◆ Application Paper
A Study on the Methodology for CTQ Selection in the course of 6-Sigma Activity about Service Company

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Abstract

As customer's needs change rapidly in recent days, the evaluation scale about service quality is changing against the variation of the customer's needs. It is fact that the need of change which established evaluation ways about service quality rise more and more.

6-Sigma activity, called "most innovative management strategy in 20th Century", have many problems apply to service company. The important one between these problems is the problem about Critical To Quality(CTQ) Selection caused from the absence of more precise evaluation system.

The objective of this study is the development of methodology for CTQ selection coincide to service company. It is the basic logic that the way to regard MOT mainly effects about total customer satisfaction index(CSI) as CTQ, after the development of the evaluation system based on MOT with customers.

Also, the study focused on the case of department store progress to exhibit the reasonableness of this logic.

Keywords : Service quality, CSI, CTQ, MOT

1. Introduction

In recent days, the economic's environment is changing rapidly and variously. The political border between countries is still existing, but the economic border is being fade even it's concept. In addition to that, the resources, technologies, informations used production and service activity of companies
recognize the concept about risen above the country. Because of this reality, the competition between companies is emphasizing more seriously.

The appearance of WTO means that the opening of border enable to free trade and the disappearance of which inferior company
's existence in the competitive economy. Such today's economic environment demand the change about manufacturing industry and service industry.

6-Sigma activity, became distinguished "20st century's last management innovation strategy", has being driven in many company. But to apply it to the service companies remains difficult problem because of the characteristics of the service quality, for instance intangible, heterogeneity, etc. This characteristics of the service quality make the problems of measurement&control in contrast
manufacturing company. We can forecast the problem that apply 6-Sigma to the service companies

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because of the measurement's problem is connected directly with control's problem.

In today's economic environment, it was the customers that to recognize quality and to valuate it. Being concerned about this reality, We will find the methodology of CTQ selection based on CSI. According to this objective, it is the basic logic that the way to regard MOT which mainly effects about total CSI as CTQ, after the development of the evaluation system based on MOT with customers.

Also, the study focused on the case of department store progress to exhibit the reasonableness of this logic.

2. Research method and structure

The objective of this study is the development of methodology for CTQ selection coincide to service company focused on department store. According to this objective, first, we subdivide the system of service supply and organize 5 MOT. Second, to define the correlation of the CSI about each MOT and total CSI. Finally, it was the basic model that to choose most relative MOT on CTQ.

The background of such modelling is that the research methodology based on existing studies fact limits to the assessment of service quality. In other words, this study begin the fact that the service factor of customers valued is different at each MOT and the effects on the CSI at each MOT to total CSI is different.

Total CSI is the result of CSI come from each MOTs which customers is supplied service, this numerical expression can define as below
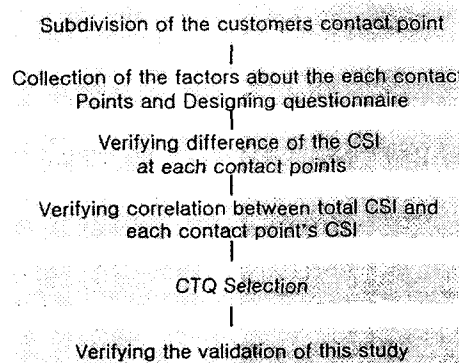
$$CS_{total} = f(CS_{cp1}, CS_{cp2}, CS_{cp3}, \cdots)$$

CS_{total} : Total CSI

CS_{cpn} : CSI about each contact

As well as, this CSI about each MOT is decided by each service quality factors which can effect each MOTs. Therefore, the customer's claim generated from service quality factor at specific MOT can consequently effect the total CSI.

This study establish the research model pay attention to this fact and verify validation from apply the research model to department store's case. The CTQ selection model according to the assessment of CSI that apply this study can schematize as below.

Subdivision of the customers contact point
|
Collection of the factors about the each contact
Points and Designing questionnaire
|
Verifying difference of the CSI
at each contact points
|
Verifying correlation between total CSI and
each contact point's CSI
|
CTQ Selection
|
Verifying the validation of this study

<Figure 1> The CTQ selection model according to the assessment of CSI

As above <Figure 1>, We will verify the validation of this study according to apply the research model to department store's case.

3. Verifying the validation of research model according to case application

The department store which used the case application in this study is the place of the product's sales in external shape, but the service is the primary product in practice. Also, production and sales of these service have concurrence that were placed simultaneously. Considering this fact, the service quality innovation in the department store is the problem of survival.

3.1 Investigation of raw data and research
3.1.1 Investigation of the raw data

For the subdivision of customer's MOTs, it devide MOT at department store to 5 MOTs that composed of parking area, shuttle bus, information desk, shop, after/event service through interview with customers and the consideration about process of the service's supply. These each MOTs devide the factors of service quality that considering about characteristic of the MOTs and supplied services through elementary questionnaire and brain-storming.

The questionnaire based on the composition of MOTs was designed self-fill type used Rikert scale. This investigation used question-naire is executed by hired 5 investigators. For the purpose of minimizing the bias of data, it maintain the equal cases about the survey questionnaire's respondent.

3.1.2 Verifying reliability of the questionnaire item

In this study, Cronbach's alpha which generally used for scale in order to recognize internal consistency reliability is used for verifying reliability and validation about the item consisted of questionnaire. This is the selection procedure of high reliability item except the item which impede total reliability because of large variation between items.

Generally speaking, it is judged high reliability if Cronbach's alpha is larger than 0.6.

According to the result of analysis, the item which composed of the questionnaire show that Cronbach's alpha is 0.884797~0.898861. This result show that the items have very consistently stable reliability. Therefore, the items which composed of this questionnaire can regard as the stable scale which have consistent reliability.

3.2 Verification of the CSI's difference between MOT

As explained earlier, total CSI is decided by the function which effected from each MOTs. That is, the fact that the CSIs in each MOTs shows significant difference is meaning about the difference of the degree of effects which each MOTs effect total CSI. So to speak, to understand the degree of effects which each MOTs effect total CSI can exhibit the validation about the logic that used this study.

As shown in <Table 1>, the result of the verification about difference between the CSIs in each MOTs that used criteria for the CSI in parking area (var 6), it show the significant difference at all MOTs except the MOT about after/event service.

3.3 CTQ selection for the application of 6-Sigma
3.3.1 Abstracting MOT that effect total CSI

Through verifying of the CSI's difference between MOT, we can find the fact that is

<table 1> Verification of the CSI's difference between each MOT

Marked differences are significant at p < .05000								
Var	Mean	Std.Dv	N	Diff	Std.Dv Diff	t	df	p
var 6	2.985915	.771716	142	-.169014	.959993	-2.09797	141	.037692**
var 10	3.154930	.827675						
var 6	2.985915	.771716	142	-.309859	.892706	-4.13619	141	.000060**
var 15	3.295775	.671494						
var 6	2.985915	.771716	142	-.302817	.914729	-3.94486	141	.000125**
var 23	3.288732	.812849						
var 6	2.985915	.771716	142	.063380	.961786	.785272	141	.433612
var 28	2.922535	.772524						

different from the degree of effects which each MOTs effect total CSI. In this study, for abstracting the degree of effects which each MOTs effect total CSI, we will find the degree of effects through Multiple Regression Analysis and to show priority's significance through Stepwise Regression.

As shown in <Table 2>, we can find the MOT which mainly effect total CSI is MOT about after service. If we will make a numerical expression about it, it is expressed as a below.

<Table 2> Multiple Regression for the abstracting of critical MOT

Multiple Regression N=142	Regression Summary for Dependent Variable: VAR29 R^2= .70413583 F(5,136)=26.748 p<.00000 Std.Error of estimate: .53034					
	Beta	St. Err. of Beta	B	St. Err. of B	t(136)	p-level
Intercpt			.296752	.292053	1.016088	.311392
var 6	.119069	.066521	.113177	.063229	1.789955	.075686
var 10	.060203	.065983	.053355	.058478	.912398	.363174
var 15	.092890	.071224	.101471	.077804	1.304190	.194372
var 23	.331605	.077106	.299244	.069581	4.300643	.000032
var 28	.385068	.065565	.365628	.062255	5.873094	.000000

<Table 3> Stepwise Regression for showing the significance of the priority

Stepwise Regression N=142	Regression Summary for Dependent Variable: VAR29 R^2= .70194092 F(4,137)=26.748 p<.00000 Std.Error of estimate: .53001					
	Beta	St. Err. of Beta	B	St. Err. of B	t(136)	p-level
Intercpt			.375096	.278975	1.344552	.180992
var 23	.344428	.075768	.310816	.068374	4.545835	.000012
var 28	.383237	.065494	.363890	.062188	5.851487	.000000
var 6	.130460	.065299	.124004	.062067	1.997888	.047709
var 15	.099746	.070784	.108960	.077322	1.409169	.164051

$$CS_{total} = 0.1132(CS_{parking}) + 0.0534(CS_{shuttle}) + 0.1015(CS_{info.}) + 0.2992(CS_{shop}) + 0.365628(CS_{A/S}) + 0.296752$$

3.3.2 Abstracting critical service quality factor that effect CSIs in each MOTs

Through the above analysis, we can find that the MOT which mainly effect total CSI is MOT about after service. Next, we apply Multiple Regression Analysis to abstract the degree of effect about each MOT and total CSI influenced by the service quality factors composing of MOT.

According to this process, we apply Multiple Regression Analysis to the parking area's CSI in order to abstract critical service quality factor in each MOTs. The result of analysis is as shown below <Table 3>.

<Table 4> Multiple Regression Analysis to the parking area's CSI

Multiple Regression N=142	Regression Summary for Dependent Variable: VAR6 R^2= .58244134 F(5,136)=13.965 p<.00000 Std.Error of estimate: .63873					
	Beta	St. Err. of Beta	B	St. Err. of B	t(136)	p-level
Intercpt			.296752	.292053	1.016088	.311392
var 1	.119069	.066521	.113177	.063229	1.789955	.075686
var 2	.060203	.065983	.053355	.058478	.912398	.363174
var 3	.092890	.071224	.101471	.077804	1.304190	.194372
var 4	.331605	.077106	.299244	.069581	4.300643	.000032
var 5	.385068	.065565	.365628	.062255	5.873094	.000000

If we will make a numerical expression about <Table 4>, it is expressed as a below.

$CS_{parking}$ = 0.1132(var 1)+0.0534(var 2)+0.1015(var 3)+0.2992(var 4)+0.3656(var 5)+0.296752

Applied the same abstraction process with above, If we will make a numerical expression about the rest of MOTs, it is expressed as a below.

$CS_{shuttle}$ = 0.1400(var 7)+0.2627(var 8)+0.4274(var 9)+0.492759

$CS_{info.}$ = 0.1818(var 11)+0.1484(var 12)+0.2012(var 13)+0.2719(var 14)+0.692738

CS_{shop} = 0.2173(var 16)+0.2767(var 17)+0.0481(var 18)+0.0873(var 19)+0.1023(var 20)+
0.0972(var 21)+0.2381(var 22)-0.249016

$CS_{A/S}$ = 0.1951(var 24)+0.1629(var 25)+0.0744(var 26)+0.2318(var 27)+1.0128

The results of abstracting critical service quality factor that effects CSI in each MOTs are that the convenience in searching a car after shopping in case of parking area, delightfulness and cleanness of the shuttle bus in case of shuttle bus, convenience facility for customers in information desk in case of information desk, sincerity and kindness of the staff in shop in case of shop, etc.

Consequently, by using this methodology of CTQ selection means that can abstract more distinctly the MOT and factor which effect considerably to total CSI. Also, it means that is able to evolve the successive improvement and control activity based on this result.

3.3.3 The result of CTQ seletion

Generally speaking, CTQ signified 6-Sigma is the factor which mainly effect to the quality. From this point of view, it seems have serious meaning that to find the MOT or factor effect to the quality mainly.

Knowing from the above result, the MOT which mainly effect to the CSI of department store is MOT about after/event service. Therefore, it come to the conclusion that to improve/control the

management of these MOT from a CS point of view become more efficient method which can advance the CSI of department store.

3.4 Verifying the validation of the study model

The main idea of this study come from the fact that the service factors belonged to equal service quality dimension show the difference in CSI accoding to the MOT which belonged to service factor.

These difference means that the different approach about improvement/control activity   need according to MOT which belonged to service factor, granted it is the service factors belonged to equal service quality dimension.

<Table 5> Example of T-test between each MOT's service factors belonged to
equal service quality dimension

Marked differences are significant at p ⟨ .05000								
Var	Mean	Std.Dv	N	Diff	Std.Dv Diff	t	df	p
var 17 var 25	3.218310 2.732394	.826135 .898505	142	.485915	.881133	6.571481	141	.000000**

As shown in <Table 5>, it is the result of t-test for verifying the difference about dimension of reactivity at the MOT of shop and after/event service. Even if it is the fragmentary example, the result show that the service factors belonged to equal service quality dimension show the difference in CSI according to the MOT which belonged to each service factor. Therefore, this result can exhibit the validation of main idea which used this study.

In addition to that, we will verify the validation of the study model by investigation the item about MOT which customer think much of. So to speak, if the result of frequency analysis about this item correspond to the result of this study, it can exhibit the validation about the study model which used in this study.

<Table 6> Frequency analysis about the important MOT by customer's selection

MOT	Count	Cumul. Count	Percent	Cumul. Percent
Parking area	52	52	36.62	36.62
Shuttle bus	29	81	20.42	57.04
Info. desk	9	90	6.34	63.38
Shop	19	109	13.38	76.76
After/event	33	142	23.24	100.00
Total		142		

As shown in <Table 6>, the critical MOT by customer's selection which showed the result of analysis is the MOT about after service correspond with result of this study.
Therefore, it can conclude that this result exhibit the validation of this study.

4. Conclusion

It is easy to select CTQ in manufacturing industry which possessed quantitative measurement

system than service industry. But it is difficult problem that select CTQ in service industry which quantitative measurement system does not exist. After all, the difficulty in finding contact point and factors which can affect on quality is connected with the difficulty in improvement and management about service quality. Accordingly, the development of the methodology of CTQ selection remains serious problem.

In this study, we progress the study by the process which divide total CSI into several MOT and service quality factors through Top-Down Processing. The objective of this process is to overcome the theoretical limitations of existing methodology come from the course of clustering the service quality factors and to make ease that apply 6-Sigma to service industry.

The limitation of this study is as follow. First, the research range is not a wide scope. Second, more accurate approach about interaction which generated between each service quality factors.

But by exhibiting the fundamental frame about CTQ selection, this study have a significance in respect of exhibition of the possibility which 6-Sigma construction in service industry.

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