WHAT IF (Sensitivity Analysis)

Iulian N. BUJOREANU
Associate Professor,Dr.
The Regional Department of Defense Resources Management
Brasov, Romania

Sensitivity analysis represents such a well known and deeply analyzed subject that anyone to enter the field feels like not being able to add anything new. Still, there are so many facets to be taken into consideration.The paper introduces the reader to the various ways sensitivity analysis is implemented and the reasons for which it has to be implemented in most analyses in the decision making processes. Risk analysis is of outmost importance in dealing with resource allocation and is presented at the beginning of the paper as the initial cause to implement sensitivity analysis. Different views and approaches are added during the discussion about sensitivity analysis so that the reader develops an as thoroughly as possible opinion on the use and UTILITY of the sensitivity analysis. Finally, a round-up conclusion brings us to the question of the possibility of generating the future and analyzing it before it unfolds so that, when it happens it brings less uncertainty.

Key words: sensitivity analysis, risk analysis, decision making process, scenario planning

"*Truth is o big mirror which fell from Heaven and broke in millions of pieces. Each of us has one piece and we think we know/have the absolute truth.*" - The Man that Contemplated His Soul (movie about dervish people and culture).

Risk Management consists of Risk Analysis, Risk Communication, Risk Monitoring and Evaluation. Risk Analysis is also the first stage in the Decision Making process, compulsory or not, according to the degree of importance one assumes to the decisions that are about to be made. Features: compulsory/not, formal/informal, thorough (detailed)/ general (quick, overview).

One can see decision making processes in most fields of activity and this is why one has to be aware of the many input elements to be taken into consideration.

Also, one can see decision making processes having almost the same steps and, most important, the decision making process is not one source of thought dependant only. It takes into consideration (or has to take) variables influenced by the psychological profile, expertise of the decision-maker.

Because of this great amount of factors one gets when trying to fit an optimum decision, there has to be a kind of framework to take all of them, or, coming to the subject, most of them (meaning the most important for that respective decision) into analysis.

There is a general acceptance of most scholars and scientists in the field that not all factors contributing to the decision making process have actually decisive influence on the final decision and, later on its results. This means that one can structure on fields, areas, directions of work most factors and see what that group influence would be on the final result of a decision being implemented.

There can be quantitative or qualitative assessment in this respect, but there can also be differential evaluation among factors inside the same group of analysis.

Usually, one would like the decision to be made so that it is viable for a wider range of factors, and the factors to have a wider variation that the values taken for the initial stage of the decision making process. In order to try to fit the decision to as many factors as one can find, and for as big of variation of the factors as one accepts as feasible while the decision making process is still in development, there is a compulsory stage in the process called sensitivity analysis.

The purpose of the sensitivity analysis is to directly assess the stability and strength of the decision to be made and its capability to stand in front of the future trials of various factors, taken into consideration at the moment of making the decision. When one says trials, one refers to the factors envisaged during the decision making process but with different values than those taken initially. This means that the decision is to prove stability for the process it has been made for when it can be maintained although the values of the factors are different than those used for initial calculations.

Sometimes, the deviation of the factors taken in consideration can go up to 10-20% difference than initially conceived for the respective element and the decision proves valuable and the process under scrutiny can go on without any change in its initial approach.

Besides the material aspects of this possible difficult to understand stage of the decision making process which is sensitivity analysis, one can see as being of high value the psychological aspects involved in the same process. These elements get a great variety and complexity as the number of people involved in the decision making process gets bigger. This means that, although most of the human factors participating into the decision making process can be in agreement about the list of factors influencing the output of the process under the respective decision, they might not be in agreement regarding the level of influence each of those factors in the list brings. Additionally, one can take in consideration the post-implementation stage of the decision when, also psychologically speaking, one can discover that, people attending the decision making process have actually changed their attitude towards the respective decision and try, by any means to

show it does not work in practice. In this respect, one can find a host of situations in the current practice of the organizations, in most fields of activity. Starting with lack of interest to implementing the decision as it was made, going through lack of activity necessary to implement it, and getting to work against it, as one can see up to the highest level in a social hierarchy, even in a country's leadership.

When one can take 10-20% variability for each factor influencing greatly a future decision and can still live with it without changing anything in its core, that is a good decision, close to optimum, one could say. But, there is a hidden aspect that one has to be aware of. The wider de variability of the factors, the more complex the decision is going to be, the more difficult the entire algorithm of actions to be taken to implement it, the more expensive and time consuming its analysis and finalization, the less additional value is to be added to the final product. What does this mean? There has to be a breakeven point where the analysis in depth has to stop and make the decision.

Most decisions are made under uncertainty. In addition, the decision making model itself will always be an approximation of the real problem and because of that brings uncertainty with respect to the quality of the optimal considered resulting solution.

It is important to remember that although all decisions can be viewed as being made under uncertainty, there are cases where uncertainty is unimportant for making decisions.

The usefulness of sensitivity analysis for understanding uncertainty is in robustness, uncertain data, and base case and scenario analysis.

There have been many types of approaches to sensitivity analysis along the development of science, and each science took advantage of it starting at a certain moment in time. Methodologies and principles have been set for this approach and models and modeling approaches have been tabled for system analysts, decision-makers, leaders in organizations, generally speaking, people who want to develop their organization activity based on an as close to the scientific truth and maximum efficiency as possible.

There is a very large and diverse literature on SA, including a number of reviews (e.g. Clemson et al., 1995; Eschenbach and Gimpel, 1990; Hamby, 1994; Lomas and Eppel, 1992; Rios Insua, 1990; Sobieszczanski-Sobieski, 1990; Tzafestas et al., 1988). However, the existing literature is limited in a number of respects. Most of what has been written about sensitivity analysis has taken a very narrow view of what it is and what it can be useful for. A large proportion of the literature is highly mathematical and rather theoretical in nature. Even those papers with a focus on applied methodology have tended to concentrate on systems and procedures which are relatively

time consuming and complex to implement. There has been almost no discussion of procedures and methodological issues for simple approaches to sensitivity analysis.

There is a big offer of applications to which sensitivity analysis is put. They are grouped into four main categories: decision making (developing recommendations for decision makers), communication, understanding or quantification of the system under analysis, and development of models to be used later in similar applications. All uses are important, but the primary focus is potentially on making decisions or recommendations.

Models are used to make easier the implementation of sensitivity analysis in several close types of approach areas of decision making (which need to be made based on similar circumstances).

In all models, parameters are uncertain, generally speaking. The analyst is unsure of the current values of the parameters and, possible is to be even more uncertain about their future values. This applies to things such as prices, costs, productivity, and technology. Uncertainty is one of the primary reasons why sensitivity analysis is helpful in making decisions, advice, recommendations, or councillorship. If parameters are uncertain, sensitivity analysis can give information about how stable the optimal solution is in the application of different values for parameters, under what conditions and circumstances the optimal decision is going to change, how that optimal decision changes in different conditions and circumstances (if it is better or worse), if the changed circumstances were ignored, they would affect the decision makers by how much compared with the initial variant if they stayed with the original optimized decision or some other strategy,

This amount of information one can get has great value in making decisions or recommending such movements. If the optimal decision is robust (meaning insensitive to changes in parameters up to a certain degree), this will let confidence play the main role in implementing or modeling it further. If it is not robust, sensitivity analysis can be used to indicate how important it is to make the changes to management suggested by the changing of the optimal alternative. Perhaps the base-case solution (the one where there is a minimum accepted for each of the parameters taken into consideration) is only slightly less than optimal in the range of parameters, so that it is reasonable to adopt in any situation. Even if the levels of variables in the optimal solution are changed dramatically by a higher or lower parameter value, one should examine the difference in profit (or another relevant objective) between these solutions and the base-case solution. If the objective is hardly affected by these changes in management and decisional strategy, the decision

maker may assume the smaller risk and decide on the small cost of not changing the strategy, for the purpose of simplicity only.

If the base-case solution is not accepted for more than a few details non-accepted in the profitability or effectiveness of the model, there might be another strategy which is not optimal in the original model (that is to be changed) but which performs well across the relevant range of circumstances. If there is no single strategy which results in acceptable values in all circumstances, sensitivity analysis will identify different other strategies for different parameter values and the circumstances (the sets of parameter values) in which the decisional strategy should be changed.

If there is certainty about the parameter values, it may be subject of knowledge that they will change in particular ways at different times or in different places. Similarly to the approach stated above, sensitivity analysis can be used to test whether a simple decision strategy is adequate or whether a complex conditional strategy is worth the effort.

Sensitivity analysis can be used to assess the "riskiness" of a strategy or scenario. By observing the range of objective function values for the two strategies in different circumstances, the extent of the difference in riskiness can be estimated and subjectively factored into the decision. It is also possible to explicitly represent the trade-off between risk and benefit within the model.

In the field of scenario implementation sensitivity analysis plays a very important role. The main part of the scenario generation is to make all possible assumptions, inferences and deductions that might be taken into calculation when deciding on different courses of action for the respective scenario.

Scenario planning, also called scenario thinking or scenario analysis is a strategic planning method that some organizations use to make flexible long-term plans.

The original method was that a group of analysts generated simulation games for policy makers. The games used to combine known facts about the elements that were going to be parts of the future, such as demographics, geography, military, political, industrial information, and mineral reserves, with plausible alternative social, technical, economic, environmental, educational, political and aesthetic trends of development which are key driving forces.

In organizational applications, the emphasis on gaming the behavior of opponents is increased (while in the business organizations the emphasis was shifting more toward a game against nature).

Scenario planning involves several aspects of Systems Thinking, specifically the acceptance that many factors may combine in complex ways to create sometime surprising futures (due to non-linear feedback loops).

The method allows the consideration of factors difficult to formalize, like new insights about the future, shifts and rifts in values, unexpected regulations or new technical evolvements that reduce to null the need for some other bigger, more expensive and less productive or effective equipments.

Systems thinking used in conjunction with scenario planning leads to acceptable scenario lines where the causal relationship between factors can be demonstrated. In the cases where scenario planning is congregated with a systems thinking approach for the purpose of scenario development, one refers to this sometimes as structural dynamics.

This paper is nothing but a small and hopefully interesting contribution to the colossal works developed by other scientists. It is to open the eyes of the people interested in getting as much as possible in the field of decision making and want to further their research in cases and situations much more complex or with many variables to keep in mind.

Sensitivity analysis is a process of creating new information about alternative strategies. It allows the analysts to improve the quality of their subjective beliefs about the merits of different strategies.

Under all circumstances presented above, there is a need to cover as much as possible of the unknown future developments of any decisional situation. This makes it so attractive to be put under analysis and so exciting to get findings that let us wonder how come one can get so many futures starting from a single point.

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