Can We Always Determine the Right Alternative in Business Problems?

By Evangelos Triantaphyllou

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What do the problems of purchasing a car, making a multi-billion dollar investment decision, and hiring a new job applicant have in common? Besides being very common in today's highly competitive business world, all these problems, and a plethora of other similar ones, seek to determine the best alternative among a set of competing alternatives. Furthermore, each alternative can be completely described in terms of a number of decision criteria. For instance, for the case of purchasing a car, the alternatives are the different cars of interest. As decision criteria one may wish to consider how important are key aspects of the cars (the alternatives) such as the price, fuel consumption, maintenance costs, and the aesthetic appeal of the cars.

For these reasons, the type of models that study this kind of problems is called multi-criteria decision-making, or MCDM in short. MCDM problems are as old as mankind and are more acute today in the complex business and technological worlds that we live in. A simple web search with the Google.com search engine on the key words “multi criteria decision making” returns more than 600,000 hits, thus indicating the high interest in this subject.

Solving a real-life MCDM problem requires to first defining the alternatives that one has to choose from and the decision criteria needed to evaluate the alternatives in terms of. It also requires gathering data that accurately describe the alternatives and the decision criteria. The next step is to process the data and determine the best alternative, or rank the alternatives when all the criteria are considered simultaneously. Finally, this decision making process may require a sensitivity analysis and repetition of some of the previous steps.

There are many software packages that can assist decision makers today in this elaborative process. MCDM software packages can be very user-friendly and provide excellent means for brainstorming and assisting the decision maker in his/her assessments and are used by many state and federal agencies and also in the private sector. They help make the decision-making process become a well-defined and structured one. Some of them also allow for the participation of multiple decision makers with different degrees of authority.

However, in some way, very little actual progress has been made on how to define and solve this critical category of problems. There are many reasons why this situation persists. For one, there is not a universally accepted way of how to express numerically qualitative assessments. For instance, in the previous illustrative example it may not be clear what is the “aesthetic value” of each car in terms of numbers. Another difficulty is with the way of defining a problem. It may not always be clear that all the pertinent alternatives and decision criteria have been identified for a given situation. MCDM often requires the simultaneous processing of both quantitative and qualitative data. Also, even the quantitative data may be expressed in different units of measurement (such as dollars, pounds, days) thus further complicating the solution process.
Various behavioral and psychological studies seem to suggest different ways for quantifying qualitative data. The use of various scales (which are instruments for translating verbal expressions into numbers) or the application of fuzzy logic methods, are almost guaranteed to result in different numerical data for describing the same problem situation. Even if all the input numerical data are identical, then it is also possible for different MCDM methods to yield totally different recommendations. This may happen when some decision alternatives are very close to each other and furthermore one alternative dominates another alternative in terms of some of the criteria while others dominate the same alternative in terms of other criteria. Although the mathematical steps involved with MCDM methods are rather simple, MCDM methods (and consequently the software packages that implement them) may generate dubious results when the above situation occurs.

The above issues are still controversial in the MCDM scientific community. Experts with behavioral, psychological, operations research, engineering, and business backgrounds actively debate different aspects of the decision-making process. Discussions deal with how humans perceive data and make decisions (descriptive methods) all the way to how they should perceive data and make the decisions (prescriptive methods).

To this day, there is no single MCDM method that is accepted universally or at least by a majority of experts. Deciding on which one is the best method can be viewed as an MCDM problem itself whose solution requires the use of the best MCDM method. Now the alternatives are the methods themselves. In this way a decision-making paradox may be reached thus further complicating the situation.

A plausible thought is that it may never be a single MCDM method that will be accepted by the majority of the experts in the field. When the alternatives of an MCDM decision problem are very apart from each other, then most of the existing MCDM methods start converging to the same recommendation. The reverse is true when the alternatives are close to each other and without a clear dominance pattern among them. Then different methods start proposing totally different recommendations. In a real-life problem one may have a more keen interest to know which one is the “best” alternative or ranking of the alternatives, when the alternatives cannot be easily ranked according to how well they meet all the criteria simultaneously. After all, that is exactly the situation when the power of an MCDM method is needed the most. In such critical situations, and some real-life problems seem to fall in this category, the various MCDM methods (and their computerized implementations) seem to start disagreeing with each other. Ironically, the closer the alternatives are, the more intense these disagreements may become.

There are many studies in the decision-making literature that clearly demonstrate that MCDM methods do fail to pass simple logic tests and such methods often exhibit ranking irregularities when they are presented with simulated test problems or even with many real-life MCDM problems. An example of a simple logic test is to have a problem in which alternative A is better than alternative B (i.e., A > B). Then if a new alternative C, which now is artificially made to be inferior to alternative B is introduced, and by assuming that no other data (such as the importance of the criteria weights) change, one should expect that alternative A is also better than alternatives C and B (since A > B, and B > C). However, some popular methods may now yield that alternative A is no longer the best alternative! This ranking irregularity may happen even under the favorable assumption that all the numerical data are known perfectly well. Interestingly enough, some very popular MCDM methods may not pass this and other similarly simple tests.
This observation by no means renders MCDM software packages useless. Many MCDM software packages are very valuable because they can make the decision making process to be a well-structured experience and thus increase the understanding of the various steps involved. In this way the final recommendation can be better documented and validated. Since such computerized tools may not always deliver the “correct” recommendation, they need to be treated as decision-support tools and not as an “oracle” whose recommendation has to be accepted without question.

The need to be able to select the best alternative among a set of competing alternatives, or rank all the alternatives in terms of how well they meet the decision criteria simultaneously, is not a mere intellectual exercise for the experts in the decision-making field. To be able to appropriately answer this frequently critical question may make the difference between failure and success for many companies in today's highly competitive world. Searching for the “best” multi-criteria decision-making method may very well be like searching for the Holy Grail of decision-making in today's complex business world.