

THE CASE FOR FUNCTION SCIENCE

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ABSTRACT

This paper discusses the development of Value Analysis/Value Engineering, Value Management and the Job Plan, and the centrality of Function Analysis in all of Value Methodology. The paper examines Function Analysis, the Logic "How-Why" relationship of functions, the FAST diagram, and introduces the idea that Function Analysis should be elevated to a Science - the science of Function Analysis. There are rules and procedures that govern the proper application of Function Analysis to problem solving and creative discontent. The FAST diagram tool with the development of Critical Paths of functions, Basic and Supporting functions is also shown to be part of the science. The benefits of considering Function Analysis as a Science are discussed

INTRODUCTION

Value Engineering, as it began to be called after its development by Lawrence D. Miles as Value Analysis at General Electric Company in the late 1950's, is a discipline which depends on the rigorous use of a number of processes: Three important processes are:

- 1.) structured Problem Solving;
- 2) Function Analysis and
- 3.) use of multidisciplined teams

Structured Problem Solving had been in use for some time prior to Mr. Miles work. Mr. Miles recognized the value of the process for his Value Analysis "Problem Solving".

The success of the problem solving process depends on the correct identification of the problem. If the problem (or problems) are not correctly identified, then the solutions that eventually developed will not eliminate the source of the problem. Function Analysis provides a uniquely productive way to find and define the "problem". The use of Function Analysis was Mr. Miles addition to the Structured Problem Solving process, which added an important and vital element by clearly identifying the problem. It is the essence of the Value Methodology.

The use of the multidisciplined teams had been a part of the earlier structured problem solving process where team work was recognized as important in enhancing creativity, developing multiple solutions and sorting out the best solutions. Mr. Miles continued the emphasis of the multidisciplined teams in the Problem Solving Process and the Job Plan, described in his book "Techniques of Value Analysis and Engineering" ¹.

FOCUS ON FUNCTION ANALYSIS AS THE "SCIENCE" OF VA/VE

There has been much work done in the field of the Value Methodology since the initial development work of Mr. Miles which has provided a better and much more in-depth understanding of Function. The development of the Function Analysis System Technique (FAST), and the FAST diagram provided better and

deeper understanding of Function and the relationships of Functions .

Function Analysis begins with the Information Phase of Mr. Miles Job Plan. In this phase all the information is gathered about the item to be studied. The scope of the study is defined, and then the item's Functions are listed. All of the Functions of the item are identified. The Functions are generally defined as that which the item does or must do (to both work and sell). As an example of the kinds of Functions that may be identified: the Functions of an overhead projector, commonly used in presentations to "project images", would include the "generate light" function of the electric light bulb, as well as the "generate heat", the "generate noise" function of the fan used to "move air" to "cool bulb", although these may not seem at first to be the major functions of the overhead projector. This is precisely the correct procedure because we are looking for all functions that are involved in the item under study, so that the process can sort out the relationships of the functions. The Functions are defined by the use of two words: An active Verb and a measurable Noun, as in the "project image"; "generate heat"; "generate noise"; "move air"; etc. examples in the overhead projector. The precise use of the verb-noun is intended to focus the thinking of the members of the multidisciplinary team to the definition of the Functions and to obtain consensus

After the functions are listed, the next step is to order the functions in terms of their relative importance to the item being studied. The most important function is the Basic Function, and all others are Secondary Functions. The rules spelled out by Mr. Miles stated that all items have one, and only one, Basic Function and all the other functions are secondary. In general this is a good rule, and is effective in the analysis of functions. A test for the Basic Function is that: if the Basic Function did not have to be done, then none of the other (secondary) functions would be required. The concept is beautiful in its simplicity.

The development of the Function Analysis System Technique (FAST) and the FAST diagram provided a tool for visualizing the relationship of Functions through the use of the Logic questions: Why? and How? ² The arrangement of the functions in a two dimensional plot in which the order of the functions can be clearly seen (by the multidisciplinary team members) provides an

important addition to the process. It was then possible to construct the FAST diagram to see the relationship of the Basic Functions to the secondary functions; develop a Critical Path of Functions; to identify those functions which were caused by other functions; those functions which occurred all the time; possibly unnecessary functions; Higher Order functions; and to provide understanding of the specification requirements as they related to the functions.

The next step is the costing of the FAST diagram, which now makes clear what and where the cost drivers are with respect to the functions. This is the payoff point. At this point, the team can see the costs that may be related to Secondary Functions that may be out of line with the "worth" of the function, and thereby generate "creative discontent" in the members of the multidisciplinary team, thereby enhancing their creativity to find alternative solutions, i.e., ways to accomplish those functions less expensively.

Another powerful addition to the use of the FAST diagram in Function Analysis for definition of the problem has been in the work of Jerry Kaufman in developing a Responsibility Matrix ³ to overlay the FAST diagram. This provides visibility to the multidisciplinary team as to who owns the function/problem.

The above has indicated the power of Function Analysis to identify the problem in a structured problem solving process - in the case outlined, a cost problem. The methodology applies equally to a process or a procedure where the parameter instead of being cost could be time, complexity, manpower, or any one of a number of parameters important to the problem being analyzed. As an example of the use of Function Analysis in a more abstract application, the search for and identification of, the Basic Function of a meeting will identify the participants needed to be present, what the agenda is, and who are the major owners of the problem.

THE SCIENCE OF FUNCTION

Science is defined in Merriam Webster's Dictionary as: "... a department of systematized knowledge as an object of study..."

The definition of Science from the encyclopedia: *Infopedia*: "SCIENCE is a term used in its broadest meaning to denote systematized knowledge in any field, but applied usually to the organization of objectively verifiable sense experience".

In the work of B.F. Skinner⁴ in *Science and Human Behavior*, he states: "Science supplies its own wisdom. It leads to a new conception of a subject matter, a new way of thinking about that part of the world to which it has addressed itself.....Science...is an attempt to discover order, to show that certain events stand in lawful relations to other events. No practical technology can be based upon science until such relations have been discovered. But order is not only a possible end product, it is a working assumption which must be adopted at the very start."

Substituting *function for events* in the above statement...(certain functions stand in lawful relations to other functions)...the statement becomes an excellent description of the Function Analysis process.

In the discipline of Value Methodology, and Value Analysis/Value Engineering, up till now, Functions and Function Analysis have been treated simply as a part of the Job Plan process. They have been recognized as the key part which leads to the identification of the problem in the structured problem solving process. However, the study of Function and Function Analysis fits the description of a Science. Function and Function Analysis are systematized studies of a body of knowledge that is then organized objectively to obtain insight to the senses and allow verification of the order so established. Function and Function Analysis as developed by Miles and others fits the descriptions of a science in their use of order and lawful relationships between functions.

Function Analysis is the engine of the Value Methodology. Function Analysis makes the understanding of the problem clear and provides, through the application of the How?/Why? logic in the FAST diagram, the communication that obtains consensus between the team members. There is benefit in recognition of the Science of Function, particularly in the interest of obtaining further academic study and research in this area.

OUR PRESENT SITUATION

The present status of membership in our field of Value Methodology has been stagnant. We have not been able to significantly increase our membership beyond the 1500 -2000 level. We lose as many members as we gain each year. Our population of leaders is getting older and we

need to rejuvenate to have new blood to handle the future. It is worth noting that growth of VA/VE offshore, out of the USA, is still being experienced.*

Successful entree into the academic world could have a significant affect on the growth of VA/VE. Efforts by the Miles Value Foundation are now ongoing to do that. This paper is intended to augment those efforts of the MVF by providing another way to see the problem. We are perhaps suffering from what has been called "management insanity" - doing the same thing over and over and expecting to get different results.

A paradigm shift to recognize our major strength; what the Value Methodology brings to the table; the science of Function, is a possible route to obtain the growth, wide acceptance and continuity into the future for our important discipline.

ENTRY INTO COLLEGES AND UNIVERSITIES WILL BE EXPEDITED WITH FOCUS ON FUNCTION ANALYSIS AS A SCIENCE

The recognition of Function as a science can result in benefits particularly in the interest of obtaining further study and research in this area. A proper setting for this activity is in the academic environment of colleges and universities. The past experience with the academic world has been that VA/VE has no lasting entity. The way in which VA/VE is presented is basically similar to a trade school activity. VA/VE has been brought to the schools in the form of the 40 hour Job Plan. Students are enrolled for the course without any specific relation to an overall course of study. Most students need the course because they have a job where the contract calls for knowledge of Value Engineering and they need to satisfy that requirement. There are generally no long term programs, and little or no career path either for the student, or for the instructor, or the academic organization. There has been little or no

*This author has questioned in other articles whether, in some way or other, the capitalistic economy of the USA could not be a factor in the reason why VA/VE grows in other countries whereas in our country it seems to have reached a plateau..

continuity beyond the individual course after the course is completed. (There have been some exceptions, notably at the University of Wisconsin, and McGill University).

However, with the study of Function recognized as a science, there will be more interest at the universities and colleges for Function as an academic field of study. Research in areas of creativity, cost analysis, structured problem solving, evaluation techniques and others would be easily related and an advanced course of study could be developed. The academic institutions would be strengthened as would the field of VA/VE.

ACCEPTANCE AND GROWTH OF VE IS THE OBJECTIVE

Function Analysis has broad application: industrial products and procedures; service industries such as healthcare, communications and financial institutions; computer software; transportation; and processes and procedures of organizations themselves. A unifying factor is to raise the level of abstraction of the thinking about Function from a Process, to a Science. The result would be the science looking for applications, rather than the application looking for a solution to its own problem. The Science of Function will elevate the Value Methodology to an academic level, and will provide a new paradigm for dealing with the applications. The acceptance of Function as a science will give Function the prestige that it has been missing.

VA/VE practitioners have always been such strong believers in the process and find it puzzling that the rest of the world has not been "getting it". We appreciate the strength of Function Analysis, but then get bogged down in the nuts and bolts of the rest of the Job Plan. Changing the paradigm will allow the VA/VE practitioners to recognize where our strength is - in the Function Analysis and not in structured problem solving.

Changing the Paradigm will ensure the growth and acceptance of VA/VE..

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