

# DEVELOPING INTERACTION AND EARNINGS AMONG STAKEHOLDERS OF ANTANANARIVO URBANIZATION

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## Abstract

Game theory is the theory of interdependent agents' rational decision: they influence one another and are aware of such reciprocal influences. More simply, this is the mathematical model formatting of game situations, therefore of strategic situations.

Such theory is applicable in several areas, including urbanization strategy of Antananarivo. The purpose of this publication is to develop interaction, as well as gains among the stakeholders, which will be the input of the theory of games among stakeholders of the urbanization of the same city.

This will prevent, about the choice of their playing partner(s), the "I know that he knows that I know that he knows ...".

*Keywords: Antananarivo, earnings, game theory, interests, matrices, urbanization.*

## 1- INTRODUCTION

The dilemma in urban planning profession lies in each person's choice since no one knows the choice of the other. The ideal situation is moral fairness, coming up with a win / win situation. As individual interest (individual rationality) takes precedence over collective interest (collective rationality), each person seeks to maximize their profits and their interest to be sure not to lose but to win.

In this publication, we will successively modeling principle by the game theory according modeling the decision for a game of stakeholders of deal with: Antananarivo Urbanization Context, the reflective process and, finally, the method of the urbanization of such city.

## 2- METHODS

### 3.1- Antananarivo Urbanization Context

Urbanizing Antananarivo is complicated at both technical (technical study, costs and profitability study, etc.) and decision making levels. Our study involves the latter. Making decisions on urbanizing areas that are still vacant (plains, etc.) in Antananarivo brings conflicts of interest into play.

If we want to create an economic dynamism through urbanization, the decision should not be unilateral: the government cannot decide alone on urbanization orientations. Decisions shall be in the collective interest of all stakeholders, shall be consensual and made in consultation by the various urban stakeholders (government, local governments, private Sector, etc.).

Now, the various stakeholders have their interest and their way of thinking which may be in conflict or in complementarity. The private sector seeks maximum profit, the population seeks for protection and respect of their rights, the local governments (CUA and peripheral municipalities of Antananarivo) think of their earnings, the Government also has its appreciation and perception of the situation.

Thus, for urbanizing Antananarivo, decisions shall be modelled. The best method for modelling such a case is Game Theory in a reflective process.

In the case of urbanizing Antananarivo, the goal is to extract from reality and previous situations "some stylized facts from which other stylized facts are deduced by applying simple models of game theory and which will be submitted to judgment by decision makers." This approach allows accompanying stakeholders (local authorities, investors, households, operators, promoters) in their thinking by providing them with a particular perspective of the situation.

### **3.2-Principle of modeling through a game theory according to a reflective process**

#### 3.2.1-Game theory and rationality

Game theory examines the rational decision by stakeholders who are strategically interdependent: they influence one another and are aware of such reciprocal influences. Such theory allows describing and analyzing interactions between players in the form of strategic games. More simply, it consists in putting game situations, therefore strategic situations into a mathematical model. In any game (non-cooperative / cooperative / incentive), there must be at least two stakeholders. And like any game, each situation depends on the attitude of all stakeholders [8].

With the "prisoner's dilemma", game theory measures the efforts (optimization of the strategy to be adopted) to be made to secure a gain. Two detainees who are accomplices of an offense are imprisoned separately without the possibility of communicating. The strategic goal of each is to spend as little time as possible in prison. The dilemma lies in the selection by either, since neither knows the choice of the other. The ideal situation is that the culprit denounces itself and clears the other: a loser / a winner. But as individual interest (individual rationality) goes before collective interest (collective rationality), either will denounce the other to be sure of having its sentence reduced. The culprit will see its sentence shortened because it does not confess to its offense, while the one who is innocent, fearing being denounced and unjustly serving a sentence, thinks of minimizing it by denouncing its accomplice. And even if they could have consulted, they would have

made the choice of betraying each other. And yet, if they had chosen to be silent, the sentence for each would have been shorter.

"The prisoner's dilemma" illustrates the conflict between individual interest and collective interest and is found in many economic (auctions, business competition,), political situations (voting, strategy ...), transmitting secured data in computer system, etc...

Game theory can explain behaviors, anticipate them or resolve situations. And assuming that each behavior is rational, repeating a situation (game) can lead to finding a balance situation and optimizing the "earnings". Ideally, individual rationalities lead to rational collective behaviors. It is foresight!

### 3.2.2- Game Theory and reflective modeling

Game theory provides a work prospect: reflective modelling enabling analyzing situations in which interactions among actors are crucial. Such reflective modelling aims to act further upstream on the mental representation by which decision-makers structure their schematic view of reality. Such mental representation refers to the preconceptions of decision makers and their past experiences. Such elements are often decisive in decision making. Reflective modelling extracts from realities stylized facts from which other stylized facts are deduced by applying simple models of game theory, and which will be submitted to the judgment of decision makers. Such process allows supporting decision-makers in their thinking by providing them with particular light on the situation.

Reflective modelling thus opens a space for game theory to describe and analyze real situations. Such concept provides both an objective and a working methodology - an objective in that such modelling type is not intended to replace decision makers or to provide a ready to use solution, but to help clarify their strategic choices. It is less to determine the existence of solutions than to clarify the nature of the difficulties to achieve them : coordination issues, conflicts of interest, reputation effect, ... (Figure 1). [2]



Figure 1 – Schematic diagram of reflective modeling

Such approach is intended only to describe the nature of strategic interactions of stakeholders in order to logically draw the implications and consequences thereof.

### 3.2.3- Reflective modeling and analyzing territories

In reflective modelling, interacting stakeholders are involved in developing the model in order to improve their understanding of the situation, issues and possible solutions. In the case of the reflective approach, the obtained results can be used to question the decision makers' thought patterns so that, under a dialogue with the modeler, they can question and / or criticize the model and assumptions - which will enables refining their mental representation. Moreover, it is possible to associate stakeholders to involve them in the game described in the model. The originality of such method lies in the joint construction work of an urban project from confronting stakeholders based

on evaluating different probable scenarios of cases studied. In this prospect, reflective modeling allows understanding real complex situations with many uncertainties.

Reflective modeling renews the traditional posture of expertise. It helps strengthen its judgment on the situation analyzed. Then the reflective process must meet two requirements in addition to the one already mentioned on the involvement of decision makers, which involves consistency and intelligibility. The former consists in to drawing all logical consequences of the stakeholders' choice and the latter in making the results understandable to decision makers.

**3.3- The Method of modelling the urban game theory**

3.3.1- Mapping interactions among stakeholders

The figure below shows the main elements formalized on the interrelations among stakeholders in the context of an urban project. The following performance is optimized. The figure shows optimization and simplicity of the representation of the key factors. Thus, we come up with the following logic (Figure 2) [8]:



Figure 2 – Scheme of interactions among stakeholders

3.3.2- What each stakeholder earns

- *What local governments earn*  
It seeks the best value for money of its property.
- *What promoters earn*

It is assumed that the economic agent is willing to maximize profit. Owing to the forced aspect of construction costs (standards, market price), promoters have the lever of purchase price of land and the lever of the selling price to investors and households. Their strategy will therefore consist in negotiating the lowest possible prices with the community and in seeking the maximum price acceptable to the market possibly through tax exemption devices [4].

- *What investors expect to earn*

At the time of their decision, investors pay a real price turnkey with a rent payment promise. Their risk focuses on the ability of its future tenants to pay the full rents. Their uncertainty relates to the long term with potential capital gain from purchased premises. Will the project of the municipality be attractive enough for them to guarantee that their fixed assets will become liquid again? [4]

- *What households expect to earn*

The expectations vis-à-vis the Local Community consist in having a wide range of services –free of charge or by paying -. Schools, transports, leisure and activities provisions, closeness to shops can be mentioned [4].

Indeed, the acceptable price level of service provision depends on local income, employment levels and overall macroeconomic factors (credit rate, bank loans, acceptable term, former price levels, )

- *What operators expect to earn*

Operators are economic agents who will come and integrate the project. They are merchants, service providers, artisans ... They take premises on lease and must have be present at their establishment. Hosting households nearby is a crucial factor in the development of their business. Their expected gain upon signing the lease will depend on the volume of customers that they can attract, on the level of achievable margin on their products and services, and on the market share that they can secure from their competitors [4].

Finally, the charged rent level must be consistent with the potential profitability of the activity on the relevant premises. It appears as a result of a choice that is rather rational. It can therefore be integrated into the matrix of gains.

**3- FINDINGS**

Building the earnings MATRIX

A basis for an earning matrix is defined in the spirit of game theory. This element is essential in our modeling.

The earning matrix (Table 1) is built from the earnings of each stakeholder. The matrix (table) below shows the expectations in maximizing earnings of each stakeholder in a column compared to other stakeholders online [5].

Table 1 – The matrix of Gain

	CL	developer	investor	household	operator
CL	xxx	Low land price	Long term security environment	Free of charge and paying	Free of charge and paying

				service provision	service provision
developer	High land price	xxx	Maximum return expectations, long term capital gain	Long term capital gain	
investor	Tax and dutypayment	Max turnkeys	xxx	lowestrents	lowestrents
household	Tax and dutypayment	Max turnkeys	Rent collection	xxx	All purchases
operator	Tax and dutypayment		Rent collection		xxx

#### 4- DISCUSSION

We must think in terms of asset management (housing stock, infrastructure networks and equipment), to move up, at variable speeds according to the heritage element and depending on the location, at the request of the concerned ... not systematically aiming at a standardized production.

- The limit of modeling: illegal parking, illegal vendors... which constitute spontaneous disturbance on the pathways and cannot be considered in this modeling.
- This study constitutes an introduction to research. It can and must be deepened in order to approach, as much as possible, the reality and to become a very effective tool in decision making

#### 5- CONCLUSION

The behavior of Antananarivo city urban stakeholders is quite difficult to study and to model. The bottom line, at any level, is the conflict of interest and the search for maximum profit.

The individual choice by each stakeholder, which is considered ideal and rational for each of the "stakeholders», is to achieve its goals while respecting the completely irrational collective choice since laws and other regulations do not optimize their "gain".

This raises the following question: "What is the limit of this matrix based modelling in relation to behavior reality and characters of each stakeholder?"

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