IMPLEMENTATION IN PUBLIC ADMINISTRATION OF MEXICO GOVERNMENT USING GAMES THEORY AND SOLVING WITH LINEAR PROGRAMMING

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ABSTRACT
This paper shows how to implement as a negotiating with trade unions called STASPE (workers employed by the executive branch) in Mexico Government within the public administration can be performed using a methodology called game theory and being solved with linear programming through the implementation with structured algorithms like Gams, (General Algebraic Modelling System) software. A creative, ingenious and practical way and modeling tool is achieved with a polynomial time response lavish. This implementation can be used by governments, any enterprises businesses as well as partnerships to strengthen their strategic decisions. The use of science as a way to solve conflicts should be a path to the professionalization and competitiveness inside public institutions in Mexico and another countries.

KEY WORDS: Optimization, Games Theory, Union, Strategies, Matrix, Values, STASPE

I. INTRODUCTION

Game Theory was created by Von Neumann and Morgenstern in 1944 had anticipated some ideas. Economists such as Cournot and Edgeworth were particularly innovative in the nineteenth century. Other scholars and scholars also made important contributions among which we mention the Zermelo Borel and mathematicians.

• In the early fifties, a number of very famous mathematicians John Nash items broke two barriers that Von Neumann and Morgenstern were self-imposed.

• Game Theory currently has many applications, among disciplines are: Psychology focused on gender , Economics, Political Science , Biology and Philosophy and is a very fertile field of public administration where the use of this methodology allows for extremely competitive advantages in optimizing resources and broad vision to achieve compliance goals and objectives.

Each year public institutions must review salary increases as well as the benefits to be granted to employees, have been periodically conducted through agreements between leaders without considering science as a way of finding the best solution for both sides, is here where arises the intention to use an unusual methodology as a way of solution to labor disputes between public institutions and public service workers.

Remembering, how Game theory is an approach to understanding human behavior that conceives of decision-makers as players in games. Most situations we face don't come with a book of rules like the ones for parlor games or sporting events. But a game theorist tries to design rules that capture the constraints faced by decision-makers and asks ¿"What actions would be chosen by players facing these rules?" If the predicted actions are similar to the behavior of real-life decision-makers, then the model helps us "understand" that behavior.

By other hand it is important to start the use of scientific tools like game theory represented across the linear model that allows the search for competitiveness in public institutions in Mexico. Traditionally

the public institutions have not been a goal. Additionally the search for clarity in negotiations will give transparency and many conflicts which generally results in the strike of employees in the public sector. Original and unusual idea is shown in the form of quality management and looking for solution within the framework of optimization area. The originality could be a pioneer in kind of implementation tools not only in Mexico and in Latin America too.

II.   OBJECTIVE

The main purpose of make implementation game theory inside public Institutions is to establish a guideline to professionalization and transparency inside rational processes in strategic situations which are simulated reality games events called processes, which involve rational people looking for improvement labor rights generating competition beyond the own common sense.

The Strategies; A simulation in public institutions through game theory which uses strategies can be defined as a specific set of rules that is what a players can do in all possible circumstances. The game is played denominated shares that are subject to rules to achieve the goal, in particular solve conflicts between workers and Directors and Managements.

In our problem the main assumption is that all the players (Employers and Public Institutions Directors) who participate try to use rational attitude and always following the conservatism criterion to maximize profits or minimize losses.

The payoff matrix represents the amounts that a player can win or lose based on their opinion, represented in a quantitative manner that will measure performance.

Game theory is linked to the linear programming and in the case of two

Person zero-sum can be raised as a linear programming problem. In these games a player attempts to maximize payment while trying to minimize is paying his opponent, in the zero-sum game in two player J1 is the row player and J2 is the column player. The complete solution of a set of strategies includes:

a) The value of play
b) The optimal strategies for each player

III.   LITERATURE REVIEW

Game Theory Evolutionary

Revising the state of art we found the theory of evolutionary games continues to grow. Many pure game theorists believe that this is not true theory of games, since the actors are actually pre-programmed mechanisms. However, in a sense, these mechanisms can be considered reasonable models with limited rationality agents. Also there are good possibilities to examine the experimental evidence for the predictions of evolutionary game theory: basic biology and the study of animal behavior offer considerable ground for large-scale simulations where the masses of agents are still relatively simple behavioral rules to avoid conflicts. The aim is to understand the problems instead of worrying about the status of methodological procedure. The game theory evolutionary could be a complementary part in a process of rational strategic analysis between humans that seek to solve problems of thousands of people, an analysis of the way he is thinking and acting can be transformed into processes that provide quantitative values to fill the matrix negotiations

Cyber

Theoretical work of Rubinstein (1986, Neymann and Okada (2001) are important. You need to keep experimenting with artificial players in zero sum games (but also in those with non-zero sum), since this work shows us important insights and comparisons between humans and machines.

The work of Arthur AA.VV. (1997) in which simulates individuals choosing among a collection of heuristic rules to the extent they are learning market, offers an approach to the problem of how a body learns to choose expectations and prices in the stock market . This is indicative of new directions that the purists would not consider game theory, but pointing to the heart of the problem: competition and cooperation, only from a different perspective.

The study of game theory has given us a powerful language that has helped us to examine some of the problems faced by conscious optimizing agents in competitive situations how is to avoid workers on strike. The success of these applications has shown its limits. Analytical and computational

requirements, we will show the way to solve these problems. The paradoxes that appear between individual rationality and social rationality and indicate the difficulty of pointing the right solution for a set of n people. The growing evidence of how individuals behave in experimental games and interest to understand the competition and cooperation between cells, insects, plants and other living organisms indicates the direction of future development of game theory.

It is very important to mention that we did not find evidence in the literature of Latin America about implementation using game theory inside public institution as a way to take decisions with transparency to professionalization, where it has used how scientific tool or an alternative to solve a labor problem, where both parties come to the solution of conflicts with rational strategies implemented to the mathematical programming as a way of modeling and solution in polynomial time. This is one of the reasons why it is showing as a useful and practical way in making intelligent decisions in public administration and we can think that it could be applied to private institutions.

IV. METHODOLOGY

Linear programming is an important field of optimization for several reasons; many practical problems in operations research can be stated as linear programming problems. Some special cases of linear models, such as games theory were considered in the development of mathematics important enough by themselves to generate much research on specialized algorithms for their solution. A series of algorithms designed to solve other optimization problems are special cases of the broader technique of linear programming. Historically, ideas from linear programming have inspired many of the central concepts of optimization theory, like games theory implementation and of course duality, decomposition, and the importance of convexity and its generalizations.

In our research paper we have formulated the hypothesis that a scientific tool as it is game theory in linear programming can help resolve disputes regarding to professionalization using contending opinions and translating them into percentages possibility to use a particular strategy, providing different options to get the best results according to their interests. In order to show solutions using scientific tools like game theory which conveys the results of the negotiations?

In our research paper we had to identify alternatives to establish the matrix of negotiation, four levels and chose one that would represent the logical point, the legal, the optimistic point and the technical point as a set of strategic perceptions.

The values within the matrix of negotiation were obtained through averaging the weights of opinion of the participants on both sides as a function of their knowledge, experience and interests. The tool shown is timeless because it will be possible to use it in each annual period authority and workers gather to update salaries and benefits for employees of the public institution.

Table I: The game model using linear programming for the player J1 is

$$Max, z = v$$

$$Subject, to$$

$$\sum_{i=1}^{n} a_{i1} X_i >= v$$

$$\sum_{i=1}^{n} a_{i2} X_i >= v$$

$$.....$$

$$\sum_{i=1}^{n} a_{in} X_i >= v$$

$$\sum_{i=1}^{n} X_i = 1$$

$$X_i >= 0, \forall, i = 1, 2, n$$

$$v, unrestricted$$

Table II. The game model using Linear Programming for the player J2 is:

$Max, z = w$

$Subject, to$

$$\sum_{j=1}^{n} a_{1j} y_j <= w$$

$$\sum_{j=1}^{n} a_{2j} y_j <= w$$

.....

$$\sum_{j=1}^{n} a_{nj} y_j <= w$$

$$\sum_{j=1}^{n} y_j = 1$$

$y_j >= 0, \forall, j = 1, 2, n$

$w, unrestricted$

The information matrix has increased the level expected for each of the views between the Union (and the approval body STASPE Union State through the Ministry of Administration) performance. This is implemented in the program merits.

The increase in performance assessment percentages expected back to training received by public Servants and public servers on the premises of the Executive Service shown in the following table:

Table III.

STASPE union opinion / Government Opinion	Logical (b1)	Legal (b2)	Optimistic (b3)	Technical (b4)
Logical (a1)	30	40	50	25
Legal (a2)	20	30	45	20
Optimistic (a3)	25	28	55	40
Technical (a4)	20	15	32	18

It generates the following Question: Which alternative should the Union consider? And which alternative should the government consider? Using the methodology of game theory. The Optimal Expected Performance Service personnel executive. That you can see how is not possible Reaching Breakeven.

$v_1 = 0.25 <= v <= v_2 = 0.30$

So you need to implement randomized strategies
Now we pose the linear programming problem associated to the game

Table IV.

$Consider$:

$x_i = probability, choo \sin g, a_i$

$y_j = probability, choo \sin g, b_j$

$ForUnion, STASPE$

$Minimize, w$

$subjec, to$

$0.3y_1 + 0.40y_2 + 0.50y_3 + 0.25y_4 <= w$

$0.2y_1 + 0.3y_2 + 0.45y_3 + 0.20y_4 <= w$

$0.25y_1 + 0.28y_2 + 0.55y_3 + 0.40y_4 <= w$

$0.20y_1 + 0.15y_2 + 0.32y_3 + 0.18y_4 <= w$

$y_1 + y_2 + y_3 + y_4 = 1$

$y_j >= 0, \forall, j = 1,2...n$

$w, unrestricted$

$for, Government:$

$Maximize, v$

$subject, to$

$0.30x_1 + 0.20x_2 + 0.25x_3 + 0.20x_4 >= v$

$0.40x_1 + 0.30x_2 + +0.28x_3 + 0.15x_4 >= v$

$0.50x_1 + 0.45x_2 + 0.55x_3 + 0.32x_4 >= v$

$0.25x_1 + 0.20x_2 + 0.40x_3 + 0.18x_4 >= v$

$x_1 + x_2 + x_3 + x_4 = 1$

$x_i >= 0, \forall, i = 1,2...m$

$v, unrestricted$

Table V. Code for the linear Programming Model using software GAMS

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*Implementation of games theory using linear programming in Publica Administration Mexican
Government
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*October 2014
j / 1*4/
i / 1*5/ ;
Parameters
b(i) / 1     0
      2     0
      3     0
      4     0
      5    1/;
Parameters
c(j) / 1   0
      2   0
      3   0
      4   0/;
free variables
z, w
positive variables
y(j)
table A(i, j)
          1      2     3     4
     1   0.3    0.4   0.5   0.25
```

2	0.2	0.3	0.45	0.2
3	0.25	0.28	0.55	0.4
4	0.20	0.15	0.32	0.18
5	1	1	1	1

Equations

fo   Objective Function

Rest1(i) constraint one

Rest2   constraint two;

fo .. z =e= w;

Rest1(i) .. sum (j, A(i, j)*y(j))-w=L= b(i);

Rest2 .. sum(j,y(j))=E=1;

OPTION OPTCR=0.00001;

Model ejerc /all/;

Solve ejerc using LP minimizing z;

Table VI. Experimental Results using Gams Software

GENERATION TIME   =   0.010 SECONDS
S O L V E   S U M M A R Y
TYPE   LP   DIRECTION MINIMIZE
SOLVER   CPLEX   FROM LINE 53
MODEL   ejerc   OBJECTIVE z
**** SOLVER STATUS   1 NORMAL COMPLETION
**** MODEL STATUS   1 OPTIMAL
**** OBJECTIVE VALUE   0.2875
Optimal solution found.
Objective: 0.287500

	LOWER	LEVEL	UPPER	MARGINAL
1	.	0.750	+**INF**	.
2	.	.	+**INF**	**0.083**
3	.	.	+**INF**	**0.225**
4	.	0.250	+**INF**	.

V.   CONCLUSIONS

- The expected increase in the performance evaluation of public servants and public
For the state approval body options are: (0.75, 0, 0, 0.25)
- Therefore we can conclude that both the Union and the State should choose the alternative 1.1 (Opinion Logical, Opinion Logical)
- To achieve optimal enhancement of 28.75% on the expected work performance
- Public Service Employers have an 28.75%

For the STASPE Union the options are: (0.75, 0, 0.25, 0)

- We can see how was possible to find a solution to both participants using scientific tool called games theory as an alternative to promote professionalization and transparency in management decisions.
- Limiting the use of the tool will be transparency and the attitudes of participants have as a way to bring clarity and transparency to the administrative process of setting annual work benefits.
- The hypothesis mentioned in the methodology could be accepted because the results get obtained for each strategy of participants to be satisfied allowed in terms of their chances and aware that the best option is free of corruption and get obtained from a clear and transparent

way and the process will be fair and equitable that could be updated each period using a scientific tool linked to linear programming using theory of games.

- The paper presents an original programming code to find the value of the game and the chances for each partner strategy of contestants, the code it is efficient and practical and could be working on a large scale model.

I. Suggestions and Recommendations.

1. The use of game theory using linear programming is a simple and practical tool for implementation as well as economical in public administration.
2. The use of science in organizations reduces uncertainty in strategic decision making
3. The extended model allows large-scale optimization in real-time solutions.
4. Science is a way to professionalize institutions
5. The amazing speed gams software and runtimes are amazing just 0.010 seconds

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