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What-If Simulation for a Brazilian Company Regarding Marketing Budget

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Abstract. The article research is a case study regarding how to design the marketing budget for a small Brazilian company that started the activity one year ago. Considering the data that we gather, we decided to use What-if simulation. The case study is a simplified model representation of a company, adjusted according to the data that is released as target for the following year. In practice, the formulation of a scenario allows the construction of a hypothetical world that the analyst can see and navigate.

Keywords: What-if, simulation, multidimensional, hypothetical, predict, business modelling, scenario, goal seek.

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1. Introduction

What-if analysis is a specific method, whose purpose is to define the behaviour of a complex system, such as a business simulation, totally or partially, under some assumptions, called scenarios, are given. Having the ability to assess the impact precedence of a strategic or tactical move, in order to elaborate better strategies to achieve their objectives, managers need systems that are projected and trustworthy.

The case study presented is a simplified model representation of a company, adjusted according to the data released as target for the following year. In practice, the formulation of a scenario allows the construction of a hypothetical world that the analyst can observe and navigate.

2. Literature Review

What-if analysis is centered on a simulation model, establishing a complex set of relationships between some business variables, corresponding to significant authorities in the field of trade (for example, costs, revenues, customers, services, etc.). A simulation model supports one or more sets, each describing one or more options to produce a forecast of interest to the user. The prediction takes the form of a multidimensional cube as presented in Fig. 1, which measures the dimensions and corresponding business variables, to be operated by the user interactively [www1].

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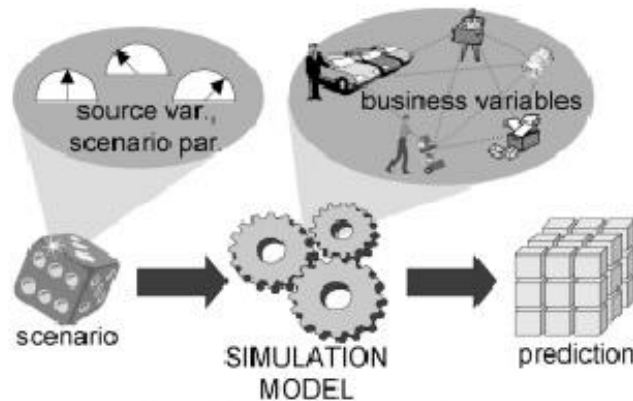


Fig. 1: Illustration of *What-if* analyses [www5]

A scenario is characterized by a sub-set of business variables, so-named *source variables* and a set of additional patterns, called *setting of standards* that predisposes member to run the model and obtain a forecast.

The changing patterns among business variables are important because they allow the user to understand which are the "variable values" that it can independently adjust and drive the simulation.

Each simulation can generate different scenarios, one for each assignment of source variables and standard settings.

Importantly, the *what-if* analysis, it should not be confused with a sensitivity analysis, which aims to assess how sensitive the system behaviour is, due to a small change in one or more parameters. In addition, there is an important difference between the *what-if* analysis and forecast simple, widely used, especially in the banking and insurance sector. In fact, while the forecast is usually performed by extrapolating trends out of stored history information systems, *what-if* analysis requires simulation of complex phenomena, whose effects cannot simply be determined as a past data projection. On the other hand, application of prediction techniques is often required during hypothetical analysis [Golfarelli, 2006].

Some authors report a useful classification of forecasting methods to judge, such as those based on opinions and role-playing and statistics, such as extrapolation methods, expert systems and rule-based forecast. The applicability of these methods to different domains is discussed, and an algorithm to select the best method depending on the specific characteristic of the problem in question. A special mention is for the system dynamics that has an approach to shape the behaviour of nonlinear systems, where the relations of cause and effect between abstract events are captured as dependencies between numeric variables. Generally, these dependencies can give rise to interaction retroactive cycles referred to, feedback loops.

From a mathematical point of view, differential equations systems are the right tool for modelling such systems. However, a solution cannot be found analytically or by numerically mode, such that some techniques are often used to predict the system behaviour. A model of a dynamic system consists in a set



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of variables related to each other, classified as stock and flow variables; flow variables represent the rate at which the accumulation level of the variable bank changes. By running simulations that model, the user can understand how the system will evolve in time, as a result of a hypothetical action; it can also be observed, each time, the values assumed by the model variables and (possibly) modify them. So it seems that the dynamics of the system can actually support *what-if* in applications where the current status of any part of the system can influence their own future status through a closed chain of dependency links [Lee, 2006].

Designing a *what-if* application requires a methodological framework; the one presented in [6] relies on seven stages:

1) Goal Analysis, which aims to determine which business events are to be simulated, and how they will be featured. The goals are expressed by:

- a) identify the set of business variables the user wants to monitor and its granularity;
- b) defining relevant scenarios in terms of the user source variables to be controlled.

2) The business modelling, building a simplified model of the application domain, in order to help the designer to understand the business phenomenon and give you some preliminary indications about which aspects can be overlooked or simplified for simulation.

3) Analysis of the source data, aimed to understand what information is available to conduct the simulation and how it is structured.

4) Multidimensional modelling, which defines the multidimensional diagram describing the prediction by taking into account the static part of the business model produced in step 2, and respecting the requirements expressed in stage 1.

5) Simulation modelling, whose goal is to define, based on the business model, the simulation model allowing the prediction to be built for each given scenario, from the available database.

6) Design and implementation of data, during which the multidimensional prediction and layout of the simulation model are implemented on the platform chosen, to create a prototype for testing.

7) Validation, aimed to evaluate, in conjunction with the users, how faithful simulation model is the actual business model and how reliable the forecast is. If the approximation introduced by the simulation model is considered to be unacceptable, steps 4-7 must be repeated to produce a new prototype.

3. Case Study of a Brazilian Company

Company A, based in Brazil, in 2015 had a profit of € 14,800 (Figure 2). For the following year they researched two types of market, the first open a branch in Portugal and the second continues to expand in Brazil.

The company (A) offer Java courses entitled the final diploma. The company have in Brazil about 20 classes with 20 students each class. The course lasts for 40h that is distributed twice weekly 4h. Each student pays a value of 200 € in order to enrol in the course. It has 2 teachers. In the figure 2 S is one of the



school teachers and D is another teacher. The teachers also play the part of school management, each of them having a small meeting room for a monthly salary of 1,200 €. They have a fixed cost of 75 € each 4h of renting the room. The company have some events as the final snack and banners placed around the room for advertising. This year the company spent no money on travel.

Company A in Brasil - data for the year 2015				
Students per Group	20	200 €		4 000 €
Groups per year	20			80 000 €
Employees				33 600 €
	S	1 200 €	14	16 800 €
	D	1 200 €	14	16 800 €
Publicity		5%		4 000 €
Fixed Cost				15 600 €
	Rent space	75 €	4h 4	300 €
Events Spendings				12 000 €
	Snack	400 €		8 000 €
	Banners			4 000 €
Travels				0 €
Marketing Budget				65 200 €
Profit				14 800 €

Fig. 2: Marketing Budget Company A (2015)

Using *What-if* simulations, we can replace the values that we find most appropriate for the new reality to create a scenario. In this case, we will replace values as advertising for 18.000€, as if we are entering a new market should come into force. Waited have a monetary increase the level of students, for the course in Portugal will cost 300 € which is the average in Portugal, but at the same time brings more expenses like space and spending events and trips will have a higher cost, they will travel across the country (Fig 3.).

Scenario Summary		
	Actual Values	Company A open in Portugal
Variables		
Groups per year	80 000 €	120 000 €
Employees	33 600 €	42 000 €
Publicity	4 000 €	18 000 €
Fixed Cost	15 600 €	20 800 €
Events Spendings	12 000 €	15 000 €
Travels	0 €	8 000 €
Marketing Budget	65 200 €	103 800 €
Result		
Profit	14 800 €	16 200 €



Fig. 3: Scenario for Company A open in Portugal

The other scenario that will be tested is the company extension in Brazil, increasing the number of teachers, for example. Increasing teachers means increasing class sizes and get more during the year, otherwise it has to be increased the spending on space because it had been leased more rooms in order to give the lessons (Fig 6.). Comparing the two scenarios it can be drawn the conclusions, and see what is more profitable for the company and let the manager choose the best option to take into account.

Fig. 4: Change Values

Fig 5 : Choose scenario 4

Scenario Summary			
	Actual Values	Company A open in Portugal	Company A expand in Brasil
Variables			
Groups per year	80 000 €	120 000 €	200 000 €
Employees	33 600 €	42 000 €	63 000 €
Publicity	4 000 €	18 000 €	16 000 €
Fixed Cost	15 600 €	20 800 €	39 000 €
Events Spendings	12 000 €	15 000 €	30 000 €
Travels	0 €	8 000 €	10 000 €
Marketing Budget	65 200 €	103 800 €	158 000 €
Células de resultado:			
Profit	14 800 €	16 200 €	42 000 €

Fig 6 : All possible scenarios

It can be concluded that the enterprise should expand in Brazil instead of opening a branch in Portugal, because it could get more profit through this choice. In both scenarios we can see that there are some negative variables as advertising increase, because if they come in Portugal is a new market and have come into force to achieve fill classes. They paid travel to travel between Brazil and Portugal and even in the



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interior of Brazil to open up more courses in more states. Fixed costs vary because in Portugal will be more expensive lease a room than in Brazil, on the other hand will lease more times the rooms in Brazil to be able to more classes.

4. Conclusion

In short, *what-if* analysis is proper to give fast simulations of values in various scenarios that can be chosen. The case study reveals that for the Company A is better to extend the activity on Brazil market, than on Portugal market. In all the results we get, we can see that it is better to extend the courses to more states in Brazil than open already in Portugal this kind of Java courses.

Although we have the negative variables also we get positive variables by increasing values in Portugal because they are more expensive courses and Brazil get extend the java courses in more states.

Either way would be to gain more profit than at present, but makes the company the first to explore the market Brazil with its course of Java.

5. Further Research

This company could also resort to Monte Carlo simulation. It is a more reliable application that brings more accurate results when talking about launching a new product on the market. Monte Carlo method (MMC) rely on massive random samples to obtain numerical results, this is, repeating successive simulations a high number of times to calculate heuristically probabilities as if in fact they are incurred actual results casino game [www5]. MMC it can be used for evaluation of riskiness of lunching new products on a new market, for the forecast of net income, predicting structural costs, acquisition costs, determining susceptibility to various risk factors.

The company has to take into account the expansion on online market.

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