CONSTRUCTION OF SCENARIOS IN MODELS OF FINANCIAL ADMINISTRATION.

APPLICATION OF DECISIONS THEORY IN CRISIS SITUATIONS: THE CASE OF MISIONES

WATER SERVICES S. A.

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SUMMARY

The crisis situation faced by public services in the post-convertibility era, gave way to the opportunity to apply some Decision Science tools to the renegotiation of the committed obligations with the main involved actors. -

At first a training course, was held, which was of vital importance, due to the knowledge and clarity of achieved ideas, referred to the existing problems. -
It was of exceptional help to the top management, as to the crisis in which they were in.

After discussing facts, alternatives and actions to be carried out, in the enterprise, it was decided to do a mathematical model, which backed by tools such as Decision Trees, Montecarlo Simulation and Multivariate Statistics would render very important information, which would help

the negotiations being carried out. -

This paper tries to explain the most important steps accomplished, preserving the enterprise's confidentiality, the same the software owner's property rights.

KEY WORDS

Decision Tree. Scenarios. Strategic Planning. Regression. Simulation. Time Series. Multivariate Statistics

INTRODUCTION

This work tries to summarize a consultancy experience of the Operative Research Chair at the UNaM (Misiones National University) Faculty of Economic Sciences.

As a result of the crisis suffered by the concessionaire of public services, after devaluation and abandoning the 2002 Argentine convertibility, obliged them to request technical assistance from the university, in search of solutions to the problem. -

The work began with teaching activities, delivering, in the company, courses on Corporate Finances, and later to begin the mathematical model of the financial situation of the company, finishing up with the construction of software presently in use, belonging to the company. -

Historical Summary

On 1st August 1999 and after the corresponding Contract Granting process, Samsa (Misiones Waterworks S. A. INC), took over the concession of public services of running water and sewage of the cities of Posadas and Garupá.

This enterprise was made up by; Urbaser S. A. (27%), Dycasa S. A. (18%), Urbaser Argentina S. A. (45%) and APOS employees (Province Administration of Sanitary Works) (10%), the company was awarded a 30 year period the integral exploitation of the aforementioned services. -

The Impact of the 2002 Argentine Crisis

The abandoning of convertibility, the strong devaluation, and the drop of the purchasing capacity of the wages, together with the deep recession which submerged the country in 2002, destroyed all the concession planning, drawn up by the awarded group. -

The main economy - financial problems which the company had to attack, all related to each other, were, (and in some cases still are):

1 . The fall of SAMSA's profitability.

2 . Refinancing of the first payment of the loan to the European Investment Bank.

3. Running water service, tariff adjustments.

4. Contribution to the Amplification of Pending Capital payment on behalf of the shareholders

5. Recovery of forwarded capital of the Participated Property Program, in the hands of the union.

6. Dycasa S. A. leaves the society and URBASER repurchases its stocks.

7. The transfer of Province taxes and rates to the tarif.

8. ComMisiones to be paid for World Bank loans.

9. The divergence in the agreed and committed investments and in the concession sheet, as with SAMSA's resources as with those of the World Bank and of the Province of Misiones.

10. The sewer service assignment rate.

11. The conservation and maintenance rate of meters

12. The contract renegotiation that has been outside the context after the domestic macroeconomic changes, especially the amplification of the concession contract for the years that are necessary to improve the shareholder's TIR (TIRE).

13. The assignment of the one and only tariff for users which do not possess measured service of only water and sewage water. -

14. Repayment of the debt contracted with the EIB.

15. The financing search for the realization of the investments that will be agreed on with the Province or those belonging to the service.

Article 2 of the previous listing could be divided into the following contents:

Amplification of the grace period (Non payment of capital amortization as specified in the present

day contract)

Achieve an attractive shareholder's rentability margin.

Increase the financing period of payment of capital, "binding it ", to the increase in tariff and possible amplification of the concession contract.

Decrease of the kind of interest applicable to the financing in the interest payments in the grace period and in the capital payments.

Eliminate or diminish bank administration commission.

Technical Help to the Company

In March 2003, the module called Strategic Business Master Decisions Theory was delivered, where the main lecturer on Operative Research acted as course coordinator.

SAMSA's managerial levels, took part, and showed interest in continuing the training in these tools, specially focusing on their company's problems.

After successive visits and encounters between class members and managers, analyzing necessities and interest topics, it was agreed to begin a training course, prior to all technical help, which had certain singularities that deserve to be highlighted.

1. The company would offer its files so as to elaborate the examples and work exercises during the delivery of the course. -

2. This course would be delivered in the company's Computer Center, so as to have enough computers connected to an intranet to help in the teaching. -

Managerial Training

 The course delivered in the company contained the following thematic nuclei where the following bibliography is used.

· Principles of Corporate Finance [Brealey, 2000] 6th Edition

· Financial Management - Revision of Basic Concepts [White, 1984]

· Accounting Finance [VanHorne, 1997]

· Statistics [Berenson, 2000]

· Investment [Sharpe, 1989]

· Fundamentals to Corporate Finance [Brealey, 2000]

· Introduction to Decision Analysis [Hair, 2000]

The Financial Model

During the course, the problems within the company, became clearer, as well as the necessity of constructing a mathematical model so as to try to find solutions to some of them. -

They had been framed within different action courses, some or several of which, the company doubtlessly would have to apply, when it was time for reengineering.

These action courses were (Chart 1):

Chart 1

Courses of Action
Renegotiation of the concession
Agreement with the creditors
Agreement with the partners
Agreement with the suppliers

Several advances had been achieved, on important points, such as, elaborating the multi-varied functions [Hair, 2000], [Berenson, 2000] which linked the main accounts, (personnel, energy, chemical inputs, administration and delay. etc.) with the central variables of billing, exploitation, number of attended connections, etc.), see Chart 2. -

The structures of costs had also been elaborated by cost centre and associated their values, to the significant variables, such as volume of processed water, working hours carried out, investments in the operative areas, etc.). -

Within this work, it was possible to elaborate an analysis on the inventory of fixing parts, valves, meters, pipes, etc. and to be able to analyze their purchase policy, needs, etc. -

With all the historical information the group of financial flows were elaborated, (Chart 3),

using carried out and not current liabilities concepts.

The answers to be obtained, in all were:

a- Expected Annual Funds (C.A.E.)

b- Expected Present Worth Method

Chart 2

Variable Dependent	Independent variables					
Personnel Expenses:	Production	Billing	Mora	Connections	Inventory	Complaints
Exploitation	X			X		X
Maintenance	X	X	X	X		
Commercial	X	X	X			
Distribution	X			X		X
Administration		X		X		X
Chemical Product Expenses	X			X		
Energy Expenses	X			X		

Mathematical Model

The construction of the mathematical model was agreed on among all the participants of the course, be they from the university as from the company. -

The fundamental principles that should be respected in the construction of the model were:

1. Information coming from the company should be used, be it from its files, as from consultation to the managers. -

2. The obtaintion of the probability distributions that would be necessary, should be obtained from the historical data achieved through multi varied analysis or time series [Leiva, 1997], or eventually by consulting the management.

3. The confidentiality of the information, contributed by the company, would be respected.

4. It should be the sufficiently robust, flexible and simple so as to be useful, in the contingency and

in the future, to the management.

5. A hierarchical classification of the action courses should be achieved, previously identified in the course, and ordered according to their impacts to the sensibility of the model.

The main answers that the model should contribute to were:

1. Exit variables: Annual Funds in the horizon of time that the concession will last. -

2. Probabilities of occurrence of the calculated values.

A strength that the flow should have was that, the horizon of time, should be a parameter to be fixed by the management, and possible to be easily amended by the decision makers. -

A simplified outline of the stages carried out, in the construction of the model is the following:

1. Obtaining the mathematical functions that adjust the historical data, using regressions (chart 1).

2. Obtaining discreet values coming from the regression functions obtained previously. Initially they were entered, as values of independent variables, those coming from the probability distributions obtained from data of historical files. - Once the probability functions of distribution of the dependent variables were obtained, these were used to generate values grouped in discreet ranges. -

3. Construction of scenarios, all those which are necessary, so as to exhaustively analyze the contingency faced by the company (see chart 3). -

4. Construction of the generator of financial flow. Starting from this, all the flows were generated, that conformed the elaborated model. This allows to define horizons of different times, to assign in random or sequential form the vectors of revenues or expenditures of funds, their position, evolution function, distribution of probabilities, etc. -

5. Simulation of generated flow [Evans, 1998], obtaining values of boxand their distribution of occurrence probabilities. -

6. Use of the results obtained in the flow simulations, to upgrade the decisions tree.

Scenarios Elaboration

As a final work at the closing of the course, a financial flow calculation sheet, was made, (see Chart 2, column 2) where the future projection was influenced by the common scenarios (Chart 1), and that scenario analyzed, (Chart 2, column 3), where in some cases the parameter was amended according to the student's criteria.

The economic evaluation of the investment projects demanded in the concession sheet, and subject to revision, were analyzed using the theory of real options [Copeland, 2001]. -

The financial flows built, were simulated using the Montecarlo simulation, and using the well-known Crystal Ball software, where the Prediction cells, were the positions of boxes for next years (the flow horizons were variable, depending on the concession contract supposedly to be agreed on). -

Chart 3

Alternatives (Strategies)		
Financial Flows	**Characteristic**	**Particular Scenario**
1	To achieve a Concession Amplification	Increases in 5, 10 and 15 years
2	To achieve a Tariff Increase	Increases between 5% and 30%
3	To achieve a services Chronogram Change	Reorder the stages
4	To enlarge the grace period	Student's decision, between 1 to 5 years
5	To increase the terms of financing of the payment of capital.	Student's decision, between 1 to 10 years
6	To diminish the type of interest, applicable to the financing.	Student's decision, between 0,5% and 7,5 annual I% Net Annual Interest Rate
7	To reduce bank administration commissions.	Student's decision, between 0,2% and 1,5 annual % Net Annual Interest Rate.
8	To accept profitability decrease	To Diminish profitability agreed on between 15% and 30%

9	To defer disbursement of dividends	To Defer between 1 to 3 years
10	To increase capital invested.	Increases between 1,000,000 U$S and 4,000,000 U$S
11	To renegotiate short term debts	To Capitalize the interests owed to suppliers and to begin the payment in 2005 in quarterly quotas during 2 years

The Decisions Tree

The course participants were delighted in elaborating a decisions tree, as a practical work, and began to analyze its application in modeling the situation of the company. -

A soft was elaborated to solve decision tree, using the complement of calculation sheet, Tree Plan that allows to modify it and to adapt it to other programs supported in Visual Basic Application.

It allows each participant to enter the group of estimated probabilities for each strategy and then as payoff value to use the Flow Net Present Value, achieved with this strategy [Baird, 1997] (Chart 3). In the event of failure the Net Process Worth , flow was used., in the up-to-date conditions to the moment of the run processes. -

So as to design the soft, several practical works were carried out, within the course that facilitated the programming tasks, as training for its the future use.

One of the practical works carried out, was the one of identifying the central objective of the financial reengineering of the company, summed up in a box for a position for a horizon of time and subject to an index of dry liquidity (Current Asset – Goods Inventory) / Current Liabilities for the first five years of the flow. -

Lastly, the feasible strategies were elaborated to develop for each course of action, allowing each participant freedom to estimate the occurrence probabilities, according to their experiences, and inclusive the probabilities of failure in the process.

The course was made up of 10 participants, general manager, operation managers, administration, systems, legal, maintenance, besides four engineering professionals that occupied lower hierarchy posts.

The Built software

The software allows the upgrade of the data and parameters of the exploitation of the concession, and elaboration of the funds flow for its later simulation.

The main window of the software allows the modification of:

Concession Contract Goals (percentage of service in operation for user's type and year).

Evolution of M3 Connections (estimate of the average measured water sold in the concession horizon of time, according to user's type).

Consumption Structure: evolution of the demand, according to user's type

Connections Structure: evolution of the quantity of users per type

Tariff Chart: Tariff Estimate per type and period

External Data: it contains economic and financial parameters corresponding to the bank loans, investments, association rights, obligation of the concessions, etc.

The goals of the concession contract correspond to the two services concessions, water and sewage.

The software calculates, up to a 25 year-old horizon, the financial evolution measured in the positions of the boxes. -

CONCLUSIONS

The first results that the management obtained were:

The company was able to substantially improve its financial situation in the short term, if it reached an agreement with the creditors, where it obtained better results, negotiating financing terms than in achieving a grace period. -

The situation in the long term was reverted favorably, if the company was able to increase the concession period.

Also this last result, was able to improve the negotiation with the creditors, obtaining extension of terms and reduction of interests. -

These conclusions have been used in the negotiations begun by the company in 2003, and

continue up to the present, with the government of the Province of Misiones, with creditor banks and the partners. -

Due to the secrecy of these negotiations, the importance of the realized developments are not known in detail, but according to some actors' comments, it is known that the company has based its strategies on some strategies evaluated by the built model.

The experience carried out, demonstrates that it is possible to use quantitative methods in companies, that possess files with reliable data. -

The application of a statistical group of tools - interrelated mathematics, so as to obtain the necessary information to model the crisis situation in a decision tree, allowed the management to negotiate with the diverse actors involved, in sure way, and estimating the corresponding risks.

The formation of a group of students that carried out the consultancy and the development of the soft was a very valuable experience for their professional formation. -

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