FBST (Function Breakdown Structure Technique)

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ABSTRACT

A procedure to create the most effective work breakdown structure and function tree structure.

INTRODUCTION

No one has shown what mechanism may exist in the fact that there are many great male inventors and music composers but there are very few females.

This paper proposes a hypothesis for this phenomenon and arranges it in a procedure to produce effective creation.

No one has shown what relation or difference exists between work breakdown structure (WBS) (e.g. by MIL-STD-881: Ref. 1) and function tree structure. There is no good instruction on how to make the most effective WBS.

This paper shows that these relation and the procedure to make effective a WBS.

FBS technique uses "the Method of Key Word", a new technique, which connects VE technique with behavioral science and brain mechanism. (Ref. 2)

WHAT IS THE FBS TECHNIQUE?

It is the procedure to create the image of objective result, if we understand that the Method of Steplist management (Ref. 3) is the procedure to create the routing steps to reach the objective result.

This is labeled-function breakdown structure technique (FBST) which was born after Mr. C. W. Bytheway's FAST.

FBST is the procedure that creates a concrete image sketch of our end purpose under a given subject or theme by using the block diagram thinking way shown in Figure 1.

THE RELATION OF SUBJECT (THEME) - FUNCTION DEFINITION - IDEA CREATION - IDEA SELECTION - NEXT LEVEL SUBJECTS

When we start to plan or design something new, we always have a subject (or theme). That is,we start the thinking or working from this subject (or theme).

To analyze the thinking and working mechanism, I would like to identify its steps by using the example in Fig. 1. After

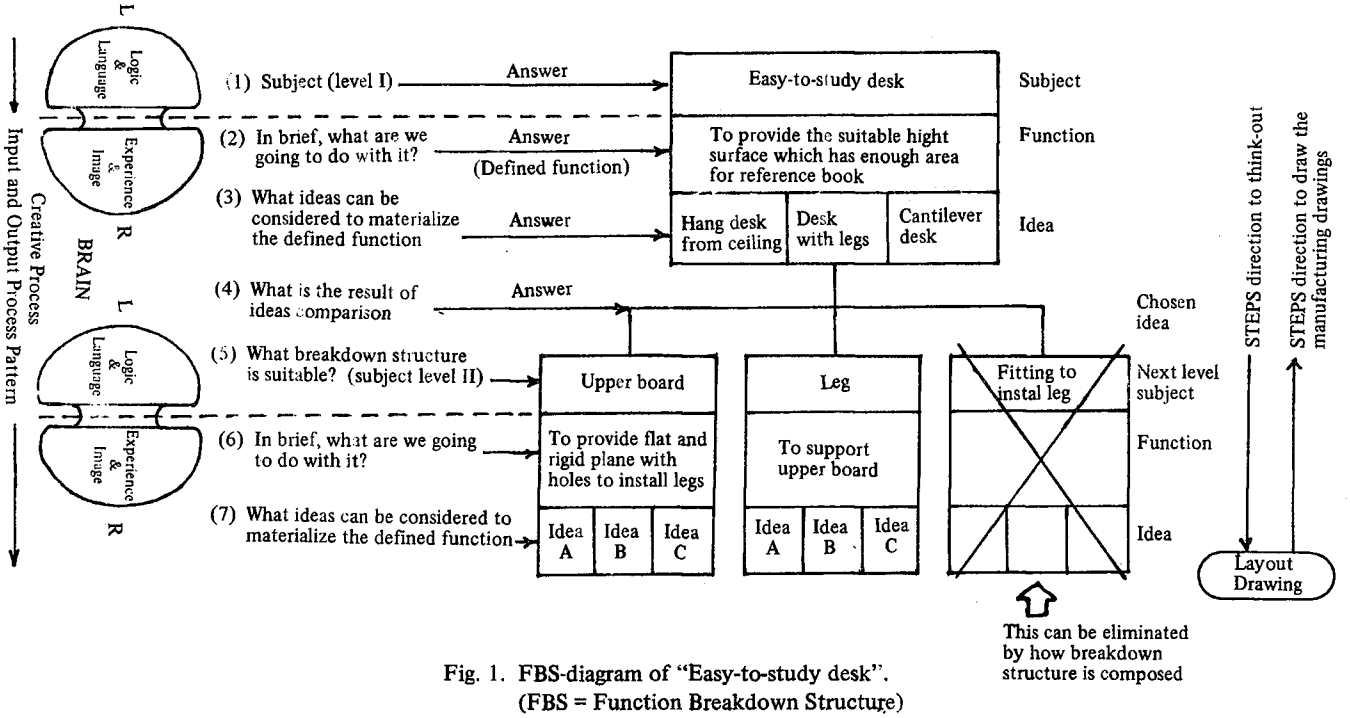


Fig. 1. FBS-diagram of "Easy-to-study desk".
(FBS = Function Breakdown Structure)

that, using the Figure 1 as a map, this paper shows the step contents which improve the creatability by bringing the sub-conscious mechanism into conscious procedures more than past creative thinking techniques.

The followings are very casual steps to think out and design something.

Note: [ ] in each step shows step's name.

(1) For example, suppose that the subject (or theme) is [easy-to-study desk].
Step Name Establishment of subject (or theme)

(2) Then, we will have the question what is the easy-to-study desk? What are we going to do with it? And we will get the answer. For example, we will convince ourselves that "Yes, in brief, it is to provide a high enough surface which has enough area to place reference books on it."
Step Name Definition of the most appropriate expression of basic function = "Key word".
Refer "the method of key word" in Ref. 2.
(Note: you can use an adverb or adjective with verb in this method.)

(3) Then when we start the investigation and creation of ideas, we will get the idea images.
Example of ideas:
- A board suspended from ceiling
- A board with legs
- A board cantilevered to wall

Step Name "Creation of idea image"

(4) We compare the ideas and then select the most appropriate idea.
Step Name "Comparison and selection of idea"

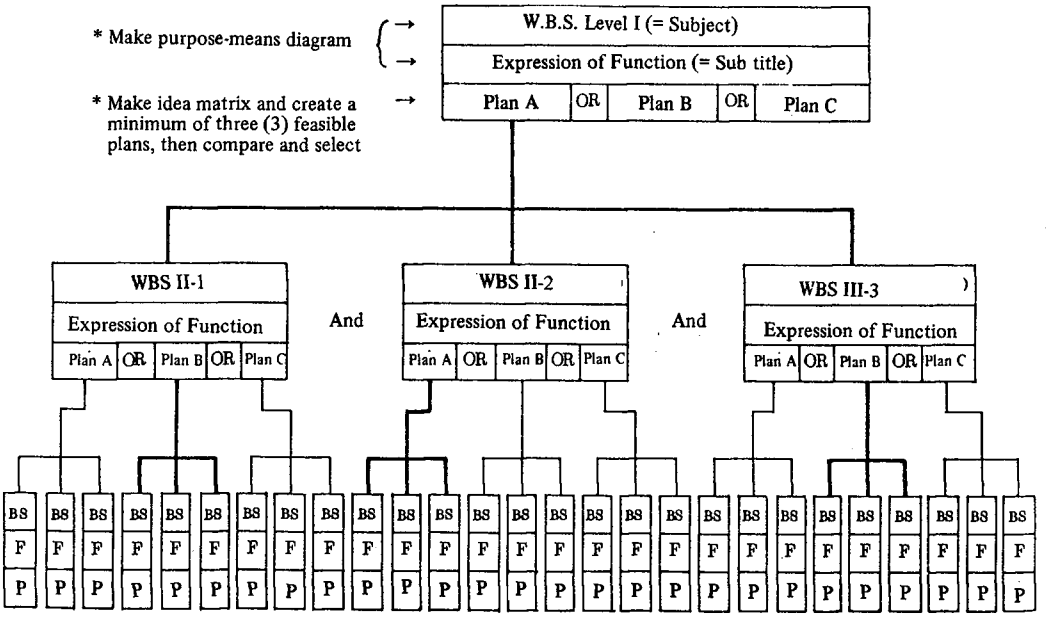
(5) We start to think up what elements are necessary and how they are to be composed for structuring.
For our example - The idea of a board with legs. The structure comprises a composite of these elements: board, legs, fittings to install legs.
But if one opted for a structure with legs directly installed into holes in the board, the element "fitting" disappears. The idea with fewest elements would be selected.
Step Name "The subject breakdown structure of next lower level"
Note: This subject breakdown structure is equivalent to the work breakdown structure (WBS) in MIL-STD-881.

(6) Thus we grasp the element names as the next lower level subject or theme, and then repeat the same steps from (1) to (5) as above until we reach the lowest level where we can fix completely materializable elements or components.
Step Name "Detail work"

(7) Here the designer usually arranges all his ideas into a layout drawing.
Step Name "Layout drawing"

(8) Then, from the lowest level of layout drawing, the designer start to draw the manufacturing drawing to upper level drawings. (This is just in the opposite direction of creating the plan.) The result is an assembly drawing.
Step Name "Manufacturing drawing"

Image sketch of
How to Combine WBS, Expression of Function and Repeated Plans



- Thick line shows example of chosen plan and WBS.
- This way of thinking is also used between the basic idea phase and the beakdown structure phase in steplist management.

Fig. 2. Image sketch of relation between subject, defined function and its breakdown structure. "FBS Block Diagram"

Figure 1 is the image sketch of these steps above. The above is the same procedural steps as in casual thinking or designing something. However, with these steps we do not know whether we reached the best solution. To reach the best solution or have one's confidence of the best solution, we should devise a detailed way to reasonably think out the best solution. Consequently, I would like to show more details of step (2), (3), (4) and (5) above, to reasonably create the best solution we possibly can. Here we label the block diagram of Fig. 1 as FBS. Figure 2 shows the common pattern of FBS block diagram.

WHAT TECHNIQUE IS THE FASTEST AND THE MOST EFFECTIVE AND QUICK TO CREATE AND CHOOSE THE MOST APPROPRIATE EXPRESSION OF BASIC FUNCTION? ; for Step (2)

Use "the method of key word." (Ref: 2)

NM-METHOD: To quickly create the effective idea to satisfy the function by using our right side brain ability. (Japanese famous creative thinking method by M. Nakayama and H. Takahashi.): for Step (3).

The detail steps are:

(1) Key Word
Find the key word "in brief, to do so" using "the Method of Key word."

(2) Question Analogy (Q.A.)
State a question "for example, just like ~?" to find out the analogical image of key word. For example, to the key word "break", the answer will be "there was a crack in sea side rock" or "vertical vibration breaks anything severely."

This imaginative thinking uses the ability of the right side of the brain (image brain).

Make card of each of these images.

(3) Question Back Ground (Q.B.)
State a question "what was happening there?."
The suitable answer, for example, will be "the pine tree grew on that rock" or "the wave was breaking on the rock." These answers are just feeling image.

(4) Question Concept (Q.C.)
Then state a question "Can this matter be the hint to break a building?"
For example, from the image of "the pine tree grew on that rock", we will think that there may be acid from pine tree's root which breaks that rock." From this image we formulate the idea "how about pouring some of the acid into drilled holes in concrete building to break a building." Or we formulate the idea "it is possible that penetrated and frozen sea water may have broken the rock." Consequently, we can reach the idea to pour water into drilled holes and freeze it by some way. Likewise, from the image of vertical earthquake, we can formulate the idea to vibrate the building vertically using blasting powder at many spots.

These questions are very effective to extract the idea creating ability, in the right of our brain (image brain), by using cards of "Key word" and image sketches which are obtained in Steps of Q.A. and Q.B. above.

HOW TO CHOOSE AND SELECT THE FINAL IDEA; for Step (4)

After creating several ideas by using Key word and NM-method, the following procedure is advantageous for comparing - selecting the optimum solution.

Think up enough ideas, then choose the three most extreme. In the case of aircraft component, this could be, for instance;

--- cost minimum
--- weight minimum
--- R & M maximum (reliability and maintainability)

Develop the maximum feasible solution for the three extremest ideas (in some cases, the three extremest ideas are the same as the feasible ones).

Seek optimum solution by comparing this maximum feasible solution. We can expect that the optimum solution exists in a triangle defined by three maximum feasible solutions.

Note: A recommended work sheet for finding the optimum solution is shown in Figure 2; the idea matrix column of the LCC/DTC work sheet.

• Effectiveness of This Procedure

The following is the explanation of why this procedure is effective for application to creating reasonable ideas, and in comparing and selecting them:

Creating two or more solutions is to create "the information of difference" which makes us to start to judge and think. (Refer to "Method of Key word" paragraph) (Ref. 3) Furthermore, two extreme ideas show the range of thinking and three extreme ideas show the depth of thinking. The extreme ideas are equivalent of "F-cost idea" in VE, and thereby, forces us to think out the optimum plan to minimize the well known value

$$V = \frac{\text{Function}}{\text{Cost}}$$

Also, this is equivalent to use of mechanism for "Management By Objectives" (MBO).

This procedure has a mechanism which leads us to choose the most reasonable and best solution in team work activities by using the established direction of value in process finding the key word (the most appropriate expression of basic function) and reasonable decision mechanism with it. (Refer to "method of key word" paragraph.) (Ref. 2)

HOW TO CREATE AND CHOOSE THE MOST EFFECTIVE SUBJECT BREAKDOWN STRUCTURE (EQUIVALENT TO WORK BREAKDOWN STRUCTURE; for Step (5)

Procedure:

To materialize the idea, the following procedure is advantageous for comparing and selecting the optimum solution.

Itemize the least composite or process element that will materialize the chozen idea. Two or more plans should be tried as illustrated for "Easy-to-study desk" in Fig. 1. Then choose the optimum plan as follows:

Example: A small flash-light with FBS block diagram shown by Figure 4. Two plans can be thought out and compared.

• Bulb, dry battery, circuit, switch, case, lens and

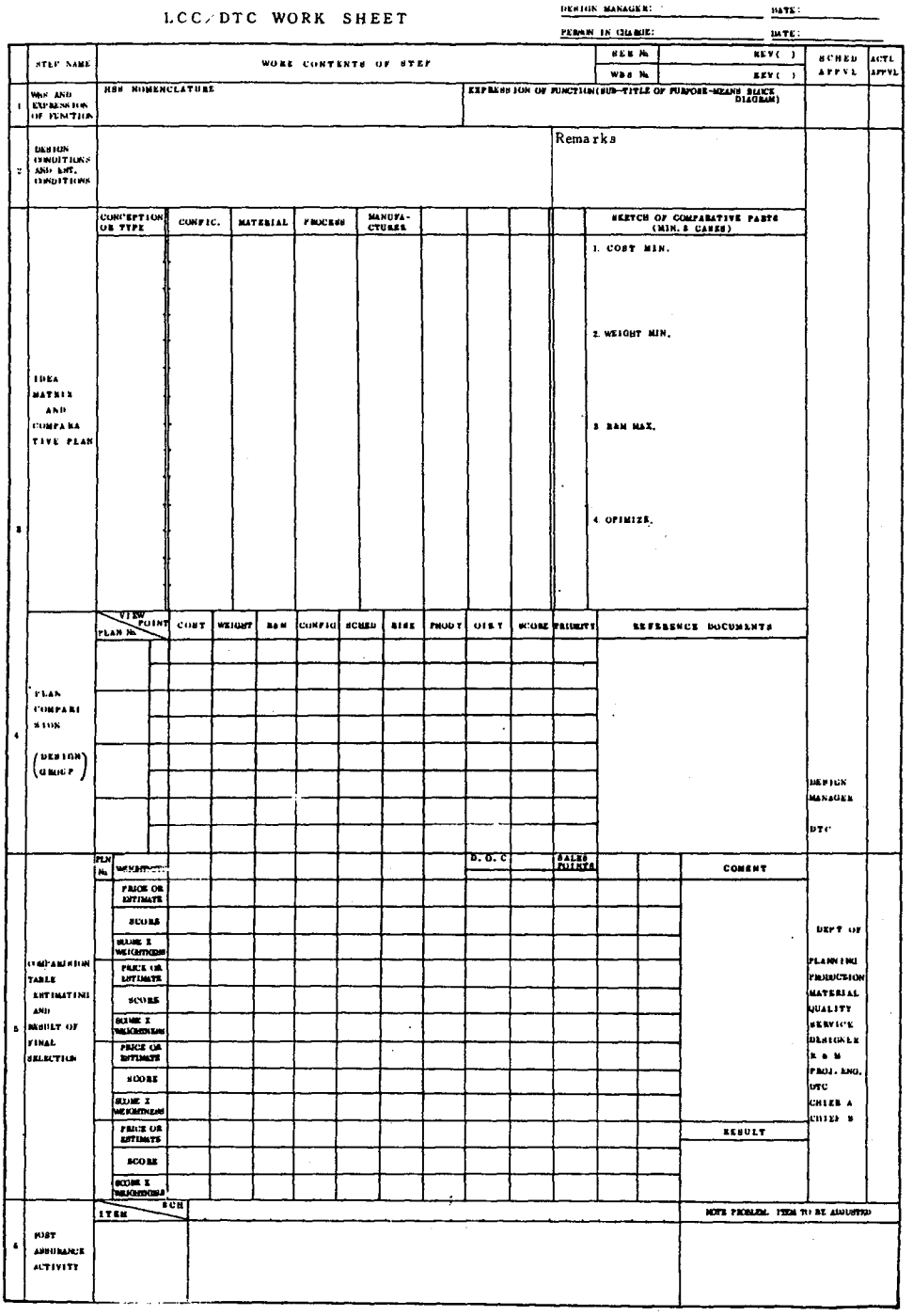


Fig. 3. LCC/DTC Work Sheet

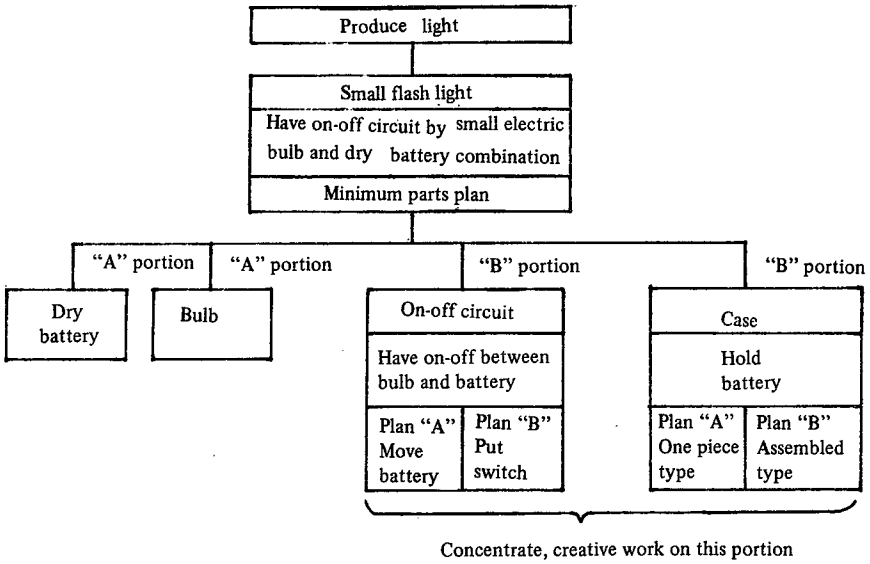


Fig. 4. FBS Block Diagram of Small Flash Light

strap ..... Total: 7 parts
Lens-bulb, dry battery, on-off circuit and case
..... Total: 4 parts

Then group these parts (element/subject) into three groups:
"A" group: parts or portion whose cost won't vary by design or condition changes to materialize the expression of "key word (basic function)."
Examples: bulb dry battery

"B" group: parts or portion which cost may vary by design or condition changes to realize the expression of "key word (basic function)."
Example: circuit, switch and case

"C" group: parts or portion not essential to realize the expression of "key word (basic function)."

- Arrange the parts or portions by group by the stated rules from left to right.
  "A" group: in the order from high to low cost parts or portions.
  "B" group: in the order from the easiest and least changeable part or portion by changing the design or conditions.
  "C" group: in the same order of "B" group.
- Enter the present cost or estimated cost by conventional design under each parts. (the "C" in V=F/C)
- Enter estimated cost assuming the extreme idea was realized. (the "F" in V=F/C)
- Compute (C/F) and (C-F), and enter the results below.
- Rank separately both (C/F) and (C-F) result.
- Multiply (C/F) and (C-F) rank - numbers and enter the answers.
- Rank these answers - they prioritize focus of improvement effort.

Note: (a) (C/F) ranking implies performance priority for improvement effort.

(b) (C-F) ranking implies economic merit priority for improvement effort.

Seek the expression of Key word for each part in "B" and "C" group. Then create and compare several ideas to realize the expression of key word. Also devise comparative plan for least cost by integrating "B" and "C" parts or combining them with "A" parts. This devising and comparing work are the direction work of effort to optimize the component and structural composition.

Figure 4 and 5 shows FBS block diagram and the least cost idea for our example.

CORRESPONDENCE BETWEEN FBS DIAGRAM AND OUR LEFT AND RIGHT SIDE BRAINS FUNCTION, AND EXPLANATIONS OF WHY THERE ARE VERY FEW GREAT WOMEN INVENTORS

Correspondence between the faultless four frames and our left and right side brains functions.

Figure 6 shows the faultless "input - preassurance activities for output - output - post assurance activities" cycles by four frames which appears in "Method of Steplist Management. (Ref. 3)

Recent research tells us that our left and right brain have different functions in mental work.

Left Brain	Right Brain
Language, theory, calculation analytical or organizational work	Non-language matters, images, geometry, music, feelings and experience type work

Figure 6 relates the cycle of four step - frames to the left and right side of brain functions. From this Figure, we can say

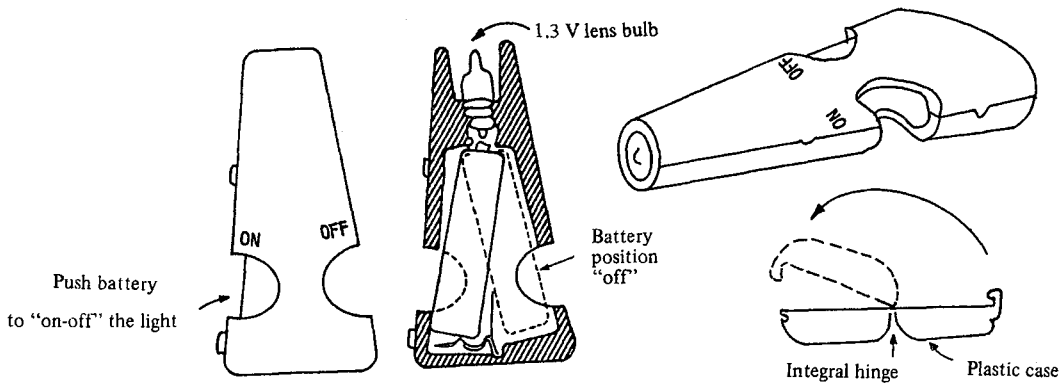


Fig. 5. Example of Small Flash Light Design.

that theoretical input and output items, e.g. ingredients and cooked meal correspond to the left side brain, while work and inspection contents, e.g. cooking and tasting correspond to the right side brain.

- Explanation of why there are very few great woman inventors - difference between man's and woman's way of thinking.

Suppose husband and wife are sharing a meal, and suppose he asked her, "Where did you buy this meat?" In almost every case the wife will replay with the question, "Why? Doesn't it taste right?"

Husband's interest	Wife's interest
Regardless of appeal to taste good or bad, he is interested in shop and brand in systematic way of thinking from input side.	She is interested in taste or cooking way from post-assurance side of output.

We have two brain lobes, left and right. The research tells us that both lobes converse with one another. Consequently, this conversation sets in only when one side accosts the other. Applying this assumption (hypothesis) to the details of the input and

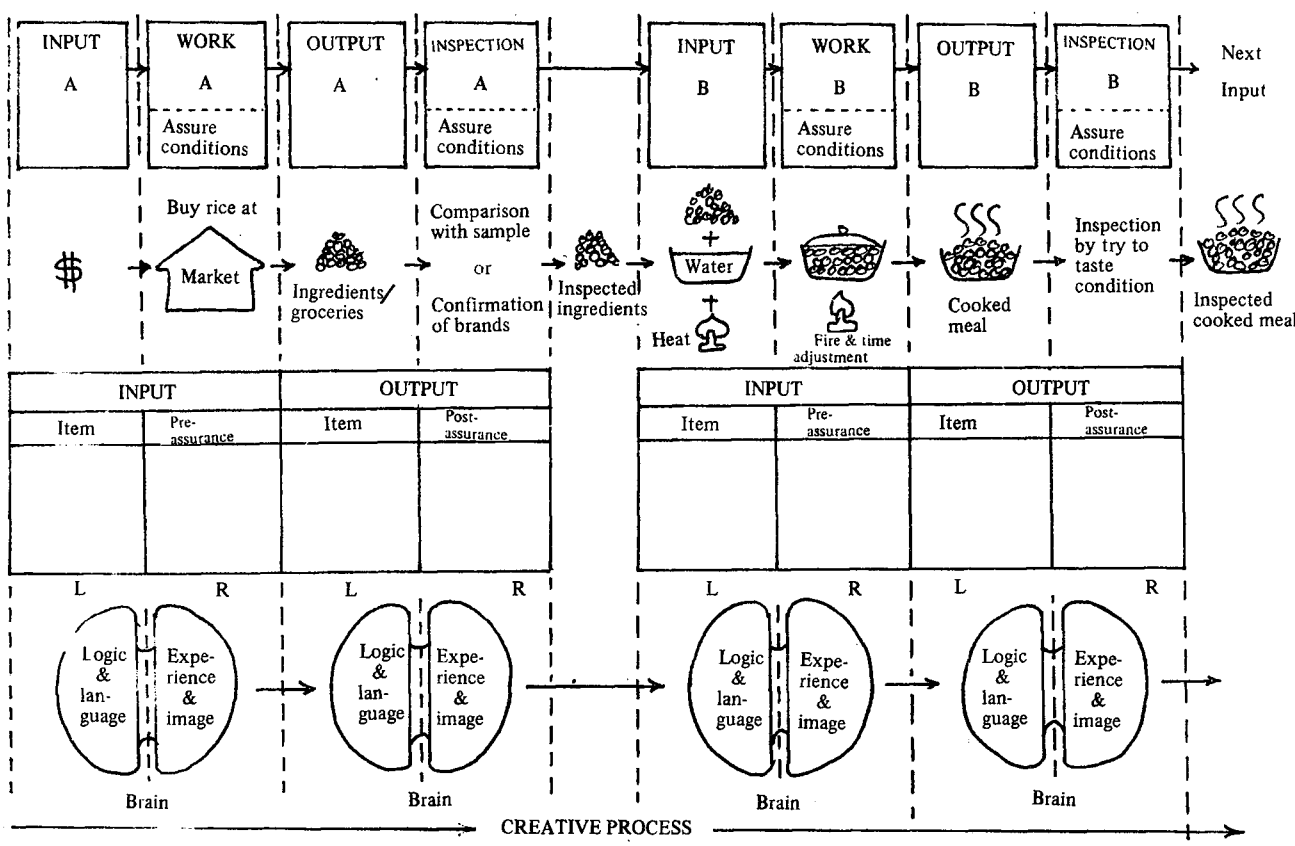


Fig. 6. Details of Input and Output Process Pattern (Example) by Four Frames

output process pattern of Fig. 6, we may conclude that "men's type" thinking starts from the left lobe of the brain and women's type thinking starts from the right lobe of the brain.

Again, if we applied the above story to the Figure corresponding to the left and right brain to FBS block diagram as in Fig. 1, we may conclude that men's thinking corresponds to FBS block diagram pattern in which the thinking pattern starts from subject side, while women's type thinking corresponds to a thinking pattern starting from idea or taste selection side. This may account for the lack of great female inventors.

However, to effectively create something new, in both men and women, we consciously can use FBS thinking process (i.e. start from the subject or theme), then we can pursue the progressive and creative thinking way.

Note 1: From women's viewpoint, these differences should not not be labeled "men's type and women's type" as women may or may not start from the side indicated. However, we take the liberty in this paper to label them men's type and women's type because thought patterns are rather casual for either sex, it is easy to remember and we are not exactly setting a precedent.

Note 2: However, stroke your left and right side neck. You will feel slight sensitivity deference between left and right. In man's case left side is more sensitive and in woman's case right side is more sensitive. This phenomenon also seems to prove my hypothesis. I discovered this phenomenon in Jan. 1981.

Consequently, the above story tells us that the two techniques (Method of Steplist Management and FBS technique) are the only technique and procedure that let us use our left and right side brain alternately in effective and faultless sequence. And also the method of key word is the technique to use the front side and aft side of our brain alternately by the sequence of "in order" and "how to" sequence.

EXPANDED APPLICATION EXAMPLE OF WBS

Upto this point, the example concerned only hardware items. FBS thinking can be applied to many software cases as well.

This paragraph will show its application to wider fields by examples.

(Case 1) The composed structure elements with corresponding function of each element.
This case corresponds exactly to that in the FBS block diagram (see Figs. 1 and 2).
As a consequence, one can see that the structure element and function elements mutually match and also that the function definition will vary depending on the selected composed structure element. In another expression, the structure element items or subject (work) breakdown structures corresponds to the left side of our brain and function tree (breakdown) structures correspond to the right side of our brain. This yields that two basic methods are to improve the value of anything.

(1) Method 1 is to change the composit on of WBS and associated elements.

(2) Method 2 is to change the idea for direct measurement to realize the expression of function related to the structure element.
There is the possibility that such a structure element involves more than one function.

(Case 2) The WBS made from the stand point of design work, i.e. Design WBS.

(Case 3) Index in report, i.e. Index breakdown structure.

(Case 4) Task allocated to small group, i.e. Team WBS.

(Case 5) Idea- breakdown in national defense system, i.e. MIL-STD-881 WBS for defense material items.

(Case 6) STEP breakdown structure of process of creative thinking and work, i.e. creative thinking Step WBS.
Example: the eight Step thinking technique is steplist management. (Ref. 3)

(Case 7) Job allotment in enterprise, i.e. Management organization WBS.

(Comment 1) FBS block diagram replaces the function tree with the structure element. Structure elements are expressed by nouns while functions are expressed by a verb and noun.

(Comment 2)

a. Structure elements materialize the upper level ideal.
b. A function expresses the specific meaning of an idea for the structure element.
c. The idea is a measure to realize the expression of function.
d. If structure or element is changed at the upper level, the respective lower level function must also be changed.
e. Composing structure/elements is thus the original point to create a new and high value concept, supplemented by ideas as a measure for realizing the selected expression of function.
f. One obtains thus "in order to, how to" sequence starting from the subject is the most effective thinking sequence for creation.

(Comment 3) In our daily creative thinking and working, once having the map of this way of thinking in our minds (brain) even without writing details on paper, we can obrain very effective results by creating a new concept.

CONCLUSION - SIGNIFICANCE OF FBS TECHNIQUE

FBS technique with the Method of Key Word establishes:

(1) The procedure of how to use our left and right brain ability and also fore and aft brain ability for creative thinking in a conscious way.
(2) Technique to combine the WBS technique and function tree technique.
(3) Instruction of how to create the WBS (e.g. MIL-STD-881).
(4) Relationship between Method of Steplist Management and FBS technique.
(5) The basic rule that the new and faultless creation must start from the subject (theme).
(6) Supplement to a new thinking and procedure of Design-to-cost. (Ref. 4)

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