Chapter 3

Examples of the Application of the Basic Method and their Considerations

Abstract

This chapter explains the PMD method and the Steplist Management method in detail and presents specific examples of their application.

Chapter 3

Examples of the Application of the Basic Method and their Considerations

3.1 How to Create the Domains of Thinking and Consensus among the People Concerned (the Details of the PMD Method and Advanced Considerations)

3.1.1 Introduction

We know from experience that if we make plans with the following two points in mind, the resulting research and development (R&D) plan and its implementation will be carried out appropriately and effectively.

(1) To select the theme/subject or project name
As a Japanese proverb says, "names and nature often agree." Therefore, it is necessary to select an appropriate theme/subjects or project name for the R&D project initially to get a good result.

(2) To have the same Consensus
Based on the theme/subject or project name, it is necessary that we summarize the thinking structure for actions in the shape of "In order to do it, how, and what is the minimum we must do?" with the necessary actions by questioning "What are we going to do with it?", and "Where do we start to do it?", and reach consensus among the people concerned.

The purpose of this section is to describe how to select a theme or subject name and effectively reach consensus by utilizing the Purpose-Measure Diagram (PMD) method, and to expand the PMD method as a practical method for obtaining the Domain of Consensus. In addition, we will explain and analyze the

PMD method in detail, enabling us to visualize the mechanism of the relationship with similar conventional methods.

Moreover, this method is intended to create a "visible direction of value" for each theme or subject among the people concerned. Therefore, if used along with the "Proper Use of Questioning to Create the Vectors of Creative Thinking and Action" in Chapter 1 (Proper questioning of "In order to do what?", "How to do?" and "Why?"), it could serve as a new method not only in R&D, which opens up new worlds, but also in project planning in private corporations, administrative planning in governments, and in the software establishment.

Transforming this method and content into software will provide a guiding structure to accumulate compact know-how for each subject. This would make information, knowledge and wisdom easier to compile and utilize.
This method creates the same view of value and its tools among the people concerned. It could be used in software R&D, as well as be an algorithm for software.

3.1.2 Purpose of the Chapter

The purpose of this chapter is to present a method of bringing together and integrating all the potential or unintegrated project names and ideas in a short time, before and after making plans to launch an R&D project in an unknown field, as well as proposing ways of collating the results into a visible consensus.

Basically, the PMD method, which the author explained in Chapter 2 and the Theme Key Word method (theme and method), which is a modified version of the PMD method, will be used throughout the chapter. In addition, this chapter reviews the need for these methods and gives specific examples of them, explains the PMD method in greater detail, and touches on expanding the use of the PMD method.

3.1.3 Definition of Terms

(1) Domain of Thinking
Indicates the range of considerations relevant to a theme or subject (scope [5] of the Domain of Thinking).

(2) Domain of Consensus
Indicates the state of affairs that results when the people concerned reach consensus about how the purpose-measure relationships are structured within the Domain of Thinking.

(3) PMD
Indicates a Purpose-Measure Diagram made according to the method described in this chapter.

(4) Structured Thinking using a PMD (or Structured Knowledge using a PMD)
Indicates structuring the Domain of Thinking, which needs to be structured into a purpose-measure relationship, according to the PMD method described in this chapter. To get the structured knowledge with a keyword by the PMD method is the same as getting wisdom before action.

(5) View of Value using PMD
The decision about what to do is made by reconciling the "information of difference" with the purpose-measure (or "direction of value") of the decision-makers. ([1] p. 161, [2] p.8, [3], [4])

Therefore, if the to-do actions of the project are rearranged by the PMD method into purpose-measure relationships, the result shows "the direction of value" of the individual or group who made the rearrangement concerning the theme or subject in question.
The view one gets by combining the "directions of value" of several themes or subjects is called "the view of value using PMD" in this book.

3.1.4 The Need for a New Method as Felt When Preparing Preliminary and Follow-up Research and Development Plans in the Conventional Way

The following is a list of needs as felt when preparing preliminary and follow-up R&D plans in the conventional way:

(1) The potential success of an R&D project is a matter of the Domains of Thinking of each of the individuals involved in the project and the combined Domain of Thinking of the group as a whole. Until now, individual Domains of Thinking have often remained unexpressed. These unexpressed thoughts and ideas appear later on as implicit criteria of assessment (Bibliography [6]).

Are there any techniques for extracting as many of these thoughts and ideas as possible and

summarizing them beforehand on paper so that they are visible?

(2) Such techniques help make it easier to examine and exchange thinking and ideas frankly, and reach consensus among the people concerned, even with outsiders if necessary. Once written consensus is achieved, it would be easier to revise and adjust the Domain of Thinking and the purpose-measure relationships even when new situations arise.
Is it possible to come up with suitable rules or convenient software for this purpose?

(3) There are many factors to consider in the early stages of R&D; furthermore, these factors often seemed to be in conflict. Moreover, in such cases, the relationships among the factors are often chicken-and-egg relationships. Therefore, we often do not know "what to do or where to start." Is there any way to establish, structure and direct the factors in a short period of time by combining the group's knowledge?

If a way can be found, it will automatically determine "how to structure the Domain of Thinking based on what purpose, how, what and to what extent, as well as where to start R&D." It will also make it easier to collect knowledge from individuals in the group, and to have better transparency (that is, being able to better trace the thinking process) because there will be written records.

(4) Conventional ways of writing are not adequate for describing the deep contents and ways of thinking concerning R&D themes or subjects. Is there a way to do this more compactly?

(5) As the Japanese proverb says, names and nature often agree. Before discussing the above matters further, it is necessary to ask if there is a good way of coming up with possible themes/subjects and R&D project names, and selecting the appropriate ones. The previously mentioned PMD [1] only states "confirm themes/subjects for work or thinking." However, ways are needed to create and confirm themes or subjects.

(6) There is another method, the KJ method, which was thought to meet the above needs. However, in reality, the method does not meet them satisfactorily. What are the differences between the KJ method and the PMD method, and how does one choose the right method in the right situation or phase? How can one choose the best of the two to fulfill certain needs and utilize it? In response to the above needs, this chapter explains the PMD method in greater detail, presents specific examples of PMDs used in actual administrative planning and R&D, and makes a brief analysis of the method.

3.1.5 Structure of the Chapter

In order to make explanations easier to understand, the chapter touches on the basic principles of applying the method, then gives specific examples of its use, explains the basic techniques and varieties, provides analysis, and outlines future prospects for the method.

3.1.6 Basic Principles of the Application of the Method

In response to the considerations mentioned in 3.1.4, the following methods are used.

(1) Needs, namely needs from 3.1.4 (1) through (4) are resolved by the PMD method, which is also known as the Key Word method.
(2) As to need 3.1.4 (5), it is resolved by the Noun Key Word method, which is a recent variation of the PMD method. The Noun Key Word method uses only nouns, whereas the PMD method uses mixed expressions of verbs and nouns in the present tense.

3.1.7 Specific Examples

Creating a PMD will be discussed in greater detail in the next section. In this section specific examples of PMDs created using the method will be presented in order to make it easier to understand. If you read the example from top to bottom following the order of purpose-measure, you will understand the order of thinking. If you read it from bottom to top repeating "in order to do, it's necessary to do," you will understand the layered conditions or rough procedure for carrying out the process.

3.1.7.a Example 1: Improvement of an Emergency Medical Treatment System (How to Create an Administrative Plan)

Figure 3.1-1 shows the PMD, which the author created together with a government administrative officer in 1984, on how to establish a helicopter emergency medical treatment system, one of the new starting points for improving the emergency medical treatment system in Japan. In 1984, the PMD method was new. The administrative officers in charge had no established ideas about how to deal with

the thirty factors and more in question. They were not sure whether all of the written cards fit into purpose-measure relationships. The diagram was made following the procedures of a preliminary PMD method created at that time and ultimately proved that all of the cards did fit.

The Entrance Key Word at the bottom of the diagram is "identify the relationship with constitution law." This entrance key word then becomes the theme of the following PMD in Figure 3.1-2. The Domain of Consensus from this PMD not only established the helicopter emergency medical treatment system, but also served as a preliminary PMD in facilitating the development of theories about how to improve the life-saving and recovery rates in emergency medical treatment.

In short, in order to realize expression no. 29 in the figure systematically, that is "decide the helicopter's target access time to the site to be 15 to 30 minutes," a letter of proposal entitled "Regarding the Establishment of Maximum Target Times to begin patient treatment in the Emergency Medical Treatment System" (see Note) was submitted by the Japan Resuscitation Society and Anesthesia Society to the Director of the Fire Defense Agency of the Ministry of Home Affairs on December 15, 1984. The catch phrase "emergency aid which helps those who can be helped" was created from the proposal.

(Note) If a target is set, the development of a system will be well-balanced and easier to organize.

Later, expression no. 30 in the figure, "identify the needs of the doctor's medical treatment on site," was examined and studied by several academic societies and organizations and led to an effort to legalize the use of alternative doctors at emergency sites. It also led to today's emergency paramedic staff system as a supplemental system.

As described in Chapter 1, the PMD method excludes why-type questions, which is the primary cause of not being able to avoid the following past examples. The PMD method is based on the idea of "in order to do A, it is necessary to do B." Therefore, it is believed that the PMD method has created the basis for improvement by removing bureaucratic barriers between ministries.

3.1.7.b Example 2: Find the Procedures to not Proceed with Design in the Early Stages of Aircraft Design (How to solve the dilemma of not knowing where to start/to escape from chaos)

The PMD in Figure 3.1-3 was made in the early stage of designing an aircraft, when it was not known how to determine the most appropriate location for the fuel tank. The development program of the aircraft

in process was carried out jointly by three large corporations (Kawasaki, Mitsubishi and Fuji Heavy Industry). The PMD was made by a dozen people representing a design team of 120 people from the three corporations.

The PMD in Figure 3.1-3 was made first. This was followed by the PMD in Figure 3.1-4, which picked up on the Entrance Key Word in Figure 3.1-3, that being "clarify the ideas of the wing and fuselage connecting structure" (Block No.53).

With this PMD, the consensus that to determine the best location of the fuel tank could start by examining five comparative(*) ideas about the wing-body connection, which appeared to be the Entrance Key Word in Figure 3.1-4, was reached. (*We used the expression of comparative ideas in order to find the information of difference between them instead of alternate ideas, because the expression of alternative has the meaning of to replace.)

This PMD also clarified the procedures for examining designs as well as the scope of the procedures and design itself.

The PMD in Figure 3.1-3 extracted 54 factors of concern, whereas Figure 3.1-4 extracted 74. Although some adjustments were necessary, all the factors extracted were put into purpose-measure relationships. In addition to this, PMDs were made to address several questions about where and how to start which had been unanswered in the early stage of the aircraft's development. With these PMDs, the scope of thinking and ideas about each theme or subject, and the procedures for examining them were resolved.

Reaching consensus in the early stage of the design led to well-balanced performance, and improved the momentum for developing and completing the aircraft in a way that accomplished the targets for performance, cost and schedule.

3.1.8 The Basic Model of the PMD Method and Variations on the Model

The detailed basic model of the PMD method described in Chapter 2, some variations on it, and supplements are described below.

3.1.8.a The Basic Model of the PMD Method and Procedure (No. 1)

1) Confirm the theme or subject among team members.

2) Ask team members the following two questions about the theme or subject: "What are we going to do with it?" and "What is the minimum that must be done?"

3) Write down all the possible answers on paper in the form "(verb) + (object)" (present tense and positive: active or functional expression) (You can write whatever comes to mind in the beginning; however, as you proceed, the secret is to choose brief expressions which are specific and easy to understand).

4) After writing everything down, cut the paper into individual pieces and make cards (If you use different colored paper for each individual participant in the process, later you can tell who wrote each specific card).

5) Pick cards one after another and place them on a large paper as vertically as possible into purpose-measure relationships such as "In order to do A, it is necessary to do B" after repeating from top to bottom.

a) Only place cards horizontally if it is not possible to place them vertically. If more than one member is engaged in the activity, there should be a team leader.

b) The leader is to place each card in front of all the members and read its content. After that, the leader should place the card tentatively where it seems to fit. If all the other team members agree, the leader goes on to another card, reads its contents, and so forth (see Note 1).

c) If there are gaps between the top card and the bottom card, add more cards or adjust the expressions on the cards so that all the cards are placed in purpose-measure relationships.

d) If expressions are duplicated, stack the cards or dispose of them. If you feel there needs to be something in a certain place to keep the flow from top to bottom, add a blank card.

(Note) You can either put down all the cards you have, or if necessary, dispose of the ones that all members agree to discard in order to make the PMD easier to understand. However, in cases of doubt it is advisable to keep all cards.

e) When you come across cards whose contents are unclear or need to be subdivided, make additional cards in the "(verb) + (noun)" format by repeatedly asking yourself what they really mean and place the cards into purpose-measure relationships. By doing this, you will see the flow of purpose-measure relationships even if the cards at the top and the bottom carry almost the same expressions.

f) If cards with similar expressions are needed in more than two locations, differentiate them by naming them "Pre-pre-Plan", "Pre-Plan", "Plan before Decision", or "To do A the first

time,""To do A the second time" and so on from the bottom up because this is often the way in which redundancies are eliminated step by step.

g) When you have to choose between cards with conflicting ideas or parallel actions, place cards as in Figure 3.1-5 for the time being, and complete the PMD.

6) When all the cards are placed from top to bottom into purpose-measure relationships, that is "In order to (verb) + (noun), it is necessary to (verb) + (noun)," tape them to a large piece of paper.

7) Search for a card with the level of expression that covers both the upper and lower levels of expressions. This is called searching for the Main Key Word (see Note 2).

a) The search for this card should proceed by a vote of the team members. If any team member has conflicting ideas about what the top and bottom relationships are, they should say why. After they've given their reasons, everyone should vote again.

b) Everyone should continue to freely exchange their opinions on which expression is the key word, without sticking to the first expression chosen, until all members agree on one expression (The principle is that this process should not be decided by majority, but rather agreed upon by all. Exchange of opinions is essential if even one of the members does not agree). The expression agreed upon is the Objective Result or Expression of Basic Function for the theme, and is called the Main Key Word.

(Note 1) The team leader placing cards "tentatively" is a good starting point for other team members to present their own ideas. The secret is to put cards where they seem appropriate rather than being unable to decide.

(Note 2) Expressions above the Objective Result are the abstracted expressions leading to the Objective Result. The expressions below it, if read from the bottom upwards, represent rough procedures to realize the Objective Result.

(Note 3) The reason why why-type questions are allowed here is based on the premise that the person in question already has established the appropriate purpose-measure relationships in his/her mind and is trying to explain them plainly.

8) The bottom-most expression of a PMD represents the entrance action that needs to be taken to realize the Main Key Word. Add cards until no further cards with specific actions are found. The bottom-most expression is sometimes "make this PMD."
a) If there are expressions that are unclear or should be subdivided, make another PMD of the expressions in question following procedure (1) to (8), or replace the cards with another PMD, after understanding the expressions highlighted by the PMD.

An example would be if the ambiguous expression is "inform." In this case, raise questions continuously about what exactly "inform" means, make another PMD, and be specific about the contents of the expression.

3.1.8.b Detailed Procedures for Making a PMD (No. 2)

In general, the previous procedure for making a PMD is practical enough to lead to consensus. However, the following methods facilitate the systematic extraction of creative wisdom from a group.

1) Each member should use cards with a different color. By doing so, it will be easier later to ask what the member really means or has in mind. In addition, it is advisable to glue colored cards with the names of the corresponding members in the bottom left of the large sheet of paper that makes up the PMD.

2) It is also useful to keep a record of the date the PMD was made, the time it was started, and the time it was completed for future reference. By doing so, it becomes clear that all members are trying to resolve the problem by reaching the same goal using their special expertise.

3) Place blank cards in places where it seems something is missing while making the PMD. Later it will become clearer what is missing as the blank cards speak for themselves (This is one of the creative advantages of making a PMD). Add expressions if necessary.

4) A PMD with too many expressions is difficult to understand. If necessary, summarize the PMD so that non-participants are able to comprehend the framework easily.

5) In order to make the purpose-measure diagram easier to implement, include the seven techniques of the DTCN method as expressions in the PMD as necessary. By doing so, the flow of purpose-measure will become easier to implement.

(Examples of Expressions Which Include Seven Techniques of the DTCN Method)

6) Make a PMD.

7) Make a steplist (To create the phased procedure by the matrix to cover all the necessary phases and procedures).

8) Make an FBS/WBS (To create the structural image of objective result).

9) Create a process of improvement through the 3-5 Phase Improvement method.

10) Use the WBS Theme Phasing Management method (a method to extract all the knowledge possible from the people concerned).

11) Adopt a Root Organizing System.

12) Make an implementation plan.

3.1.8.c Direct Effects of the PMD Method

The Main Key Word represents the summarized expression of M action, and the basic function of the theme or subject. Therefore, it includes specific images and ideas which are led by action, and basic function or thinking.

(Note) There are various PMDs. For instance, "Action PMDs" represent action and thinking, "Function PMDs" represent function, and "Combined PMDs" are a mixture of the two. It is possible to create a suitable PMD without being too concerned about its boundaries.

With PMDs, it is possible to inform non-participants about the Domain of Consensus in a short period of time (several minutes). Similarly with PMDs, it is no longer necessary to make long introductory remarks to strangers before going into the main subject. Introductory remarks can be replaced by reading PMD, which only takes several minutes.

Expressions such as "the important thing is" or "it is significant" have often been used. Using a PMD

makes it clear that there are four meanings of "important/significant", as listed below. With PMDs, therefore, it is possible to explain which one of the four meanings of the words is intended in each case that the word is used. "Important/significant" can mean:
an overriding objective in an abstract sense;
the Main Key Word;
the Entrance Key; and
the most important/significant factor when various factors are found at the level of the Main Key Word.

3.1.8.d The Theme-PMD Method (Theme Key Word Method)

Occasions when the Theme-PMD method is used:

This method is used when it is unclear how to select an appropriate theme or subject, or project name, as well as when the theme/subject about which a PMD should be created is unclear.

In the Theme-PMD method, the basic method of generating PMDs described above should be altered as follows:

1) Instead of writing "(verb) + (noun)", come up with as many phrases stating objectives as possible in noun or noun phases. These phrases may take the form of "to + (verb) + (noun)" if necessary.

2) Place the phrases as "purpose" on the upper side and "means" on the lower side.

3) Apply the same basic method of PMD to discover the most appropriate level of generality. If members split over which level of generality is appropriate, combine these two levels, for instance "with reference to."

4) In the Theme PMD method, it is not necessary to follow the rule of "exchange ideas until all team members agree on one Main theme or subject expression" (A specific example is shown in Figure 3.1-5). The PMD created here is to be called the "Theme-PMD" or "Theme-key word Method."

(Notes)
The Theme Key Word method is, fundamentally, a way to reach agreement on the theme or subject as the first basis of agreement among team members before proceeding to the next PMD. Therefore, it is possible

to create a PMD based on a theme or subject chosen by the Theme Key Word method, and then revise the theme or subject based on the result of the selection of the Main Key Word by "(verb) + (noun)" PMD Method. This can be the best way to select the most appropriate theme or subject.

Based on the above, it can be said that the Theme Key Word method and the "(verb) + (noun)" PMD method complement each other and so, one can begin with either, depending on the circumstances.

The standard given for selecting the Theme Key Word is a guideline. Another guideline is to select key words that represent images of the roles and functions of the theme or subject itself.

3.1.9 Further Considerations

The following points require analysis because the PMD method has characteristics that complement other methods in other circumstances as well as unite them.

3.1.9.a Analysis 1: Creating Process of PMDs and the Result

1) An analysis of the above process follows. Since all members concerned are advised to give all considerable answers to the two basic questions in 3.8.1 (2), all of their ideas of action or function should be represented on cards without exception. (If confronted with problems or detailed issues that might require the examination and selection of ideas in the future, take notes on the "Theme/Idea Sheet" as described in Chapters 2.5, and only state in the PMD a word/phrase, such as "examine," which will be considered later on.

2) It is not possible to write "(verb) + (noun)" without having vivid images or knowledge about actions or functions. Also, it is not possible to place sentences into purpose-measure relationships without being able to connect these images or knowledge of actions or functions. Once the images of the actions or function are connected without any gap, it is possible to physically implement them.

3) Since all the cards written carry answers to the questions "What are we going to do with it?" and "What is the minimum that needs to be done?", it is natural for these cards to be placed into purpose-measure relationships. In addition, seeing all the cards being placed in order will trigger a sense of participation among participants.

4)Through the process of placing cards into purpose-measure relationships, all team members are repeatedly given chances to verify the contents of the cards. In addition, the cards carry every conceivable answer that the participants can come up with. Taking the above two facts into consideration, the PMD contents are reviewed objectively by all of the parties concerned.

5) Having several team members create a PMD means that the common purpose of all the team members is included in the PMD. Through this mechanism, inappropriate"purpose-measure" will be excluded. Individuals with inappropriate "purpose-measure" in mind often object to creating a PMD or stage a tacit disturbance.

6) One thing that needs to be considered is that if team members create a PMD for their own benefit, the created PMD is likely to consist of egoistic factors. Therefore, in general, it is necessary to reconfirm who the customer is in the spirit of the Design to Customers Needs (DTCN) method.

7) It takes a tremendous amount of effort to compose a document that carries the same contents as PMDs, like the ones in Figures 3.1-1, 3.1-2, 3.1-3, and 3.1-4, in the conventional documentation form. However, documenting the contents can be done without difficulty if one repeats sentences of the form "in order to (verb) + (noun), it is necessary to (verb) + (noun)" as one does in constructing the PMD.

8) When inserting a word that represents a new concept, explaining it can be done more easily in a PMD than in conventional writing forms. Moreover, with this method, a new concept can be created without difficulty.

9) Reaching a Domain of Consensus means that the parties concerned share an identical decision-making mechanism (direction of value) about the theme or subject using the "Decision Mechanism by Information of Difference" as described in the Chapter 1. If PMDs are made on several themes or subjects by the parties concerned, the participants are able to share the same values, at least in the visible realm because visible "directions of values" are created.

10) In addition, the PMDs that are created are visible to third parties because they are presented on paper, and represent the Domain of Thinking as well as the Domain of Consensus of the people or parties concerned. Therefore, being able to solidify PMDs on paper means creating the Domain of Thinking and Domain of Consensus on which negotiations with third party people can be based.

11) When applying the Detailed Procedures for Making a PMD (No. 2) of 3.1.8.b, it is possible to select a level of purpose-measure that efficiently utilizes the DTCN method or various conventional methods. The PMD method should be placed at the very bottom as a basic method, which means that the PMD method should be used first.

12) If it is necessary to add or revise answers to the questions "What are we going to do with it?" and "What is the minimum that needs to be done?" it is less problematic to determine how to do so with a PMD than with conventional writing forms.

13) The English software shown in Figure 3.1-7 (Microsoft Windows Version 3.0/3.1), which was created on an experimental basis in America utilizing this method, can be used for this purpose.(In 2001, Soft ware is available in the style of MS-Excel VBA at author)

According to the person in charge of creating the software, the software would be very useful and convenient if used in data communication networks. This is especially true in the United States, where there is a five-hour time gap within the country (including Honolulu). With this, it would be easier to create and coordinate the Domain of Thinking and the Domain of Consensus between various offices scattered around the nation (1992).

14) The difference between PMDs in Japanese and in English is that the Japanese language better clarifies subtle relationships of purpose-measure. The reason is that the Japanese language consists of both ideograms and phonograms, whereas English only consists of phonograms. However, in both languages, PMDs better translate words with ambiguous meanings into purpose-measure relationships.

15) When confronted with difficult challenges, it is advisable to create a PMD before going to bed. By doing so, solutions are often found by the next morning. That is why PMDs are also called the "24-Hour Thinking Tool."

3.1.9.b Analysis 2

What if one rotates the expressions in a PMD with contents intact by 90, 180, and 270 degrees? Now let's compare this method with typical methods that utilize these patterns.

From a general point of view, rotating a PMD clockwise by 90 degrees shows a conventional PERT (Program Evaluation Review Technique) (Bibliography [9]). Rotating it clockwise by 180 degrees shows the

conventional pattern of a top-to-bottom procedure flow diagram (which is called gravity-type procedure flow). Finally, rotating the PMD clockwise by 270 degrees shows a conventional FAST (Function Analysis System Technique) diagram (Bibliography [10]). Table 3.1-1 as well as the following figures and comments show the results of such experiments.

Figure 3.1-8 and the following comments show the result of rotating a PMD by a salaried worker on the theme of "Construction and Management of Apartment Buildings" (same as Figure 2.1-1) without altering its contents. It also gives a comparison of the characteristics of the PMD and each previously mentioned technique.

Based on the experiment, it is clear that the expression pattern generated by the PMD method is the most suitable pattern of spatial positioning for the purpose for using PMDs.

Characteristics of Each Method Resulting from Different Card Layouts

From Figure 3.1-8,

1) By rotating the PMD 90 degrees into the PERT diagram, it becomes clear that it is appropriate to include block nos. 8 through 12, although block nos. 8, 9 and 10 are ambiguous. It also proves that block nos. 1 through 7 are inappropriate to include in a PERT diagram because they are abstract.

If one rotates the PMD by 90 degrees into the PERT diagram, block nos. 8 and 9 seem to be backwards. It reads "In order to take the chance of reducing building cost, it is necessary to build and operate the apartment house," which is quite contrary to the real purpose-measure relationships revealed through the PMD. The reduction in construction cost was a vital point in making a decision to construct and manage apartment buildings.

From the above analysis, it is clear that transporting purpose-measure relationships into the PERT diagram results in concealing the cause and effect relationship between blocks 8 and 9. This often happens in conventional writing forms, either writing from right to left or from top to bottom. Therefore, a PMD is more precise and concise than conventional documentation methods for seizing and communicating the subtle relationships of the "purpose-measure relationship in mind."

Based on the comparison between PMDs and PERT, it is clear that PMDs are meant to be a tool to

reveal the relationships of purpose-measure. PERT, on the other hand, is meant to be a tool to reveal the physical relationships of cause and result/effect.

2) By rotating the PMD 180 degrees into the gravity-type flow table, it becomes obvious that the table does not present clear procedures. Therefore, it can be said that this technique is also meant to be a tool to reveal actual procedures.

(Note) On the far right side of Table 3.1-1 is a form of the Steplist method. The method combines PERT (which reveals the relationships of cause and result/effect) and the gravity-type flow table (which is procedure-oriented) into a matrix, and includes, without exception, all the activity procedures and condition terms of guarantee. At the beginning of section 3.1.7, the author stated that "If you read a PMD from bottom to top, it represents the rough procedure for carrying out the process." The Steplist method is the way to establish detailed procedures for putting the process described in the PMD into practice.

3) If one rotates the PMD by 270 degrees, we can get a FAST diagram, which shows the same relationship; however, with this horizontal expression, it is difficult to find the key word expression as in the PMD method.

Confirming the Characteristics of Each Method

Based on the above comparison, the following points can be made:

- The PMD method is efficient for showing the relationship of purpose-measure and its range of application. The PMD method also succeeds in revealing the Main Key Word, Entrance Key Word and the "directions of values in mind" on the theme or subject, which other methods often fail to do.

- The PERT method is effective in clarifying specific activities, and points of contact between them on the schedule as well as their effective relations of cause and effect.

- The gravity-type flow diagram is useful for creating, establishing, understanding and utilizing procedures.

- FAST is useful for people who only have the left-to-right writing structure to clarify purposes and solutions when they are preparing to do something. However, compared to PMDs, FAST is more likely to

conceal the subtle order of reasons and solutions with the key word. Therefore, Japanese people have difficulty in finding the key word by this method.

- Once contents are put back into the original PMD, after the special characteristics that are brought out by each technique are included, the PMD is transformed into a purpose-measure diagram with detailed factors and procedures.

- Based on the above comparisons, it is clear that it important to choose the best technique depending on what needs to be clarified, or to combine them if necessary.

3.1.9.c Analysis 3

How do characteristics based on differences in spatial positioning come into existence? The following are possible interpretations to this question:

1) In PMDs, mental deliberations about "in order to, how" [11] are represented on paper (see Episode 1 in this book).

2) In PERT, the dialogue between the left and right hemispheres of the brain on the cause-and-effect relations between the inputs and outputs are represented on paper. In addition, our eyes, which are placed horizontally on our face, can be used as a mechanism to examine the faultless input and output flow, as in a steplist management framework.

3) The gravity-type flow diagram is easy to understand because the diagram matches the mechanism of digestion, which automatically starts after a meal ("fu ni ochinai" in Japanese, which is literally translated as "does not go into the viscera," means "cannot understand." The same is true with another expression, "hara ni hairu," which literally means "go into the stomach").

4) The FAST diagram can be regarded as a sequence of purpose and measure, "in order to, how to," that matches the language structure of people who write from left to right. However, unlike a PMD, FAST is not sufficient for fully communicating all of one's mental deliberations.

5) Based on the above comparisons, the difference in expression structures caused by the order of the content and its display on paper is thought to be one of the factors that triggers differences in the structure

of thinking. Conversely, with the help of computers, it is possible to transform this difference into a tool that supports a new thinking structure by combining different techniques.

3.1.9.d Analysis 4

What are the differences between the PMD Method and the KJ Method, and how does one choose between them?

1) The KJ method is basically a method of writing down what is seen and thought onto individual cards, putting them on a large piece of paper on a desk or a Japanese tatami mat, and grouping them according to what the cards say. In some ways, therefore, it is a grouping method. It is also a very flexible method that enables one to share data written on cards and ideas.

2) The difference between the KJ method and the PMD method is that the PMD method focuses on the purpose-measure relationships of actions "(verb) + (noun)," which flow from the top to bottom. Unlike the KJ method, the PMD method can be used immediately in circumstances when it is necessary to do something according to the relationship of purpose and measure.

3) For reference, Figure 3.1-9 compares the KJ method, the Theme Key Word method and the PMD method, rating each on a scale of 0 to 4 from the point of view of a person who has used them in business.

4) Figure 3.1-10 shows typical card arrangements in the PMD method which are different from those in the KJ method.

3.1.9.e Analysis 5

The Relationship between the PMD Method and Conventional Organizational Methods

The following shows the relationship between the PMD method and conventional organizational methods.

1)The NM Method ([13] pp. 54-59, [14] p.39) (see attached appendices A in this book)

This procedure, invented by Masakazu Nakayama, starts with "select a Key Word that represents the real

nature of a problem." Unfortunately, he only presents a way to come up with the Key Word by example and does not give a theoretical explanation of how to do so in detail.

The PMD method can be used as a way to find the expression of Key Word, or to select it logically. Although the NM method does not require the Key Word to be selected through the PMD method, selection of the Key Word through the PMD method will make it easier to proceed with the NM method.

(2) Brainstorming ([13] pp. 8-13, [14] pp. 31-34)

Brainstorming is intended to collect ideas, and accelerate organizational processes with the collected ideas. Brainstorming is seen as a way to resolve problems and is often used to solve "existing problems." It is useful for solving problems that exist in the current social system or in the field. However, if problems are misidentified, this method may fail to resolve the problems or may come up with inefficient solutions. It also requires a long time to find solutions.

The PMD method is a method for helping the parties concerned not to wrongly identify problems and is useful in precisely identifying problems before brainstorming. If the purpose-measure relationship and challenges are identified before brainstorming through the PMD method, the positive characteristics or attitude of brainstorming will be further enhanced, and the time spent on brainstorming and summarizing the results will be shortened.

Using the PMD method makes it possible to identify previously unknown theme or subject expressions to be challenged . This is not possible in the conventional brainstorming method, which relies on appropriate ideas being forthcoming. Using the PMD method, many positive and effective ideas emerge.

3.1.9.f Analysis 6

The Relationship between the AHP Method and the PMD Method
(this section through 3.1.9.h is for those who know the AHP method and PATTERN method)

The AHP (Analytic Hierarchy Process) method [15] shows how to make the best selection, as an individual or a group, among given options. The relationship between the AHP method and the PMD method is explained as follows based on examples given in the bibliography [15].

1) Figure 3.1-11 shows the structure of the AHP method.

2) On the left side of Figure 3.1-12 lies the PMD of "New Car Selection by AHP Method." This PMD was made based on the Main Key Word of the PMD on the right side, considering the component of the AHP method. In the beginning, cells in the right side of PMD are blank, to be filled in when the calculations are done. Fill in the blank cells from the bottom up by row. In this way, it is possible to make calculations with the ultimate purpose in mind.

3) Based on the aforementioned explanations, the relationship between the PMD method and the AHP method is:

The PMD method is suitable for precisely clarifying purpose-measure relationships before reaching the point where the AHP method is used. It also presents the procedures to be used in the AHP method in rough.

The AHP method includes the Forward Process technique, which is an evaluation technique, and the Backward Process technique, which is used to prepare conditions for the use of the Forward Process technique. The PMD method can include these techniques in purpose-measure relationships using the "Diamond Repeat" pattern of Figure 3.1-10 and can show the relationship between the two techniques in a compact format.

The relationships between the PMD method and the AHP method are:
a) The PMD method is suitable for precisely clarifying purpose-measure relationships before reaching the point where the AHP method is to be used.
b) It presents rough procedures to be used in the AHP method.
c) The PMD method combined with the AHP method can make the procedures of the AHP method easier to understand.

6) The author would like to make a generalization about the PMD method here. The PMD method is a method that clarifies ideas and procedures so that other conventional methods can be used effectively, and presents an outline of the use of conventional methods in a compact format.

3.1.9.g Analysis 7

The Relationship between the PMD Method and the Decision Tree Method

The following example is also quoted from the bibliography [15].

The theme is "Whether Device A needed to be overhauled: A comparison of B the breakdown rates and costs with and without an overhaul." Figure 3.1-13 shows a decision tree of the topic. Use the figure as follows:

1) Prepare a blank decision tree.

2) Collect figures according to their purpose to be put into the decision tree.

3) Fill in the decision tree with the collected figures in purpose-measure relationships and perform calculations to find the answers.

4) Decide whether it is necessary to overhaul the device based on these answers. This is the purpose of the decision tree, and procedures 1) through 3) are the measures that need to be taken in order to realize the purpose 4).

If we make a more specific PMD for theme 1 in Figure 3.1-14, the PMD on the left in Figure 1 is obtained. Next, themes 2 and 3 of Figure 3.1-14 are made in an effort to clarify the ambiguous elements of Theme 1. Themes 2 and 3 link together as purpose-measure. Based on these figures and explanations, the following relationships are found between the Decision Tree method and the PMD method.

The PMD method can present preliminary relationships of purpose-measure, as well as procedures for reaching a conclusion through the Decision Tree method.

The PMD method can describe how the decision tree should be filled in utilizing purpose-measure relationships.

If data are not available to put into in the decision tree, the PMD method can show how to collect data using the AHP method (as shown at the bottom on the right side of Theme 2 in Figure 3.1-14).

As shown in Themes 2 and 3, the PMD method can present a preliminary purpose-measure relationship and procedures for making a decision tree with a blank format.

3.1.9.h Analysis 8

The Relationship between the PATTERN Method [13] (pp. 254-256), [14] (pp. 352-395) and the PMD Method

1) The PATTERN (Planning Assistance through Technical Evaluation of Reference Number) method is a type of relation method which arranges wide-ranging problems logically and evaluates their importance. Figure 3.1-15 is a relation tree made through the PATTERN method, and Figure 3.1-17 shows the preliminary outline of flow that explains what comes before and after the relation tree in the procedure. (Figure 3.1-16 will be discussed later.)

The purpose of the PATTERN method is to decide which part of "the relation tree" should be emphasized, and find answers to the following questions:

- What are the missions and challenges that need to be emphasized?
- What are the technical problems in the project in question and their significance?
- What are the technical improvements that need to be made and their significance?
- How are alternative plans to be assessed?

2) The PATTERN method, the PMD method, and the DTCN method [1], which includes the PMD method, complement each other in the following situation:

It is possible to create a Domain of Consensus before making a relation tree if a PMD is added to the left side of Figure 3.1-17. In this way, a relation tree is to be made based on the Domain of Thinking and the Domain of Consensus. (Refer to Figure 3.1-18)

Also, by inserting a phrase into the PMD, it is possible to supplement a weak point of the PATTERN method, i.e. that it is "unable to express factors of environmental conditions and dynamic transition, as well as reciprocal connections among these factors" ([16] p. 148) [example of application of 3.1.8.b (5)] [1]. The phrase is "partition the process of improvement through the 3-5 Phase Improvement technique."

"Partition the process of improvement through the 3-5 Phase Improvement technique" means that it is possible to rearrange the relationships between the factors of dynamic transition, which are inevitable in the ordinary implementation of projects and other factors, if dynamic transitions are divided into the following five phases ([1] pp. 176-178)

PHASE I Effective measures that can be taken immediately. Transitional measures before PHASE II.

PHASE II Measures that need to be taken as soon as possible, but some preparations are necessary.

PHASE III Measures that need to be taken after taking various factors into consideration (same as the approach in the Steplist method).

PHASE IV Measures that cannot be taken without first resolving certain problems or themes.

PHASE V Measures that cannot be taken without resolving certain problems. However, it is uncertain what the problems or themes are. Therefore, it is necessary to start by determining or identifying the problems or themes to be solved.

Figure 3.1-16 shows the relation tree of Figure 3.1-15 transformed into a PMD-type diagram. By transforming the relation tree of the PATTERN method into the PMD-type diagram, it becomes possible to transform the contents of the relation tree into dynamic relationships of purpose-measure, and to connect these purpose-measures without a gap. It also becomes possible to supplement the weak point described in section 2, to find the Key Word that might lead to the discovery of unexpected factors or effective alternative plans, and to extract the actions for these unexpected factors and plans.

In addition, by transforming the relation tree into the PMD-type diagram, it also becomes possible to select subordinate procedures and ideas that are created based on the overriding Key Word, to revise subordinate items and actions based on the result of selection, and to utilize the NM method as a breakthrough to the problem when the situation becomes stagnant.

All of the above becomes possible through contact points of each Key Word (In this case, trade studies that compare and select the most appropriate plan out of several options using the FBS technique ([1] pp. 171-173), which is mentioned in section 2.3 of this book, play an important role).

Unlike the PMD method, the PATTERN method does not explain how to make a relation tree in detail. Therefore, it is important to use the PMD method and the FBS technique as supplements. Because the Relation Tree method evaluates each case by the block evaluation method, it is sometimes inconvenient if the relation tree consists of active expressions of the form "(verb) + (noun)." In this case, use the PMD method or the FBS technique to transform the tree into one composed of noun phrases. This transformation can be done by the FBS technique, which clarifies the relationships between challenges and functions, or by the PMD method by simply replacing "(verb) + (noun)" expressions with "(noun) of (noun)" ones.

In the PATTERN method, the term "importance" is often used. Using the PMD method, determine the

meaning of the term among those listed below (Refer 3.1.8.c):

1) important/significant as an overriding objective in an abstract sense.
2) important/significant as the Main Key Word (or as the objective result).
3) important/significant as the Entrance Key to reach the objective result.
4) important/significant as the most important/significant factor when various factors are found at the level of the Main Key Word or the objective result.

This clarification prevents confusion in the meaning of the term "importance." Based on the above explanations, the PMD method supplements the PATTERN method. At the same time, the PMD method integrates the overriding programs, overall actions, and techniques necessary to realize the programs, necessary actions, and necessary conditions.

3.1.10 Future Perspectives (as of 1992)

By expanding the use of the PMD method, the following will become feasible:

1) When implementing an R&D project on a topic, theme or subject which has no precedence, or in an unknown field, the PMD method will help to set the overall standards to be used in a decision-making process before making the actual R&D plan.

2) The PMD method clarifies subtle relationships of words by transforming them into purpose-measure relationships, which prevents confusion.

3) With the PMD method, it is possible to create new relationships of purpose-measure as well as new verbal concepts without any difficulty. Therefore, this method can be used as a powerful tool to form a new direction of values and a new world of values in the new era.

4) The mechanism of the PMD method can be used for the purpose of "research on the meaning and usage of words."

5) The PMD method was invented by the author, who is Japanese. However, developing software pertaining to the method proceeded in the United States. Therefore, it is necessary to develop software

that is suitable for Japanese people. (Because the software developed in the United States includes the cultural background of the United States, it is necessary to japan-ize it. In doing so, it is important to preserve those elements that are good.) By doing this, it is possible to make a breakthrough in the area of the CASE (Computer Aided Software Engineering) techniques, where development has been stalled.

6) Based on the above, it is important to establish systems for accumulating knowledge and information using the PMD method.

7) The PMD method can be used as a tool in private corporations as well as in governments to formulate plans. This method is particularly useful in government agencies where personnel reassignment takes place every two or three years. A PMD diagram is useful for confirming to what extent a project is complete, and handing over this information in a compact format from one set of personnel to another.

8) The PMD method can be used to close gaps in perception among ethnic groups.

9) The PMD method can be used as a powerful measure to establish appropriate TA (Technology Assessment).

10) The PMD method can be used as a technique to create new standards for science and technology.

11) The PMD method can be used as a method to present the requirements for creating a new system or object from many angles.

12) The PMD method can be used as a method to show the direction of development in new software-related technology and expert systems. It can also be integrated into software as an algorithm [12].

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Figure 3.1-1 PMD for Emergency Medical System

Theme:
Emergency Medical Helicopter
PMD of how to realize the helicopter emergency medical sysytem in Japan 1984-5-8

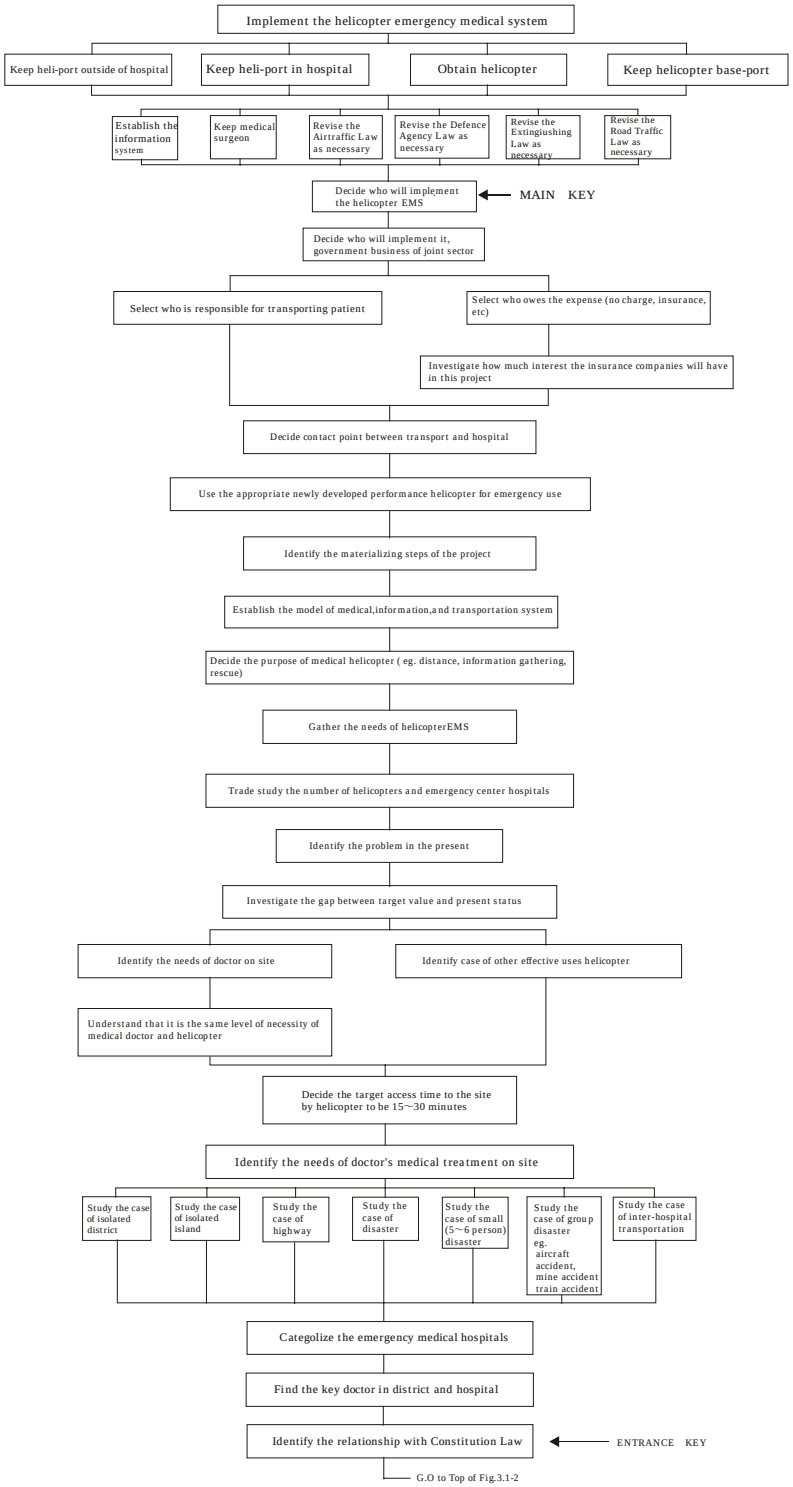

Figure 3.1-2 To Identify the Relationship between Emergency Medical Helicopter and Constitutional Law

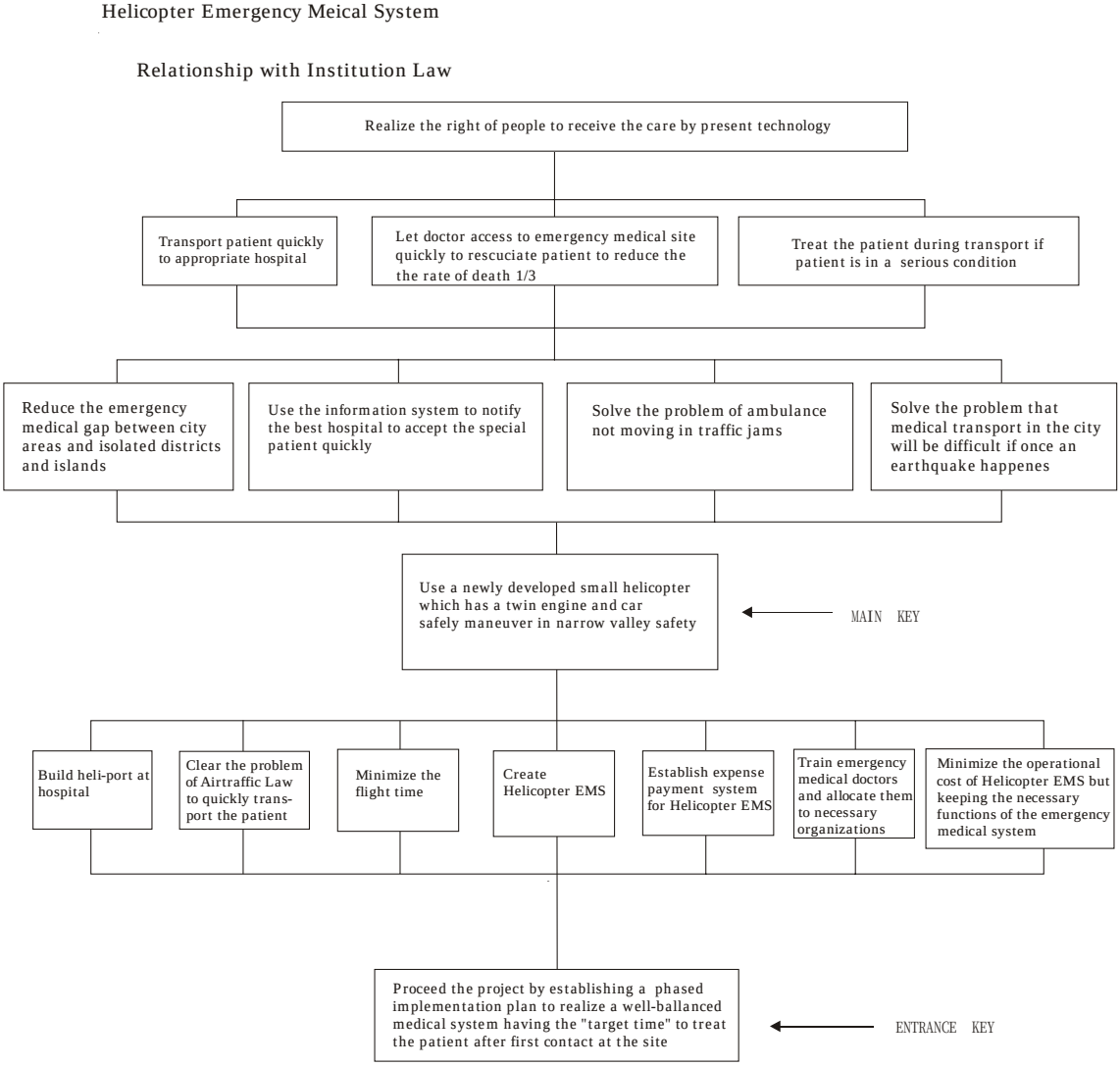

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Figure 3.1-3 PMD of Best Fuel Tank Arrangement

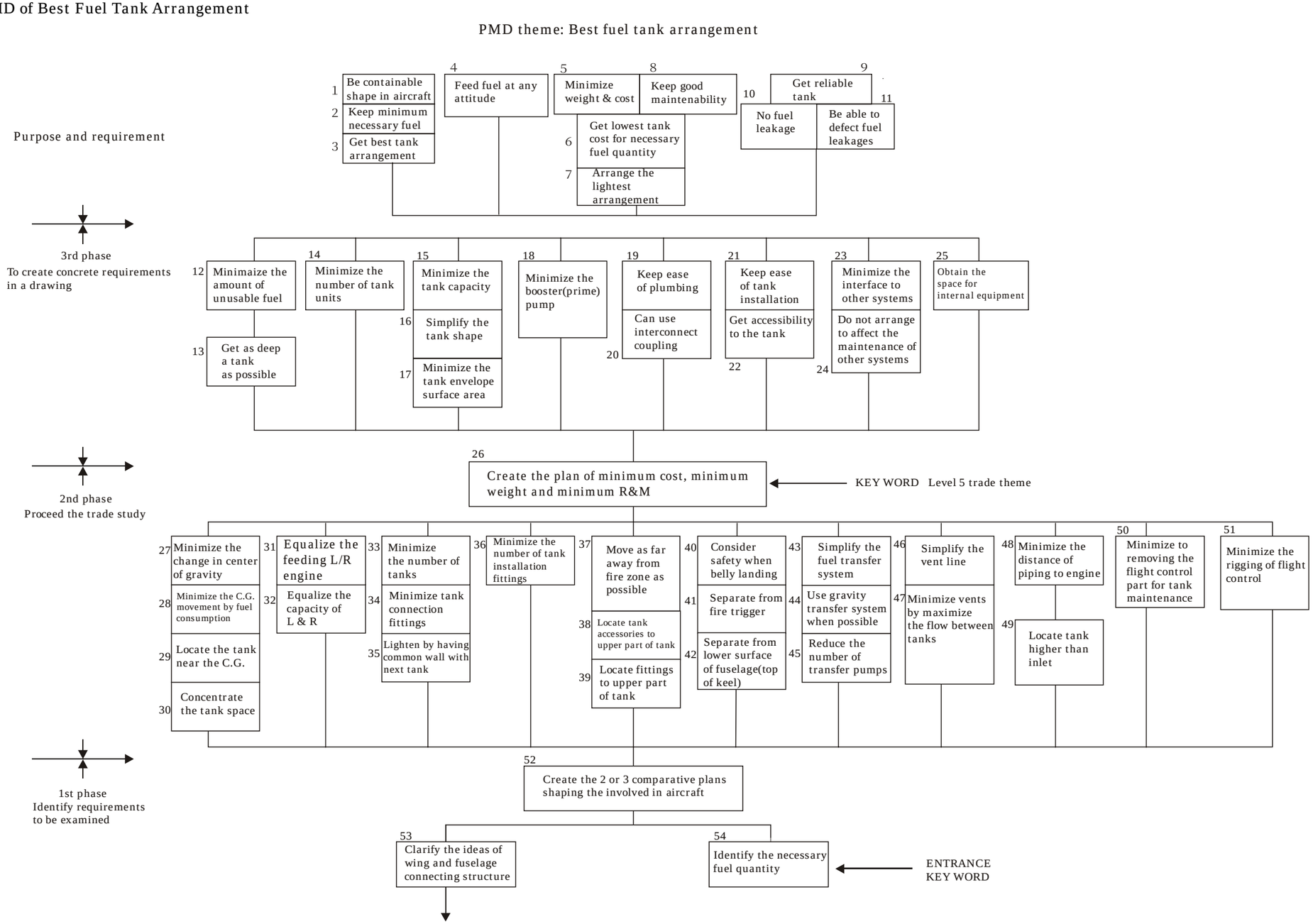

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Figure 3.1-4 PMD of Wing and Fuselage Connection

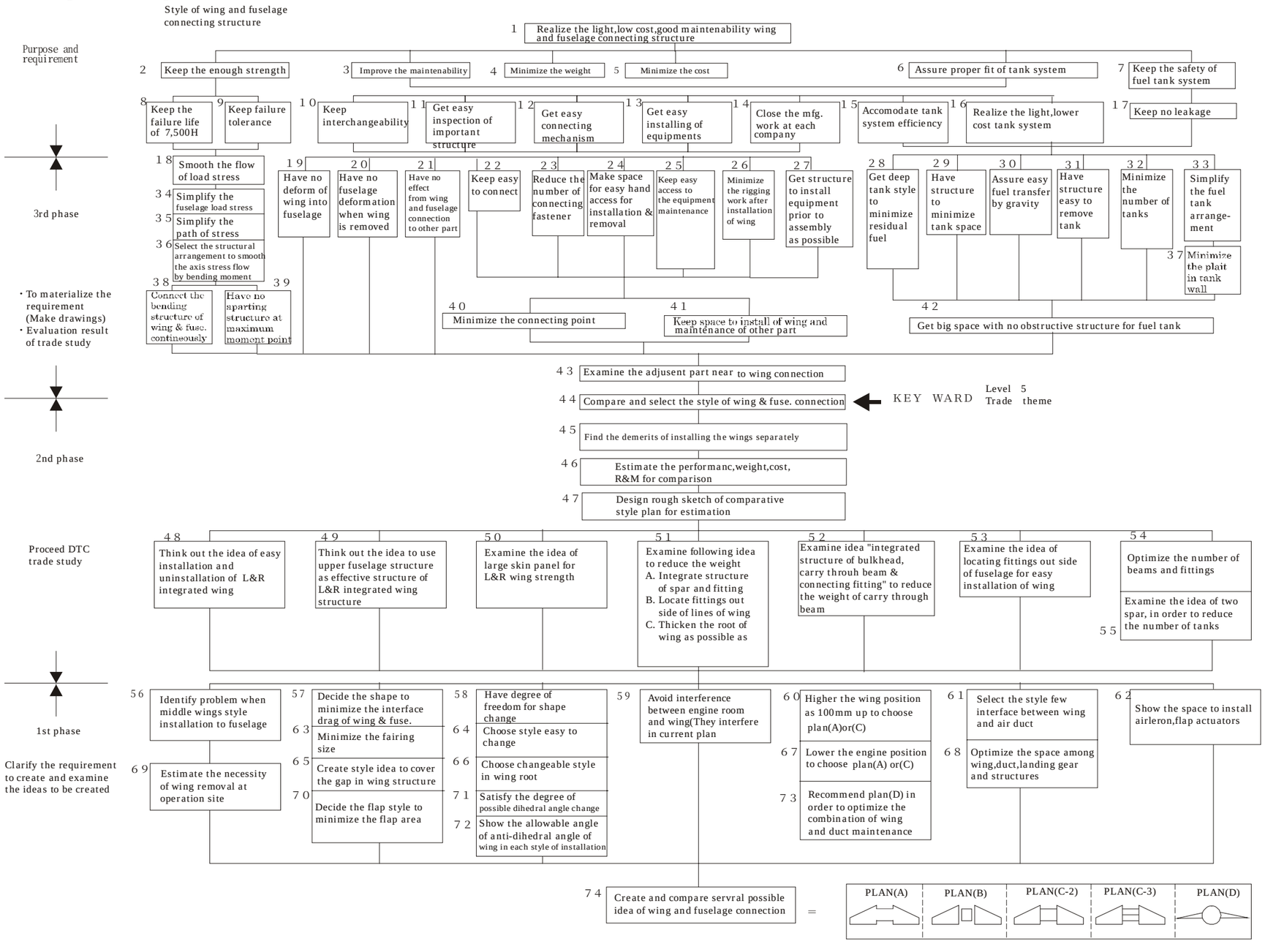


Fig. 3.1-5 Counter measures when comparable or combinable ideas come up

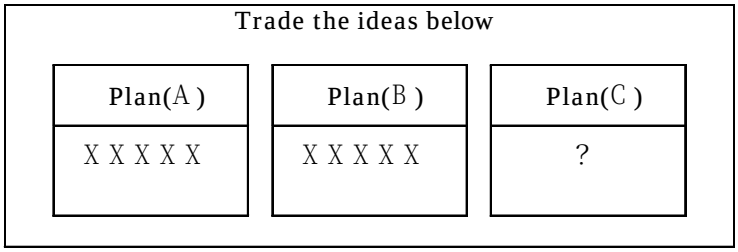
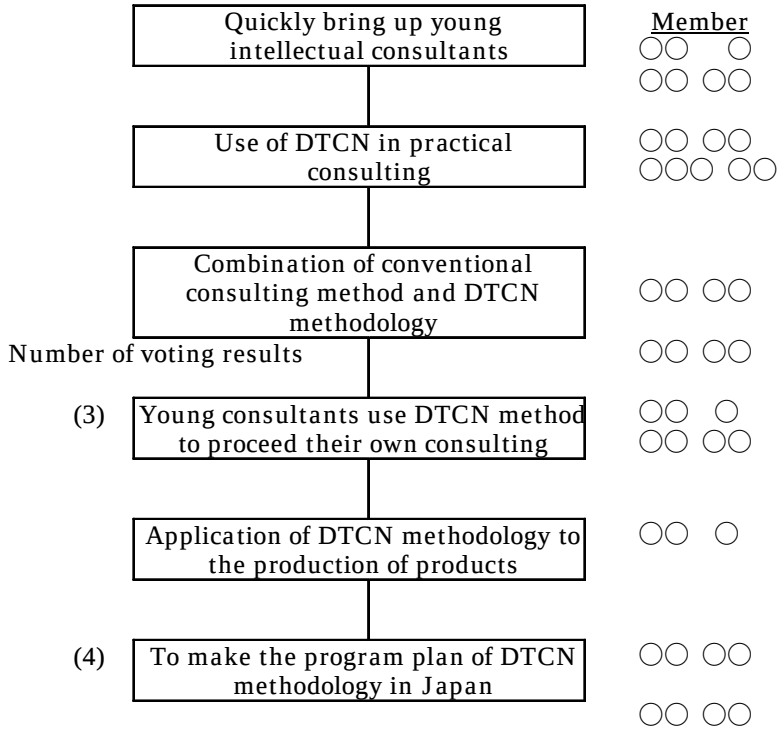


Fig. 3.1-6 Example of theme key word method (Theme PMD Method)
The selection of theme name
92/.4/11 13:10 ～ 13:40 at Japan Management Association Consulting



⇒ Select the theme name (by using theme PMD above)

To make a program plan of DTCN methodology in order to make it is easy for young consultants to proceed their consulting by using DTCN methodologies

Figure 3.1-7 Example of PMD Software (1992)

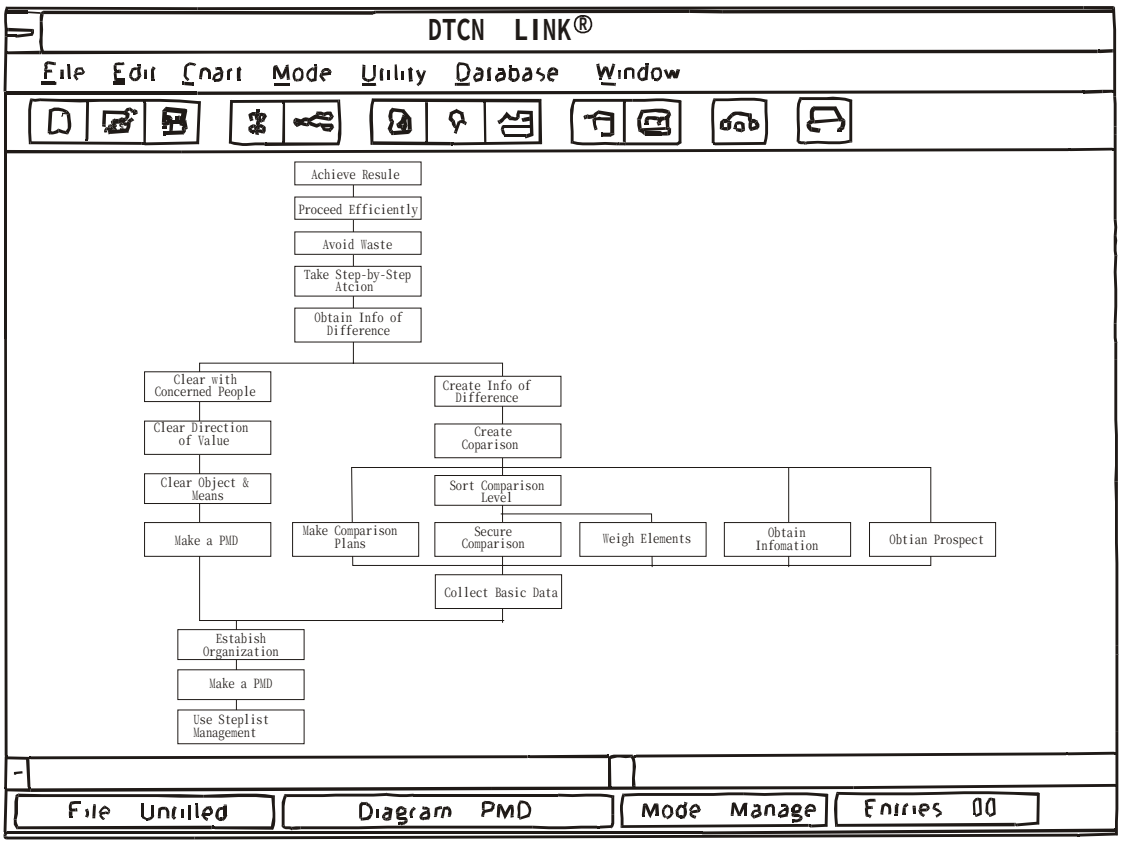


Figure 3.1-8 Visual Comparison of the Original PMD and the 90°, 180°, and 270° Rotated PMDs

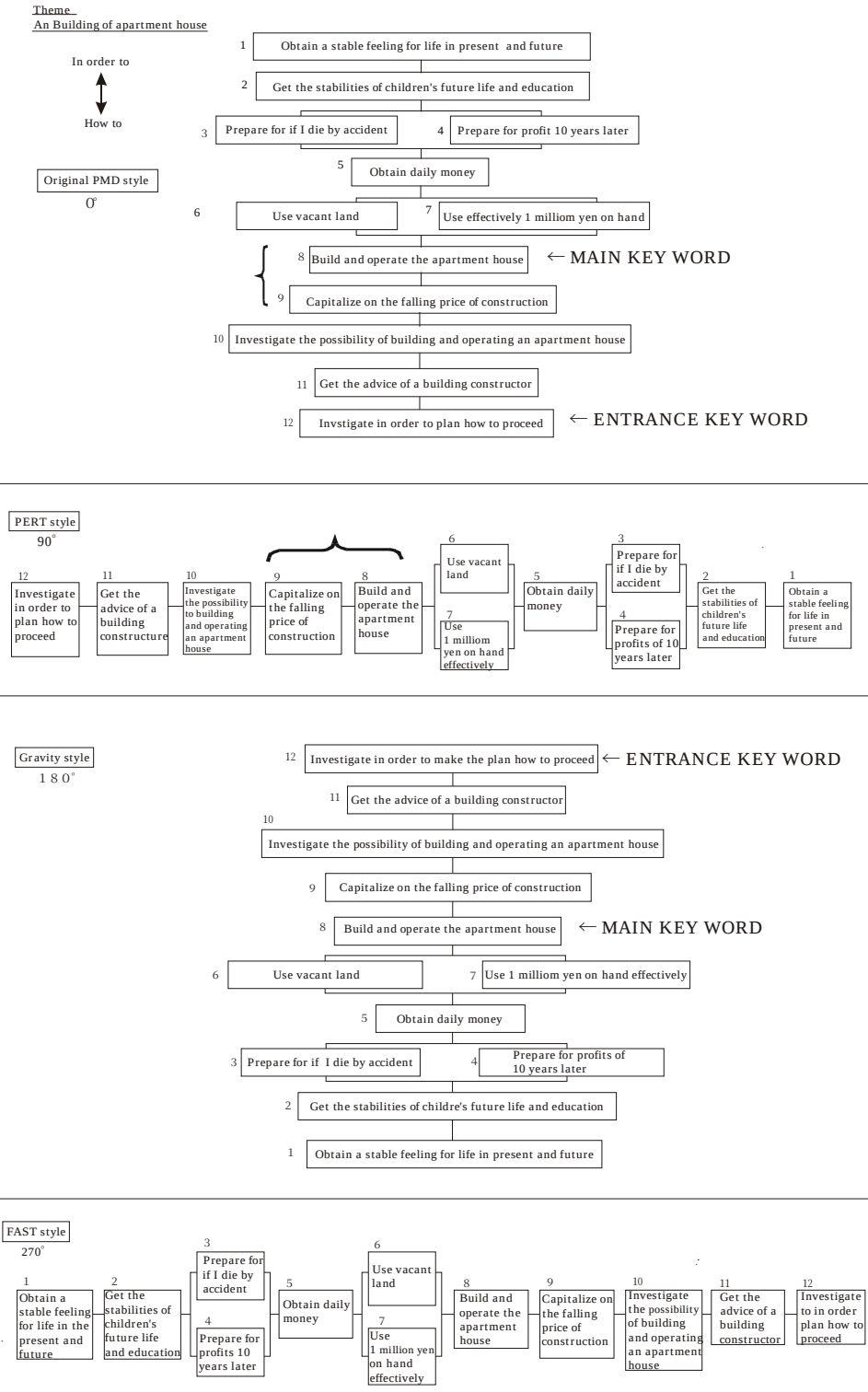


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Table 3.1-1 Comparison of the Relationships between PMD and Other Creative Thinking and Procedural Thinking

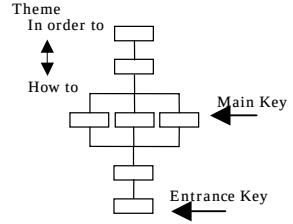
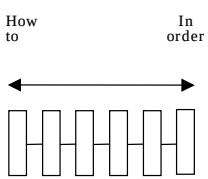
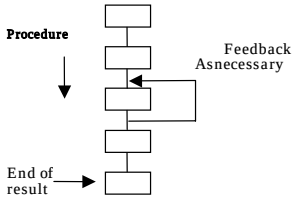
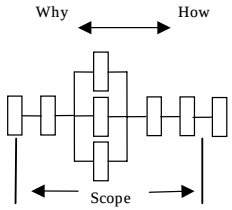
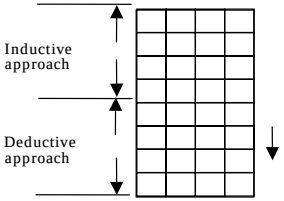
Methodology Group	Design To Customer's Needs	Independent	Independent	Value Engineering	Design To Customer's Needs
Method compaered	PMD; Purpose Measure Diagram (Thinking way)	PERT (Procedure)	Gravity flow chart (Procedure)	FAST; Function analysis Technique (Thinking way)	Steplist (Procedure)
Image of method					
Use	1. To establish the way of thinking (purpose-measure relationship) 2. To create a rough procedure for some theme	1. To establish the precedence of procedure 2. To show the critical path and schedule, and input and output relationship	1. To show an already established procedure comprehensively	1. To establish the way of thinking (purpose-measure relationship) 2. To create a rough procedure for some theme	1. To create faultless phases and procedure to reach the objective result
Distinctive characteristics	1. Establish the most appropriate expression of objective result of theme (MAIN KEYWORD) 2. Find out where we can start (ENTRANCE KEYWORD) 3. Show the domain of consensus 4. Create a rough procedure including the matter concerned 5. Create similar decision-making among the people concerned	1. Clarify the relationship of input and output 2. Clarify the critical path to reach the objective result 3. Easy to correspond to bar style schedule chart 4. In other words, easy to make image of schedule	1. Comprehensive expression of an established procedure 2. To understand this, more comprehensively, read from bottom to top, then top to bottom (Note) This form is the reverse of PMD, but if PMD is rotated 180° ,another detail and concrete procedural element become apparent.	1. The purpose is the same as PMD Method, but is not easy to use among nations who do not use only left to right sentence structure 2. Difficult to find the expression level of main key word 3. Necessary to introduce the concept of "Scope"	1. Clarify phases which consist of inductive and deductive approaches. 2. Pick up the faultless elements in the relationship of input and output including the pre and post assurance activity. 3. By this assurance and its conditions, we can clarify the phased evaluation standard by combining with PMD.
Situations in which to use	1. For TQM 2. To create abduction thinking 3. To establish the direction of view under each theme 4. Use in group thinking and group decision support systems	1. Connects PERT flow to schedule scale, then follows the sequence of input and output	1. To use the established procedural methodology 2. If you use this diagram before you establish the algorithm by PMD, you will sometimes miss the path of integration, because first input will constrain your thinking.	1. To grasp the purpose-measure relationship in the way of left to right block flow 2. A little difficult to use among Japanese people	1. TQM / Project management 2. To establish a faultless framework to proceed a new things. 3. Combine result of PERT and gravity style by adding the column of pre- and post- assurance activities.
The part of brain used	1. Fore and aft brain 2. Fill the perception gap between people or nations 3. Think in the sequence of in order, how to, what	1. Left and right brain after having fore and aft. brain conversation	1. Same as the column to the left. 2. Absorb the procedure just as your stomach digest food.	1. The purpose of this diagram is to find the relationship of purpose-measure inside the fore and aft brains, but using a horizontal expression is apt to lead to an input/output relationship	1..Conversation between left and right side brain after establishing the keyword level by PMD method. 2..Combine with European and orient cultures, especially Japanese culture.
Comments	1. Invented by Japanese, who have top-bottom sequence sentence structure 2. First methodology to be used in management 3. Effective to create a new values 4. Easy tool to transmit complicated concepts to other people	1. Invented by American who have the Left-right sentence structure.	1. Conventional worldwide	1. Investigated by Americans, who have left to right sentence structure 2. Confusion will be caused between fore/aft. And left/right brain conversation structure	1.. Faultless mechanism because of matrix style. 2.. Invented by Japanese who have both top to bottom and left to right sentence structure.

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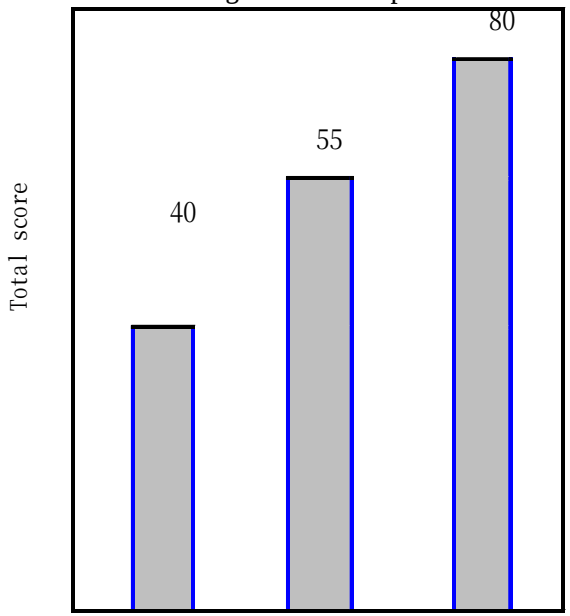
Fig.3.1-9 Comparison of KJ, Theme Key Word, PMD

The following are the compared results from the standpoint of proceeding business by grading "0,1,2,3,4"



	KJ	Theme key word	PMD Method
Score	40	55	80
	Independent use	Reciprocal use	

	Question	KJ	DTCN		Note
			Theme Key Word	PMD	
1	Is it used personally ?	4	4	4	
2	Is it used by a group ?	4	4	4	
3	Is the result useful in business ?	1	4	4	Note(1)
4	Is it practical ?	4	4	4	
5	Does it fit with brain mechanism ?	4	4	4	
6	Is it useful to focus the theme ?	2	4	4	
7	Is it useful to get consensus ?	3	3	4	
8	Is it useful to find where we can start to realize the objective result ?	0	2	4	
9	Do we have same vectors ?	1	3	4	
10	Can we find the very sensitive relationship of measure ?	0	3	4	
11	Is it hierarchical system ?	3	3	3	
12	How is the procedure operated ?	0	0	4	
13	Is it possible to make a decision with it ?	0	2	4	Note(2)
14	Is it a categorizing tool for words ?	4	1	1	
15	Is it possible to arrange the purpose-measure relationship ?	0	4	4	
16	Can we find the most appropriate expression of the key word ?	1	2	4	
17	Can it accumulate understanding ?	4	3	4	
18	Can it accumulate ideas of how to proceed ?	0	0	4	
19	Is it possible to organize wisdom and intelligence ?	0	0	4	
20	Is it useful to building information systems ?	1	1	4	
21	Can it become software ?	4	4	4	
	Total score	40	55	80	

How much time is required to use the method ?	4～5Hrs.	0.5 Hrs.	1～3.5 Hrs.	

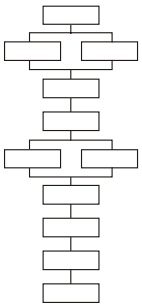
1. Scoring standard : Excellent 4
   Good 3
   Satisfactory 2
   Acceptable 1
   Not Applicable 0
2. Reciprocally use PMD and Theme Key Word Method as necessary

Note:
(1) PMD is used to identify the things at least to be done as the result, steplist and 3-5 improvement method are used to create and adjust the procedure to reach the objective result.
(2) To make a PMD is also a form of decision-making

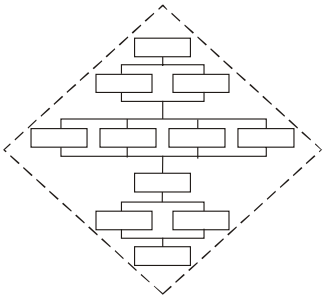
Figure 3.1-10 Typical PMD Patterns

(1) Vertical bar(A)

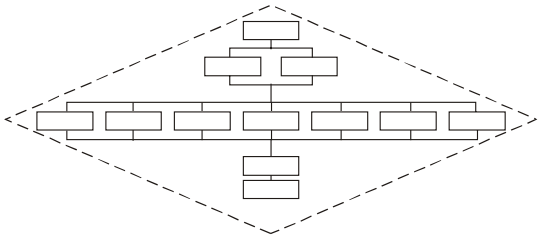
(2) Vertical bar(B)



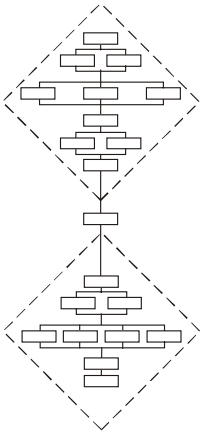
(3) Vertical diamond



(4) Flat diamond



(5) Diamond repeat



(6) Dual entrance key

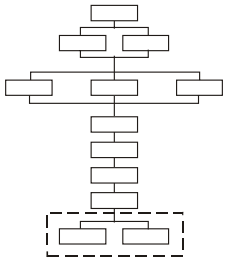
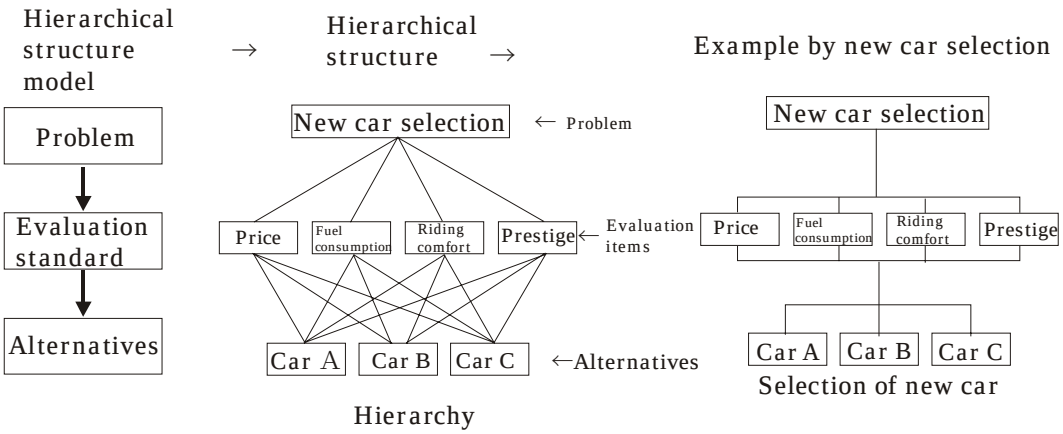
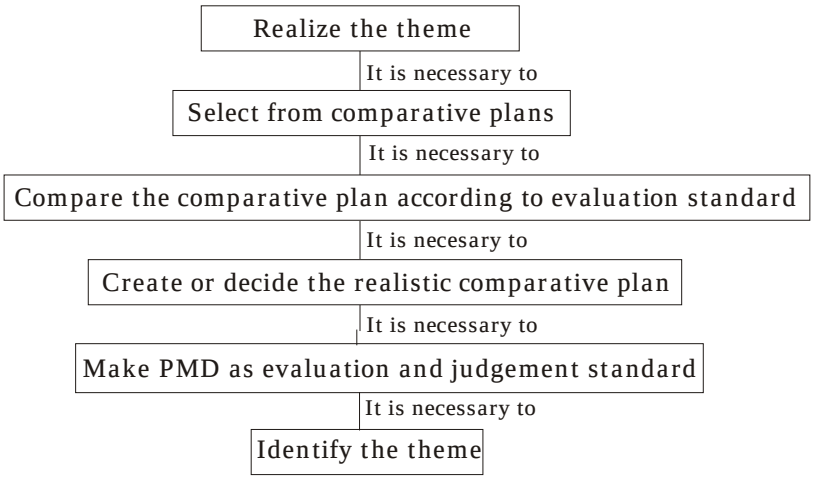


Figure 3.1-11 Comparative Examples of the AHP [15] - Method and the PMD Method



Reference : Hierarchy of PMD is as below



In PMD : The comparative plan is used instead of the alternative plan.

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Figure 3.1-12 PMD of AHP-Method Example

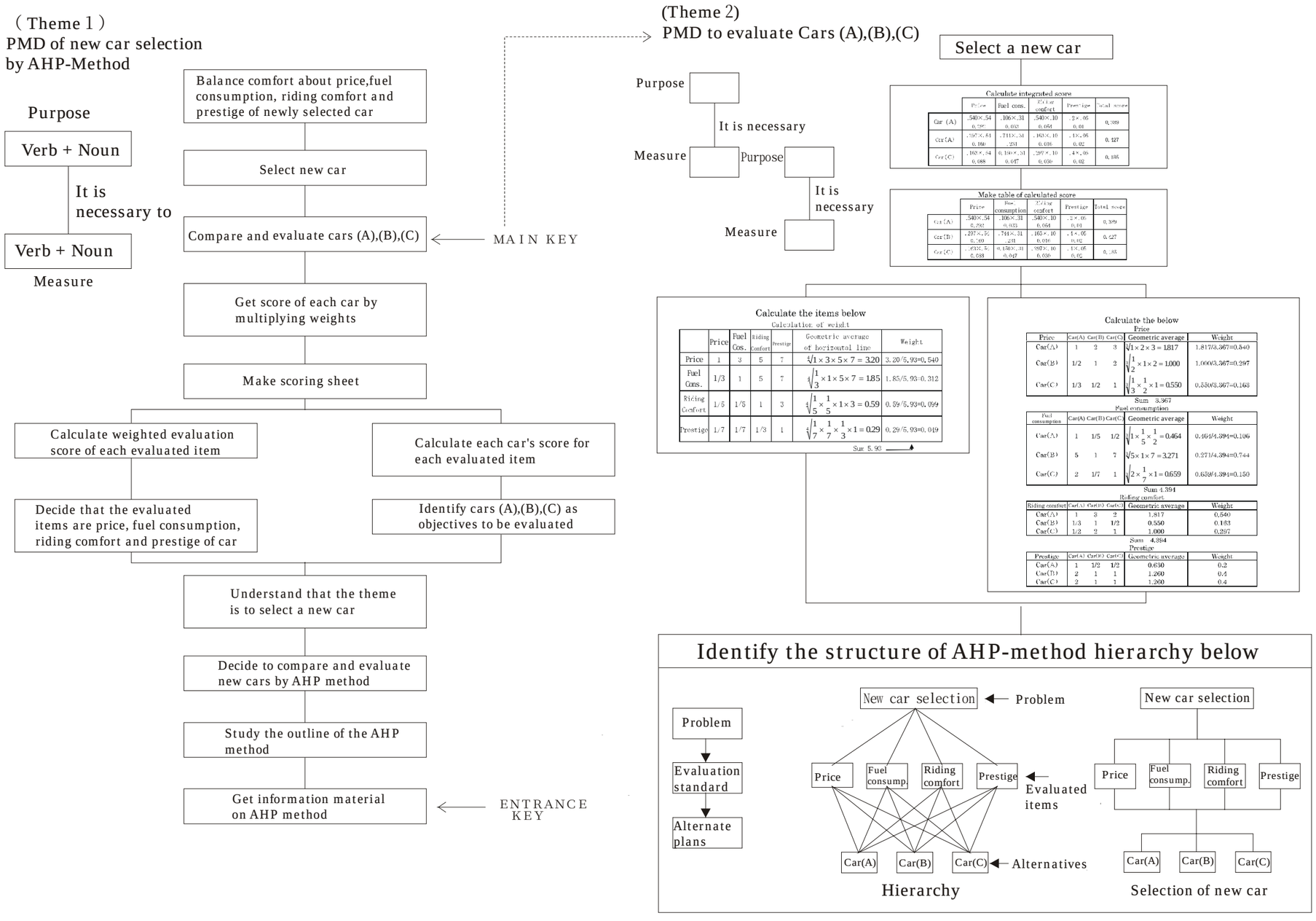

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Figure 3.1-13 Correspondence between PMD and Making Work of Decision Tree

Decide the intention

It is necessary to have

Written result of decision tree

It is necessary to have

Data for decision tree

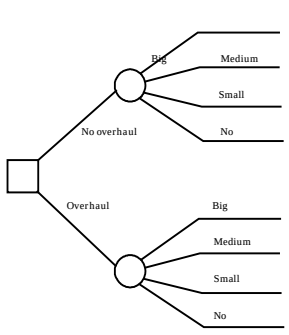
It is necessary to have

Blank decision tree

It is necessary to have

Identification of theme

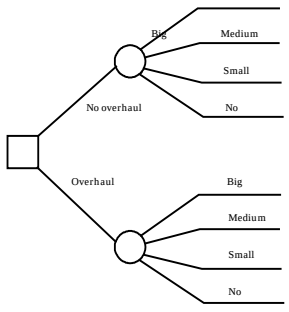
Examine the necessity of overhaul



Estimated cost($)
100×0.5=50T
50×0.3=15T
10×0.2=2T
0×0=0
100×0.1=10T
50×0.2=10T
10×0.2=2T
0×0.5=0

Action \ Failure	Big	Medium	Small	None
No overhaul (Cost; 0 T$)	0.5 (100 T$)	0.3 (50 T$)	0.2 (10 T$)	0.0 (0 T$)
Overhauled (Cost: 50T$)	0.1 (100 T$)	0.2 (50 T$)	0.2 (10 T$)	0.5 (0 T$)

Estimated cost ($)



To decide whether an overhaul is necessary or not

Refer from " Decision Making Method with game feeling " Kaoru Tonegawa (NikkaGiren Published Co.1986)

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Figure 3.1-14 Example of the PMD to create a Decision Tree (Refer to original and Modified [15])

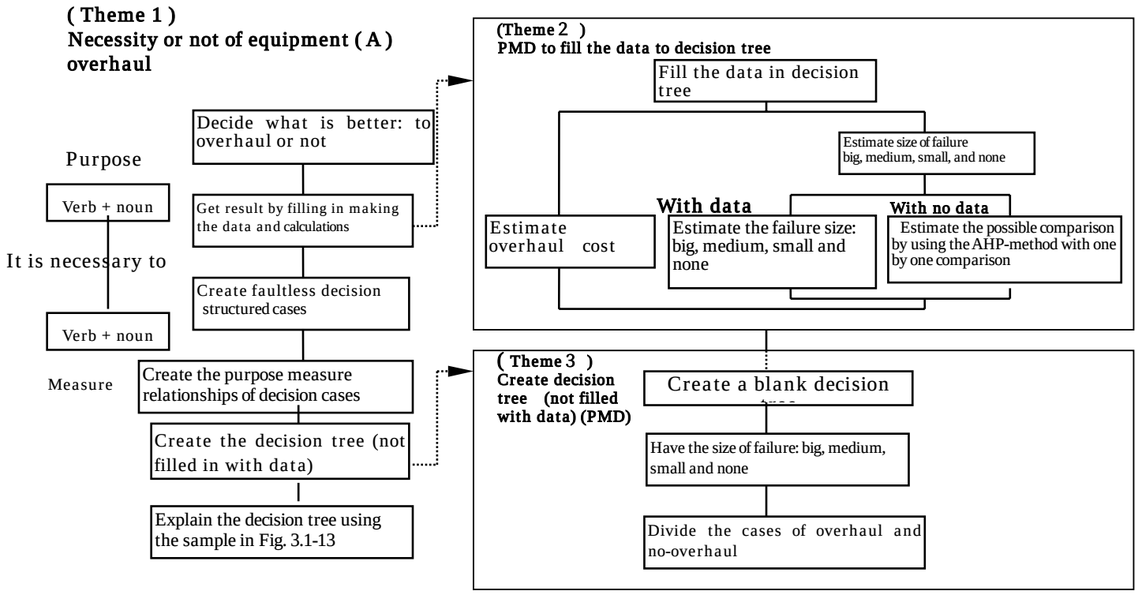

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Figure 3.1-15 Relation Tree by Pattern Method (Refer to [14])

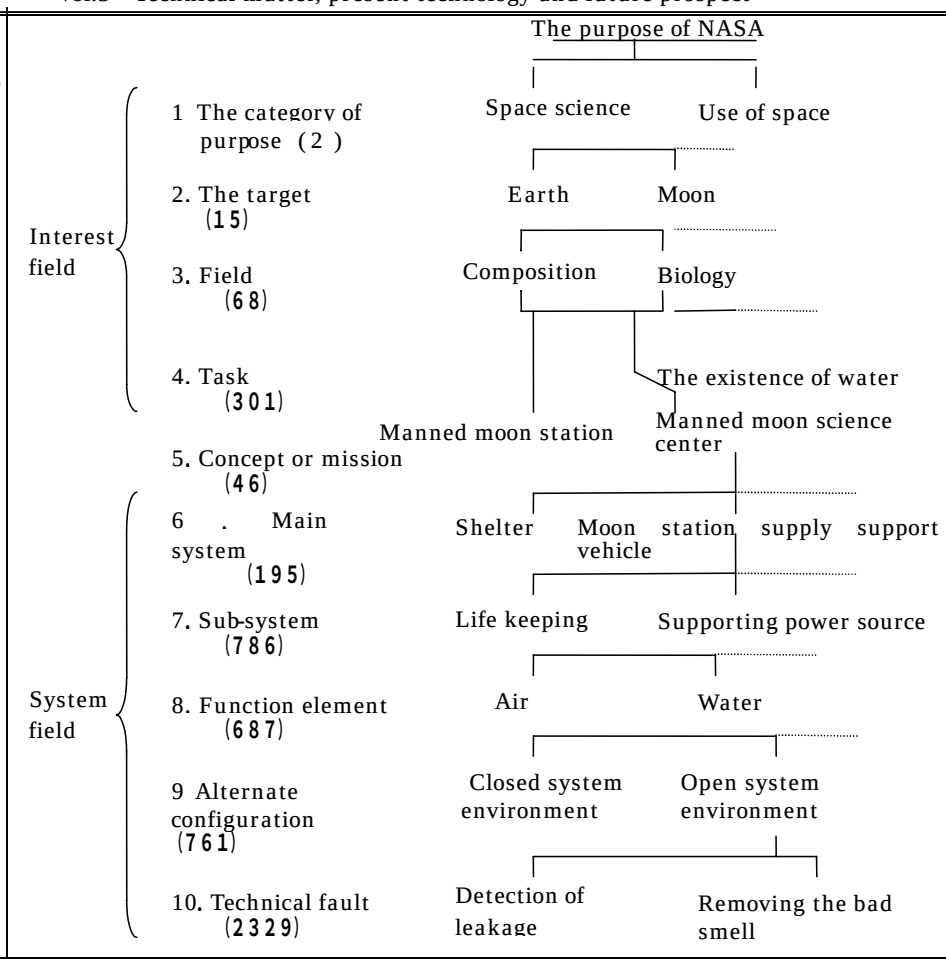
	Satan Space
Scenario	Taken from Relevance Guide (1985) Vol.1 Information on how to use space science ,the difference of purpose and ability in space development between the USA and the Soviet Union. Vol.2 Concept Vol.3 Technical matter, present technology and future prospect
Relation tree	
Criteria	1. The new material benefit to mankind 2. Expansionof knowledge 3. Nation power 4. Comparative importance 5. Comparative ability

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Fig. 3.1-16　PMD-style decision tree of Fig.3.1-15

(By using PMD, it is possible to make fine adjustments of level and action.)

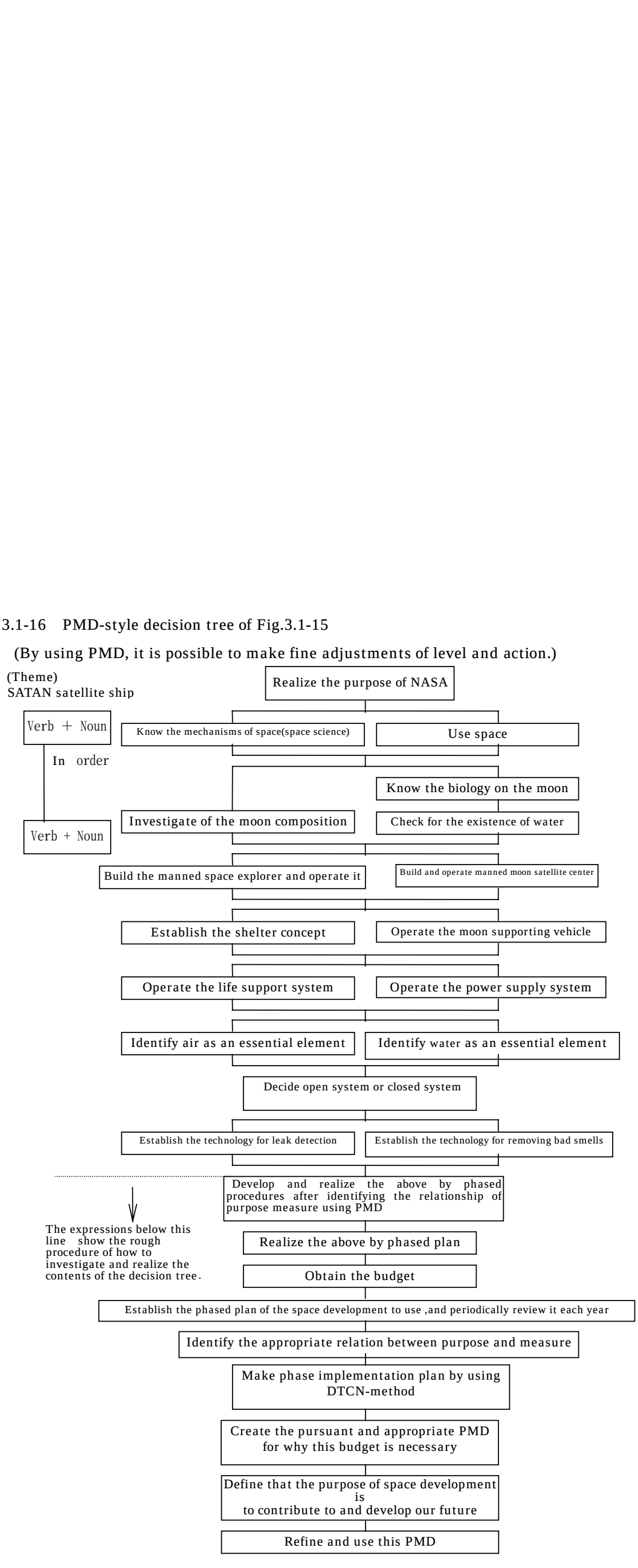

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Figure 3.1-17 Flow of PATTERN Method

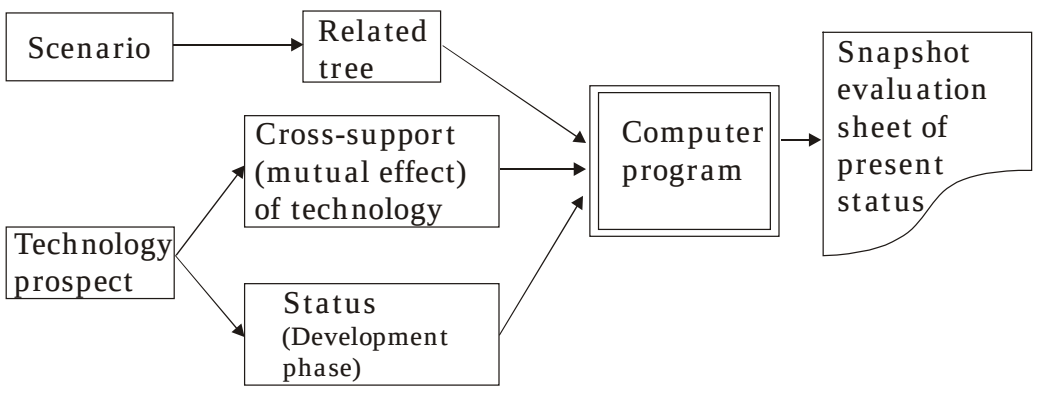

Figure 3.1-18 Linking the PATTERN-Method with the PMD-Method

(Through this link, you can use DTCN-Methodology compatibility with PATTERN-method)