CHAPTER 5

TARGET COSTING PERFORMANCE BASED ON ALTERNATIVE PARTICIPATION AND EVALUATION METHODS: A LABORATORY EXPERIMENT [1]

5.1. Purpose of the Study

Most companies in the global market are operating in an environment featuring shortening of product life cycle due to rapid technological innovations, rapid exchange rate fluctuation, ever-changing customers' demands, severe market competition in terms of quality and price, etc. Under such radical internal and external environmental changes, the cost management techniques, which have so far been applied, may no longer be useful. To survive in the competitive market and to provide customers with desired quality at an affordable price, the companies are striving to lower prices while devising a cost system that will still ensure profitability. This type of cost reduction system in the product development phase is known as 'target costing'. This paper attempts to study target costing in manufacturing industries and to analyze the behavioral aspect of cost reduction policy that would be helpful in achieving the amount of target cost reduction.

In this article, theories of leadership style and performance-evaluation information of behavioral accounting research are applied to target-costing process to observe the effects of participation and performance-evaluation factors on the cost-reduction performance of product designers. In target costing, product designers scrupulously design product by taking information on alternative methods to achieve the required functions of products and parts and selecting the best methods to attain the lowest costs. The cost-reduction performance of product designers may vary since different levels of participation and performance-evaluation methods will motivate

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them in different ways. Therefore, the main objective of this study is to examine how participation in target cost setting and controllability in performance-evaluation information in the target cost system will influence cost-reduction performance.

5.2. Target Costing and the Research Interests

5.2.1. Meaning and Application of Target Costing

Target costing is defined as companywide profit management activity during the new product development stage that includes: (1) planning products that have customer-pleasing quality, (2) determining target costs (including target investment costs) for the new product to yield the target profit required over the medium to long term given the current market conditions and (3) devising ways to make the product design achieve target costs while also satisfying customer needs for quality and prompt delivery (Monden, 1995).[2]

Target costing process can be divided broadly into five phases such as corporate planning, developing the specific new product concept, determining the basic plan for a specific new product, product design, and the production transfer plan (Monden, 1995). Among these five phases, determining the basic plan for a specific new product (the detailed product plan) and product design are examined as the objective of this study. The various design departments for each functional modules of a product carry out their design of each function's or each part's cost-setting activities (see Figure 5-1) until,

the estimated cost $\leq$ the target cost[3]

In this process target cost will be compared with the estimated cost. If the target cost cannot be achieved, i.e. if the estimated cost is greater than the target cost, the cost-

reduction activities will be repeated by investigating the alternative designs, until the estimated cost becomes, at most, equal to the target cost.

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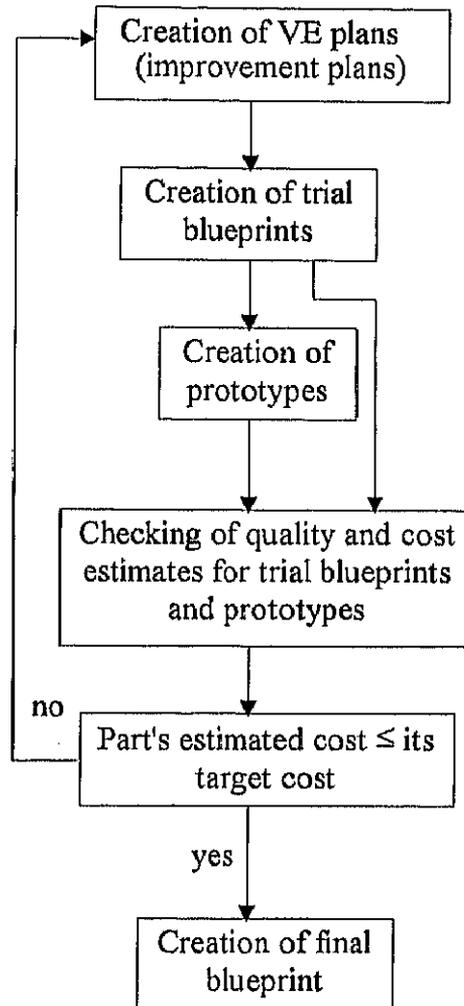
Figure 5-1. Design process from the perspective of target costing

There are two methods for setting target costs per product: (1) the sales price based method (where target cost is determined by deducting target operating profit from target sales price), and (2) the estimated cost based method (where target cost is determined by deducting per unit profit improvement target value from the estimated cost). To achieve the per unit target cost of a product, the designers initially break

down this target cost into functional elements assigned to corresponding design departments which are again broken down into part elements.

Toyota was the first to develop this kind of system in 1965 and now-a-days it is widely used not only in the automotive industries but also in many other manufacturing areas. More than 80 percent of Japan's largest assembly manufacturing businesses have adopted target costing (Sakurai, 1991). It is also used in process-type industries (Tani *et al.*, 1994).

5.2.2. The Research Interests in Target Costing

5.2.2.1. Effect of participation in target cost setting on cost-reduction
performance

In target costing, the target cost of a product is distributed/ allocated to its constituting parts. For the cost reduction activities in order to realize the target cost of part, each responsible designer must have to generate new ideas. Actually, between a final product and its constituting parts, there exist different functions, and hence the target cost of a final product is first distributed to different functions (subsystem), which are then allocated to different parts.

In order to determine the allocation rate for apportioning the per unit target cost of a product into parts, all the designers of the product development team will evaluate the relative importance of each part and vote on each part to establish the priorities. Target cost of each part determined in this way is called provisional part-specific target cost. In order to determine the actual part-specific target cost, the product manager will compare his or her own product conception with that of the designers and also check the attainability of the target. The product manager has the right to allocate the total target cost per unit of a final product among the relevant design departments. However, instead of determining this cost allocation alone, the

product manager will negotiate with the staff of the design departments in order to reach an agreement about specific cost allocations. Usually, two types of approach exist for determining allocation rate of target cost: (1) top-down, where target is imposed by the product manager, and (2) bottom-up, where each designer and the product manager negotiate to determine the target cost of each part for which he or she is responsible. However, the degree of participation of the designers and that of the product manager in determining target cost of parts varies from one company to another. This paper will investigate whether the difference in these simplified approaches will have any impact on cost-reduction performance.

5.2.2.2. Effect of performance-evaluation method on cost-reduction performance

Performance evaluation in target costing has not yet been researched well by the academicians. To check the achievement level of target cost, usually design review (DR), cost review (CR) and follow are conducted. After setting target cost, all the efforts are paid to achieve the target. Estimated cost is calculated for this purpose and by comparing this with the provisional target cost if the target cost is found unattainable, then cost reduction activities will be continued until estimated cost becomes equal to target cost.

Through these regular review activities, the product manager will receive the judgment of design review committee on the achievement level of overall product or function's target cost. The product manager is then reviews the designing activities of the designers of the component parts. However, this review process is not directed towards determining the reward based on their performance evaluation, but to promote the improvement of target achievement in the target costing process.

In target costing, performance evaluation of a product manager is different from that of the product designers. Usually, a product manager is responsible for the

realization of the target cost of a final product and also for the contribution margin of a new product on the basis of which he is evaluated. However, still now there is no specific index to evaluate the performance of the part designers.

Each designer in a project team may be evaluated by the group performance of the project team, i.e. how they achieve the target cost of the final product itself or of the functional module that is composed of many parts. Here, the designers would even be held responsible for someone else's activity over which they have no control (this is called performance evaluation by uncontrollable information). Again, each parts designer may be evaluated by his or her individual performance, i.e. how they achieve the target cost of the parts for which they are responsible (this is called performance evaluation by controllable information). The suitability of either of these two methods depends upon the type of the company. This paper will examine whether the differences in the methods have any impact on cost-reduction performance.

5.2.3. Previous Studies on the Behavioral Approach to Cost Accounting

The theoretical background of this paper is mainly based on previous behavioral accounting research, for example, the 'total' or 'integrated' approach of budgetary control systems proposed by Ansari (1976). This approach regards the system as consisting of two interrelated parts: (1) an information structure, and (2) 'behavioral' processes. An information structure refers to the network through which information relating to target performance, actual performance and deviations from these is communicated to the participants. 'Behavioral' processes consist of psychological factors such as, perceptions, attitudes, beliefs, values, cognition emanating from the degree of participation by the participants.

To achieve the objective and to get the optimal results the joint impact of participation and controllable information as well as their separate impacts on cost-

reduction performance are to be studied. From the previous research in behavioral accounting and psychology it can be said that feedback information, both positive and negative, can alter satisfaction or aspiration levels that ultimately influence the performance (Argyris, 1952; Hofstede, 1967; Stedry, 1960; Becker and Green, 1962). The participation of subordinates in budget setting is usually regarded as effective in getting subordinates to internalize the standards embodied in the budgets and thus in achieving the goal congruence (Welsch, Hilton and Gordon, 1988). Vroom (1960) argues that participation makes employees feel more a part of the activities, less dominated by a superior, and more independent; and thus this improves their attitudes toward the job.[4] However, Cherrington and Cherrington (1973), Coch and French (1948), and French, Kay and Meyer (1962) find that there is no direct correlation between participation and improved productivity.

The effect of participation can perhaps be best understood in the context of group dynamics. In this context, participation tends to increase performance if interaction of individuals leads to greater group cohesiveness and if the group norms are such that they are conducive to higher levels of production (Ronen and Livingstone, 1975). The level of satisfaction as well as the performance of the employees who can participate in any decision-making process will be different from those of the employees who cannot. Moreover, employee satisfaction and performance may be affected by both self- and supervisory evaluations when these two evaluations contradict each other. This contradiction may create cognitive dissonance.

From the above literature survey, it was found that expectancy theory was used to study the impact of each individual factor such as participation and performance-evaluation information on performance or motivation. On the other
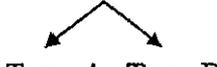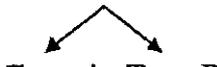
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hand, cognitive dissonance theory was used to study the interactive effect of two cognitive elements emanating from two factors. Therefore, this paper is based on the model of Porter and Lawler (1967), House (1971), Ronen and Livingstone (1975), who used the expectancy theory to explain the separate effects of leadership style and performance-evaluation information on motivation. It also considers cognitive dissonance theory to present the interaction effect between leadership style and performance-evaluation information as was also used by Ansari (1976). Finally, to attain the objective of the experiment, this paper combines the expectancy theory and cognitive dissonance theory as in Brownell (1982). It should be noted that the use of expectancy theory and cognitive dissonance theory in this paper is the first in target costing literature.

5.3. Experimental Design and Procedures

5.3.1. Research Design

In the experiment, there were two main independent variables: (1) factors relating to participation, and (2) factors relating to controllable information. Both these variables have two levels that will create a 2 x 2 matrix. In order to study the effect of learning the time factor is also considered as an independent variable. The experimental design will describe the decision making-process in setting the target cost of parts as used in this experiment. The structure of this process is illustrated in Table 5-1.

Table 5-1. Decision making process in setting target cost for parts

	Groups in determining the allocation rate of parts target cost	
	Nonparticipative (Top-down)	Participative (Bottom-up)
Expost performance evaluation of groups engaged in setting target cost for products (evaluation by group performance)	Group1 Team A Team B	Group2 Team A Team B
Expost performance evaluation of groups engaged in setting target cost for parts (evaluation by individual performance)	Group3 Team A Team B	Group4 Team A Team B

5.3.1.1. Controllable information

Each designing member of Groups 1 and 2 will be evaluated based on variance between product target cost and product actual cost attained. Each designing member of Groups 3 and 4 will be evaluated on variance in target cost and actual cost for the part for which he or she is responsible. For simplicity, it is assumed that a final product consists of two parts, A and B and each group is composed of two teams, A and B. While designing the parts, the employees of Team A have to achieve target cost of part A and those of Team B the target cost of part B. In Groups 1 and 2, the performance of each team member will be evaluated by the group performance, i.e. their performance is evaluated based on how they achieve the target cost of the final product itself. On the other hand, in Groups 3 and 4, the staff of each team will be evaluated by his or her own performance, i.e. the staff performance will be evaluated based on how they achieve the target cost of the parts for which they are responsible. In other words, the members of Groups 1 or 2, have common responsibility for the target cost of the final product and each member will be regarded as having the same performance and will be evaluated with the cost terms that include uncontrollable factors. The members of Groups 3 and 4 will be evaluated by their controllable costs

items. Dividing each group into two teams and the use of project team evaluation are unique to this experiment, since this procedure was not adopted in earlier studies, (e.g. by Ansari or by Stedry).

5.3.1.2. Participation

Two levels of participation have been used in this experiment. No member of Groups 1 and 3 can participate in the target cost-setting process of parts; rather, the target is imposed from the upper level. The team members do not know the rationality or the validity of the target to be achieved by them. On the other hand, each team member of Groups 2 and 4 are allowed to participate in the target cost-setting process of parts. The team members can negotiate with the team leader and may give suggestions if the target is not defined properly.

5.3.2. Research Methodology

5.3.2.1. Experimental environment and work procedure

The present laboratory experiment was designed to assume a real-world situation of target cost-setting process where to determine target cost in an environment of product design and development a department was created. One hundred and twenty subjects participated in the experiment under the supervision of four coordinators. All the subjects were divided equally into four groups (having thirty members in each group), and each group consisted of two teams (having fifteen members in each team). The sample size of Team i (i = A, B) in group j (j = 1, ...,4) is 15. That is, total sample size is 120 (= 4 groups × 2 teams × 15 students or subjects). Each group had one group manager and each team had one team leader. The group members were randomly selected.

The experiment was conducted four times (each trial took three minutes) and each time the subjects were made to solve problems relating to addition. To make the

students acquainted with the experiment, a practice test was conducted before the actual experiment. Two sets of questions were prepared for each team in each group. The problem given to Team A was comparatively more difficult than that given to Team B, in order to serve as an analogy with the actual target cost-setting process of different parts. Practically, the types of the parts vary depending on the degree of complexities existing in different functions. The actual number of correct answers of each subject was converted to its reciprocal, and this figure was considered equivalent to the amount of cost reduction. It was assumed that the more the subjects were motivated to obtain the correct answers, the less would be this reciprocal and the greater would be the amount of cost reduction. The problem-solving activities under this experiment are similar to the cost-reduction activities of parts designers. In reality, when designers design the trial blueprint, the estimated cost each time must be smaller than that previously. In the same way, the subjects also attempted to raise the number of correct answers above the target at each subsequent trial. In practical designing activity, the designers try to reduce the variety of parts by increasing the number of common parts. In other words, greater quantities of the same part can be produced, thus leading to a reduction in the unit cost of parts. The maximization of the number of common parts is similar to the number of correct answers of this experiment.

To control the experimental environment, the subjects in different groups were assigned with specific jobs. At the beginning of each trial, the group manager informed the subjects of the target number of answers for that trial. The target to be achieved in every subsequent period was increased by 7% to account for on-the-job learning, chosen as a kind of standard learning coefficient based on a pilot study. In the experiment, the subjects were informed beforehand that their grade point of the

managerial accounting course would be determined partially based on the performance of this experiment. All the subjects were undergraduate students in the College of Policy and Planning Sciences at the University of Tsukuba. It was assumed that all the subjects possessed similar abilities and there was almost no significant difference among the groups. The reasons for this assumption were: (1) the very strict Japanese system of entrance examination for engineering school, which requires a very high standard of mathematical ability, assures that each student would perform at about the same level for moderate tasks such as the addition task administered in this experiment; (2) they could be considered to have similar knowledge of target costing, that is, the motivational impact of this process, since they were well lectured about the target costing system beforehand; (3) the sample was equal (30 subjects) for each group.[5]

The coordinators were selected from the students to help the experimental process. In fact, they were not included in the 120 subjects and did not sit for the experimental trial itself. The team leader is among the 15 members of each team and was not the coordinator of the experiment itself. The total number of coordinators was eight corresponding to the total number of team. The coordinators participated in the experiment as the collaborators of the experimenter but they pretended to know nothing about the experimental manipulations. To avoid the possibility of any bias, after each trial the coordinator in each group collected the scripts and gave the scripts of the members of Team A to the leader of Team B and vice versa. After this, they collected the marked scripts from the respective teams, made some calculations and wrote down the 'target number of correct answers of this time' on the scripts, and this value was used in the next trial. The experimental environment was designed to resemble cost-reduction process in developing new products, where the members of

the product design and development department would receive the plan from the group manager and be motivated to achieve it. The total time period needed for this experiment was 3 hours. The order of the groups selected for this experiment was randomly determined. The experimenter was very careful to avoid any bias.

5.3.2.2. Target cost-setting method

For all the groups used in this experiment, a group's 'total target number of correct answers of this time' is equal to that group's 'total target number of correct answers of the previous time' multiplied by $(1 + \alpha)$, where α is a learning coefficient. In this experiment α is determined based on trial experiment and fixed at 0.07. The managers of groups 1 and 3 will determine the target number for their respective teams A and B, based on the group's 'total target number of correct answers of this time', where the allocation ratio is determined by the experiment designer.

In case of groups 2 and 4, the team leaders of Teams A and B will discuss with their respective team members and determine the provisional target number of correct answers for each team. Having this provisional figure, both team leaders will negotiate with the team members and determine the target number of correct answers of this time for each team on the basis of the total target number of correct answers of the group in question.

5.3.2.3. Performance-evaluation method

In Groups 1 and 2, a Group's actual number of correct answers of the previous time is equal to the Median of Team A's actual number of correct answers plus the Median of Team B's actual number of correct answers. Each student's grade is calculated by dividing the group's actual number of correct answers of the previous time by the group's total target number of correct answers for the same time. This grade point is the same for all the members of Groups 1 and 2. Individual performance or merit is

not considered here. If any team member makes an active or positive effort in achieving the team's target, then eventually, the group performance will be improved. Although this evaluation measure includes uncontrollable factors, it partially reflects the real performance of every team member.

In the case of Groups 3 and 4, a team member's actual number of correct answers of the previous time is equal to team member's target number of correct answers of the previous time. Each student's grade point is determined by dividing the team member's actual number of correct answers of the previous time by the team member's target number of correct answers at the same time. The method of determining the team member's target number of correct answers of the previous time differs between Groups 3 and 4 since the former can participate in the target cost-setting process whereas the latter cannot.

5.3.3. Comparison between Real World and the Experiment

Real World	Experiment
1. Product team	1. Group
A product team, consisting of a product manager and designers, is responsible for a product.	A group, consisting of a group manager and members, is considered equivalent to the product team. There are four groups in this experiment.
2. Parts composing a product	2. Teams constituting a group (A and B)
A product is composed of many parts and a team of designers is responsible for a part.	Each group is composed of two teams and each team is responsible for a part. The problem given to Team A was comparatively more difficult than that given to Team B, in order to serve as an analogy with the actual target cost-setting process of different parts. Practically, the types of the parts vary depending on the degree of complexities existing in different functions.

3. Cost-reduction activities

Cost reduction activities for each part continues until the estimated cost becomes approximately equal to the target cost.

3. Solving the simple addition problem in a given time period

The actual number of correct answers of each subject was converted to its reciprocal, and this figure was considered equivalent to the amount of cost reduction. It was assumed that the more the subjects were motivated to obtain the correct answers, the less would be this reciprocal and the greater would be the amount of cost reduction.

4. Target cost of each product

4. Target number of problem to be solved by each group

Target cost is the allowable amount of cost that can be incurred on a product and still earn the required profit from the product. It is a market driven costing system in which customer requirements and competitive offerings set cost targets. Cost targets are achieved by focusing on product and process design and making continuous improvements in all support processes.

Target number of correct answer is similar to target cost in the sense that the subjects have to answer the number as fixed by the experimenter to prove their efficiency. In real world also, the designers has to design the parts, function, or products at the target cost.

5. Allocating product's target cost into different parts

Usually, the target cost of a product is allocated into different parts. In other words, the target cost of product is achieved by achieving its parts target cost.

5. Allocating the target number of answer to Teams A and B in each group

Total target number of correct answers expected from each group is allocated to Teams A and B in the same way as a product's target cost is allocated to different parts.

6. Project leader (product manager)

6. Team leader (to be elected for each team)

7. Determining the allocation rate for the target cost of a product into different parts

(i) Top-down situation (Nonparticipation

(i) Target value will be determined in advance

of the employees in determination target cost)

(ii) When the employees participate in allocating a product's target cost into the constituting parts (Participation in target cost determination)

(a) The degree of importance of each part is evaluated and determined collectively by all the individuals

(b) Cost allocation will be conducted in proportional to the degrees of importance

(c) Making plan for determining the provisional target cost for each part

(d) The final target cost is determined after considering its revision, if needed

8. Performance evaluation

(i) The designers of the component parts will be evaluated by the difference between target cost and the actual cost of the final product

(ii) The designers of the component parts will be evaluated by information relating to the difference between target cost and actual cost achieved for which he or she is responsible

for the members of Groups 1 and 3 (Nonparticipation in determining the target value)

(ii) Each member of Groups 2 and 4 will participate in deciding the allocation of target value to each team (Participation in determining the target value)

(a) Among the team members of teams A and B mainly the team leader will decide the provisional target value

(b) Based on the above provisional target value, each team leader will confer with the allocation ratio of target value

(c) Total target value for each group will be allocated to the each team of A and B

(i) Relating to Groups 1 and 3→
Each group will be evaluated by its actual performance in terms of the target performance

(ii) Relating to Groups 2 and 4→
Each member will be evaluated by his or her actual performance in terms of the target performance

5.3.4. The job of Coordinator

Group 1

1. Distribute the question paper to the members of the concerned team, ask the student to write his/her student's number on the top left of the backside of the question paper.

2. Collect the question papers after the test is over and exchange the papers with the coordinator of the other team that belong to the same group.

3. Deliver the received question papers to the members of the concerned team, and then conduct the grading scheme by reading audibly the answers that have been prepared beforehand.

4. Collect the question paper when the grading is over, deliver these to the coordinator of the other team, and then take back the question papers of own team.

5. Calculate the median value of the actual number of correct answers of each individual and then add this to the median value of the other team. Consider this figure as the previous actual number of correct answer (X).

   Group's previous actual number of correct answers (X) = Median value of the actual number of correct answers of Team A of Group 1 + Median value of the actual number of correct answers of Team B of Group 1

6. Determine the grade of each group member based on Group's previous actual number of correct answer (X) and Group's previous total number of correct answer (Y).

   Your Grade = Group's previous actual number of correct answer (X) + Group's previous total target number of correct answer (Y)

7. During the next test, fill in the student's number of each team member on the question paper.

8. Fill in the performance evaluation information "Group's previous actual number of correct answers" and "Your Grade" to the respective sections on the question papers of the next test.

9. After filling up, distribute the question papers to the members of the concerned team.

10. By arranging the question papers of the previous tests, stop these by a stapler.

11. Return to step 2, and repeat the following process.

Group 2

1. Distribute the question paper to the members of the concerned team, ask the student to write his/her student's number on the top left of the backside of the question paper.

2. Collect the question papers after the test is over and exchange the papers with the coordinator of the other team that belong to the same group.

3. Deliver the received question papers to the members of the concerned team, and then conduct the grading scheme by reading audibly the answers that have been prepared beforehand.

4. Collect the question paper when the grading is over, deliver these to the coordinator of the other team, and then take back the question papers of own team.

5. Calculate the median value of the actual number of correct answers of each individual and then add this to the median value of the other team. Consider this figure as the previous actual number of correct answer (X).

   Group's previous actual number of correct answers (X) = Median value of the actual number of correct answers of Team A of Group 2 + Median value of the actual number of correct answers of Team B of Group 2

6. Determine the grade of each group member based on Group's previous actual number of correct answer (X) and Group's previous total target number of correct answer (Y).

   Your Grade = Group's previous actual number of correct answer (X) ÷ Group's previous total target number of correct answer (Y)

7. During the next test, fill in the student's number of each team member on the question paper.

8. Fill in the performance evaluation information "Group's previous actual number of correct answers" and "Your Grade" to the respective sections on the question papers of the next test.

9. After filling up, distribute the question papers to the members of the concerned team.

10. Let the group members to fill in "this time target number of correct answer" on the distributed question paper. Actually, the group members will decide "this time target number of correct answer" for each team (Having the figure of provisional target amount of correct answer, both the team leaders will discuss on it, and allocate the Group's this time total target number of correct answer to teams A and B as their this time target number of correct answer).

11. By arranging the question papers of the previous tests, stop these by a stapler.

12. Return to step 2, and repeat the following process.

Group 3

1. Distribute the question paper to the members of the concerned team, ask the student to write his/her student's number on the top left of the backside of the question paper.

2. Collect the question papers after the test is over and exchange the papers with the coordinator of the other team that belong to the same group.

3. Deliver the received question papers to the members of the concerned team, and then conduct the grading scheme by reading audibly the answers that have been prepared beforehand.

4. Collect the question paper when the grading is over, deliver these to the coordinator of the other team, and then take back the question papers of own team.

5. Determine the grade by using previous actual number of correct answer of each member in each team and team's previous total target number of correct answer.

   Your Grade = Previous actual number of correct answer of each member in each team (X) + Each team's previous total target number of correct answer (Y)

6. During the next test, fill in the student's number of each team member on the question paper.

7. Fill in the performance evaluation information "Group's previous actual number of correct answers" and "Your Grade" to the respective sections on the question papers of the next test.

8. After filling up, distribute the question papers to the members of the concerned team.

9. By arranging the question papers of the previous tests, stop these by a stapler.

10. Return to step 2, and repeat the following process.

Group 4

1. Distribute the question paper to the members of the concerned team, ask the student to write his/her student's number on the top left of the backside of the question paper.

2. Collect the question papers after the test is over and exchange the papers with the coordinator of the other team that belong to the same group.

3. Deliver the received question papers to the members of the concerned team, and then conduct the grading scheme by reading audibly the answers that have been prepared beforehand.

4. Collect the question paper when the grading is over, deliver these to the coordinator of the other team, and then take back the question papers of own team.

5. Determine the grade by using previous actual number of correct answer of each member in each team and each team's previous total target number of correct answer.

   Your Grade = Previous actual number of correct answer of each member in each team (X) + Each team's previous total target number of correct answer (Y)

6. During the next test, fill in the student's number of each team member on the question paper.

7. Fill in the performance evaluation information "Group's previous actual number of correct answers" and "Your Grade" to the respective sections on the question papers of the next test.

8. After filling up, distribute the question papers to the members of the concerned team.

9. Let the group members to fill in "this time target number of correct answer" on the distributed question paper. Actually, the group members will decide "this time target number of correct answer" for each team (Having the figure of provisional target amount of correct answer, both the team leaders will discuss on it, and

allocate the Group's this time total target number of correct answer to teams A and B as their this time target number of correct answer).

10. By arranging the question papers of the previous tests, stop these by a stapler.

11. Return to step 2, and repeat the following process.

5.3.5. Total Target to be Achieved by Each Team

	Trial 1	Trial 2	Trial 3	Trial 4
Group's total target value	125	134	143	153
Target Value of Teams 1A, 3A	50(40.0%)	54(40.3%)	57(39.9%)	61(39.9%)
Target Value of Teams 1B, 3B	75(60.0%)	80(59.7%)	86(60.1%)	92(60.1%)
Target Value of Teams 2A	63(50.4%)	64(47.8%)	71(49.7%)	67(43.8%)
Target Value of Teams 2B	62(49.6%)	70(52.2%)	72(50.3%)	86(56.2%)
Target Value of Teams 4A	57(45.6%)	70(52.2%)	70(49.0%)	74(48.4%)
Target Value of Teams 4B	68(54.4%)	64(47.8%)	73(51.0%)	79(51.6%)

5.4. Hypotheses

The hypotheses of this experiment are formulated on the basis of Cognitive dissonance theory and Expectancy theory. This necessitates explanation of these two theories.

5.4.1. Cognitive Dissonance Theory

Cognition means the things people know about themselves, about their behavior, and about their surroundings, whereas dissonance means hunger, frustration or disequilibrium or existence of nonfitting relations among cognition. According to Festinger (1957), two cognitive elements are in a dissonant relation if, considering these two alone, the obverse of one element follows from the other and these elements must be relevant to each other. Motivation and desired consequences may also be factors in determining whether or not two elements are dissonant. As soon as dissonance occurs there will be pressures to reduce it. Heider (1946) opines that 'if no

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balance state exists between two (or more) relations, then forces toward the balanced state will arise. Either there will be a tendency to change the sentiments involved, or the unit relations will be changed through action or cognitive reorganization. If a change is not possible, the state of imbalance will produce tension, and balanced states will be preferred over the state of imbalance.' Osgood and Tannenbaum (1955) also proposed a similar idea. The presence of dissonance gives rise to pressures to reduce or eliminate the dissonance. The strength of the pressures to reduce the dissonance is a function of the magnitude of the dissonance, which is dependent on the relative importance of the elements. Dissonance existing between two elements can be eliminated by: (1) changing a behavioral cognitive element, (2) changing an environmental cognitive element and (3) adding new cognitive elements.

5.4.2. Application of Cognitive Dissonance Theory to the Present Experiment

In this experiment, only two factors are taken into consideration, neglecting all other factors which will be recognized in other contexts. These stand for the factors relating to participation and the factors relating to performance evaluation. Due to the interaction of two levels of participation factor (participation and nonparticipation) and two levels of performance-evaluation factor (controllable information and uncontrollable information), different types of cognitive elements will be created which will produce dissonance or consonance of different magnitudes. The more supportive the factors, the smaller the problem of cognitive conflict and the better the resulting impact on employee satisfaction and performance (Ansari, 1976). If the reverse aspects of one cognitive element generating from one factor (e.g. participation) could be derived from the other cognitive element of the other factor (e.g. controllable information), then these two factors are said to be in a dissonance relationship. Since this cognitive dissonance will bring psychological anxiety and

tension to individuals, it will motivate the person in question to reduce the dissonance and to be in a consonance situation. Cognitive dissonance theory treats the relationship between two cognitive elements, so this theory can be applied to understand the interactive effect of two cognitive elements. Table 5-2 may be used to explain the existence of dissonance or consonance within each of the groups considered in the present experiment.

Table 5-2. Consonance and dissonance

		Factors relating to participation	
		Nonparticipation	Participation
Factors relating to performance evaluation information	Uncontrollable information	Group 1 Dissonance tends to consonance	Group 2 Dissonance
	Controllable information	Group 3 Dissonance	Group 4 Consonance

The interaction between nonparticipative target setting and evaluation by uncontrollable information could be interpreted as dissonance leading to a consonance situation. In this case, each individual designer (subject) cannot know the validity of his or her assigned grade point as the actual performance. Due to the fact that individual performances are not reported, subjects may think that they are being held accountable for someone else's fault. Because of this psychological anxiety, there is a possibility of the creation of dissonance in the minds of designers. Since designers are not allowed to participate in target cost setting, they do not know the accuracy of target and may blindly accept the target. They cannot evaluate the degree of rationality of target set by the upper level. So whenever there is any dissonance, they will be motivated to eliminate it. The magnitude of dissonance is lower in case of Group 1 and the subordinates can arrive at a congruent state. Therefore, they will be inclined to trust the target value and evaluation given by the project manager as valid.

Thus, discomfort emanating from the interaction of nonparticipative target setting and evaluation by uncontrollable information will no longer exist. They will give up any complaint and will have no stress in their minds.

The interaction between participative target setting and evaluation by controllable information will create no dissonance at all because there is no mismatch or conflict between the elements of these two factors. Therefore, Groups 1 and 4 will be under consonance situation in terms of participation and evaluation factors, while Groups 3 and 2 will be in dissonance situation as both of them have one element which conflicts with the other. However, the degree of consonance in Group 1 will be much smaller than that of Group 4.

The relationship between various major groups— Groups 1 and 4 (supportive) and Groups 2 and 3 (nonsupportive)— in terms of consonance and dissonance situation is similar to that between the supportive and the nonsupportive groups stated by Ansari (1976). In this experiment, supportive groups are defined as the groups in which the subordinate staff or the parts designers (1) will not feel any conflicts with the product manager's behavior, or (2) can find some mechanism to resolve the cognitive dissonance without affecting the achievement of target cost. The authors propose that if the groups have failed to reduce dissonance and still experience mental frustration and stress, their performance will be lower than the groups who can reduce the dissonance and have no frustration. Based on this proposition, the following hypothesis can be formulated:

Hypothesis 5-1: The performance of Groups 1 and 4 which belong to the supportive group will be higher than that of Groups 2 and 3 which belong to the nonsupportive group. In other words,

Performance of supportive group > performance of nonsupportive group

or,

Performance of Groups 1 and 4 >   performance of Groups 2 and 3

5.4.3. Expectancy Theory Approach

The expectancy model considers the superior-subordinate budget relationship in which the subordinate's motivation to perform the task is influenced by the budget, and the superior can and may affect the subordinate's motivation by the budget. The basic tenet of expectancy theory is that an individual chooses his or her behavior on the basis of (1) expectations that the behavior will result in a specific outcome and (2) the personal utilities or satisfaction that he or she will derive from the outcome (Ronen and Livingstone, 1975). Vroom (1964) was the pioneer in using the expectancy theory to explain work motivation. Behavioral accounting researchers used Vroom's model as a basis for other expectancy models. In this area, the research of Porter and Lawler (1967), House (1971), Ronen and Livingstone (1975), Brownell (1982) is remarkable.

This paper uses House's model as a basis for expectancy theory as mentioned by Ronen and Livingstone (1975).
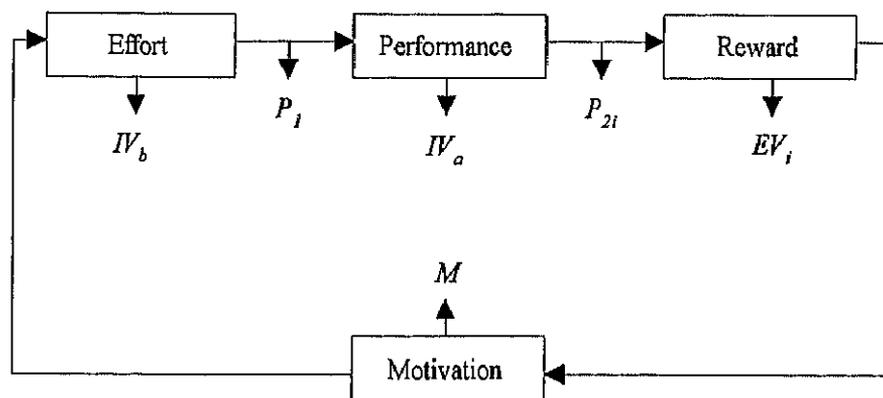

Figure 5-2. Expectancy Model

where,

M = Amount of motivation

IV_a = Mental satisfaction associated with work performance

IV_b = Mental satisfaction associated with effort or action

EV_i = Satisfaction for monetary or promotional rewards

P_1 = Subjective probability or expectancy of performance when certain action or

effort is made

P_{2i} = Subjective probability or expectancy of reward when a certain performance is

achieved

This framework of expectancy theory can be used in designing the company's management control system. In other words, if some effective factors can be introduced to positively influence the variables in this expectancy model, it will help the company in realizing high level of performance. For the purpose of this experiment, participation and controllability factors are chosen as the effective factors in management control system (based on Ronen and Livingstone, 1975), although there are many other effective factors. Factors relating to participation will influence IV_a, IV_b, and EVi, all of which will affect motivation, i.e.

$$M = f(IV_a , IV_b , EV_i)$$

Mutual adherence among the members of a group will be improved by participation. Therefore, the participative condition will improve the mental satisfaction through performance. IV_a will increase if the subordinate has influence in target setting and can exercise control. IV_b will be improved depending on how the group members are attached to each other. However, in case of this laboratory experiment, all groups are quite similar, so IV_b will not vary as a participation effect, which means there is no difference of members (subjects) between different groups.

The group members will be motivated to participate if they are satisfied with monetary or promotional rewards contingent upon successful task performance. From the above viewpoint, the following hypothesis can be formulated:

Hypothesis 5-2: The performance level of target cost achievement will be higher in Groups 2 and 4, whose members can participate in target setting than in Groups 1 and 3, whose members cannot participate in it. In other words,

Performance of nonparticipative group < performance of participative group

or,

Performance of Groups 1 and 3 < performance of Groups 2 and 4

Next, regarding the evaluation factors based on controllable information, the expectancy theory can be transformed as:

$$M = q (P_1, IV_a)$$

According to Ronen (1974), only activities recognized as controllable will give high expectancy, P_1, and also will provide intrinsic valence, IV_a, because in responsibility accounting the performance evaluation of subordinate managers should be confined to only their controllable items. On the other hand, if the performance evaluation measures include items uncontrollable to subordinates, then their expectancy, P_1, due to a certain effort will decrease. Therefore, the mental satisfaction, IV_a, felt through their performance, will be reduced and thus the accomplishment of the organization's goal will be jeopardized. From the above discussion the following hypothesis can be established:

Hypothesis 5-3: The performance of Groups 3 and 4, whose members are evaluated on the basis of controllable item information only, will be greater than that of Groups 1 and 2, whose performance measure includes uncontrollable item information. Therefore,

Performance based on uncontrollable < performance based on controllable
item information   item information

<div style="text-align:center">or,</div>

Performance of Groups 1 and 2 <   performance of Groups 3 and 4

Now, how will the order of the performance among various groups be determined based on the above two hypotheses? The order of groups based on Hypothesis 5-1 will differ from the order based on Hypothesis 5-3. If the strengths or magnitude among the hypotheses are known, the order can be arranged. However, the strengths (relative effects) of these hypotheses cannot be known for the moment. Therefore, two different orders can be expected as follows:

Hypothesis 5-4: From Hypothesis 5-1,

Performance of Groups 2 or 3 <   performance of Group 1 <   performance of Group 4

since, the degree of consonance in Group 1 is weaker than that of Group 4.

From Hypotheses 5-2 and 5-3,

Performance of Group 1 <   performance of Groups 2 or 3 <   performance of Group 4

Finally, the intrinsic validity of this experiment lies in whether or not the experiment actually reflects the real-world situation of target costing. At first, the experimenter told the subjects that the actual number of their correct answers would be transformed to their reciprocals. Moreover, the more subjects try to increase the number of correct answers, the less will be the value of the reciprocal. That is, the activities taken by the subjects are similar to the cost reduction activities taken by the designers. In addition, in the real designing activities, designers try to reduce the overall number of parts by increasing the multiple-use types of parts. This approach takes advantage of economies of scale in producing greater quantities of the same parts. That is, the number of that common part will be increased so that the unit cost of that part can be reduced. Finally, the cost behavior in target costing must be

reflected in this experiment. In other words, in order to achieve cost reduction, the

blueprint is drawn and its prototype is made for different cases; and at each time, the

estimated cost of the blueprint and prototype must be smaller than that of the previous

time. However, the amount of cost reduction at each time must be greater than the

previous one. Each time, the cost reduction rate will be made to decrease from the

current one. Therefore, the following hypothesis will hold:

Hypothesis 5-5:

Total (accumulated) amount of cost reduction in first trial	<	Total (accumulated) amount of cost reduction in second trial	<	Total (accumulated) amount of cost reduction in third trial	<	Total (accumulated) amount of cost reduction in fourth trial

However, concerning the cost reduction rate,

Cost reduction rate between trials 1 and 2	>	cost reduction rate between trials 2 and 3	>	cost reduction rate between trials 3 and 4

The result of our experiment must satisfy hypothesis 5-5.

5.5. Experimental Data

5.5.1. Actual Performance of Each Member in Different Teams

Data relating to actual performance ratio of each member in different teams is presented in appendix 5-B.

5.5.2. Changes in Average Performance in Team A

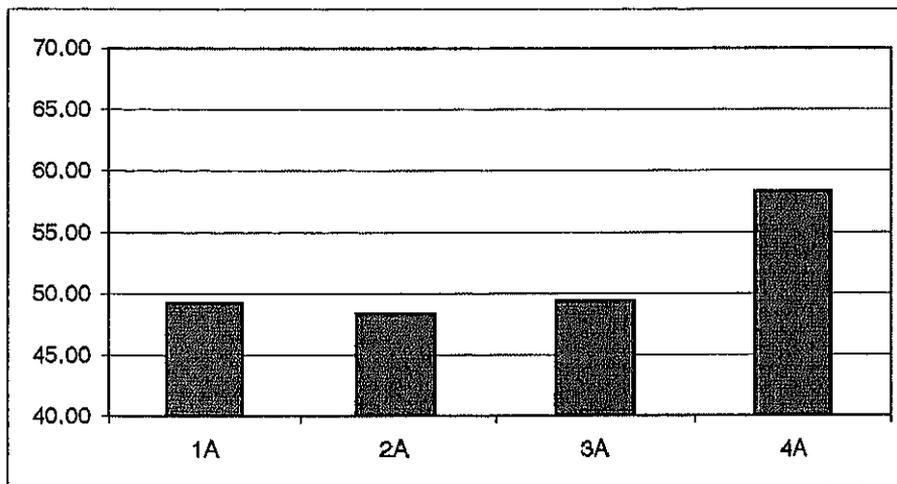| Team A	Trial 1	Trial 2	Trial 3	Trial 4	Average
1A	44.40	47.73	51.93	52.80	49.22
2A	46.60	46.67	49.20	50.93	48.35
3A	44.73	47.73	52.67	52.40	49.38
4A	54.67	59.40	59.00	60.27	58.33
Average	47.60	50.38	53.20	54.10	

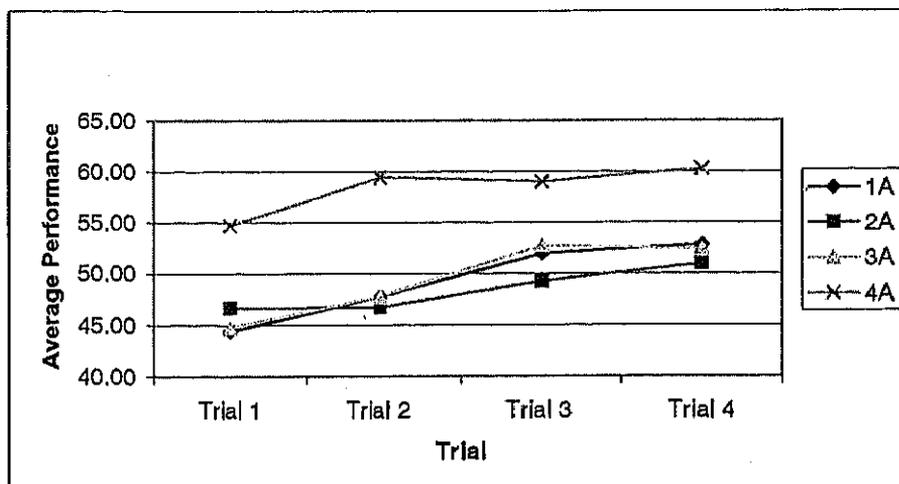Figure 5-3. Average performance of Team A in four trials

Figure 5-4. Changes in average performance per trial in Team A

5.5.3. Changes in Average Performance in Team B

Team B	Trial 1	Trial 2	Trial 3	Trial 4	Average
1B	50.80	58.53	57.27	59.00	56.40
2B	48.27	55.80	57.00	61.73	55.70
3B	55.87	62.27	62.07	66.47	61.67
4B	57.67	71.73	73.27	69.93	68.15
Average	53.15	62.08	62.40	64.28	

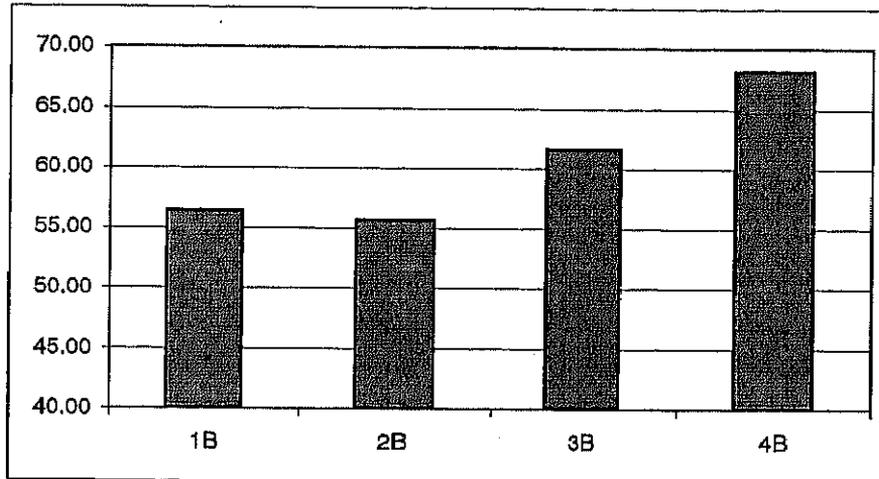Figure 5-5. Average performance of Team B in four trials
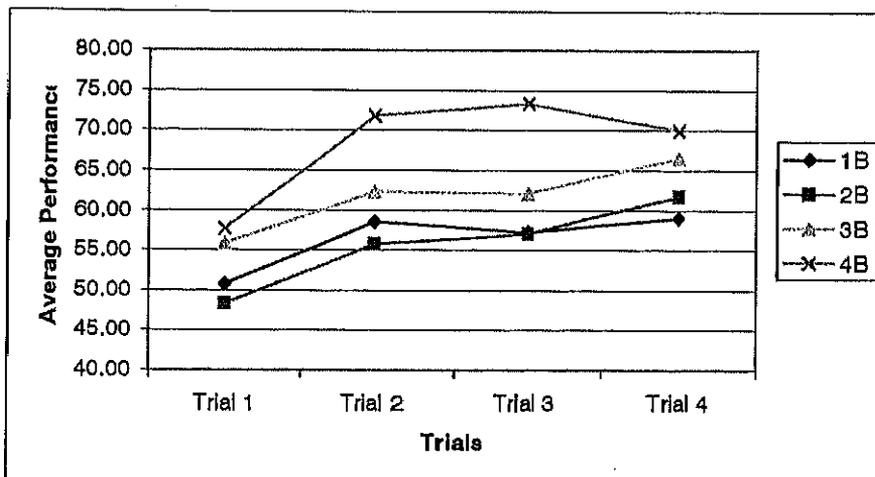

Figure 5-6. Changes in average performance per trial in Team B

5.5.4. Comparison of Average Grade of Each Team at Each Trial

Trial	Team A	Team B
Trial 1	G4>G2>G3>G1	G4>G3>G1>G2
Trial 2	G4>G3>G1>G2	G4>G3>G1>G2
Trial 3	G4>G3>G1>G2	G4>G3>G1>G2
Trial 4	G4>G1>G3>G2	G4>G3>G2>G1
Average of four trials	G4>G3>G1>G2	G4>G3>G1>G2

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5.6. Analysis and Interpretation of Experimental Results

Tables 5-3 and 5-4 summarize the results of ANOVA applied to the actual number of correct answers of Teams A and B.

Table 5-3. ANOVA applied to the actual number of correct answers in Team A

Factors	Degrees of Freedom	Sums of Squares	Means Square	F-value	P-value
Participation (P)	1	980.10417	980.10417	8.97	0.0031[b]
Controllable information (C)	1	1545.33750	1545.33750	14.14	0.0002[a]
Time (T)	3	1558.71250	519.57083	4.75	0.0031[b]
P × C	1	1445.50417	1445.50417	13.23	0.0003[a]
P × T	3	176.91250	58.97083	0.54	0.6556
C × T	3	42.61250	14.20417	0.13	0.9422
P × C × T	3	50.31250	16.77083	0.15	0.9274
Total	15	5799.49583	386.63306	3.54	0.0001
Standard Error	224	24478.80000	109.28036		
Grand Total	239	30278.29583			

[a] Significance at 0.05% level
[b] Significance at 0.5% level

Table 5-4. ANOVA applied to the actual number of correct answers in Team B

Factors	Degrees of Freedom	Sums of Squares	Means Square	F-value	P-value
Participation (P)	1	501.70417	501.70417	3.92	0.0489[c]
Controllable information (C)	1	4708.20417	4708.20417	36.79	0.0001[a]
Time (T)	3	4467.07917	1489.02639	11.64	0.0001[a]
P × C	1	774.00417	774.00417	6.05	0.0147[b]
P × T	3	262.74583	87.58194	0.68	0.5624
C × T	3	111.71250	37.23794	0.29	0.8319
P × C × T	3	349.64583	116.54861	0.91	0.4365
Total	15	11175.09584	745.00638	5.82	0.0001
Standard Error	224	28662.80000	127.95893		
Grand Total	239	39837.89584			

[a] Significance at 0.05% level
[b] Significance at 0.5% level
[c] Significance at 5% level

From Table 5-3 it is apparent that if the subordinates can participate in target cost-setting process, then the participation factor will have an effect on cost-reduction performance at a 0.5% level of significance. Again, when the group members are evaluated by controllable information, then the controllability factors also have an

effect on the performance with a significance level of 0.05%. Over the period of time the experiment was conducted, the cost reduction skill of the employees (subjects) improved, which is reflected by the 0.5% significance level of the time factor. An interactive factor between participation and evaluation by controllable information also gives a significance effect of 0.05%. Table 5-4 portrays ANOVA results applied to the actual number of correct answers in Team B. The participation factor has an effect at the 5% significance level, whereas the evaluation factor will have an effect at the 0.05% level. The time factor also has the same effect as the evaluation factor. The interactive factor between participation and evaluation measures has an effect at the 0.5% significance level. From these experimental results it can be said that very similar results were found in both teams. That is, among significant factors, the evaluation measure (controllable information) has the greatest effect on performance, the second-best effect is given by the interactive factor between participation and controllable information and the least effect is given by the participation factor. The time factor also has a significant effect, meaning that the learning effect in cost-reduction performance is revealed in this experiment. It should be emphasized that replication of the same results is confirmed in both Teams A and B under this experiment.

The ANOVA Tables 5-3 and 5-4, are different from the usual pattern and also from Ansari's (1976) ANOVA table (Table 2, page 202), which are written with the separation of variation sources i.e. 'Between Subjects' and 'Within Subjects'. The reason is that in the present experiment all subjects (students) can be regarded as equivalent in terms of their abilities because all of them were taught target-costing system in their accounting class. Also, the number of subjects in each team of each group is as many as fifteen and the students with unusual performance were removed

to reduce the influence of outliers. The difference within subjects is considered in ANOVA by using time factor as one of the independent variables.

Now let us test the difference between population average, i.e. the difference in the interactive factor between participation and controllable information. This factor has four different levels in terms of the number of combinations between participation and evaluation factors.

Table 5-5. Average performance of Teams A and B

		Factors Relating to Participation	
		Nonparticipation	Participation
Factors Relating to Performance Evaluation Information	Uncontrollable Information	Group 1 Team A 49.22 (10.34) Team B 56.40 (12.39)	Group 2 Team A 48.35 (8.57) Team B 55.70 (11.90)
	Controllable Information	Group 3 Team A 49.38 (10.22) Team B 61.67 (11.60)	Group 4 Team A 58.33 (12.69) Team B 68.15 (12.01)

Figures in brackets are estimated standard deviations

Table 5-5 shows the average performance of each team in each group. Using this table's results and applying the multiple comparison method (which is used to find the difference in performance between two groups), a test for the difference between the population average of interactive factors can be made. The results are shown in Table 5-6

Table 5-6: Tukey's multiple comparison method

Difference between	Team A	q	Team B	q
Group 1 and Group 2	0.87	5.05	0.70	5.46
Group 1 and Group 3	0.16		5.27	
Group 1 and Group 4	9.11		11.75	
Group 2 and Group 3	1.03		5.97	
Group 2 and Group 4	9.98		12.45	
Group 3 and Group 4	8.95		6.48	

(At 5% level of significance)

From this result in Team A, the differences in population averages are significant between Groups 1 (G1) and 4 (G4), Groups 2 (G2) and 4, Groups 3 (G3)

and 4. In Team B, the differences in population average are significant between Groups 1 and 4, Groups 2 and 3, Groups 2 and 4, and Groups 3 and 4.

Now, according to Hypothesis 5-1, the performance of the supportive groups (G1 and G4) is greater than that of the nonsupportive groups (G2 and G3). Let us take the average within the supportive and nonsupportive groups as shown in Table 5-7.

Table 5-7. Average of supportive and nonsupportive groups

	Team A	Team B
Group 1	49.22 (10.34)	56.40 (12.39)
Group 4	58.33 (12.69)	68.15 (12.01)
Average of supportive group	53.78 (12.40)	62.28 (13.51)
Group 2	48.35 (8.57)	55.70 (11.90)
Group 3	49.38 (10.22)	61.67 (11.60)
Average of nonsupportive group	48.87 (9.41)	58.69 (12.08)

Figures in brackets are estimated standard deviations

From this table, it is apparent that in both Teams A and B,

Average performance in nonsupportive group.<   average performance in supportive group. In other words,

    Average performance of G2 and G3 <   average performance of G1 and G4

Therefore, it seems that Hypothesis 5-1 is verified by this result. Also, the interactive effect between participative and performance evaluation factors may be considered as significant, as evident in the ANOVA tables. However, the ANOVA tables do not provide any information regarding the superiority of one group over the others, which makes the interactive effect between participative and performance evaluation factors significant. As the test by using Tukey's method (Table 5-6) shows a significant difference between the results of Groups 1 and 4, it is questionable to take the average of these two groups. Therefore, it is rather difficult to strongly support Hypothesis 5-1.

Hypothesis 5-2 states that Groups 2 and 4, whose members can participate in setting target cost can achieve higher performance in attaining target cost, than Groups 1 and 3, whose members cannot participate in the target cost-setting process. It is apparent from the ANOVA results that the participation factor will provide a significant effect on performance, but these results do not explain the relative effects of the respective groups in accounting for the significant effect of the participation factor on performance. Thus when simple mean performance of the nonparticipative group and that for the participative group are taken it reveals this fact in Table 5-8.

Table 5-8. Average of nonparticipative and participative groups

	Team A	Team B
Group 1	49.22 (10.34)	56.40 (12.39)
Group 3	49.38 (10.22)	61.67 (11.60)
Average of nonparticipative group	49.30 (10.24)	59.04 (12.24)
Group 2	48.35 (8.57)	55.70 (11.90)
Group 4	58.33 (12.69)	68.15 (12.01)
Average of participative group	53.34 (11.89)	61.93 (13.44)

Figures in brackets are estimated standard deviations

As can also be seen in Table 5-8, the average of the nonparticipative group is smaller than that of the participative group. In other words, average performance of Groups 1 and 3 is smaller than the average performance of Groups 2 and 4; thus, Hypothesis 5-2 holds true. Therefore as a practical suggestion, to get better performance designers should be given the opportunity to participate in the target cost-setting process.

According to Hypothesis 5-3, Groups 3 and 4, whose members are evaluated by the controllable information only, will show a better performance in achieving the target cost than Groups 1 and 2 whose members are evaluated by the information that includes uncontrollable factors. As per the result of ANOVA, the evaluation factors relating to controllable information will also have a significant effect on performance. Due to the inadequacy of the ANOVA tables, it is not possible to know which group's

performance is superior to others. This is clear from the simple average performance of the above two groups as shown in Table 5-9.

Table 5-9. Average of controllable and uncontrollable groups

	Team A	Team B
Group 1 or G 1	49.22 (10.34)	56.40 (12.39)
Group 2 or G2	48.35 (8.57)	55.70 (11.90)
Average of uncontrollable groups	48.79 (9.47)	56.05 (12.10)
Group 3 or G3	49.38 (10.22)	61.67 (11.60)
Group 4 or G4	58.33 (12.69)	68.15 (12.01)
Average of controllable groups	53.86 (12.32)	64.91 (12.20)

Figures in brackets are estimated standard deviations

The average performance of Groups 3 and 4 (controllable group), is better than that of Groups 1 and 2 (uncontrollable group); thus Hypothesis 5-3 holds true. Therefore, as a practical suggestion, it can be said that the designers will be better motivated in achieving their target cost when they are evaluated by controllable information only, rather than information that includes uncontrollable factors.

Hypothesis 5-4 consists of four different orders among groups in terms of performance. The first is based on Hypothesis 5-1 that considers only cognitive dissonance theory,

Performance of G 2 or G 3 <   performance of G 1 <   performance of G 4

and the second is based on Hypotheses 5-2 and 5-3 (i.e. each factor is considered separately),

Performance of G 1 <   performance of G 2 or G 3<   performance of G 4.

However, as can be seen in Table 5, the actual order in terms of average performance is:

Performance of G 2 <   performance of G 1 <   performance of G 3 <   performance of G 4.

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Since this order differs from the above hypothesized order, Hypothesis 5-4 must be rejected from either perspective as mentioned earlier. Now the critical order shown in Table 5-10 is based on the levels of significance contained in ANOVA (Tables 5-3 and 5-4).

Table 5-10. Different levels of significance

	Team A	Team B	Effect
Factors relating to controllable information (i.e., hypothesis 5-3)	0.0002	0.0001	Largest
Factors relating to interactive effects (i.e., hypothesis 5-1)	0.0003	0.0147	Moderate
Factors relating to participation (i.e., hypothesis 5-2)	0.0031	0.0489	Smallest

As per Table 5-10,

The effect of Hypothesis 5-2 < the effect of Hypothesis 5-1 < the effect of Hypothesis 5-3.

Thus, since Hypothesis 5-3 or factor relating to controllable information is the most effective among the three factors, the following order must be initially established from the viewpoint of Hypothesis 5-3:

Performance of G1 or G2 < performance of G3 or G4   (1)

Next, since Hypothesis 5-1 or an interactive factors stand in the second position among the three factors, the following orders will be established from the viewpoint of Hypothesis 5-1.

Performance of G2 < performance of G1, performance of G3 < performance of G4   (2)

Combining (1) and (2), the following order will hold,

Performance of G2 < performance of G1 < performance of G3 < performance of G4   (3)

This order coincides with the actual results.

Finally, although Hypothesis 5-2 or participative factor also has an influence on performance, its effect is much weaker than the other two factors. The order (3)

cannot be changed by the influence of Hypothesis 5-2, though the actual performance of Group 2 is closer to that of Group 1 and the performance of Group 4 is distinctly high.

To explain the reasons for the difference between Hypothesis 5-4 and the actual results obtained, the relative influence of the constituents of interactive factors must be explained carefully. Statistically, factors relating to controllable information have the largest effect on cost-reduction performance while the effect of participation factors is the smallest. Therefore, in the interactive factors the relative effect of controllable information factors is much more than that of participation factors. Due to the interaction between evaluation factors and participation factors, different degrees of cognitive dissonance and consonance will be created. The performance of Group 4 is the highest because the interaction of participative target setting and evaluation by controllable information will create consonance, as there is no mismatch between the cognition of the two elements and there is also no conflict. The members of Groups 3 and 2 will be in a dissonant condition due to the nonfitting relationship between the elements of the participation and evaluation factors. The reason for the better performance of Group 3 over Group 2 may be due to the stronger effect of controllable information on cost-reduction performance than the participation factor. In Group 3, the members are not aware of the rationality and the tightness of target cost, but they are well informed of their individual performance and if their performances are good, they will be highly motivated toward better performance. In other words, Group 3 achieves better performance by virtue of the following: (1) the members can successfully use dissonance-reducing mechanism with cognition of their true performance, and (2) they can justify nonparticipation since they were not allowed to participate in the target cost-setting process. In Group 1, a member cannot

participate in the target cost-setting process and has limited information, i.e. relating only to the group's performance. In this situation, the members can reduce their dissonance and reach a congruent state by blaming the information structure for not reporting their true performance (which is incapable of differentiating between controllable and uncontrollable information). Moreover, since the target is imposed from the upper level, they have nothing to do with the irrationality and tightness of the target. Keeping these cognitive elements in their minds, as soon as any dissonance or conflict arises, they will try to reduce it on the ground that they should not be held accountable for the defects of built-in organization structures. The members of Group 2 are in a state of psychological anxiety due to the interaction of two nonfitting relations of evaluation by uncontrollable information and participation in target cost setting. All of them can participate in target setting but simultaneously they are evaluated by group performance and they are not rewarded for their personal achievements. Therefore, they can compare their self-evaluation with the evaluation by the product manager (group manager) and can determine whether or not there is any injustice. In this situation, the magnitude of their dissonance will be high and they may not find any plausible ground for reducing dissonance, which may be the cause of their worst performance among the four groups.

From the above explanation, the following practical suggestion can be proposed. First, when designers are evaluated by controllable information only, then in order to achieve better performance, they should be able to participate in setting target cost. Second, when designers are evaluated by information that includes uncontrollable factors, then they should not be allowed to participate in target cost-setting process. Rather, they should be given the target from the top, i.e. the product

manager, in order to achieve better performance. This second proposition is one of the most remarkable findings of this experiment.

Hypothesis 5-5 is formulated to see whether time factor can provide any learning effect in reducing cost continuously and partly checks whether this laboratory experiment reflects well the actual condition of cost reduction activity in the real world. The following relationship is observed in the total amount of cost reduction (TACR):

TACR of Trial 1 <   TACR of Trial 2 <   TACR of Trial 3 <   TACR of Trial 4
    (T1)   (T2)   (T3)   (T4)

This relationship holds for both Teams A and B, which is also reflected by their average performance (Table 5-11).

Table 5-11. Learning effect as shown by average performance

	Trial 1	Trial 2	Trial 3	Trial 4
Team A	47.60	50.38	53.20	54.10
Team B	53.15	62.08	62.40	64.28
Average of Teams A & B	50.38	56.23	57.80	59.19

Again the hypothesized cost reduction rate (CRR) is:

CRR between $T3$ and $T4$ <   CRR between $T2$ and $T3$ <   CRR between $T1$ and $T2$

This hypothesis is verified for Team A but not for Team B. However, when the average cost-reduction rate of Teams A and B is considered, the above hypothesis is supported (Table 5-12).

Table 5-12. Cost reduction rate (CRR) of Teams A and B

	CRR between Trial 1 & Trial 2	CRR between Trial 2 & Trial 3	CRR between Trial 3 & Trial 4
Team A	1.058	1.056	1.017
Team B	1.168	1.005	1.030
Average of Teams A & B	1.113	1.031	1.024

As a result it can be said that the experiment reflects the actual process of target cost achievement; thereby the intrinsic validity of the experiment is verified.

Based on the results discussed above, the findings of the experiment and practical guidelines that they provide for target cost setting can be summarized as follows:

(1) Participation factor, controllable information factor, time factor and the interactive effects of the first two have an effect on cost reduction. Hypothesis 5-1 is substantiated by the results that the supportive group produces better performance than the nonsupportive group. Even though Groups 1 and 4 belong to the same major group (supportive), there is a significant difference between their performances. Therefore, averaging their performance will not provide a premise for supporting Hypothesis 5-1. Hence, Hypothesis 5-1 cannot be strongly defended.

(2) Hypothesis 5-2 is corroborated by the results that the performance of the participative group is better than that of the nonparticipative group. Due to the same reasons mentioned above, Hypothesis 5-2 cannot also be strongly defended, since the performance of Group 2 is far below than that of Group 4. However, as a practical suggestion, designers should be allowed to participate in the target cost setting process to achieve a better performance.

(3) Hypothesis 5-3 can be supported without any reservation. It confirms that the performance of the groups who are evaluated by the controllable information only is better than that of the groups who are evaluated by the information that also includes uncontrollable factors. The strongest effect of Hypothesis 5-3 is apparent in ANOVA (Tables 5-3 and 5-4). Therefore, as a pragmatic suggestion it can be proposed that designers will be better motivated in achieving their target cost if they are evaluated

by controllable information only, rather than information that also includes uncontrollable factors.

(4) Hypothesis 5-4 gives a different order from the ranking established at first. As the reason of this difference it can be said that the strength of the individual effect of Hypotheses 5-1, 5-2, and 5-3 could not be understood properly during the formulation of Hypothesis 5-4. However, if Hypotheses 5-1, 5-2, and 5-3 are combined it will provide a ranking that is consistent with the actual order of performance. Hence, as a realistic suggestion it can be recommended that when the designers are evaluated on the basis of controllable information only, then in order to achieve a better performance they should participate in the target cost-setting process. Again, when designers are evaluated by the information that includes uncontrollable factors, in order to achieve a better performance they should not be allowed to participate in the target cost-setting process but the target should be given by the product manager. The second proposition is one of the remarkable findings of this experiment as it cannot be suggested by the common sense.

(5) Hypothesis 5-5, which is meant to show the learning effect in cost-reduction activity is also strongly supported by the results. Therefore, it can be said that this experiment reflects well the real-world situation of cost-reduction activity and target cost achievement.

5.7. Conclusion

In this paper, the tools for behavioral accounting research (especially performance evaluation methods and budgetary control systems of behavioral scientific research) are applied to study the target costing system. The use of expectancy theory and cognitive dissonance theory has proved to be successful as they facilitate theory

formulation on target costing. It is evident from this experiment that the joint influence of the independent variables is different from their separate influences. When the participation and controllable information factors are considered separately (interactive factor is not taken into consideration), both factors will have their respective effects on cost reduction performance. Again when interactive factor is taken into consideration the combination of controllable information and participation factors and that of the uncontrollable information and nonparticipation factors will have better effects.

The reason for the failure to observe the rankings predicted in Hypothesis 5-1 is due to the unexpected excellent performance of Group 3. Since both Groups 3 and 4 are evaluated by controllable information only, the results suggest that the evaluation method may have been the governing variable over time. The superior performance of Group 3 over Group 2 (these two groups are being compared since both have one negative factor) may be because the evaluation method has a stronger effect on performance than participation. In Group 2, participation will help to judge the rationality or the validity of target and since the subordinates are held accountable for someone else's fault, it may have contributed to their frustration.

It is noteworthy that in each group, both Teams A and B show similar performances, this being authenticated by the replication of same results. In fact, the questions prepared for Teams A and B were completely different. It can be asserted that the internal validity of this experiment has been proved by including time as one of the independent variable. The learning effect in cost-reduction activity resembles the real-world situation.

Finally, one of the limitations of this laboratory experiment may be the discrepancy between the calculation trials by the subjects and the actual cost-reduction

activities in the real world which are essentially based on ideas created by designers. A comparative study between the laboratory experiment of this paper and the real-world situation will be the next topic in the empirical study of target costing system. Again, in the target costing system, while determining the target cost, cost reserve is considered as its complement. However, examining the existence of a cost reserve becomes important if the target cost cannot be achieved. The relationship between cost reserve and cost reduction target per unit and the analysis of the psychological state of designers may be interesting aspects to consider in future.

End Notes

1. Monden, Akter and Kubo publish this chapter as an article in the *Managerial and Decision Economics* in March 1997.

2. See also Noboru and Monden (1983), Monden (1986), and Monden and Hamada 1991.

3. The reasons why the initial estimated cost $\geq$ the target cost are as follows:

(i) The target cost of a final product is usually determined as the market-based price minus the target profit per unit, while the market price of the similar products is always inclined to be reduced due to rapid technological innovations in a competitive market. Therefore, the target cost of a new model is usually much lower than the actual cost of the existing one. The initial estimated cost is, on the other hand, determined based on the actual cost of the existing model plus (or minus) the cost of initial plan of specification changes to the existing model.

(ii) The target cost of each part constituting the final product is determined by apportioning the target cost of the final product (which is much lower than the initial estimated costs as stated in (i)), among these parts.

Therefore, it normally follows that the initial estimated cost of a part $\geq$ its target cost. However, if the initial estimated cost of a certain part is less than its target cost, then that estimated cost will be treated as the target cost of the part and there is no need of cost reduction effort for that part.

4. For similar results see also Argyris (1952) and Ronen and Livingstone (1975).

5. In the original data set, the size of each team varied from 16 to 20. The authors arranged the data of each team in a random fashion. Since there is a need to have equal number of data for the application of ANOVA, the authors have chosen 15 data from this randomized set for each team and eliminated the others. After that, outliers among the 15 selected data were replaced with data from the initially eliminated set. No cases were encountered where the number of outliers exceeded the number of data in the eliminated set.