Appendix A

NM Method

Abstract

NM Method (Way of Getting An Image Idea Developed by Masakazu Nakayama)
This appendix is edited under approval by Mr. Masakazu Nakayama, the inventor.

NM Method

1. Introduction
2. Technique Outline and Characteristics
3. Method for Advancing Technique
4. Important Notices
5. Application Field

1. Introduction

(1) This method is to be used in combination with the Key Word in the PMD method in order to search for ideas.

(2) This method, which was developed by Mr. Masakazu Nakayama (Creative Engineering) as a method for thinking about 20 years prior to the appearance of the PMD method, has not only been contributing to the creative growth of the economy and engineering in postwar Japan, but will continue to be used very effectively in developing engineering and economies in the world.

(3) Occasionally, some of the terms in this appendix are used with a meaning different from that used in other parts of the book. This is only the result of maintaining the terminology used by the original author and does not interfere with the usage of the method.

(4) Nippon Business Report, Creative Technique Handbook (the author and editor, Makoto Takahashi and the supervisor, Akira Onda) and Mr. Masakazu Nakayama are acknowledged for their approval, suggestions and addition of illustrations in preparing this appendix.

2. Technique outline and characteristics

2.1 Technique Outline

Problems are solved sometimes by means of logical analysis (i.e. repetition of inductive and deductive reasoning). To obtain a creative solution, an assumption has to suddenly strike the mind of the person searching for it. Although induction in general involves this 'strike', the HBC (Human Brain Computer) Assumption Model (See Fig. 1), which forms the basis for the NM method, argues that this strike is not generated by rational action but by the intuition inherited from wild animals.

Intuition can not be consciously worked as "technique" because it is an unconscious function. But its

process can be simulated on the surface of consciousness if the mechanism by which unconsciousness gives birth to intuition is understood. This means the way of thinking with priority given to the right hemisphere of the cerebrum.

At present, the left and right hemispheres of the cerebrum are considered to constitute a memory system giving priority to language and images, respectively. If it is true, analysis is an activity to extract images (past experience) stored in the right hemisphere by means of language stored in the left hemisphere. On the contrary, in intuition, the past experience appears first and then the image is given language.

The following procedure shall be followed for consciously simulating this process:

(1) Select Key Words (referred to as KW) representing the real nature of the problem;
(2) Put a question "Just as ~?" to the KW. This analogy, which is called QA (Question Analogy), is the "memory of the past" stored in the right hemisphere. Therefore, QA is set by intuition.
(3) Put a question "What is happening there in the background?" to QA. This is called QB (Question Background); that is, QB is the measure to pull out the peripheral memory by analogous thinking.

The process up to this point is diverging thought in psychology: the right hemisphere taking priority, but afterward the image is being transferred to the left hemisphere, that is, handed over for evaluation and support with logic. This process is to put a question "Does it give us a hint to ~?" and is called QC (Question Conception). Several QC, which may only hint at the problem, must be combined into an idea. The process up to this point is called the NM method.

There are two methods for combining the hints obtained by QC. The first method is the "spatial combination" method, Type A (Area), in which two pieces of data, A and B, do not have a cause and result relationship with each other. The other method is the "combination based on tempo" method, called Type S (Serial), in which there is a cause and result relationship between two pieces of data, A and B.

2.2 Characteristics

It frequently happens that keeping the steps shown by the NM method leaves us an assumption in a situation in which there is nothing to do after carrying out all possible analysis. That is, the NM method may hasten the instant of noticing. For insufficient analysis, however, it is generally not very efficient because the synapse resistance of the nerve system from the left to the right hemisphere has been

reduced by education, which solely endeavors to put knowledge into the left hemisphere. This is a kind of memory and means that the repetition of flow from the left to the right strengthens "the memory of the way of thinking."

For this reason, it happens that, for example in the case of QA, you try to build up an image by language, giving precedence to the left hemisphere. This technique does not work well and there is nothing but practice to overcome this difficulty. This is in fact the difficulty which you encounter when trying to practice Synectics (W. Gordon), or an equivalent transformation (Kikuya Ichikawa).

It is recommended that the NM method not be considered the way for solving a problem, but rather a manual for thinking, giving precedence to the right hemisphere. Don't think of the procedures for the NM method being used for solving problems, but rather that practicing the NM method leads to developing a brain capable of automatically generating ideas. With such a brain, ideas naturally generate at the manufacturing site without use of theNM method. It is important not to misunderstand this point.

2.3 Background for the Birth of Technology

Synectics and other equivalent transformations already existed before the appearance of the NM method. Synectics is the inductive finding of technique called "analogy" by means of asking the question: "What way of thinking does an inventor employ?" Namely, "you must be able to create ideas if you are imitating an inventor's way of thinking."

Also in an equivalent transformation theory, an equivalent transformation equation was inductively obtained by means of surveying, from example, the "relation between information before and after the creative action."

In the NM method, on the other hand, based on McCaro Bits' "shape neuron model," the HBC (Human Brain Computer) model (Fig. 1) was introduced starting with the question "what computer is functionally equivalent to the brain." In addition, the relation between intuition and analysis was also introduced as an assumption. As a result, the NM method obtained "technically" similar conclusions to Synectics and the equivalent transformation.

Accordingly, "setting assumption" comes first in the NM method, and so the NM method is not an inductively obtained result. It may be said that the NM method was arrived at from the other side of

Synectics or an equivalent transformation. It may also be said that the NM method was created through the way of thinking shown by the NM method.

3. Method for Advancing Technique

Steps for technique

It is assumed that a given problem has already been sufficiently thought out in an analytical manner. Next the steps necessary for the NM method are determined as follows. These steps are, however, not necessarily prescribed, but are considered to be an exercise, as mentioned above.

(1) Select the real nature of the problem from the point of view, "What should be solved for the present?"
For example, "break" is the real nature of the problem "method of breaking a building," but the KW need not be a simple word, because it is not real language, but an image.

(2) Put an analogy QA: "Just as XXX??"
Concerning "break" QA will be "a rock on the shore is cracked," "vertical motion of the earthquake is terrible," and so on.
For QA, the phrase "to break with a hammer" or "to make a hole with a drill" gives language precedence. These are not efficient analogies, because they inherently carry the concept of breaking. Giving priority to the right hemisphere means there is the existence of past experience, but it can not be understood whether this experience is useful or not. The language of the left hemisphere is left until later. It is technically better to write down on cards as many analogies as appear in the mind.

(3) QB: such an image as "what is happening there in the background?" Examples of QB for the above QA "a rock on the shore" are: "a pine tree grows on that rock," "the wave splashed against the rock," "children were gathering shellfish attached to the rock," and so on. These do not require to be written down because they are images.

(4) QC: Consider whether the images mentioned above give hints about the problem "breaking building" or not. For example, if the thought that "acid or something which melts rock may possibly seep out from the root of the pine tree" arose from the image that "a pine tree was growing," transferring the idea to the problem leads to the idea "how about pouring something which can dissolve concrete into a hole dug out of the concrete wall?" In addition, considering "whether the seawater, which permeated the crack of the rock generated by the roots of the pine tree and froze in winter, has broken the rock or not" generates the idea "how about pouring and water into the holes dug out of the concrete wall and freezing it?"

Similarly from the QA: "being weak against vertical motion," the idea that "how about giving the concrete structure vertical vibration after setting an explosive in an important position" or "how about focusing destructive power on one point with a concave explosive" may be generated. It is easier to shift to another analogy when extracting many ideas from one analogy which has reached a dead end.

Setting some KWs, creating some QAs for each of the KWs, and then getting some QCs for each analogy result is the commonly used Type T of the NM method (Fig. 3). There is another pattern of deployment called Type H of the NM method (see Fig. 4). If it does not work to directly get QCs from one analogy, this type takes up another analogy. This type is often used in inventive efforts.

Type T or Type H, which are relatively easy to use as techniques, and so are frequently used, also provide the means of basic training for making the brain flexible, that is, thinking by giving precedence to the right hemisphere. Therefore becoming skillful in these two methods makes it possible "to combine heterogeneous things," the principle of creative thinking. Naturally the NM method progresses to the next steps, Type A (Fig. 5) and Type S (Fig. 6).

In Type A, "the third assumption which connects the heterogeneousness of two things" is constructed. For example, from A: "broken shoji (sliding paper door)" and B: "Japanese nightingale," assumption C: "both are longing for spring" is obtained (Fig. 7).

In other words, it has the same structure as "giving cross meaning puzzle." Although detailed analysis, that is, the repetition of Type T and H also arrive at assumption C, Type A is recognized as a better exercise for more intuitively arriving at C.

Type A (Fig.5) is effective in cases where there are no concrete objectives as in the case of invention and there is a theme such as "anything having good sales" or "any new products to eat." Type S (Fig. 6) is available to produce ideas for planning or operation, and is especially effective as a commercial message or cartoon.

Another type is Type D (Discovery). This type proposes to try "setting the assumption first, and then giving proof for it with data when an enterprise or government agency wastes time at meetings which reach no conclusion."

Taking the example of a criminal investigation, in addition to the important scientific investigation

in which a criminal is inductively inferred from all of the collected data, there is another kind of investigation such as one employed by Edo period detectives like Heiji Zenigata. In this type of investigation, a detective intuitively marks somebody down as the criminal and then searches for supporting evidence through a pair of colored glasses. If a mistake is made, the procedure is repeated in the same way. This method may become the subject of discussion in a criminal investigation, but this method will speed up company meetings. 80 points is preferred to 100. Time is considered more important than getting 100 points.

Because being familiar with Type A and Type S is very important for avoiding mistakes of intuitive aim with D-Type (namely, setting an assumption), they are considered to be especially good manuals for raising the abilities of managers.

4. Important Notices

There are no difficult requirements to perform the NM method. The NM method can be performed by any "tools," by any "lineup member," or only "one member," at any "site," for "any time duration," (i.e., quit using it only when losing interest in it), and with or without a "leader."

If however the NM method is used for developing the brain, the following program could be set up:

Each member of, say, a foursome reads, say, "Everything of the NM method" in turns. The only reason for making the group is that isolated reading grows tiring. It is therefore not prohibited that a positive person makes up his mind to read by himself. A member explains a few pages which he has read to the other members. Themes which are considered not to have any relation with themselves must not be omitted. As they continue to read, the synapse resistance between the right and left hemispheres will gradually decrease. (This means cutting a fixed idea down.)

The above-mentioned enlightenment can be obtained by an ordinary person within 6 months when the above reading takes place roughly once a week, and each member is given some kind of homework each time. The manufacturing site automatically grows wise even without declaring the NM method. In a company, this works best when someone at section chief level picks a positive person to host the reading circle.

5. Application Field

Policy from the top is important in management, but at the same time, the wisdom of each staff member must not be forgotten. Let's look at a familiar example. In the operation of a shop, it is important that the boss gives detailed direction to a salesman. If a salesman makes a customer angry, the customer may never come back to the shop. The reason why a salesman makes a customer angry is that he can not solve the problem existing between the customer and himself. This is not a problem of knowledge, but of wisdom. There is no quarrel where there is wisdom. This is the most universal expression of creativity. Things are the same in a department store as in a shop. Trouble which occurs between a superior and a subordinate, or among colleagues, remains an uncomfortable image in the brain. Eventually it disturbs the concentration needed to tackle a problem.

Generating wisdom is to create the mechanism which functions like lubricating oil in an enterprise.

Does an entrepreneur forget this mechanism of wisdom beyond the mechanism by more salary and welfare? If a person can fully play by his wisdom, he can have a positive attitude anytime.

Although the NM method is useful as a technique for creating ideas in situations where creative solutions cannot be arrived at through analysis, the real intention of the writer lies at the point where all employees (including top management, if possible) can raise their level of wisdom using this method. Any number of ideas can be extracted during work at a manufacturing site with a high level of wisdom. I recommend that you consider that there is a field of application for the NM method at this point.

Although cerebral physiologist Tadanobu Tsunoda said "a Japanese, on average, leaves the right hemisphere of the cerebrum idle. If he fully used it, his ability could really be increased as much as 5 to 6 times," this writer's experience shows that it is easy to increase his ability as much as 10 times. (This is by estimate of an engineer's ability to invent through paid patent fees.)

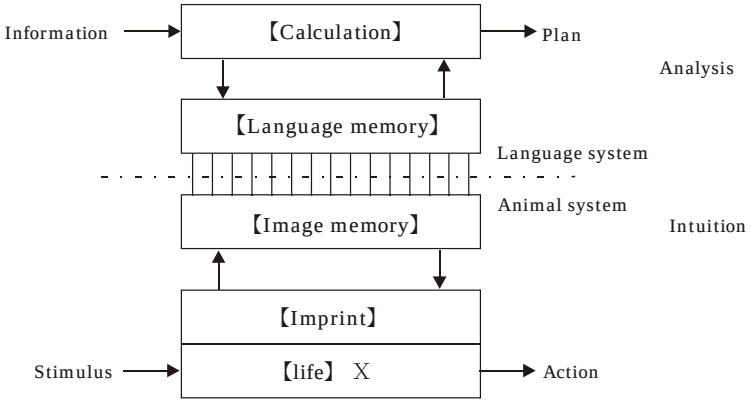
There are many examples of this. A machinery manufacturer's profits increased rapidly with the development of this ability, which was proposed by a person from the section chief level. An iron manufacturer that miraculously eliminated the occurrence of accidents which every manufacturer had, up to that time, accepted as a reality. A textile mill that beautifully completed technological innovation through adopting a theme which every manufacturer in every country had abandoned as a terrible money eater. To our surprise, no one in top management knows how that came about.

The writer believes that buying the wisdom of employees through the proposal system is the way of thinking of American business, and the assumption that an unwise person is not worth employing is a Japanese way of thinking. This is the reason why the writer recommends that you deal with the NM method according to your own opinion from here on.

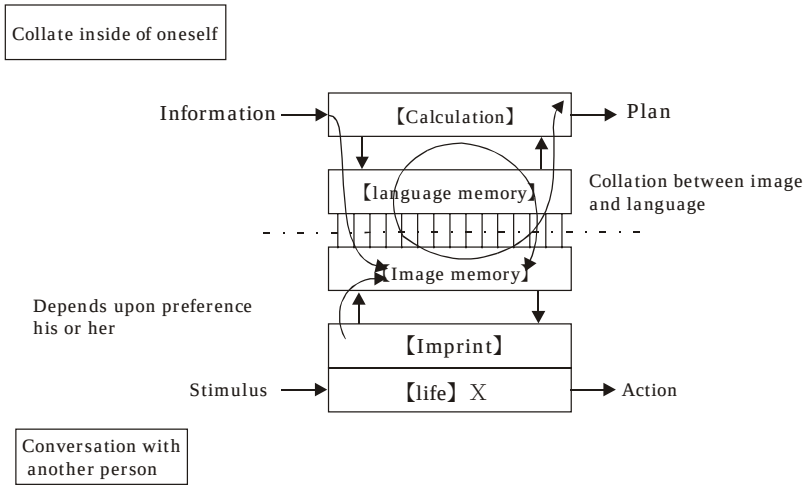
References

(1) Masakazu Nakayama, “Everything of the NM method,“ Sangyo Nouritu Daigaku Publishing Co. (1972). (Refer to for details of the NM method.)
(2) Tadanobu Tsunoda, “The Cerebrum of the Japanese” Daishukan, (1978).
(3) Outline of creative thinking is the following literature:
Masakazu Nakayama, “Self-discovery of creativity,” Blue Backs, Kodansha.
(4) Wisdom Group, “Wisdom”, Soko Co. Ltd.

Fig.1 HBC(Human Brain Computer) model(By M. Nakayama)



【Life】; Computer to control the minimum functions required to live
【Imprint】; Computer memory to store the basic rules required to live
【Image memory】 ; Computer memory to store the memory which keep the experienced stimuli
【Language memory】 ; Computer and logical thinking to search word memory
【Caluculation】 ; Computer and logical thinking to search word memory



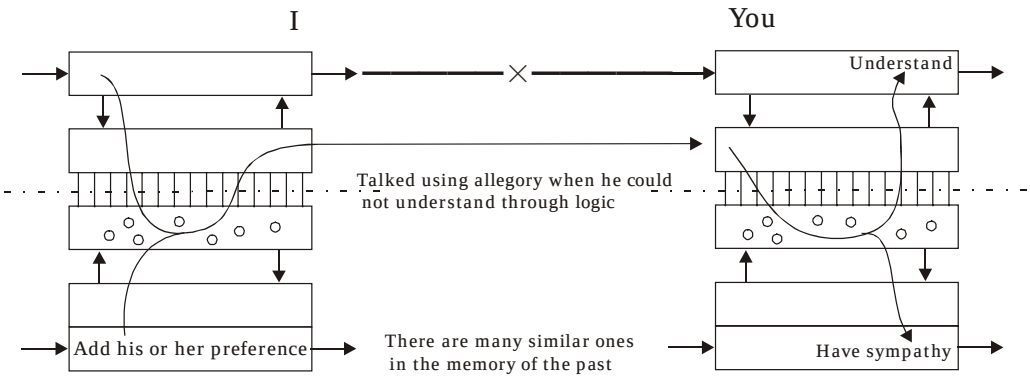
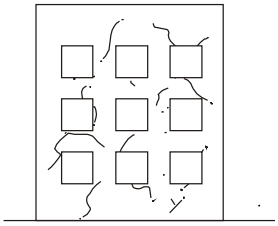
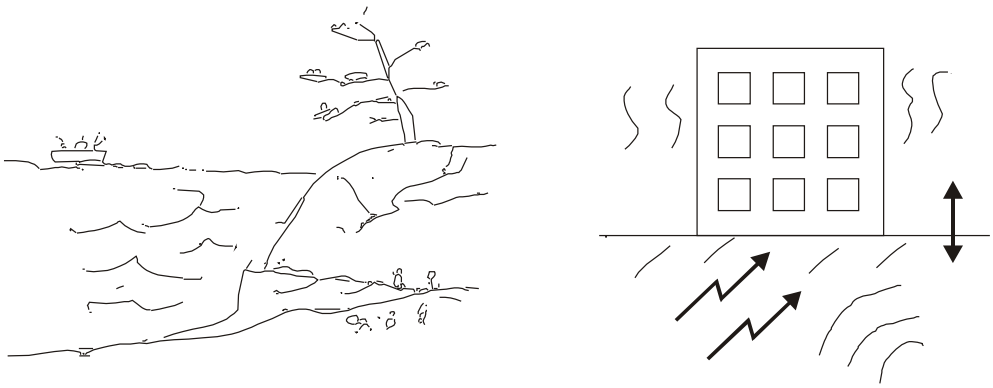


Fig.2 Example of QA, QB, QC

KEY WORD：「Discracy」



QA "Just as ～"



QB What is happening there in the background?

QC Does it give us a hint to destroy the building?

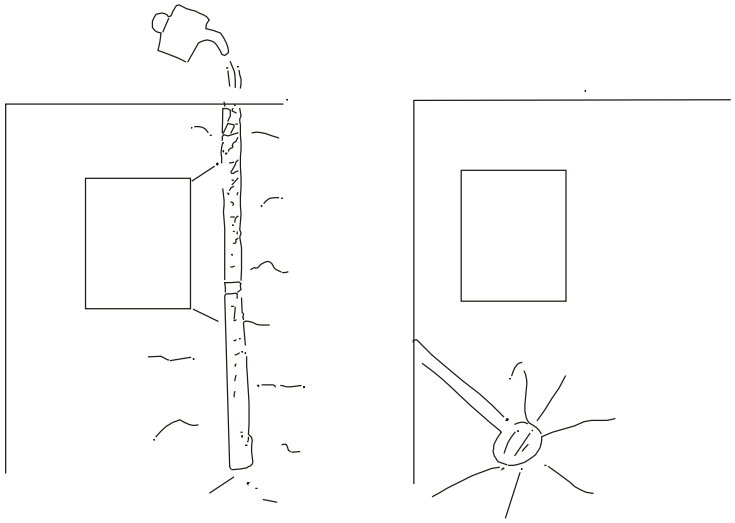


Fig.3 NM-method, T-type

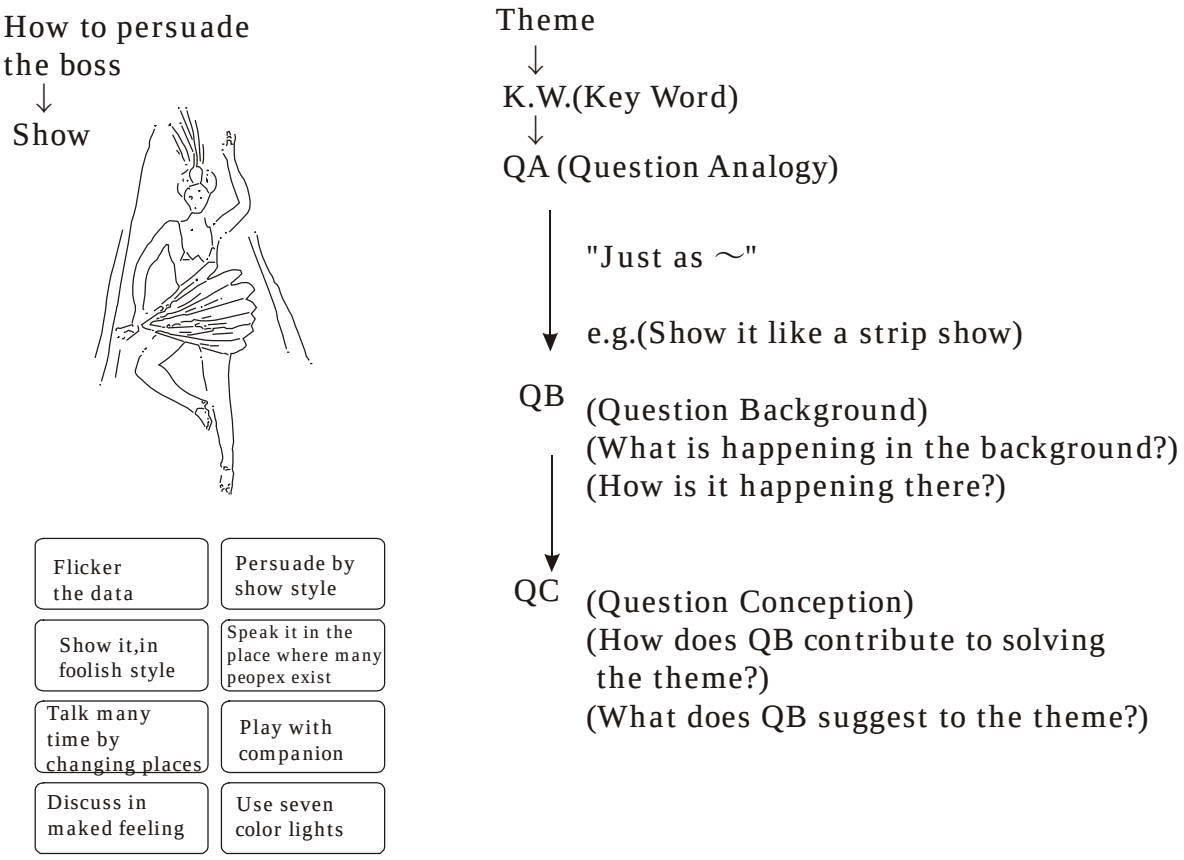


Fig.4 NM-method, H-type

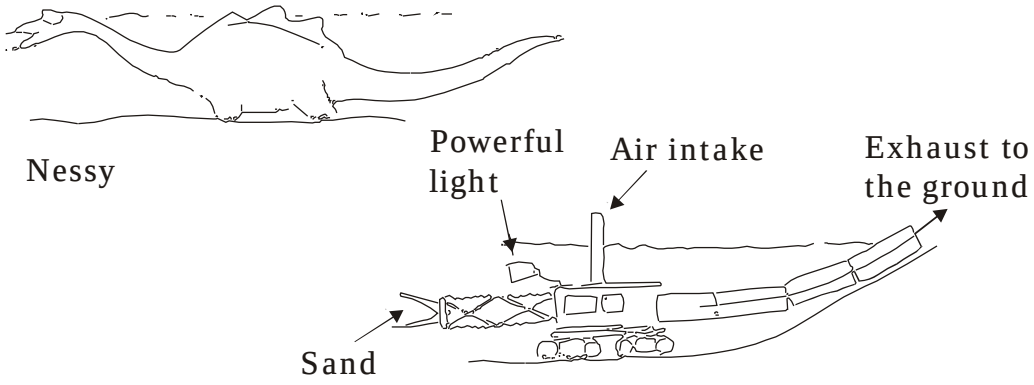
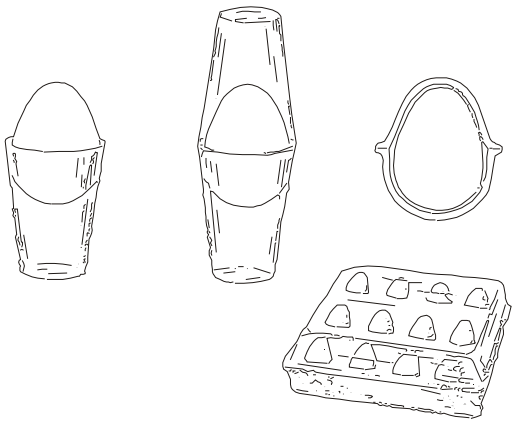


Fig.5 NM-method, A-type



Cup and Eggs

Fig.6 NM-method, S-type

Introduction Development Denoument Conclusion

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Different nature

Fig.7 Broken “Shoji(Sliding Paper sliding door) and Japanese nightingale

Appendix B

The subsequent material is supplementary material for the finely-tuned use of the DTCN/DTC methodology.

Abstract

This supplementary material is cumulative, so readers are invited to add their supplements or applications of DTCN/DTC methodology.

Please send them to the author even if they are in the preliminary stages. After due consideration, they will be added to the revised version of this book or listed on the DTCN/DTC home page.

1. Framework Flow Chart for the Storage of Know-how and Cost Management in Enterprises
2. Creating Missions of Seeds, Needs and Mine or My Own Organization
3. Creating Customer Needs by Information Node and Concurrent Engineering Flow Chart
4. What is "Plan to Cost"?
5. Method for Cost Reduction and Improvements at Manufacturing Sites
6. Method for Effective and Proper Expediting
7.Inquiries and Reports, Planning Papers and Implementation Plans
8 Forms of Meetings, Their Classification and Uses

Appendix B-1

Framework Flow Chart
For the Storage of Know-how and Cost Management in Enterprises

Framework Flow Chart for Storage of Know-how and Cost Management in Enterprises

(1) The storage of know-how and cost management in-house is necessary for the survival and growth of an enterprise. Fig. 1 is a flow chart showing the contents. If there is an interruption anywhere in the flow, the enterprise cannot grow. Therefore this flow chart is the basic criteria for the storage of know-how and cost management in an enterprise. The "K-card" in Fig. 1 indicates "K-card or its database of know-how and cost data."

(2) The concept of Grade of Estimate in the left of Fig. 1 is as shown in Fig. 2. The contents of Fig. 2 can be summarized as follows. Grade of Estimate 9 means the accuracy of estimate during the phase in which "value creation" is getting started with PMD, etc. in circumstances where the matters wanted are not specialized. Grade of Estimate 7 is for the early stage of the project and is the only requirement with a wide margin of estimate. Grade of Estimate 1 corresponds to the case in which a highly precise estimate is possible because the results of man-power and reviewed result are available. Grade of Estimate 0 means the accuracy of estimate in circumstances in which production is steadily repeated because of already stabilized market needs. For example, for the same one million yen, the grade of estimate 7 may give an error of ±50% or so, and grade 1, very little error.

(3) The following is an actual case. About 10 years ago, a company whose management flow chart was interrupted almost became bankrupt. The company, which was in the red, accepted a director from the parent company. At the first sales meeting he attended, the following comments were exchanged:

Head of Sales Department: We got the contract of this product for 1.2 million yen.
Director: Do you have a proper profit?
Head of Sales Department: Yes, of course.
Director: What is your judgement based on?
Head of Sales Department: I believe so because it is compatible with the manufacturing cost.
Director: Well, well. Where has the GCIP gone? (GCIP: General Cost, Interest and Profit)
Head of Sales Department: It's OK because this company's way of estimating costs differs from yours.
Director: Check it with the Accounting Department.

The next morning...

Head of Sales Department: Everything is working as you said.

Director: Why were you possessed with such an idea?

Head of Sales Department: Here is an instruction for sales.

1. Standard product price is manufacturing cost multiplied by 115%.
2. Custom product price for the user is manufacturing cost multiplied by 150%.

   Custom product price for the dealer is in principle 90%.

I thought that on the basis of this data in instruction, we could make a profit even if we sold our product at manufacturing cost

Director: The instructions are vague, don't you think? The second sentence of paragraph 2 should have been clearly expressed as paragraph 3, saying 90% of the price shown in paragraph 1 and 2. This is one reason why the company is in the red by 15% every year and why the top management of this company and the parent company have reported that subcontractors do not cooperate to pull costs down. In addition, our efforts in-house to lead cost reduction have not brought us the profit that this manufacturing cost (?) has assigned to subcontractors. A wrong assignment never brings costs down, does it?

Head of Sales Department: If the top management, who decided to sell the company because of a lack of profit, or the parent company knows about this situation, it will cause serious trouble.

Later the director reported the situation to the Head of the Administrative Department of the parent company, who quashed the report, and the executive on loan was called back to the company.

(4) Here is another similar example of a company facing a crisis. One division was always in the red. It was decided to ask volunteers to make a DTC step-list for the flow from selling to making a profit.

The following inquiries were given in the process:

A: GCIP is what % of the division?

B: 15%

A: Because the division carries out in-house product design and orders whole productsfrom an outside supplier, it is necessary to add at least 25% of GCIP. Please check whether this is true or not.

A little while later...

B: Terrible! The Chief of the Accounts Section became nervous when I asked him.

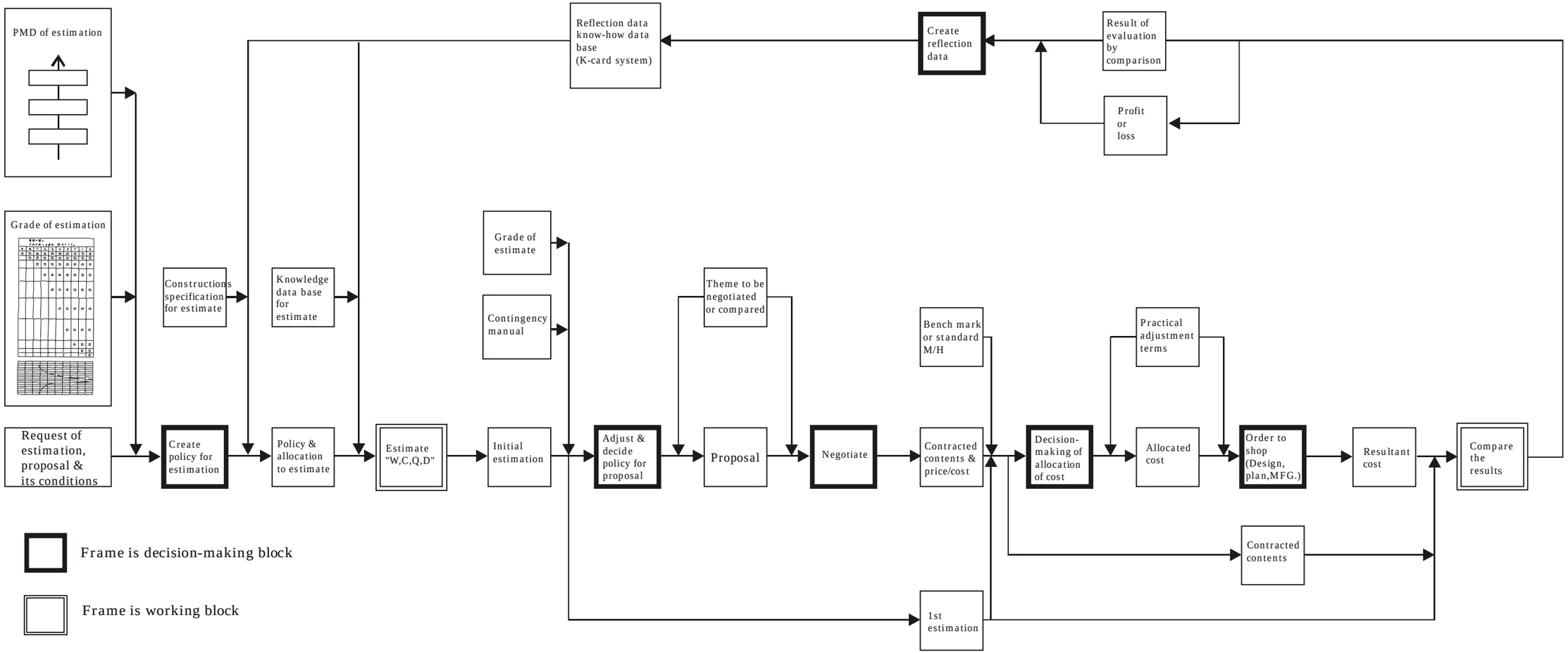
A: This is really the reason why we have been in the red for so many years, isn't it? The selling price, and the inside and outside assignments have been wrong all along.

B: Who should report this situation to the Division Director, and what countermeasures should we take for this?

A: There is no other way to improve the situation than to report this to the incoming Director, with whom I am friends. The present director is expected to leave.

Fig. 1 Knowledge and Cost Management Flow Chart for a Company

Inside the company, this flow must be kept without a gap from a long range strategical stand point

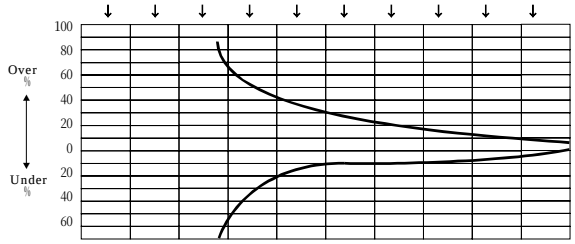


Note 1 : K-card indicates "Know-How"card.
Note 2 : Grade of stimation is refered in next page.
Note 3 : Flow of cost and know-how management must linked without gap.
Note 4 : There must be feed back between blocks.

Fig.2 9-step Grade of Estimate

(We call this “9 grade of thinking or 9 grade of fuzzy as necessary)

Phase name	Data obtainable for estimation	Grade of estimate “O” mark means obtainable data									
		9	8	7	6	5	4	3	2	1	0
Value creation	Value creation work(0-phase PMD)	○	○	○	○	○	○	○	○	○	○
Customers needs creation	Needs, Sees own mission		○	○	○	○	○	○	○	○	○
Requirement definition	Basic function(In brief to do ～) Basic requirement, development plan(with sub system) etc.			○	○	○	○	○	○	○	○
Concept	Rough sketch、Developme nt plan (With sub system) etc. = Concept Drawing				○	○	○	○	○	○	○
Breakdown Structurization （Optimization）	Total plan, WBS, Function tree Basic plan drawing(3 view, structure,system equipment layout) + WBS					○	○	○	○	○	○
Basic design	Report of basic design,Decision caluculation report, Performance test plan,AEMO Plan Drawing （3view, lines structure DWG. Parts layout DWG. System DWG, Parts layout DWG. Part/Equipment spec.DWG. Jig spec.DWG. Material spec, Manufacturing facility spec, Quality assurance spec, Assembly sequence chart						○	○	○	○	○
Detail design	Manufacturing DWG.(Assembly, Installaction, Fabrication part DWG. Spec. control DWG. Circuit DWG. LayoutDWG. External identification DWG.etc.) APL(Assembly parts list), Packing and delivery spec. Spare part spec. Logistic sup port facility spec. Manuals(Budget estimation for mass-production), JIG DWG., Facility plan							○	○	○	○
Prototype	Shop order(With standard manhour), Direct material qu ality, Direct material purchase quantity								○	○	○
Review	Actual manhour, Data of material used corrective Actions									○	○
Mass-production	Stabilition by repeat production										○



Appendix B-2

Creating Mission of Seeds, Needs and Mine or My Own Organization

It is a convenient and controllable means for understanding the relation between seeds, needs and my own organization's mission to represent them in a matrix by assignment into a 5-phase improvement scheme expression as shown in the figure on the next page.

Creating Missions of Seeds, Needs and Mine or My Own Organization

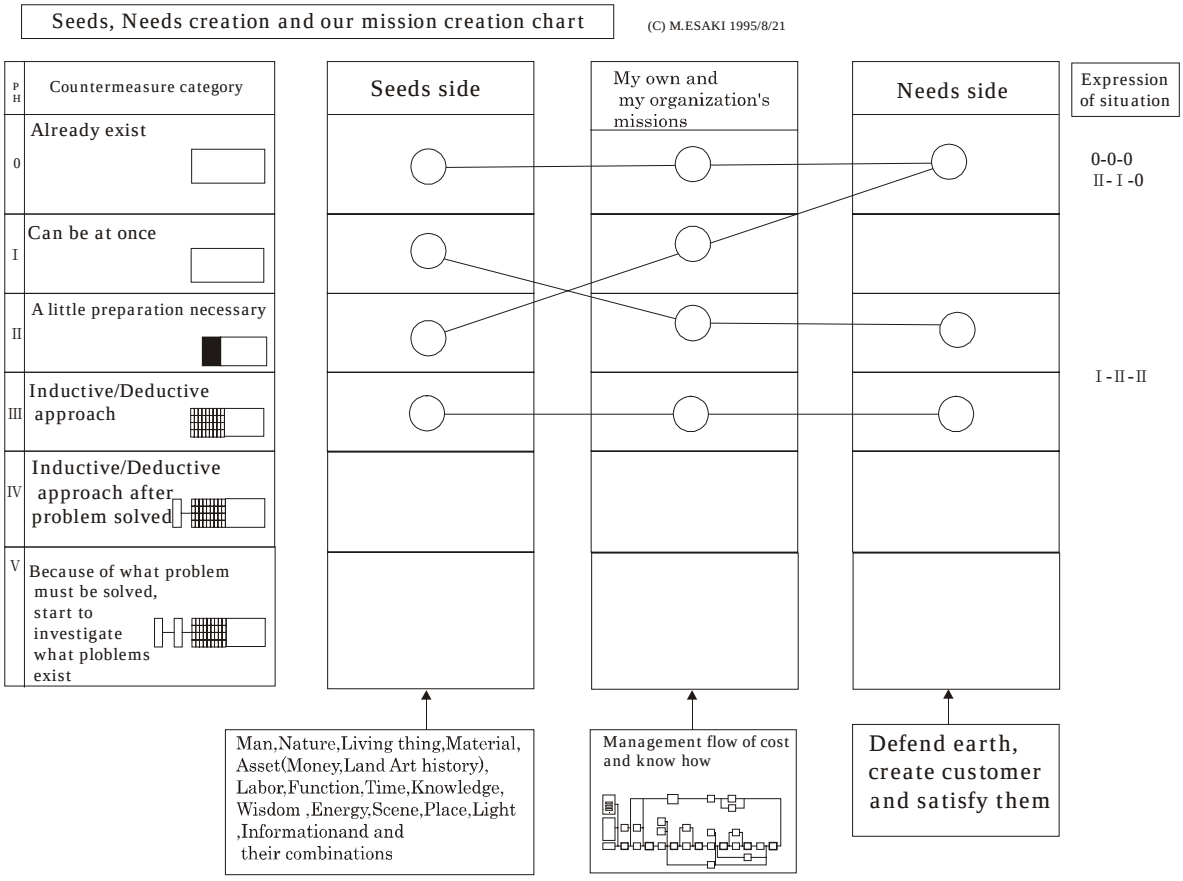
Firstly, look at Fig. 1 (Appendix B2) bellow.

The situation where the matters concerned require only to be connected is said to be the situation of "0-0-0 of seeds, mission, needs" and the situation where various things that need to be done must be considered individually as seeds, mission and needs is called "III-III-III of seeds, mission, needs."

We can now distinctively express any seeds or needs as those at the level of "maybe useful for something" or at the level of "practically clear," and so on.

"Creating missions of mine or my own organization" means that things at a lower level in the framework are pulled up in a social pattern to the upper apparent level.

Fig. 1 (Appendix B2) The sheet to create the seeds, needs and mine or my organization mission



Appendix B-3

Creating Customer Needs by Information Node and Concurrent Engineering Flow Chart

1. How can the Information Node for concurrent engineering be created by means of the DTCN/DTC method?
2. How can customers' needs be created using this key?
3. How can concurrent engineering be carried out?

Creating Customers' Needs and Flow Chart of Concurrent Engineering

By rearranging the DTCN/DTC method,
"Creating Customers' Needs and Concurrent Engineering Flow" by "Information Node"
becomes:

1. Way of thinking

In the process of doing work using information, it becomes important that all the parties concerned share information, make a decision, and make the results visible to any person at a certain stage of the process (Information Node). The success or failure of these actions depends on the time and pattern by which information is shared (e.g. format and method for preparing/using information).

2. In this paragraph, a concrete method of carrying out concurrent engineering based on this consideration is described.

Namely,

(1) P-Drawing Meeting is employed for the above-mentioned "stage."
Also the following items are considered as the format and documents for information sharing:
(2) Trade Worksheet of DTCN/DTC;
(3) PMP (Pre-Manufacturing Plan);
(4) Drawing Release Request Schedule; and
(5) Drawing before release of formal manufacturing drawing (sometimes called a white drawing).

These stages and format/documents together are called "information sharing point (Information Node)," which is handled as a trigger (an opportunity or a handhold) for advancing concurrent engineering. Here we take up an example in which the opportunity for concurrent engineering is built up in the flow starting with the creation of customer needs and ending at customer satisfaction.

3. What is the real nature of Concurrent Engineering?

There has been only one figure, shown in Fig. 1, in conventional books which illustrates concurrent engineering in an information-oriented system. Namely, the contents of concurrent engineering and how it works have not been clarified so far in any books. The only explanation of concurrent engineering is realized by the fact that information is shared in the box shown at the bottom of Fig. 1 (CALS-type of concurrent engineering).

The way of thinking shown here is one concrete method for realizing concurrent engineering. That is, when manufacturing drawings are complete, everything for manufacturing is already prepared so that production can be started.

4. Making Triggers for Sharing Information for The Sake of Concurrent Engineering by DTCN/DTC Method and a Concrete Example (See Table 1.)

Table 1 is a stepwise description of the trigger for sharing information. Figs. 2 to 4 can also be referred to. Specifically, making a DTCN/DTC Worksheet as shown in Fig. 2 enables us to make transverse consideration steps, as shown in Fig. 4, through the flow of work, as shown in Fig. 3.

As a result, all of the following items obtain triggers to simultaneously start the work of examining:

A. Plan to Cost (Division in charge of production engineering),

B. Plan to Operation Cost (Division in charge of operation),

C. Logistic Support to Cost (Division in charge of logistic support), and

D. Sales to Cost (Division in charge of sales)

To make an information sharing point for concurrent engineering, it is most important that first a steplist is produced using the DTCN/DTC method. Then the cause and effect relationships are carefully investigated. Next, the Node at which the personnel concerned argue is identified. And finally, the important matters required for rapidly making good cheap products are decided. These Nodes are put together and called the Information Node.

Fig. 1 Comparison of Conventional and CALS/Concurrent Engineering

(From: Successful CALS by Kazuo Nezu)

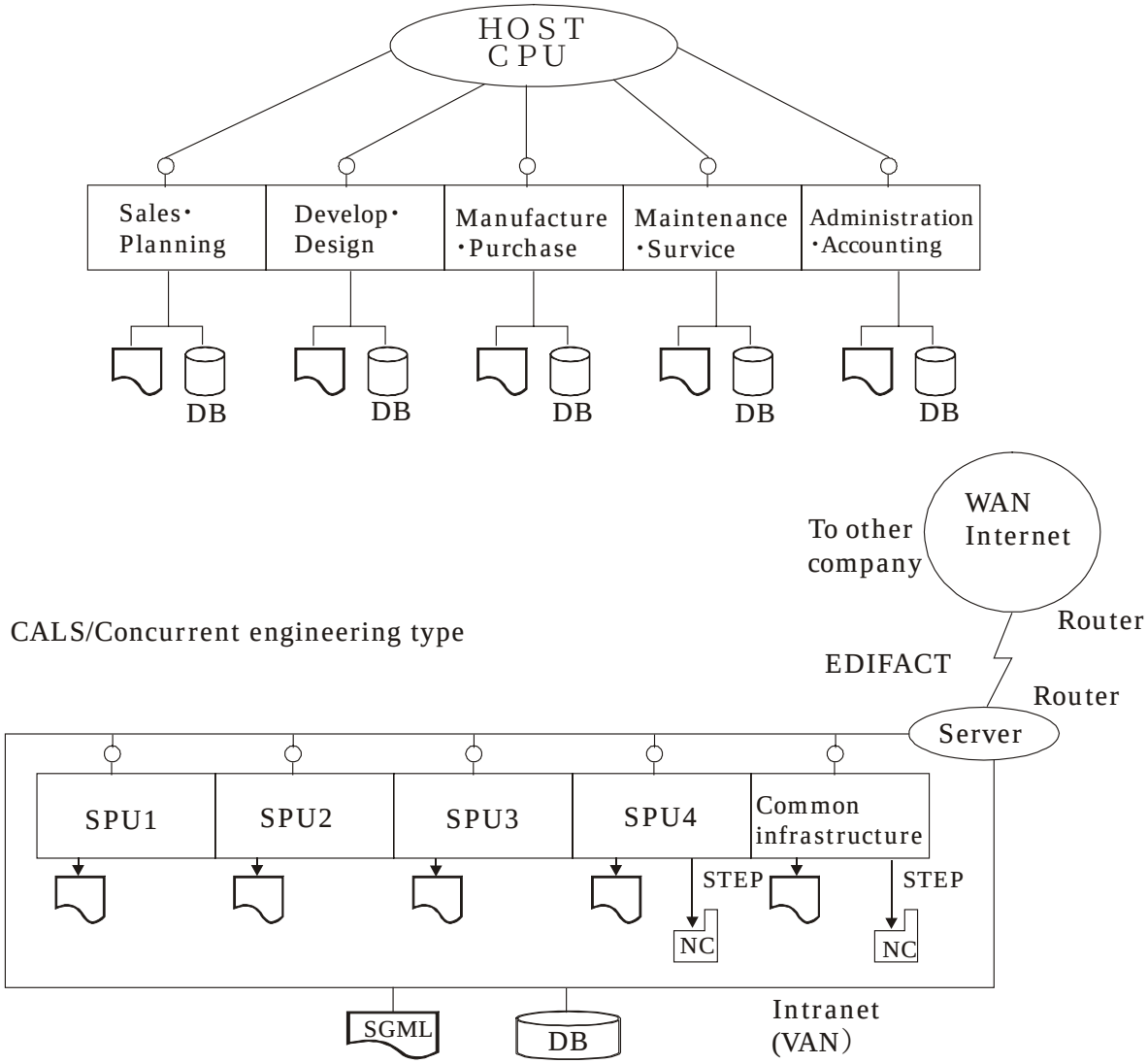


Table 1 Trigger for Sharing Information

	Step of trigger	Trigger tool	How to create the trigger
1.	Before to draw the Conceptual drawing	DTCN/DTC trade work sheet (see Fig.2)	Create DTCN/DTC trade theme from reviewing the base line idea
2.	Before to draw the basic plan drawing	DTCN/DTC trade work sheet	Create DTCN/DTC trade theme from viewing the conceptual drawing and its WBS
3.	Before to draw the detail plan drawing (e.g. Final selection of basic material)	DTCN/DTC trade work sheet	Create DTCN/DTC trade theme from viewing basic plan drawing and WBS
4 A.	Before to draw the manufacturing drawing(Draft)	P-DWG, Meeting (Plan drawing examination meeting before making each manufacturing drawing)	Draw out the ideas to be waved into manufacturing DWG with production department people
4 B.	Before to finish the manufacturing drawing	DCCB(Design Change Control Committee) examination by re-planning work sheet	Get agree between the manufacturing plan group and design group people on manufacturing drawing draft
5 A.	Before to draw the manufacturing drawing	P-DWG, meeting	Same as step.4A
5 B.	Before to finish the sub-assembly drawing	DCCB(Design Change Control Committee) examination	Same as step 4B
6 A.	Before to draw the assembly drawing draft	P-DWG. Meeting	Same as step 4A
6 B.	Before to finish the assembly drawing	DCCB(Design Change Control Committee) examination	Same as step 4B

Fig. 2 (Appendix B-3) Example of Filed DTCN/DTC Trade Worksheet

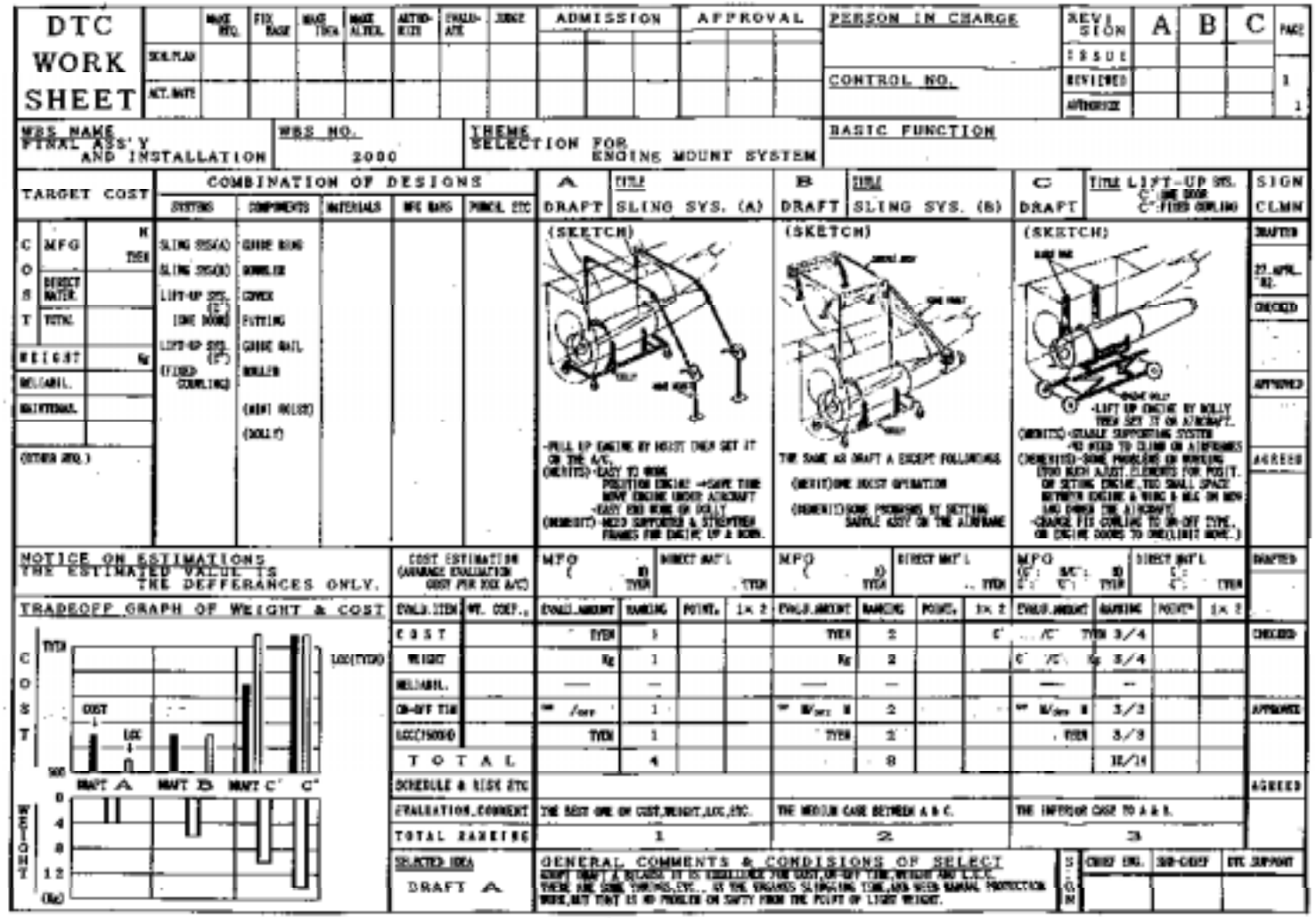


Fig. 3 Flow diagram to create information node of CALS/BPR/Concurrent Engineering by DTCN/DTC methodology

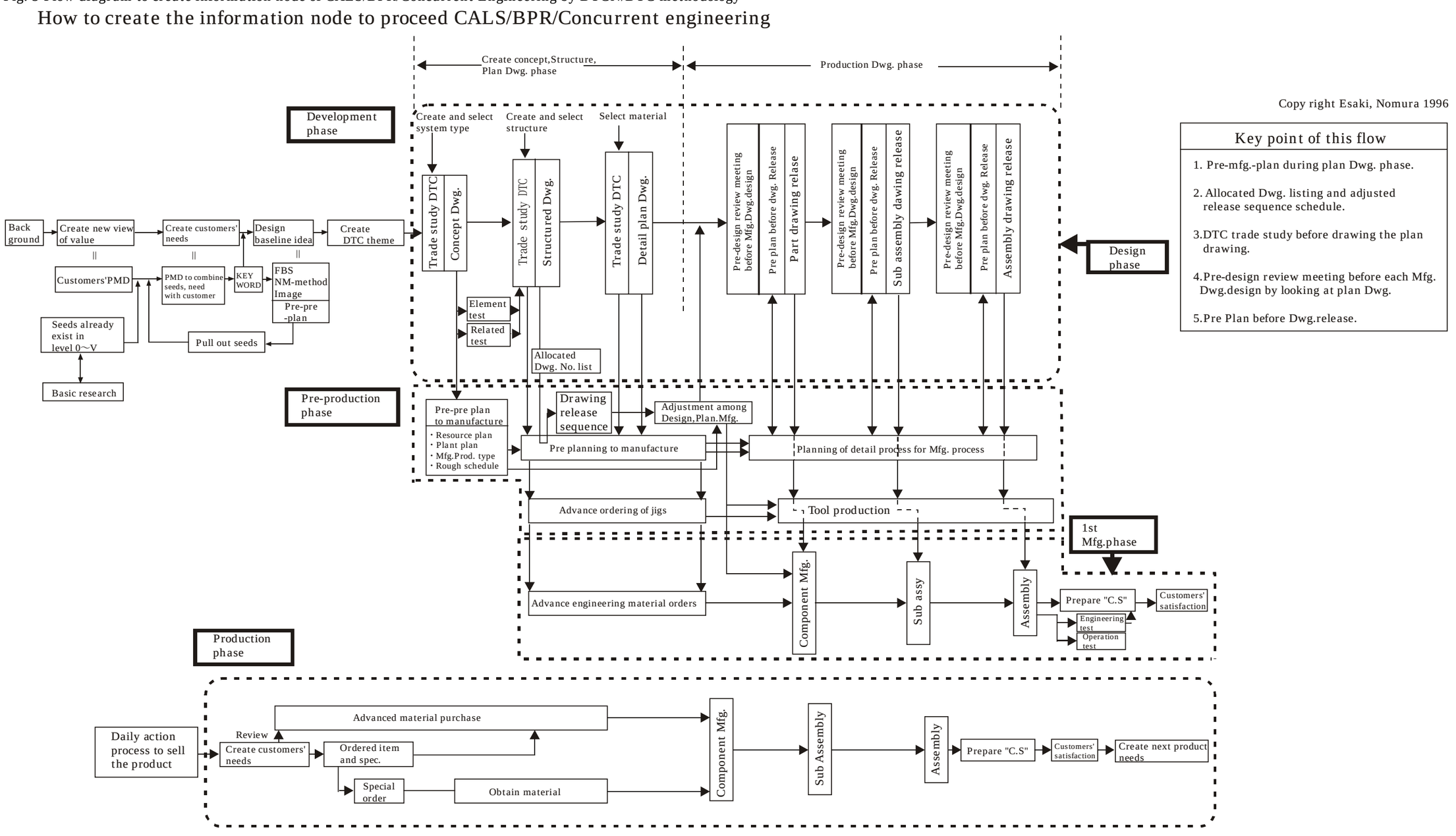
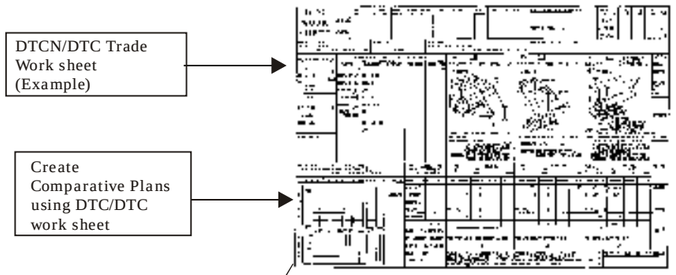


Fig. 4 Trigger Mechanism of Information Node for CALS/BPR/CE Mechanism by DTCN/DTC Methodology



DTCN/DTC Trade Work sheet (Example)

Create Comparative Plans using DTC/DTC work sheet

CREATE THE THEMES, THEN CREATE THE DTC WORKSHEET, CREATE THE STARTING POINT OF CONCURRENCY AMONG CONCERNED GROUP

DESIGN GROUP | MFG. PLAN GROUP | MANUFACTURING GROUP | OPERATION GROUP | LOGISTIC GROUP | SALES GROUP

DTC TRADE STUDY TRIGGERS THE COMMON INFORMATION NODE AMONG THE CONCERNED PEOPLE AND CONCURRENT ENGINEERING AND PRODUCTION

PHASE	DESIGN TO COST
I REQUIREMENT	MAKE CONCEPT DRAWING AND WBS
II CONCEPT DRAWING	TRADE STUDY OF SYSTEM AND WBS
III BASIC DRAWING	TRADE STUDY OF COMPONENT AND EQUIPMENT
IV PLAN DRAWING	TRADE STUDY OF MFG. PROCESS AND DETAIL IDEA
V MANUFACTURING DRAWING	
VI MANUFACTURING	TEST AND EVALUATE THE PRODUCT
VII REVIEW	REVIEW AND CORRECTIVE ACTION

PHASE	PLAN TO COST
I	・TRADE STUDY SUPPORT BY ESTIMATION ・ESTIMATION OF PRESENT COST AND SET THE TARGET COST
II	
III	ESTIMATE THE IDEAS AND SET THE PART ITENS NUMBER
IV	PLAN THE PRE-PLAN
V	PLAN THE MANUFACTURING PROCEDURE. DESIGN THE TOOLS
VI	FIND THE PROBLEMS AND THE PLAN THE SOLUTION BY MAKING PRODUCT
VII	NORMALIZE THE SHOP LOAD AND SHORTEN THE MAKING SPAN

PHASE	MANUFACTURING TO COST
I	ALLOCATE MANUFACTURING COST
II	MAKING JIGS
III	MANUFACTURE THE FIRST PRODUCT
IV	REVIEW THE GENBA BEFORE ALL OVER THE PRODUCTION
V	CONTINUE COST DOWN EFFORT ALL OVER THE PRODUCTION

PHASE	MISSION OP. TO COST
I	STUDY AND TRADE TWO OR MORE PLANS BY STAND POINT OF MISSION SUCCESS AND COST EFFECTIVENESS
II	
III	
IV	
V	
VI	
VII	
VIII	

PHASE	LOGISTIC SUPT TO COST
I	STUDY AND TRADE TWO OR MORE PLANS BY STAND POINT OF READINESS AND COST EFFECTIVENESS
II	
III	
IV	
V	
VI	
VII	
VIII	

PHASE	SALES TO COST
I	STUDY AND TRADE TWO OR MORE PLANS BY STAND POINT OF SALES PROMOTION
II	
III	
IV	
V	
VI	
VII	
VIII	

Appendix B-4

What is "Plan to Cost"?

"Plan to Cost" is a link in the chain "Design to Cost." The procedure shown below is similar to that for DTC.

Fig. 1 Plan to Cost Connection with Design to Cost

Upper stream of plan to cost is design to cost, down stream of plan to cost is manufacturing cost are shown below.

PHASE	DESIGN TO COST
I Requirement Definition	Make conceptual draws(Draft) Make WBS
II Basic concept	Proceed trade study of main structure equipment system
III Basic Plan Dwg.	Proceed trade study of detail structure and material Equipment vendor selection
IV Plan Dwg.	Proceed trade study of manufacturing method Weave the detail idea into drawing
V manufacturing Dwg.	Reflect the meeting result of P-Dwg. meeting
Prototype production	Test by prototype
Review	Reflect corrective action in mass-Production Dwg.

PHASE	PLAN TO COST
I	Establish present cost and target cost by conceptual Dwg.
II	Compare and select manufacturing method
III	Gather and example to adopt or not, and establish the target part item quantity
IV	Pre-plan work for manufacturing
V	Plan manufacturing process and design the JIG.
VI	Grasp the problem during first production and create the countermeasure
	Normalize the work load and shorten the making span

PHASE	MANUFACTURING TO COST
I	Allocate production cost budget
II	Verify and analyze the prototype result
III	Production of JIG.
IV	Review before mass-production in production department
V	Reduce the cost during the mass production process

Fig. 2 Organization of Plan to Cost

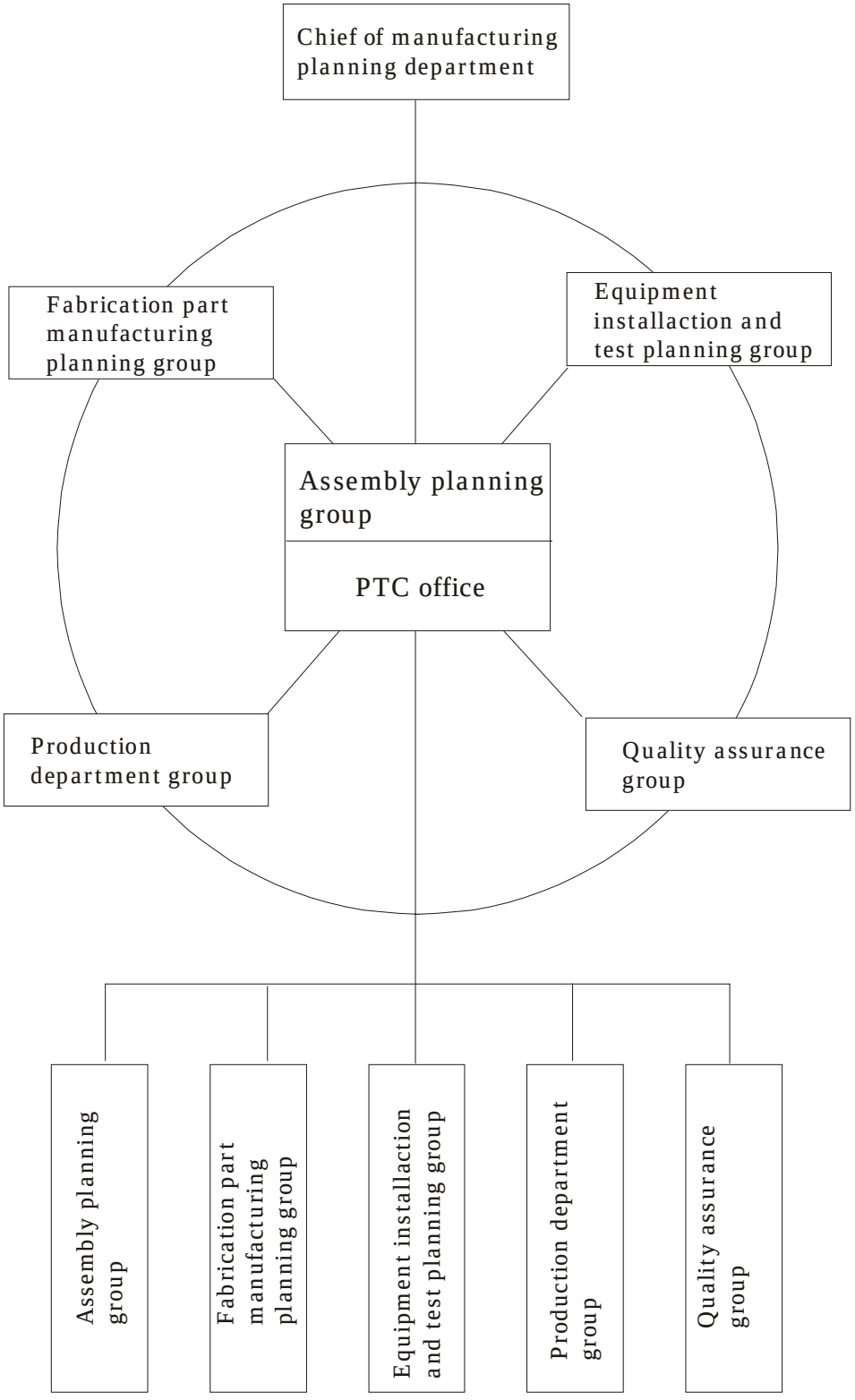


Table 1 Details of Steps in Plan to Cost

	Phase ( ) means DTC output	Step contents	Input		Output		Notes conditions	Output approval level
			Item	Pre-assurance activity	Item	Post assurance activity		
I	Original Concept (Basic concept Dwg.)	Establishment of the Present cost and the target cost by conceptual Dwg.	・Concept Dwg(Draft) ・Required Performance ・Related matter	Estimation work by the conventional design and manufacturing method	・Present cost ・Target cost(Draft) ・Implementation plan of PTC ・PTC cost schedule graph	・Decide the target cost ・Decide conceptual Dwg.		・Design chief ・Manufacturing planning chief ・Project manager ・Factory chief
II	Break down structure (Basic plan drawing)	Selection of manufacturing method concept	・Experiences of past productions ・Conceptual Dwg. DTC cost scheduled curve	Selection of manufacturing method concept	Item list of wants and idea to be weaved into drawing Item list of wants and idea to be weaved into manufacturing plan Manufacturing Type/concept concept(plan), basic plan drawing	Decide concept of manufacturing type by trade study.(e.g. structural breakdown, special process and its type)	Estimate the present cost and allocate the target cost first time.	・Manufacturing planning chief ・Design chief
II	Basic matter Basic design (Plan drawing)	Examination to adopt or not the wants/idea to be weaved into drawing and manufacturing plan. Decision of target number of part items.	Item list of wants and ideas to be weaved into drawing	Examination Meeting (Decision group) Adopt or not (Man of planning group)	Plan drawing of adopted wants/ideas	Grasp the number of part items by plan drawing and decide the target number of part items	Estimate budget for JIG making *Everything must be real base	・Design chief ・Manufacturing planning chief
V	Detail matter Detail design (Manufacturing drawing)	Pre-plan work	Plan Dwg. P-Dwg. meeting schedule PTC scheduled Curve	Exact wants and ideas by looking at plan drawing among the concerned people. P-Dwg. Meeting. And pre-plan work by draft of manufacturing drawing	Decided item to be weaved into drawing Estimated part items and its number Item list of planning improvement	Estimate present cost of each plan drawing. Divide the cost reduction by design and manufacturing method	Proceed plan work by considering cost driving factor of manufacturing process and work.	・Planning chief
V	Implementation (Prototype production)	Main planning work	Item list of planning improvement	・Weave the improvement ideas into shop order, tool order, tool design order. ・Estimate the improved cost effect	・Estimated man hour for prototype	Difference analysis between estimated M/H and target M/H and estimation M/H of counter measure	Proceed plan work by considering cost driving factor of manufacturing process and work.	・Planning chief
√I	Review	Problem extraction by prototype and counter measure plan	・List of counter measures ・List of key question	Extract the problem thru prototype production and counter measure of problem	Item list and its effect to be improved in mass-production planning	Approval		・Production department chief ・Planning chief ・Design chief
/II	Normalization of work load	Normalizing of work load and shortenig the making span	Prototype Manufacturing assemble part list	Normalize work load by simulation	Manufacturing assembly parts list for mass-production	Make part order list for mas-production		・Production department chief ・Manufacturing planning chief

Table 2 Trade Study Example During the Manufacturing Plan

	Upto plan drawing phase	Manufacturing drawing phase	Production phase
Common and Assembly	1. Assembly breakdown and sequence. 2. Tact line breakdown structure. 3. Concept of assembly Jig.	1. Working posture of work man in Assembly line. 2. Breakdown structure of Jigs. 3. Effectiveness of power tool..	1. Trade study of counter measure investment effectiveness(Do or not). 2. Trade study of counter measure wants/idea.
Fabrication Part	e.g. Cutting speed trade the effectiveness and necessary investment money	1. Trade study of which fabrication or Forming is totally effective. 2. Trade study between preciseness of tool and reduction of man hour (e.g. Number of stiffener between frames)	1. Measures to prevent the distortion or ward of parts.

Table 3 Example of Cost Drawing Factor During Manufacturing Planning

Category	Factor to be reduced	Factor to be increased	Note
Process plan	1. Number of process 1. Number of person for one process 2. Number of crane/lift at necessary Scene 4. Number of excess trim work 5. Number of paint 6. Number of writing document 7. Number of functional test 8. Number of posture to up ward 9. Number of harness board 10.Number of inspection 11.Number of soldering	① Number of parallel working ② Net trim number ③ Number of low price purchase than implant cost	1. Number of order means In wide sense: Number of load center in marrow sense: In narrow sense: Number of settings 2. No bench test before installation but provide the harness for trouble shooting
Tool design (Including tooling manual)	1. Number of fastening 2. Number of fastening action 3. Number of adjustment 4. Weight of tool	① Number of scaffoldings ② Number of scribing line in Jig	3. Standard weight ・Up to 10kg for one person ・Up to 40kg for two person work ① Increase scaffoldings to go to next scaffolding ② The many scribble line in the Jig, the better and quick corrective action
Facility Examination	1. Waiting time before starting work and closing time before stopping the machine 2. Cycle time of process 3. Operating time of crane or lift 4. Number of person to operate the crane	① Number of automatic machine number of power tools	2. Reduction of cycle time must include cutting speed, depth of cutting etc.
Examination of handtool	1. Weight of hand tool	① Number of power tools ② Number of one man operating tool	Example and allocate the scene which is necessary to have special tools before purchase

Fig. 3 Concept Image of Breaking Point of Manpower if Tolerance Increases

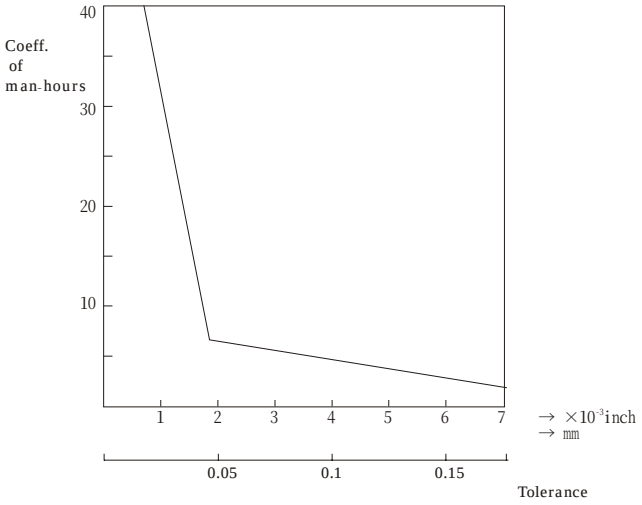


Table 4 Example of Checklist for Manufacturing Drawing

DTC checklist for manufacturing drawing （Examine the idea from statement of function shown in plan drawing）	Drawing No.		Checked by	Group leader	Section Leader	Department chief
PHASE Ⅰ (Check plan drawing before making each manufacturing drawing)		Date				
1．Did you request and receive the wants and ideas by showing the plan drawings?						
2．Are there any parts in common?						
3．Are there any themes or perts to be integrated into one part or function?						
4．Are there any parts which can be substituted by a lower costing part?						
5．Are there any places where the cost driving factors can be reduced?						
6．Is it possible to realize the target number of parts allocated for each plan drawing if you approve this drawing?						
7．Did you record the scheduled theme to be examined in the mass-production phase drawing?						
PHASEⅡ（Before pre-planning）		Date				
1．PHASE Ⅰ-Does this drawing involve the theme examined in Phase I.						
2．Did you realize the target number of parts allocated. If not, did you ? the potential theme to be examined at mass-production drawing phase						
		Date				
PHASEⅢ（After pre-plan work）						
1．Did you finish examining all proposed items from the manufacturing and quality departments?						
2．Are there any additional themes to be examined in the mass- production drawing phase?						

Appendix B-5

Method for Cost Reduction and Improvements at Manufacturing Sites

The secrets (know-how) of rapid cost reduction at manufacturing sites are as follows:

1. A special two-person cost reduction shall be put under the direct control of a factory manager.
2. Obtain information about the existence of problems on manufacturing sites by means of questionnaires
3. The special cost reduction team shall visit the shop which identified a problem, and solve the problem.
4. Settlement is accelerated if a member of the team takes photographs of the manufacturing sites with problems, writing directly on the photograph the problem and instructions for measures to solve the problem(s).
5. For cases which require a long period to solve or settle, B-6 "Effective And Proper Method for Progress Control" shall be applied.

Method for Cost Reduction and Improvements at Manufacturing Sites

1. Recognition of Essential Features

(1) Specific "entrance to possible cost reduction and improvements" at manufacturing sites is determined by the "existence" of "a problem requiring solution or necessary condition" which requires the execution of cost reduction and improvements.

(2) The "existence" of "a problem requiring solution or necessary condition" cannot be found without "eyes and opportunity, or a trigger."

(3) The opportunity to create the above "eyes and opportunity" is given by clear expression of object terms such as "cost reduction, quality improvement, time saving, functional improvement, work load leveling, danger prevention, and so on" and asking oneself or a person in charge "the proper questions."

(4) Accordingly, the person in charge naturally notices "a problem requiring solution or necessary condition," if you put the "objective items," "proper questionnaire along the objectives," and "opportunity to ask timely questions, " which you have come up with, to yourself and to the person in charge.

(5) When the person in charge notices a problem, it becomes naturally possible for him to answer at least the question of the "existence" of "the problem requiring solution or necessary condition."

(6) "A handhold for possible cost reduction and improvement" for a whole organization can be obtained as long as the minimum information of "existence " is known.

2. Problems at the Manufacturing Site

(1) The position of workers/person in charge is in general the situation as shown below:

① On a manufacturing site, the ceaseless continuation of imposed process work is given the highest priority.

② Problems at manufacturing sites are almost always too difficult to be solved by only one person,

In many cases, they are independent of whether the above-mentioned existence of "the problems requiring solution or necessary conditions" for cost reduction or improvement are noticed or not.

③ As a solution, the organizations of enterprises and government agencies have employed such methods as small group activity and proposal activity. But even in small group activity, it is

still necessary that a proposal be written (on paper or on computer) so that the "requirement and its effect" are understood by a third party.

④ If they have a rough idea of the above in the small group activity, the problem still remains that the time required for collecting the necessary information and knowledge, exhibiting wisdom, and writing documents can not be sufficiently obtained.

⑤ As a result, it is always expected"to solve these problems mentioned above".

3. Detailed Problems at a Manufacturing Site

① A lot of time cannot be taken to collect, set and understand the necessary information and benchmarks.

② "The viewpoint and the know-how (how to imagine, how to ask, attitude and viewpoint) needed to face up to the reality of the manufacturing site" can not easily be understood.

③ While some cost reductions or points to be improved are dimly noticed in the mind, these are not expressed clearly.

④ A proper advisor who can teach how to specifically express the above points can not be found.

⑤ Even if the contents could be expressed, there is no time to ask for cooperation or coordination among the superiors or persons in another department to realize the expressed idea.

3. Method for Solving the Above Problems

The important points of one method for the effective, efficient and rapid realization of the "settlement of problem or preparation for it" in the organization of an enterprise or a government agency are described here.

(1) Appointment of a Special Cost Reduction Team

① Two people will be assigned by a factory manager or the head of the organization to a special team to carry out improvement and cost reduction at the manufacturing site for a certain period. (This means that everything shall be done by talking with each other.)

② The following missions will be given to the team:

A) The team shall support workers in a friendly manner at the manufacturing site to find a way of thinking and a handhold, which workers require to achieve the viewpoint necessary for arriving at the "problems and necessary conditions for realizing objectives."

B) The team shall help the workers in their writing, liaison and coordination, and practical work to realize the "settlement of the problem or necessary conditions for improvement." In that time, the team has to "perform the work as a substitute for a person in charge" in

the situations where it is "difficult for a person in charge" or "takes a lot of time", and follow up on the results.

A practical example is that when they can not find suitable tools, a member of the team takes the tools from the warehouse.

C) The Special Cost Reduction Team:

a. cannot give orders to the line;

b. can coordinate line functions;

c. if required, can deputize for the shop workers who have problems and for the need to request counter-actions from another shop or department.

4. Special Cost Reduction Team Tasks

(1) First make a PMD of the matters which the Special Team has to do.

(2) On the basis of the above PMD, make terms of the questionnaire as shown in Fig. 1, Sample Questionnaire, and get it answered.

The following items must at least be collected:

① The place where there is a problem or facts to be improved (the content of the problem is not needed).

(The minimum requirement is to answer the existence of a problem in an individual questionnaire.) It is appreciated if the contents of the problem or improvement are written down.

(1) If the place and person having the problem are known, a member of the team goes there and looks at the site, listens to the people there, and then arranges the contents of the action and procedures for it.

There are two other methods:

① To start by extracting only the theme/idea to be considered and the instructions for the procedures to cope with it.

② To take photographs at the scene of the problem or the scene requiring improvement, write down a possible counter-measure on the photograph and then make the proper counter action possible. (Because a cartoon includes both figure and letters, it creates a scene where both the right and left cerebrums work together and so, it is easy to understand.) We utilize this principle here and call it "improvement method with cartoon."

A "Theme/Idea Sheet" or an "Improvement Implementation Format" is used for this purpose. Fig. 3 and Fig. 4 are examples of completed forms.

(1) When this form is used, its contents shall include the assignment of a counter-action and the procedures that the concerned line/person in charge shall carry out. The process of this action is written in a chain connected by arrows at the top of a sheet.

(2) After the assignment of this counter action, timely acceleration and coordination shall be performed by the special team.

The "Action Promotion Sheet" shown in Fig. 5 is used as a Promotion Item List in this case, in which the action column for each "theme/idea" is filled with contents which are written in a chain-style connected by arrows at the top of the form shown in paragraph (4).

The authority of promotion and coordination are as follows:

a. Promotion and coordination is first performed up to the level of the person or section chief in charge.

If it is not successful, promotion and coordination are moved one rank higher, for example manager level, accompanied with the comment "lower level failed to coordinate."

If there is a point which could not be coordinated at that manager level, the promotion and coordination are sent to a manager one rank higher again.

The highest coordination level may be the head of the organization (president level). (If necessary, an outside organization may be included.)

b. Use the Method for Effective and Proper Expediting.

5. Supplementary Explanation

With a Special Cost Reduction Team, you can specifically understand the situation at the manufacturing site and the quick and proper method for understanding and coordinating the conditions necessary for achieving the goal and solution of problem.

The special team shall therefore be composed of the people who will carry the organization on their shoulders in the future. It can also be used as an opportunity to find and groom such people.

Attached Samples:

Fig. 1 Sample Questionnaire

Fig. 2 Improvement Implementation Format (Theme/Idea Sheet can be used with this format.)

Fig. 3 Example of written improvement implementation sheet (1)

Fig.4 Example of written improvement sheet (2)

Fig. 1 Sample Questionnaire

Questionnaire for clues in cost reduction

The purpose of the company is to provide support for you and your family.

To this end, we have decided to develop and market a new low-cost ZZ. We must therefore cut costs in our existing ZZ and raise funds for the development of the new version. Also, we need new themes and ideas to incorporate cost reduction in the new ZZ.

To lower the cost of the existing ZZ, we only need to do our work within a shorter time, with less labor, and in a tidy manner.

Please tell us how hat can be done (or its clue) “if we do it this way,” “if we have such a tool”, or “if we modify a tool this way” by writing it down on this sheet.

Since clues are already helpful, We will appreciate you if you only write “The problem is exist”(No need to write detail). So, we will visit you to hear the detail of the problem. If this sheet is too small, please write just underneath the question , or use another sheet.

Please hand in the sheet by (month)(day)(year) to the secretary for cost reduction.

---

1. Should an existing tool be modified, or should such a tool be obtained?
2. Should an existing facility be modified, or should such and such a facility be introduced?
3. Should an existing rule be modified, or should such and such a rule be introduced? (work site rules, management rules, and other rules)
4. Are there tools or facilities which allow work to be done without or by one person, work presently done by two or more people?
5. What are the parts or purchased parts which always cause problems? Do you have any ideas for improvement? (shortages of parts included)
6. Are there assembly sequences, work divisions and combinations which should be reexamined?
7. Are there any problems with the assembly process or combination of parts?
8. Are there any problem with part fabrication in assembly line ? e.g. location change of machine ?
9. Would work be greatly speeded up if the design department could do such and such a thing?
10. Is there something that could be done to guarantee quality?
11. Any improvements regarding in-house parts?
12. Any improvements regarding outside products?
13. Any improvements regarding purchased items?
14. Any improvements regarding outsourcing?
15. Are there aspects which are overdue or should be improved in the worsite improvement guided by manager AA ?
16. Anything else?

Fig. 2 Improvement Implementation Format (Theme/Idea Sheet can be used with this format.)

ACTION → → → → → → →

Improvement implementation	REG. No		CALENDAR DAY	MFG DAY	How many days it takes
	Name	Date			
	Approved by	Finishing date			

Model		P/N		Name		SEG		Assembly	Sheet metal	Heat treat	Bonding	Paint	Surface treat	Machining	NC machining		

(Problem)
Install the eye bolt to sling the heavy index mount.

KEY WORD

Necessary conditions

Requested serial No.		Applied effective serial No.	

	Present method	New method
		.
Material		
JIG		
Tool		
Facility		

Cost comparison		M/H/ Q'ty	Unit price	Cost/ AC	Total A/C		Q'ty M/H	Unit cost	Cost/ AC.	Total A/C		Cost down value: Per A/C		Cost down value: Life cycle	
					M/H	Cost				M/H	Cost	M/H	Cost	M/H	Cost
	Material														
	JIG material														
	JIG M/H														
	Fabrication														
	Tool														
	Facility														
	Total														

Fig. 3 Example of written improvement implementation sheet (1)

ACTION → → → → →

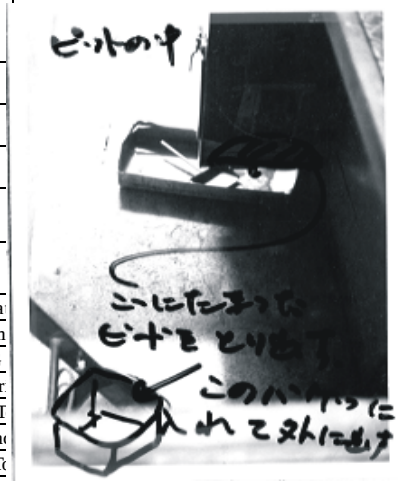
Improvement implementation	REG. No		CALENDAR DAY	MFG DAY	How many days it takes
	Name		Date		
	Approved by		Finishing date		

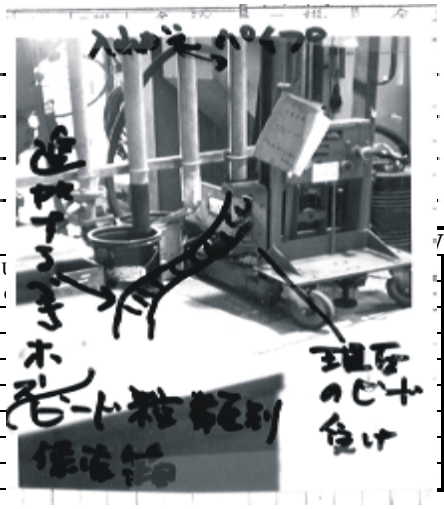
Model		P/N		Name		SEG		Assembly	Sheet metal	Heat treat	Bonding	Paint	Surface treat	Machining	NC machining		

(Problem)
Right now, it takes too much time to exchange the beads for shot peening.
If improve this, the work of 4 hour per day will be reduced 2 hour per day.

KEY WORD			
Necessary conditions			
Requested serial No.		Applied effective serial No.	

	Present method	New method
	1. Because of the small exit width of the pit it is necessary to lift the small bead bracket through the small pit space many times. 2.A hand fork-lift is used to return different size of bead to each size box. Write the idea how to improve, on the picture directly. So, it become easy to let a person understand the idea to remodel	Provide a pulley to the upper side of the pit, so it is easy to pull the bead bracket out from the narrow pit space. Extend a flexible hose to each bead size box. Write the idea how to improve, on the picture directly. So, it become easy to let a person understand the idea to remodel
Material		
JIG		
Tool		
Facility		





Cost comparison

	Q'ty M/H	U	n value Life cycle M/H	Cost
Ma				
JIG m				
JIG				
Fabr				
T				
Fa				
T				

Fig.4 Example of written improvement sheet (2)

ACTION → → → → →

Improvement implementation	REG. No		CALENDAR DAY	MFG DAY	How many days it takes
	Name	Date			
	Approved by	Finishing date			

Model		P/N		Name		SEG		Assembly	Sheet metal	Heat treat	Bonding	Paint	Surface treat	Machining	NC machining		

(Problem)

Install the eye bolt to sling the heavy index mount.

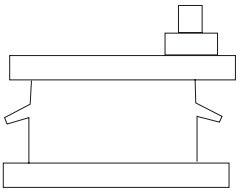
KEY WORD

Necessary conditions

Requested serial No.		Applied effective serial No.	

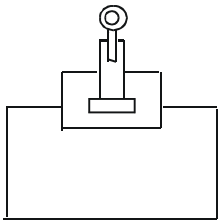
Present method

Good example
(See below)Fasten the bolt by chuking and sling the index mount



New method

Fasten the bolt by chuking and sling the index mount



Make new

Sling bolt (fabricate the bolt)
Fasten the bolt by chuking

It is not recommended to
Drill holes in the index mount,
in order to keep the strength and the function of the index mount

Material	Good example	Bad example
JIG		
Tool		
Facility		

Cost comparison

	Unit cost	alue fe cycle H	Cost
Mat			
JIG ma			
JIG I			
Fabri			
To			
Facility			
Total			

Fig. 5 Example of Completed Action Promotion Chart