Chapter 22
Intelligent Business Decision-Making in Global Organizations via Fuzzy Reasoning Systems

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ABSTRACT

Companies, organizations, governmental departments, and universities need to adopt globalization patterns for their generative survival in dynamic productive outputs. Such outputs are possible only after effective, rational, logical, and systematic treatment of all available input knowledge and information. These inputs mostly have imprecision, uncertainty, vagueness, incompleteness, and missing parts, which together provide a fuzzy arena where an expert is confronted with decision making under a set of conflicting and mutually inclusive vague alternatives. Any uncertain ingredient may be considered as a set of linguistic adjectives attached to the input and output variables so as to refine them into meaningful and less uncertain sub-sets. Logical propositions that combine each sub-set of any input variable to suitable sub-sets of other variables through logical ANDing connectives as precedents are related to a specific sub-set of output as consequent, which constitute fundamental logical rule. These are expert reflections towards management problem solving. The combination of such rules with logical ORing connectives presents linguistically the holistic decision structure of any management system. This chapter presents the essential steps required to achieve decision making under uncertainty for effective management via a fuzzy logic inference system. The basis of fuzzy logic modeling is presented which may be used by different business management experts.

INTRODUCTION

Most often in business, economy, engineering, social and other disciplines, uncertainty ingredients are driven off the thinking and reasoning scenes by taking final decisions as absolute truth (1) or false (0) without any middle possibility (approximately true or false). Such approaches are referred to as "black-box models" based on two-valued crisp logic, which is the basis of many scientific solutions through mathematical formulations and modeling. In social, economic, cultural, anthropologic, political and business management studies, crisp logic may not lead to

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desired goals through sound concepts. Today, it is clear that conceptualization and idealization leading to satisfactory mathematical structure of any physical actuality are often an unrealistic requirement. The following sayings are among the valuable information along this line.

So far as the law of mathematics refers to reality, they are not certain. And so far as they are certain, they do not refer to reality (Einstein, 1954).

All traditional logic habitually assumes that precise symbols are being employed. It is, therefore, not applicable to this terrestrial life but only to an imagined celestial existence (Bertrand Russell, 1948).

As the complexity of a system increases, our ability to make precise and yet significant statements about its behavior diminishes until a threshold is reached beyond which precision and significance (or relevance) become almost mutually exclusive characteristics (Zadeh, 1973).

Any firm with trans-boundary aspirations attempts to enter international markets either as an exporter or an importer, although some others may have mixture of the two in some uncertain (fuzzy) rate. Trans- or extra-boundary (overseas) exports can be achieved directly by sending the goods and products to host country or through a distributor (agent) in an indirect way. In this case, the firm should have its own database of research results and logistical policy towards host countries. Initially there are many sources of uncertainty in such transactions. However, in the case of indirect export alternatives, a firm sells to overseas using export houses or trading firms in which research activities are not much involved due to uncertain elements. Unfortunately, there is no common consensus about foreign market entry into global business, i.e., there are fuzzy (vague, dubious, incomplete, uncertain) ingredients in these affairs.

Social, economic, natural, political and many branches of engineering issues are full of linguistic and numerical uncertainties considered by decision makers through intelligent reasoning to develop a set of alternative solutions leading to a final optimum decision given the environmental, physical, cultural, social, and economic circumstances. It is possible to consider three types of uncertainty as past, present, and future. Past uncertainty is concerned with unknown, vague, incomplete and contradictive decisions or uncertainties that cannot be solved in exact manner. The present uncertainty embraces the future and current issues including health, social, economic, weather prediction, and similar issues. This is the type of uncertainty which ignites current reasoning and triggers it towards present problem solutions for daily or very short-term decisions. As for the future uncertainty, one search even for approximately possible solutions, and step by step the problematic situation is improved towards optimum solution with remaining uncertainty ingredients. Among various types of uncertainties essentially "fuzziness," "greyness," "randomness," "roughness" and "vagueness" are related to present and future uncertainty types.

Internationalization is a process in which global firms increase their levels of international involvement as they gather more information and gain more knowledge about the foreign markets (Johanson & Vahlne, 1990; Johanson & Vahlne, 1977, 2006; Johanson & Wiedersheim-Paul, 1975). This statement also indicates that the current knowledge is not adequate to reach complete solutions and the process has fuzzy involvements. In general, these uncertainties possess verbal forms (not numerical data); therefore, modeling procedures cannot be solved by probabilistic, statistical, stochastic, analytical or numerical methods. Subjective verbal knowledge can be digested objectively through a fuzzy system modeling where both input and output variables include vagueness (Mamdani, 1974). Many of the classical modeling approaches have been criticized (Fina & Rugman, 1996) for