elements (improvement in the supply of road infrastructure and reorganization of metropolitan public transport)

would make for smart growth of the GAM that would decrease travel time and additional expense in fuel, turning it in improved productivity, competitiveness and territorial quality of urban life and a decrease in costs associated with urban diseconomies. On the other hand, it is recommended that this policy also integrate a component of maintenance, repair and modernization of road infrastructure.

Meanwhile, in terms of local economic development, it is advisable to encourage the implementation of support programs rooted in the local government and implemented in the framework of concerted actions with the private sector, chambers of commerce, universities along with vocational training centers and financial entities, acting as promoters and catalysts for development of new business ventures based on the exploitation of resources related to knowledge, experience and information. This would improve the urban living conditions, increasing the competitiveness of urban areas and promoting the cities of the GAM as a destination for business and international and domestic tourism. Similarly, could act as enablers of urban development by providing stimulus to the renewal of urban spaces, some of them depressed, and reinstate the economic dynamics, avoiding further social and cultural segregation.

Additionally, it is desirable that local economic development of the GAM is grounded in the formulation of a Metropolitan Strategic Plan for Tourism that would integrate initiatives of information about attractions and tours in the hands of business chambers and municipalities at the local level and its transformation into tourist circuits. In that sense, we would recommend government action oriented to support the tourist circuits in the GAM, articulating the cultural attractions with the nature ones, for the express purpose of contributing to increase the accommodation and spending segment of international tourism in socio-economic and educational as well as increasing domestic tourism.

Finally, a third area of policy delineation should focus on the metropolitan urban management and financial sustainability, both by the Central and local governments. To maintain an important activity in terms of investment in urban development should be important to consider the goal of increasing investment in urban development equivalent to 1% of GDP, so as to ensure minimum availability of resources to carry out works of urban infrastructure necessary to recover the functionality of the GAM and even more to line up with the demands of globalization and the demands of different social groups living in it. This will require making a long-term financial planning to ensure the commitment of the different institutions involved and new forms of organization for metropolitan management. Whereas the endowment is not sufficient to ensure effective and efficient action for the metropolitan urban management, it is necessary, especially for the beginning.

6. Acknowledgments

This chapter is the result of various research projects by the authors, at the International Center on Economic Policy (CINPE, acronym in Spanish) of the *Universidad Nacional, Costa Rica*. The opinions expressed herein are the author's responsibility and do not necessarily respond to institutional positions. The authors are grateful to Lizzy Solano for translating the article to English and proofreading it, and to Carlos Eduardo Espinoza for his help during the data collection.

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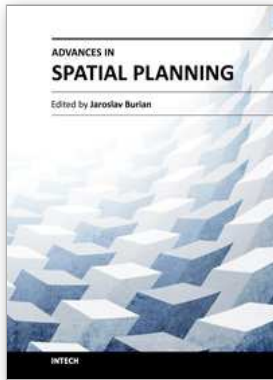
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Advances in Spatial Planning

Edited by Dr Jaroslav Burian

ISBN 978-953-51-0377-6

Hard cover, 366 pages

Publisher InTech

Published online 21, March, 2012

Published in print edition March, 2012

Spatial planning is a significant part of geosciences that is developing very rapidly. Many new methods and modeling techniques like GIS (Geographical Information Systems), GPS (Global Positioning Systems) or remote sensing techniques have been developed and applied in various aspects of spatial planning. The chapters collected in this book present an excellent profile of the current state of theories, data, analysis methods and modeling techniques used in several case studies. The book is divided into three main parts (Theoretical aspects of spatial planning, Quantitative and computer spatial planning methods and Practical applications of spatial planning) that cover the latest advances in urban, city and spatial planning. The book also shows different aspects of spatial planning and different approaches to case studies in several countries.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Arlette Pichardo-Muñiz and Marco Otoyá Chavarría (2012). Agglomeration Economies Versus Urban Diseconomies: The Case of the Greater Metropolitan Area (GMA) of Costa Rica, *Advances in Spatial Planning*, Dr Jaroslav Burian (Ed.), ISBN: 978-953-51-0377-6, InTech, Available from:

<http://www.intechopen.com/books/advances-in-spatial-planning/agglomeration-economies-versus-urban-diseconomies>

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University Campus STeP Ri
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51000 Rijeka, Croatia
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Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821