VALUE ANALYSIS FOR ESTIMATING LABORATORY AT UNIVERSITY

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Abstract

The laboratories at universities are the bases of teaching and research. But the education budget is not enough . So there is a optimal problem to meet the requirements of teaching and research at the lowestcost, or to meet the demand possibly within the budget. To achieve the optimal goal, a proper and suitable approach to estimate the laboratory and the factors which composed the lab is necessary.This paper suggests a new approach which differs from the traditional methodto estimate the laboratory and its factors on the basis of VE principles,such as the Function Analysis, the Functional cost Analysis and the ValueEstimation.

PREFACE

labs in colleges and universities are important bases where we carryon experiments and researches. The level of administrating labs diretly affects its function. The goal of value analysis of labs is evaluating the level of labs objectively, finding where the rub is, and providing a reliable proof toconstruct and administrate labs.

One hand, the indices we used to use are qualitative ones or the combination of qualitative and quantative indices, some of which are easily affected by man-made factors,limited to their surroundings,and unrelated,or, they HAVE some relation. but can hardly reflect the internal relationship among the indices.

Thus, the results of evaluation sometimes cannot procisely reflect whatthe facts are.

Here we list some evaluating indies we used to use.

1.Average usable floor area of labs

2.Average fixed ass

3.Utilization rate of equipments

4.Composation of technical staff

For the first index, it is assumed that the greater the usable area is, the better, but it is not always so. Then comes to the question what the optimal value is. Usually we make a general maximum value in the light of experience and other factors, but the maximum value differs from lab to lab. That whether these maximal values are reasonable or not is anther question needing studying. For the second index, there exists the same problem.

Similarly, for the third index, the utilization rate of equipment, is considered the higher the better. Conversely, if the rate is low, we cannot say that it is a bad thing. We should make a concrete analysis of each specific question. For example, the utilization rate of highly specialized lab is lower than that of a foundmental lab,but we cannot say that it is a bad thing.

On the other hand, the indices we speak of are lack of nessaryrelation.In fact,constdering the labs as a whole, the indices of the labs should have certain relation,but what kind of relationship should be is a question tobe studied.

Considering the labs as a whole, we apply the theories of Value Engineering to proceed

VA. and to analyse the relationship among the indices.Then,it can reflect the situation of the labs and can provide a proof for administrating and constructing the labs.

SYSTEMATIC ANALYSIS OF LAB

Seeing from the systcmatic viewpoint,industrial production is kind of process of peoducing change, or a kind of system of producing change. As a kind of system,it must have its special elements:input, output,composation and function. Similar to industrial production, labs are also a kind of broad sense system of producing change. Here follows the comparison of two systems.

stable 1

elemen. type	input	composition	function	output
industrial production	raw materials	heman.money prmperty. information	magement mannfactue	product
iabs	students. course	human.money proprty. information	teacheing researching	talent people, scientific achievement

Considered as a kind of system, labs have their own demands: making achivement, bringing up talent people and improving techniques of experiment to adapt the demands of teaching and research.

The efficiency of lab system and the quality are determined by the composition of each element and the level of administration. How to make the best use of labs, is the question to be solved in constructing and administrating labs. Here we regard the labs as a object to be analysed because they just like other object which need consuming certain cost when they are formed and have some functions which can fulfill people'requirements in some respects. Therefore, they have value, and at the same time, there exists thequestion how to improve their value.

defination:cost=function/cost

(c=f/c)

VALUE ANALYSIS OF LABS

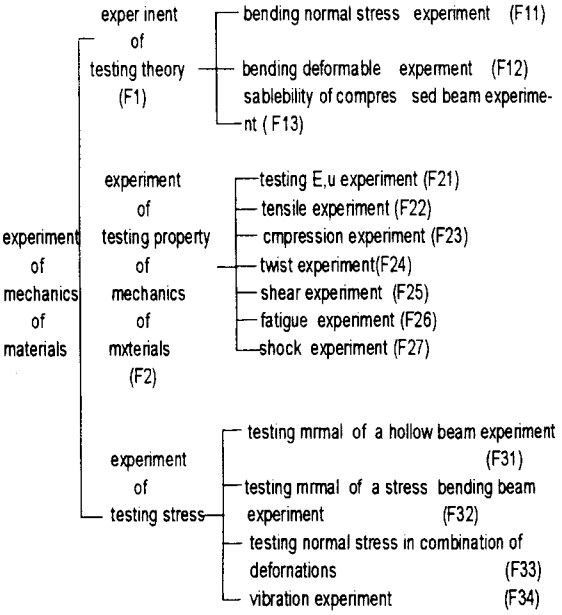
Here, we apply the theories of Value Engineering to analyse labs of mechanics of materials,and through VA,we can find where the problem is,point out how to improve it and provide a proof for constructing and adminstrstinf labs.

1.Function analysis of labs of mechanics of materials

(1) According to the goal of the course, analyse the function of thecourse should have. See stable 2,functional system tree.

stable 2

FUNCTIONAL SYSTEM TREE



(2) Functional defination for each main element in labs of mechanics ofmeterials stable 3. Here, we mainly define the function of labs and equipments,but do not involve persons and subordinate factors.

2. Functon evaluation

The goal of function evluation is quantitatively evaluating the elementsin functional system tree, and so that we can know how many or how much function there is. As we know, we can count function in two ways, one is counting it in form of a sum of money, the other is giving it a mark.When we can not or have no time to use the former, we use the latter,which is widely used because it has the characteristic of concision. Here,we must pay much attention to

that the value of function evaluction is just purely rational functional im-portance, and it does not change if the function does not change.That is, it won't change with time.

The following steps are how to evaluate function.

stable 3

	composision	function
labs	Room (A1)	provide a place for tensing. conpressing,bending shearing and stress analysis
	Room2 (A2)	provide a place for twist and stress
	Room3 (A3)	provide a place for stocking,repai-ring and manufacturing
equipments	WE-30 (A4) universal testing machine	tensing twist,bending shearing. testing E.u stress analysis testing the stablebility of compres-sed beam,thrust augmentation equi-pmint
	WE-30 (A5) universal testing machine	tensing twist,bending shearing. testing E.u stress analysis testing the stablebility of compres-sed beam,thrust augmentation equip-mint
	YJD-1 (A6) dynamic equipment	testing E u beuding,stress anslysis and dymanic analysis
	YJ-5 (A7)	testing E.u beuding,stress anslysis
	YJ-5 (A8)	testing E.u beuding,stress anslysis
	stablebility of compressed be-am testing ma-chine (A9)	stablebility of compressed beam experiment
	twist testing machine (A10)	twist experiment

2.1.Mark F1,F2,F3 by way of directly evaluating, that is,evaluating the proportion of the three function in teating and research.(see stable 4-1)

And F1+F2+F3=1

2.2.By way of 0-4, sum up the marks,and workout the average values and their evaluating coefficient.

And F11+F12+F13=1

F21+F22+F23+…+F27=1

F31+F32+F33+F34=1

see stable 4-2,4-3, and 4-4

2.3.Work out the cofficients of function evaluation of each element.

A1=0.1013, A2=0.0416, A3=0.0326,

A4=0.2552, A5=0.1410, A6=0.0689,

A7=0, A8=0.0695, A9=0.0563,

A10=0.0549

3.Value analysis

According the coefficients of functional importance of each element,We can work out the cost coefficient of each element, and then we can analyse.

stable 4-1

function	mark
experiment of testing theory (F1)	30
experiment of testing property of mechanics of materials (F2)	50
experiment of testing stress (F3)	20

stable 4-2

function evauating value function	F11	F12	F13	total mark	coefficient of functional evaluation
F11		3	3	6	0.5000
F12	1		2	3	0.2500
F13	1	2		3	0.2500
total ment				12	1.0000

stable 4-3

function mark function	F21	F22	F23	F24	F25	F26	F27	total mark	codficie-nt of fun-ctional e-valuation
F21		2	2.5	2	3	3	3.5	16	0.1928
F22	2		2.5	2	2	3	3.5	15	0.1807
F23	1.5	1.5		1	2	2	2	10	0.1205
F24	2	2	2		2.5	2.5	3	14	0.1687
F25	1	2	2	1.5		2	2	10.5	0.1265
F26	1	1	2	1.5	2		2	9.5	0.1145
F27	0.5	0.5	2	1	2	2		8	0.0964
total								83	1.0000

stable 4-4

function mark function	F31	F32	F33	F34	total mark	codfficient of functional ev aluation
F31		2	2.5	3	7.5	0.3125
F32	2		2.5	3	7.5	0.3125
F33	1.5	1.5		3	6	0.2500
F34	1	1	1		3	0.1250
total					24	1.000

3.1.The formula of cost coefficient of each cost element(see stable5):

$$\text{cost coefficient of the element} = \frac{\text{cost of the element}}{\text{total cost of all elements}} \times \frac{1}{\text{life of the element}}$$

※ life of each element is counted by year

stable 5

element	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	total ment
cost per year	512	361	168	600	166	285	244	210	70	587	3204
cost coefficient	0.097	0.082	0.052	0.019	0.345	0.089	0.076	0.066	0.022	0.183	1

3.2.The formula of vaue coefficient (see stable 6):

$$\text{value coefficient} = \frac{\text{functional importance coefficient}}{\text{cost coefficient}}$$

stable 6

element	cost coefficient	coefficient of function evaluation	value coefficient (V)
A1	0.0974	0.1013	1.0400
A2	0.0824	0.0416	0.4502
A3	0.0524	0.0376	0.7176
A4	0.01870	0.2552	1.3647
A5	0.1454	0.1410	0.9697
A6	0.0890	0.0689	0.7742
A7	0.0755	0	0
A8	0.0655	0.0695	1.0061
A9	0.0218	0.0563	2.5826
A10	0.1832	0.0549	0.2997

Analysis of cost coefficient(V):

Obviously, when V=1, that means the element have been made the best use of it. When V <1, that means we can still exploit the function of it. When V> 1, that means the functional importance to be achieved is very high, but the cost is a little low, and it needs to be increased.

According to the coefficients in stable 6, we analyse the situation of each element.

a. From the stables, we can see that the cost coefficients of A1, A4,A5,A8,A9 are all near or greater than 1. That means they are better used, especialy A9 (V=2.5826) , the stablebility of compressed beam testing machine, which only cost 350 YUAN. Although we have only four sets of that kind of equipment,they have already fulfilled our requirement.

b.Analysing A6,A7

According to the way we used to use, we know that the utilizationrate of equipments of A6 is high. A6 is dynamic equipment,which is mainlyused for electric testing experiment. And from stable 6, V6=0.7742, which is not satisfying, just because the equipments do not match each other.Being lack of light oscillograph and agnetic monitor, the equipments cannot be made the best use of them. Thus, we can see that the index"utilization rate of equipments"cannot objectively reflect the real situation,and sometimes there exists a rather big error.V7=0, it means we have not use it at all.A7 is left unused because A4 andA5 which previously matched A7 match A6 and A8 now.

c.Analysing A2

Acccording to the way we used use,the index" average usable floor areaof labs", we regard it a good thing if it is high, but after value analysis,we can see that V2=0.4502. It is very low. This sample indicates that having a larger usable floor area cannot certainly get high mark. Now,because of being lack of money, our school cannot buy fatigue testing machine which we planned to buy, and this made us waste the usable floor area of labs.

d.Analysing A10

A10 is the only one twist test machine which undertakes all the twist experiments. Though it has a high utilization rate, from V10 we can seethat it is not satisfying A10 is the most expensive twist testing machinein our country, for the purpose of fulfilling the requirement of teaching and research, it is not that wise to buy

such a expensive machine. It can fully fulfill our requirement if we buy a machine which cost only 2,000-3,000 YUAN. Therefore, we can see that we did not comprehensively discuss before we bought this kind of machine. One hand, this made us waste a sum of money, on the other hand,it points out that it is not that good if the average fixed asset is high.

CONCLUDING REMARKS

We think that the administration and construction of labs shouldbegin at the time of designing and planning, and apply the theories of Value Engineering to analyse comprehensively. Even after the labs havebeen bulit, when we need to buy new machine, we should still set out from the whole labs'system or the whole system of the university and carry on VA in the light of specific condition to assure investing properly,otherwise, it will lead to inadequate function or unmatchment, and cannot fulfill the requirement of teaching and resarch, in fact, it is anotherkind of waste.

Altogather, VA is a method setting out from the whole system andconsidering related factors of each composition. So, it can procisely and objectly reflect the situation of labs, and it is adesirabl emethod in constructing and administrating labs.