Research on Platform of Testing Reference Point Effect under Managerial Decision-making Simulation Environment

Yang Jiang, Zhuchao Yu, Zhu Wang, Xueying Hong

Abstract—Reference point effects of top managers exerts an influence on managerial decision-making behaviors. We introduces the main idea of developing the decision behavior testing system designed for top manager in team task circumstance. According to the theory of the reference point effect, study of testing experiments in the reference point effect is carried out. Under managerial decision-making simulation environment, a platform is designed for testing reference point effect. The system uses the outcome of the value of the reference point to report the characteristics of the decision behavior of top managers.

Keywords—reference point effect, decision-making behavior, top manager, managerial decision-making simulation environment.

I. INTRODUCTION

WITH the development of society, human's life become more and more informational and networked. Faced with the massive information, to make a reasonable decision becomes an abnormal difficulty. What is more, as top managers, they face with the great pressure and risk. So it is more difficult for them to make a reasonable decision in rigorous team task circumstances. In a top management team, every member is different in knowledge structure, thinking mode, cognitive abilities, psychological factor, which all lead to the status that it is hard to make a unified decision. And then, the conflicting decision making phenomenon occurs. In different managerial decision-making scenarios, facing with different level of the pressure, the top manager's decision behaviors will be influenced by external factors, and then appear the diversified characteristics of decision-making. Therefore, the study of testing and evaluating decision makers' behavior becomes a important research focus in management field.

Since Expected Utility Theory was proposed by Von Neumann and Morgenstern, it is the basis of the modern decision-making theory [3]. This theory claims that the rational agent's behavior selection is totally rational in the uncertain decision-making scenario. According to maximizing the subjective expectation utility [4], the rational agent makes a decision.

In addition, Expected Utility Theory supposes that the decision maker's preference is constant [5]. But the Prospect Theory proposed by Kahneman and Tversky says, people will systematically perform differently with the rational decision standards, and raise various irrational phenomenon including framing effect, reference point effect, dominance violation and so on[1]. When decision is made by top manger in the practical process, reference point effect perform really important role. Generally, applying reference point effect can help to get a satisfied answer. In other words, it will bring bad influence to decision-making, if you make an improper selection of the reference point [6]. Therefore, under the frame of the prospect theory, the article analyses the possible existence of the reference point effect on top managers, then design a proper decision-making testing system to measure the characteristics of decision making of them, and try to use the outcome of the test to improve their methods of decision-making to realize the intent of improving the decision quality.

II. PROSPECT THEORY AND REFERENCE POINT EFFECT

A. Prospect Theory

Prospect Theory's proposes to replace the decision model of Expected Utility Theory with a more practical behavior hypothesis model [7]. Plenty of experimental studies on Prospect Theory discovered that decision maker's behavior is not rational all the time, their utility is not always a simple profit function, and they are not always averse the risk[12]. Behavior decision maker's utility can be reflected as a Value Function in S Curve style (See Fig 1). There is an inflection point WO at an intermediate point which is called reference point. The positive half axis in the transverse axis represents profit, while the negative one represents loss. In the range of the profit, the Value Function is generally concave, while in the range of loss, it is generally convex. What is more, in the range of loss, the slope of the curve is steeper than the one in the range of profit. That is, according to the Prospect Theory, in the situation of loss, the behavioral investors generally prefer risk, while in the situation of profit, they averse the risk. And the pain they suffered when they loss is more than the happiness they felt when they profit [7].

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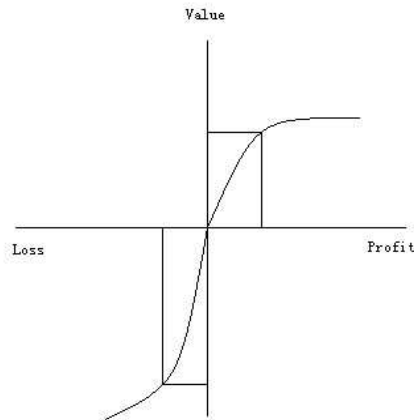
Fig. 1 Value function of prospect theory

B. Reference Point Effect

There are many behavior effects possibly exist in the decision behavior of the top management team, such as Reference Point Effect, Framing Effect, Fuzzy Evasion Effect, Certainty Effect, etc…

Generally, the most significant effect is Reference Point Effect. Because of the pervasive existing of the Reference Point Effect in decision-making scenarios, decision makers will form their own reference point, and evaluate the reference point as the basis for decision making. However, in different scenarios, the reference point of the decision maker will change. Furthermore, it will influence the believable degree of the decision results. Obviously, eliminating the reference point effect is impossible to most decision makers. If considering the reference point effect when they make a decision, it may decrease the bad effect of the reference point effect. According to the Prospect Theory, the total value V of the prospect of decision is determined by Decision Weighting Function $\pi()$ and Value Function $v()$. $\pi()$ is a decision weights which is relative to the prospect probability. $v()$ reflects the subjective value quantity which is relative to the reference point, and presume zero as the reference point generally. Furthermore, v actually measure income value or loss value which is deviated the reference point [8]. Therefore, we can get the location of the reference point of the decision maker by measuring v, and evaluate it as a basis for perfecting the decision model.

III. DECISION-MAKING SIMULATION ENVIRONMENT OF TESTING REFERENCE POINT EFFECT

In this study, for testing the characteristic of the decision-making behavior of the top manager, we develop a managerial decision-making simulation environment to simulate the real decision-making environment. It is an environment of management which is based on real managerial cases. It is a online managerial simulation system. In the simulation circumstance, several decision makers form a management team for operating a company.

Generally, every team includes 4-6 decision makers who attend this managerial simulation. As a top management team of a company, they develop serious management actions under the market environment simulation and compete with other companies [8]. During the competition, every team should improve their companies' competing performance and market position.

Obviously, the managerial decision-making simulation system can provide a perfect testing environment for testing various decision-making behavioral effects of the top managers.

Based on the above concepts and ideas, the managerial decision-making simulation environment is built. Fig. 2 shows the main components of the managerial decision-making simulation environment for testing Reference Point Effect.
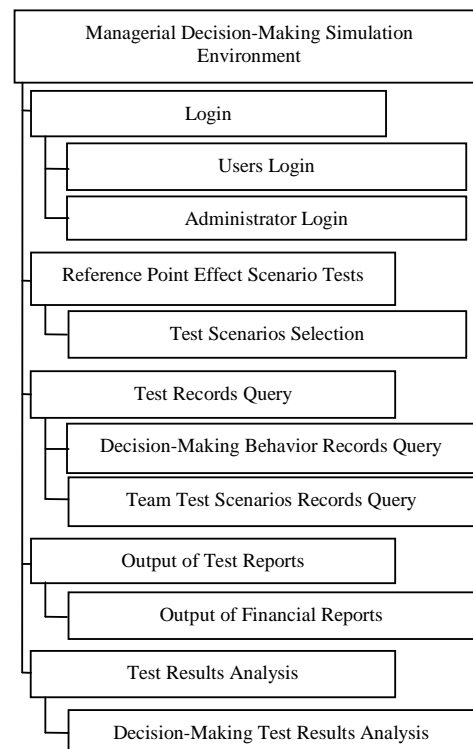

Fig. 2 Main Components of the Managerial Decision-Making Simulation Environment for Testing Reference Point Effect

IV. TEST SCHEME OF REFERENCE POINT EFFECT

A. Test Purpose

In testing procedure, we can get the variation of the reference point of the decision maker by testing the variation of the decision factors which they decide in difference situation. Therefore the influence of the Reference Point Effect on decision-making can be observed. That is to say, the decision-making simulation environment can test top management team's characteristics of decision-making in team tasks uncertain situation by controlling conditions.

B. Test Steps

There are several steps in the process of the test.

Step 1 is login;

Step 2 is making a choice of the scenario tests;

Step 3 is submitting the testing parameters;

Step 4 is outputting the test results;

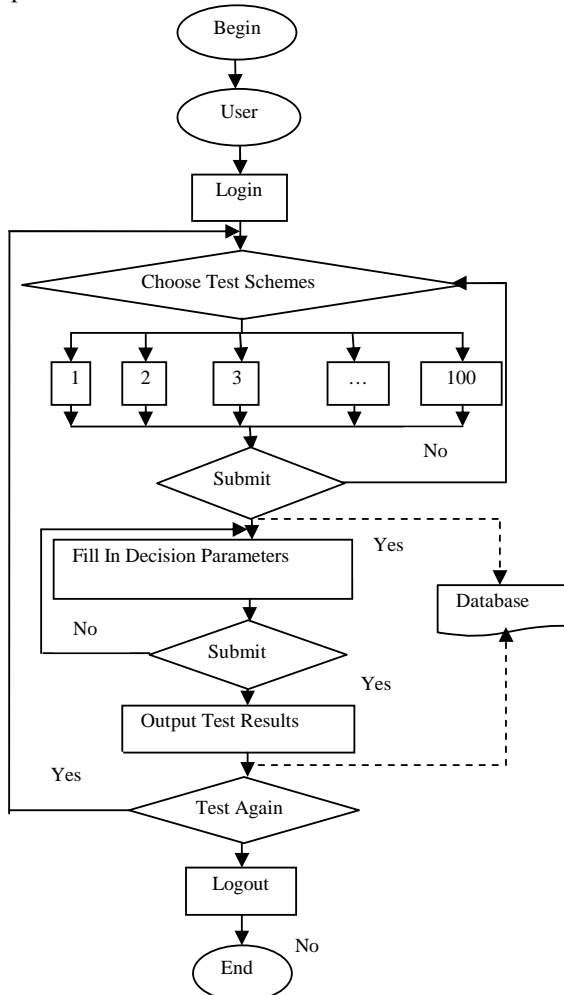Step 5 is backing to the second step for new test, otherwise, stop the test.

Fig. 3 Flowchart of the Test Steps

C. Test Method

The test team is made of one or several decision makers who participate the decision-making behavioral testing. Every team manages a virtual corporation in the decision-making simulation environment. Their enterprise's total capital is 1 million. For simplifying the analysis of Reference Point Effect, the value of R&D expense, marketing expense, capital investment, domestic production remain constant. The only variable is demand quantity which is differs in different time quantum. On this basis, test team makes a decision of selling price to compete with other corporations for getting more market share and enlarging profits. After the first step of decision-making, according to their enterprise management condition, decision-maker makes a second decision in the next step of decision-making.

Such as, Fig. 4 describes an experiment scheme for testing. In this experiment, test team makes the first decision of selling price. Hint from managerial decision-making environment says that there may be 50% possibility that this product's demand quantity is 200,000, there may be 50% possibility that this product's demand quantity is 300,000.

Test team can make a choice of selling price between $2000 and $3000. If the selling price is $2000, it means that every product's profit is less than the profit of selling price $3000. But the market share of selling price $2000 is more than the market share of selling price $3000. Test team should estimate the relationship between demand quantity and selling price. Decision maker should make a second decision in the next step of decision-making according to the profit or loss. In the second step of decision-making, test team make a decision about the selling price of the second time quantum according to the enterprise management condition after the first step. Test team should make a choice of selling price between $1000 and $4000.
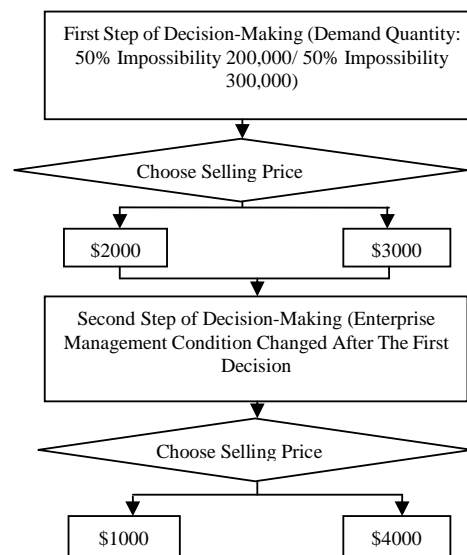

Fig. 4 Description of the Experiment Scheme

In the first step of decision-making, test team should make a choice of selling price between $2000 and $3000 according to the hint of the demand quantity. Hint from managerial decision-making environment says that there may be 50% possibility that this product's demand quantity is 200,000, there may be 50% possibility that this product's demand quantity is 300,000. After submitting selling price, managerial decision-making environment output the accounting report of the company managed by test team. In the second stage of decision-making, test team make a second decision according to the accounting report from the first stage of decision-making. Test team should make a choice of selling price between $1000 and $4000.

Test team should repeat this kind of experiments keep doing for unless than 10 times. Then, the system changes the demand quantity in different time by changing the time and demand

quantity function. Meanwhile, according to the beforehand parameters, the system controls the selling price of other companies to compete with the company of test team for market share so that it can get different profit results. Therefore, test team makes diversified decisions so that it can get test team's weighting function of decision-making, value function and decision propensity after reference point is changed. Furthermore, the tester can observe the deficiency of its decision-making.

V. ANALYSIS AND UTILIZATION OF REFERENCE POINT EFFECT SCENARIO TEST RESULTS

A. Analysis of Test Results

For analyzing easily, this article keep analyzing the test based on the example in the above sections.

By changing the parameters, decision makers make the first decision. If the test team profits and chooses the few selling price $1000 in the second step of decision-making, it means that test team is overly conservative and biases risk aversion. If the test team profits and chooses the more one $4000 in the second step of decision-making, it means that test team prefers risks. If the test team loses and chooses the few selling price $1000 in the second step of decision-making, it means that test team is overly conservative and biases risk aversion.

If the test team loses and chooses the more one $4000 in the second step of decision-making, it means that test team prefers risks. It is described as a decision tree shown in Fig. 5.

B. Utilization of Test Results

Based on the above analysis, this experiment reveals the change of reference point along with parameters change in different conditions, which decision makers may meet during decision making. And, decision makers can see the law of the changing of decision-making reference point along with parameters change. Therefore, it can be used to improve the quality of decision-making.

VI. SUMMARY

This article based on managerial decision-making simulation environment, designs test schemes for Reference Point Effect and gets the tendency of reference point and decision-making changes in different conditions. Furthermore, it output the analysis results of decision makers' decision-making characteristics, so that decision makers can improve their decision behavior. This article only cites one case to explain the experiment scheme for testing Reference Effect. Diversified experiment schemes can be performed by changing parameters, such as selling price, demand quantity, marketing expenses and so on. Furthermore, the tendency of the reference point changes in different conditions of the decision maker is being tested. After that, we can keep studying on top management team's characteristics of decision behavior based on other decision behavior effects to help them improve the rationality of decision-making.
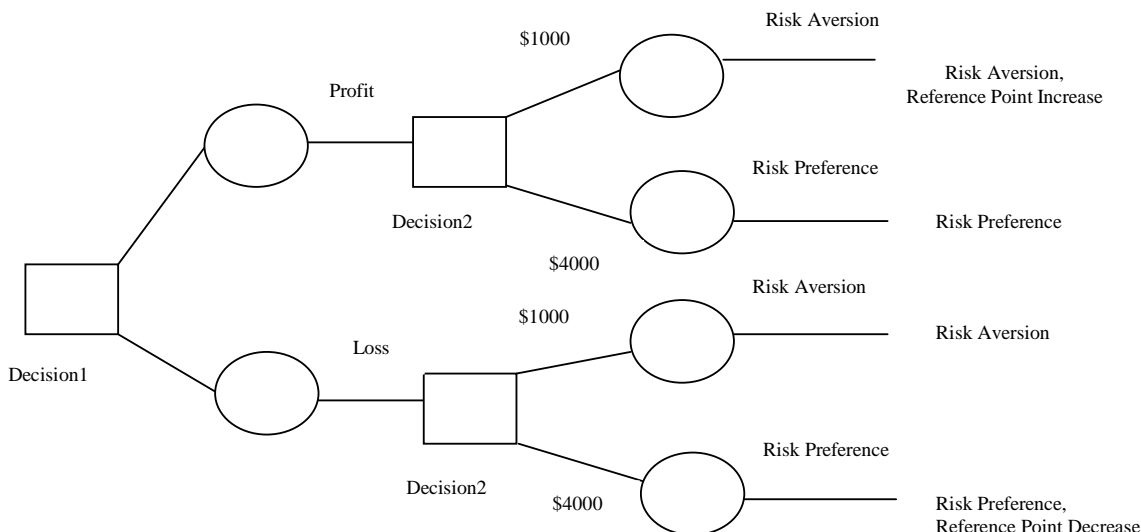
Fig. 5 Decision Tree

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