Structural Analysis for Customer Satisfaction Change of System Integration Services

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Summary

This paper presents satisfaction analysis result of system integration service customer surveys. The authors has been conducted several customer surveys focusing on some factors specific about system integration services, comparing to consumer goods. Using these accumulations and adding analysis for relevant issues for customer satisfaction of system integration services, we had analyzed satisfaction change structure. Analysis of satisfaction change of each firms showed that difference of BPR (business process reengineering) policy or IT implementation policy causes total difference.

Key words:

system integration(SI), customer satisfaction(CS), satisfaction structure, satisfaction change structure, system evaluation,

1. Introduction

Various methods has been tried to apply evaluating information system. However, evaluation of total system integration service has been rather behind to other information system evaluation methods there are focusing on technical aspects. Some of the system integrators had started to make customer surveys of satisfaction, though it is focused on each element of current system integration satisfaction scored by IT section of the firms. However, satisfaction of system integration service is implicated by various organization of a firm, not only IT section.

Iizuka had tried approach customer satisfaction structure from the view point of organization structure [1] [2]. Some satisfaction theories those had been adapted to consumer products [3] [4] were arranged to make satisfaction structure model. Correlation between expectation, performance and current satisfaction are analyzed and verified. Organization behavioral factors and theories such as proposed by Sheth [5] were also arranged and build into the model. Survey sheet was sent to three sections (IT section, business planning section, end users section) to each firm, and analyzed organization satisfaction structure. In 1997 Chikara had adopted customer satisfaction theories [4] to information system audit area. Customer satisfaction model was used a part of audit items [6], and it was sort of epoch-making event.

Although these trials for applying customer satisfaction theories to system information evaluation were successful, some relevant issues have come out. Various relationship types between IT section and business planning section has came in. In some firms, IT section and business planning section are independent section, but in some firms IT section and business planning section are belong to same superordinate organization, in some cases IT section is a part of business planning section, and in some firms, all IT service functionality is supported by IT subsidiary company. BPR policy are the aspect that also shows variety; drastic business process reengineering and as-is process based business improvement. System implementation policy also shows variety, such as "system specification should be comply user business process requirement", or "define business process considering IT capability". In order to clarify customer satisfaction structure considering these relevant issues, the authors had conducted and formulated another customer survey and analyzed from various aspects.

2. Related Works

2.1 Customer Satisfaction Related Works

Though it is more than decades has past since the customer satisfaction became one of the most important topics of business, most of the studies of early date are focusing on consumers as customers, not organization customers that is considering its structure. Most consumer satisfaction researches have progressed understanding consumer behavior. They perceive consumer satisfaction from behavioral perspective, and investigating how to measure consumer satisfaction [7]~[13]. However, most of the customer satisfaction research of organization is barely focus to organization behavior. This is the reason why the authors had made a new framework for customer satisfaction studies for system integration services that is considering and theory of organization behavior.

2.2 System Integration User Research Related Works

There are plenty of information system customer surveys that are conducted by many media, research organizations. They are focused to particular technology deployment, information system budget, project management, and so on. However, most of respondents of these researches are people who work for information system in the firm, or individual end user (consumer).Organization structure and behavior is hardly concerned.

2.3 System Audit Related Work

Chikara tried to use CS as an element of information system audit [6]. Information system audit is "activity of evaluating and inspect information system totally, advice and admonish to management of the organization, by system auditor who is independent and clinical" [14] The point of view of information system audit is "inspect" and "quality" of information as "goods".

Chikara tried to add several questions to hundreds of auditing items, such as, efficiency, functionality, operability, clarity. He had researched to end users (such operators, users of report outputted form computer) of two projects. Although both of this research and the authors' research include key word of "information system" and "customer satisfaction", they have different objectives and different view point, therefore result is also different.

2.4 Indicating and Redefining Consumer Satisfaction Theories to System Integration Business

There are some theories that could be built into our framework.

● Degree of Attainment and Range of Desire

Shimakuchi proposed to define consumer satisfaction, using Thourough's implicit definition of "degree of warfare". "Customer satisfaction can be described by his/her range of desire and power of attainment"[4].

$$F(p,q) = \frac{q}{p}$$

$F(p,q)$:Degree of Consumer Satisfaction
p: range of desire
q: power of attainment

● Function Fulfilment

Swan and Com described consumer satisfaction as function fulfillment [15].

Essential Function	Surface Function	Satisfied/ Not Satisfied
$\geqq E$	$\geqq E$	Satisfied
$\geqq E$	$< E$	Not Satisfied
$< E$	$\geqq E$	Disappointed
$< E$	$< E$	Disappointed

E: expectation

This theory is based on the idea that essential function effects whether satisfied or disappointed, while surface function effects whether satisfied or not satisfied.

● Performance and Expectation

Satisfaction explained by expectation and performance were proposed by some researchers such as Anderson, Oliver and Dover. Description was expressed as below [16] [17] .

$$S = \alpha E + \beta(P - E)$$

S: degree of satisfaction
E: degree of expectation
P: degree of performance
α , β : parameters

The authors are going to indicate these theories to our research framework as component by verifying availability of using these theories to organizational customer satisfaction.

2.5 Requirement for System Integration Service's Customer Satisfaction Research Framework

In order to analyze customer satisfaction of system integration service, the authors consist that there are critical considerable points in addition to related works as below.

(1)Constructing model considering organization behavior
(2)Focus "total satisfaction", not particular technology or quality only
(3)Analyze satisfaction structure from macro view and find trend and variable of satisfaction
(4)Analyze satisfaction change structure

Research framework considering these requirements is described in the next chapter.

3. Customer Satisfaction Research Framework for Information System Service

3.1 Characteristics

Characteristics of our framework are as below;
(1) Analyze how "satisfaction of this time" effects next procurement.
(2) Analyze satisfaction structure, and see the difference of "total satisfaction" between organizational sections (IT section, business planning section, end user section).
(3) Analyze correlation between "total satisfaction" and "satisfaction of each factor" (technical issues, project management, business impact, satisfaction of other sections).
(4) Analyze correlation between "satisfaction of each factor" and "expectation and performance of each factor".
(5) Analyze correlation between BPR policy or organization structure, and "total satisfaction".
(6) Analyze satisfaction of business impact, BPR policy, organization structure is especially considerate for resent issues for information system.
(7) Analyze firm "aggregated satisfaction structure" (aggregation of satisfaction of each organization).
(8) Analyze satisfaction change structure, and analyze correlation between change delta of "satisfaction of each factor" and change delta of "total satisfaction" using data of customer surveys of time 1 and time 2.

3.2 Surveys

The authors conduct several customer satisfaction surveys in order to fulfill characteristics we had written in 3.1.(Table1).

Table 1: Customer Satisfaction Surveys

	1992	2002
Satisfaction Survey about Organizational Buying	(a)CSS-OBP92	(b)CSS-OBP02
Satisfaction Survey about Organization Type Category		(c)CSS-OTC02
Satisfaction Survey about Impact of Environmental Change		(d)CSS-IEC02

CSS-OBP: CS Survey from Organization Buying Perspective
CSS-OTC: CS Survey from Organization Type Category
CSS-IEC: CS Survey from Impact of Environmental Change

(1) About CSS-OBP 92/02

These surveys are designed to perceive satisfaction structure of system integration services from the perspective of organization buying characteristics.

Indicating consumer satisfaction model, expectation, performance and satisfaction ratings were asked by each element of system integration services and total satisfaction. Survey sheets were sent to three sections to each firms (IT section, business planning section, end user section) CSS-OBP92 was done in 1992, and CSS-OBP02 was executed in 2002 after ten years.

(2) About CSS-OTC

This survey is designed to analyze customer satisfaction from the perspective from consequence of BPR policy (drastic business process reengineering and as-is process based business improvement). Three sections a company were investigated, similar to CSS-OBP92/CSS-OBP02.

(3) About CSS-IEC

This survey is designed to analyze customer satisfaction change. To see the relation between the change and the satisfaction rating by installing the question asking what change had happened. Fitting together this answer and change delta between two surveys of CSS-OBP, satisfaction change structure should be perceived.

Most of the questionnaires are asked by 5 point scale. Survey sheets were sent to 236 firms (3 sections for each firm) for CSS-OBP92, 226 firms for CSS-OBP02, CSS-OTC02 and CSS-IEC02.

3.3 Major Hypotheses

We had formed 16 hypotheses based on our framework as below.
- Hypothesis 1: "Total satisfaction at this time" gives effect to next time procurement.
- Hypothesis 2: "Total satisfaction" is different by each organizational section in a firm.
- Hypothesis 3: Structure of "total satisfaction" (correlation between "total satisfaction" and "satisfaction of each factor such as satisfaction of technical matter factor, project management factor, and business impact of using IT") is different by each organizational section in a firm.
- Hypothesis 4: Structure of "satisfaction of each factor" can be explained by "degree of attainment and range of desire".
- Hypothesis 5: Structure of "satisfaction of each one factor" can be explained by "performance versus expected". (Expectation – Performance Hypothesis)
- Hypothesis 6: "Total satisfaction" of an organizational section can be influenced by satisfaction of other section.

Table 2: Summary of Research Result

Hypo-theses	Analysis Objectives	Verification Method	Survey (Level of Significance)
H1	Importance of customer satisfaction	Regression of satisfaction score and will for selecting same system integrator for the next purchasing time	CSS-OBP92(**) CSS-OBP02(**)
H2 H3	Structure of customer satisfaction of each element explained by expectation and performance - Degree of Attainment and Range of Desire - Performance vs. Expectation	Regression of satisfaction score and q/p (*p:* range of desire, *q:* power of attainment) Multi regression of satisfaction score and E, satisfaction score and (*P-E*) (*E*: degree of expectation, *P*: degree of performance)	CSS-OBP92(**) CSS-OBP02(***)
H3	Difference of satisfaction (by section)	Difference of average score of satisfaction by section Correlation of satisfaction score of three section	CSS-OBP92(**) CSS-OBP02(*)
H5 H6	Structure of "total satisfaction" by section	Multi regression of "total satisfaction" score and score of "satisfaction of each element"	CSS-OBP92(***) CSS-OBP02(***)
H7	Structure of "total satisfaction" and BPR policy	Multi regression of "total satisfaction" score and score of "satisfaction of each element" by each BPR policy type	CSS-OTC02(***)
H8	Structure of "total satisfaction" and IT implementation policy	Multi regression of "total satisfaction" score and score of "satisfaction of each element" by IT implementation policy type	CSS-OTC02(***)
H9	Structure of "total satisfaction" and organization structure	Multi regression of "total satisfaction" score and score of "satisfaction of each element" by organization type	CSS-OTC02(***)
H10	Structure of "total satisfaction" and IT subsidiary firm's organization	Multi regression of Total Satisfaction degree and degree of satisfaction degree for each subsidiary type	CSS-OTC02(***)
H11	Ranking change of "satisfaction of each element"	Comparative Analysis of ranking of CSS-OBP92 and CSS-OBP02	CSS-OBP92+.CSS-OBP02 (Difference was seen between CSS-OBP92 and CSS-OBP02 for ranking)
H12	Change of structure of "total satisfaction"	Comparative Analysis of correlation result (H5,H6) of CSS-OBP92 and CSS-OBP02	CSS-OBP92+.CSS-OBP02 (Difference was seen between CSS-OBP92 and CSS-OBP02 for correlation result)
H13	"total satisfaction" change and BPR policy	Average score analysis of average score of "total satisfaction" score change (delta of CSS-OBP92 and CSS-OBP02) by BPR policy	CSS-OBP02+CSS-OTC02 (Difference was seen by BPR policy type for "total satisfaction" score)
H14	"total satisfaction" change and IT implementation policy	Average score analysis of "total satisfaction" score change (delta of CSS-OBP92 and CSS-OBP02) by IT implementation policy	CSS-OBP02+CSS-OTC02 (Difference was seen by IT implementation policy type for "total satisfaction" score.)
H15	"total satisfaction" change and Environmental change of these years	Multi regression of "total satisfaction" score change (delta of CSS-OBP92 and CSS-OBP02) and environmental change (SCC-IEC02) elements	CSS-IEC02+CSSOBP92+ CSSOBP02 (***)
H16	"total satisfaction" change and "satisfaction of each element" change	Multi regression of "total satisfaction" score change (delta of CSS-OBP92 and CSS-OBP02) and score of "satisfaction of each element" change (delta of CSS-OBP92 and CSS-OBP02)	CSSOBP92+ CSSOBP02 (***)

Level of significance *:10%, **:5%, ***:1%

- Hypothesis 7: Structure of "total satisfaction" is different by BPR policy (drastic BPR, or AS-IS business process based improvement)
- Hypothesis 8: Structure of "total satisfaction" is different by system implementation policy (system specification should be comply user business process requirement, or define business process considering IT capability)
- Hypothesis 9: Structure of "total satisfaction" is different by organization structure of information system section and business planning section.
- Hypothesis 10: Structure of "total satisfaction" is different by IT subsidiary firm's organization structure and function.
- Hypothesis 11: "Satisfaction of each element" changes although structure of "satisfaction of each element" is not changing.
- Hypothesis 12: Structure of "total satisfaction" is changing.
- Hypothesis 13: "Total satisfaction" score change (delta) is different by BPR policy type.
- Hypothesis14: "Total satisfaction" score change (delta) is different by IT implementation policy.
- Hypothesis 15: "Total satisfaction" score change delta is different by each firm's environmental change of these years.
- Hypothesis16: "Total satisfaction" change is different by "satisfaction of each element change delta.

4. Research Result

Response rate of CSS-OBP92 was 32.92 percent, and it is quite high rate than general customer survey. Before mailing survey sheets to company, we had explained the purpose of our surveys on the telephone. That may had made sense to respondent, and more over this rate shows so many people were interested in this theme. Response rate of, CSS-OBP02, CSS-OTC02 and CSS-IEC02 (they are mailed together in envelopes) was 22.62 percent. Although it is lower then the response rate of CSS-OBP92, it is still high than general customer survey, considering various factors (*e.g.*, respondents are get tired of increasing survey sheets from various researchers, and survey executed 2002 had much questionnaires than CSS-OBP92), this rate can ascribed that it is quite high.

4.1 Summary of Research Result

Research result is summarized in Table 2. Most of hypotheses are tested by statistical method, and level of significance was written (*,**,***)on the table as a part of result. Analysis method for hypotheses 11 to 16 are comparative analysis, so summary comments were written

on the table in brackets instead of level of significance for these hypotheses. Hypotheses 1 to 6 are tested and analyzed both in CSS-OBP92 and CSS-OBP02. Detail result of hypotheses 1 to 10 are written in former papers that the author have published.[2][18] In this paper, we would explain about hypotheses 11 to 16.

4.2 Comparative Analysis of CSS-OBP92 and CSS-OBP02

Score of "satisfaction of each element" have changed in ten years in average. Comparing ranking of "satisfaction of each element" of CSSCSS-OBP92 and CSS-OBP02, ranking of some elements are changing. Some prominent change are: system consulting skill (business planning section, rank 7 -->4), cost performance (IT section, rank 9-->14), ergonomics (business planning section, rank 11-->8 and end user's section, rank 5-->14) Most prominent changes for each elements are ranking down rather than ranking up.

Table 3: SI Element Satisfaction Score <3.0 (Average)

Section	CSS-OBP92	CSS-OBP02
IT	- Ergonomics - System consulting Skill - Skill level about advanced IT - Knowledge about business and customer's industry - Integration skill of multi vendor's products - Management consulting skill	Management consulting skill
Business Planning	- Ergonomics - Cost performance - Management consulting skill - Integration skill of multi vendor's products	- System design/ development skill - Knowledge about business and customer's industry - Integration skill of multi vendor's products - system consulting skill - Management consulting skill
End User	- Skill level about advanced IT - Knowledge about business and customer's industry - Integration skill of multi vendor's products - System planning skill - Management consulting skill	Management consulting skill

Since satisfaction (including negative satisfaction or dissatisfaction) affects customer next procurement, the

element that shows negative satisfaction scores are very critical. SI element satisfaction scores that are below 3.0 (average/neutral score) are shown in Table 3. Score of "management consulting skill" is still low in all section (IT section, business planning section, end user's section.) in CSS-OBP02. The authors do not believe that consultants or engineers' skill not progressing at all. Actually, performance score of "management consulting skill" has progressed from 2.71 (CSS-OBP92) to 2.84 (CSS-OBP02). 2.84 point score ("performance" of "management consulting skill") is less than 3.0 low, but "satisfaction " of "management consulting skill" is much lower and 2.79 point. Because "expectation" of this factor is high, and therefore system integrators have to consider this factor in order to increase satisfaction.

The result of multi regressions of various factor to "total satisfaction" (tested by organizational section) are reported in Table 4 (CSS-OBP92) and Table 5 (CSS-OBP02)

Table 4: Multi Regression Result for Total Satisfaction and SI Elements
(By section, CSS-OBP92)

Predictor Variable	Coefficients	F-value	p-value
IT section			
Satisfaction of end user	0.55	30.79	***
System maintenance skill	0.27	9.58	***
Integrator's knowledge about business and customers' industry	0.19	5.00	**
Constant	-0.12		
Overall model		30.73	***
Business planning section			
System design / development skill	0.51	26.33	***
Cost performance	0.55	25.12	***
Ability to avoid company risk	0.29	6.00	**
Skill level about advanced IT	-0.26	8.64	***
Trustful company	-0.37	13.11	***
Integrator's knowledge about customers' industry	0.38	9.83	***
Integration skill of multi vendor's products	0.21	5.11	**
System maintenance skill	-0.14	2.30	**
Constant	-0.35		
Overall model		14.39	***
End users section			
System design / development skill	0.51	26.47	***
Ergonomics	0.44	19.93	***
Integrator's knowledge about business and customers' industry	0.23	5.05	**
System management skill	0.29	6.11	**
System Consulting skill	-0.18	2.47	
Specification of each products	-0.15	2.11	***
Constant	-0.44		
Overall model		34.27	***

Level of significance *:10%, **:5%, ***:1%

Table 5: Multi Regression Result for Total Satisfaction and SI Elements
(By section, CSS-OBP02)

Predictor Variable	Coefficients	F-value	p-value

Predictor Variable	Coefficients	F-value	p-value
IT section			
Integrator's knowledge about business and customers' industr	0.38	7.92	***
Support for system trouble	0.28	5.26	**
Satisfaction of end user	0.27	4.70	*
Constant	-0.05		
Overall model		10.20	***
Business planning section			
Satisfaction of end user	0.57	11.83	***
Management Consulting Skill	0.40	6.48	**
Constant	0.18		
Overall model		16.44	***
End users section			
Synthetic system planning skill	0.36	7.67	***
Relationship with system integrator	0.36	3.70	*
System maintenance skill	0.19	5.05	*
Constant	0.32		
Overall model		9.85	***

Level of significance *:10%, **:5%, ***:1%

Table 6: Multi Regression Result for Total Satisfaction and SI Elements and the effect brought by using information systems
(By section, CSS-OBP02)

Predictor Variable	Coefficients	F-value	p-value
IT section			
Cost reduction among entire firm	0.64	18.09	***
Integrator's knowledge about business and customers' industry	0.27	4.543	**
Support for system trouble	0.26	5.13	**
Cost reduction of IT section	-0.22	3.52	*
Constant	-0.08		
Overall model		12.76	***
Business planning section			
Cost reduction within business Planning section	0.85	22.01	***
Strategic decision making speed improvement among entire firm	0.47	10.37	**
Satisfaction of end user	0.44	8.25	*
Cost reduction among entire firm	-0.36	4.45	**
Specification of each products	-0.36	2.36	-
Constant	-0.29		
Overall model		14.39	***
End users section			
Workload reduction within end user section	0.44	19.42	***
Having good connection (from integrators)	0.57	25.53	***
Strategic decision making speed improvement among entire firm	0.42	17.53	***
Cost reduction among entire firm	0.21	5.73	**
Support for System trouble	-0.19	3.42	*
Ability for avoid company risk	-0.20	3.03	*
Constant	-0.61		
Overall model	-0.61	20.59	***

Level of significance *:10%, **:5%, ***:1%

Number of integration elements that has correlation with "total satisfaction" has reduced in 2002. However, system elements that are listed above seem to be carry less conviction. One of the reasons is coefficient value seems

to be not large enough. Therefore the authors tried to form multi regression including satisfaction of effect of using information system. (Table 6)

This result seems to be with more conviction. That means effectiveness using information system has become important issue for system integration service.

4.3 Analysis about Satisfaction Change

Analysis of customer satisfaction change in our project is focusing, not only macro comparative analysis. We had also analyzed change of customer satisfaction by surveying particular firms. We define these changes of each firm as "change delta". We had sent survey sheet to some particular firms both 1992(CSS-OBP92) and 2002(CSS-OBP02, CSS-OTC02, CSS-IEC02), and analyzed change (delta).

Looking for "total satisfaction" change delta for each firm and, average score showed difference by BPR policy. Average satisfaction score of firms whose policy are "drastic BPR" marks 0.59 point increasing, while "As-is business process based improvement" group did not changed in average.

Table 7: "Total Satisfaction" Score Average (by BPR policy type)

BPR Policy (CSS-OTC02)	Change Delta From CSS-OBP92 To CSS-OBP02
Drastic BPR	0.59
As-is business process based improvement	0.00

Looking for "total satisfaction" delta for each firm and, average score showed difference by BPR policy. Average satisfaction score of firms whose policy are "draw to-be business process at first, and consider IT deployment" marks 0.47 point increasing, while "consider to-be business process and IT deployment opportunity collaterally" group shows negative change in average.

Table 8: "Total Satisfaction" Score Average (by IT implementation policy type)

IT implementation policy (CSS-OTC02)	Change Delta From CSS-OBP92 To CSS-OBP02
Draw To-be business process at first, and consider IT deployment	0.46
Consider To-be business process and IT deployment opportunity collaterally	- 0.17

Correlation between environmental change of each firm and satisfaction delta is shown on Table9. Collaboration within/inter firms are considered to be an important issues of system integration projects.

Table 9: Multi Regression Result for "Total Satisfaction" score change delta (CSS-OBP92 to CSS-OBP02) and environmental change (CSS-IEC02)

Predictor Variable	Coefficients	F-value	p-value
Collaboration within firms becomes more important issue than before.	0.39	5.18	**
Collaboration inter firms becomes more important issue than before	0.29	2.70	-
Time span of information system project has become shorter	-0.38	3.05	*
Constant	-0.74		
Overall model		3.56	***

Level of significance *:10%, **:5%, ***:1%

Correlation between "total satisfaction" change delta and "satisfaction of each element" change delta are shown on Table10.

Table 10: Multi regression of "total satisfaction" score change delta of CSS-OBP92 and CSS-OBP02 and score of "satisfaction of each element" change delta of CSS-OBP92 and CSS-OBP02

Predictor Variable	Coefficients	F-value	p-value
Cost Performance	0.28	7.63	***
System maintenance skill	0.26	6.53	***
Integrator's knowledge about business and industry.	0.26	4.35	**
Satisfaction of end user	0.04	4.40	**
Constant	-0.21		
Overall model		6.93	***

Level of significance *:10%, **:5%, ***:1%

Though "Cost performance" looks very effective element to "total satisfaction", considering other factors such as BPR policy or other relevant issues, because these relevant issues are surveyed from 2002.

5. Conclusion

As for customer satisfaction of system integration services, there are various infulencer for organizational buying and satisfaction structure is different by sections in a firm. Therefore understanding satisfaction structure of each section is considered to be crucially important.

Through several customer satisfaction surveys the authors had conducted, we had found that there are factors of changing and not changing. The point that "satisfaction structure of each SI element are" explained by expectation and performance is not changed, while the point that structure of "total satisfaction" which is composed by SI element and effect of using system has changed. In

addition, by analyzing change delta of each firm, "drastic BPR" are effective to increase satisfaction score.

To conclude this paper, we would consist that in order to increase customer satisfaction of system integration or other some services, understanding satisfaction structure from a variety of different angles is very important and our framework would help that activity.

Acknowledgments

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