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Effect of customer satisfaction measures on a supply chain

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Abstract: This paper concerns with a survey study considering customer satisfaction requirements in a supply chain. The model analyzes the effective satisfaction measures of the customers on supply chain. The decisions made here help to determine the profit provider satisfaction measures. A case study illustrates the applicability of the proposed mathematical model.

Keywords: Customer satisfaction; supply chain

Introduction

The outputs from one system are the inputs of the other systems. Thus, integration of the complete scope of the supply chain from the supplier through the manufacturer to the retailer needs to be considered so that fully transparent information is shared freely among members, and collective strategies can be designed to optimize the system's joint objectives. While the importance of achieving integration in the supply chain is generally well recognized, for real-world applications designing a sophisticated integrated system is an arduous task. Few firms are so powerful that they can manage the entire supply chain so as to drive individual members to a superimposed integrated objective (Lee, 2007). A fundamental change in the global competitive landscape is driving prices to levels that in real terms are as low as they have ever been. One result of this has been overcapacity in many industries (Greider, 1998). Overcapacity implies an excess of supply against demand and hence leads to further downward pressure on price. A further cause of price deflation, it has been suggested (Marn et al., 2003), is the Internet which makes price comparison so much easier. The Internet has also enabled auctions and exchanges to be established at industry wide levels that have also tended to drive down prices.

While this trend has brought benefits in that businesses have been able to concentrate on their strengths and focus their main assets in specific areas, this strategic orientation also has increased the need to collaborate and integrate activities between the different companies in the supply chain. Therefore, most companies today try to establish relationships with their partners in the supply chain rather than concentrating on purchasing (Narayandas and Rangan, 2004). This development is further supported by today's business relationships offering one of the most effective remaining opportunities for significant cost reduction and value improvement

(Christopher and Gattorna, 2005). However, Frazier et al. (1988) observes that these opportunities mainly depend on the closeness of the relationship. In this sense, suppliers in particular have cultivated business relationships for years by investing in their customers with a view to safeguarding subsequent business dealings from out-suppliers (Jackson, 1985). However, there comes a point where making business relationships closer is only possible when both the supplier and the customer are prepared to invest in this special type of collaboration, as relationships in which the reason for staying in are solely determined by investments made on the part of the supplier are unstable by their very nature. As soon as competitors offer comprehensive benefits in alternative business transactions, there is an economic reason for customers to switch suppliers (Bonner and Calantone, 2005). This means that further investments will only become financially viable from the supplier's point of view if the customer is also prepared to put himself into a position of some dependence on the supplier. Taking the situation into consideration where a market or branch has completely switched into SCP, the use of our concept will no longer dispose of our stated over all advantage. In this situation, it can surely amount to nothing more than the prevention of competitive disadvantage (Rokkan et al., 2003).

Modeling the problem

This work studies the customer satisfaction measures in a multi-layer supply chain to find the effective items on the supply chain. The dependent variable is supply chain and the independent variable is the list of customer satisfaction factors. The aim is to determine the effective satisfaction measures on the multi-layer supply chain based on customers' opinions. To do that, a questionnaire study is conducted and the related statistical tests are reported. The research model is shown in Figure 1.

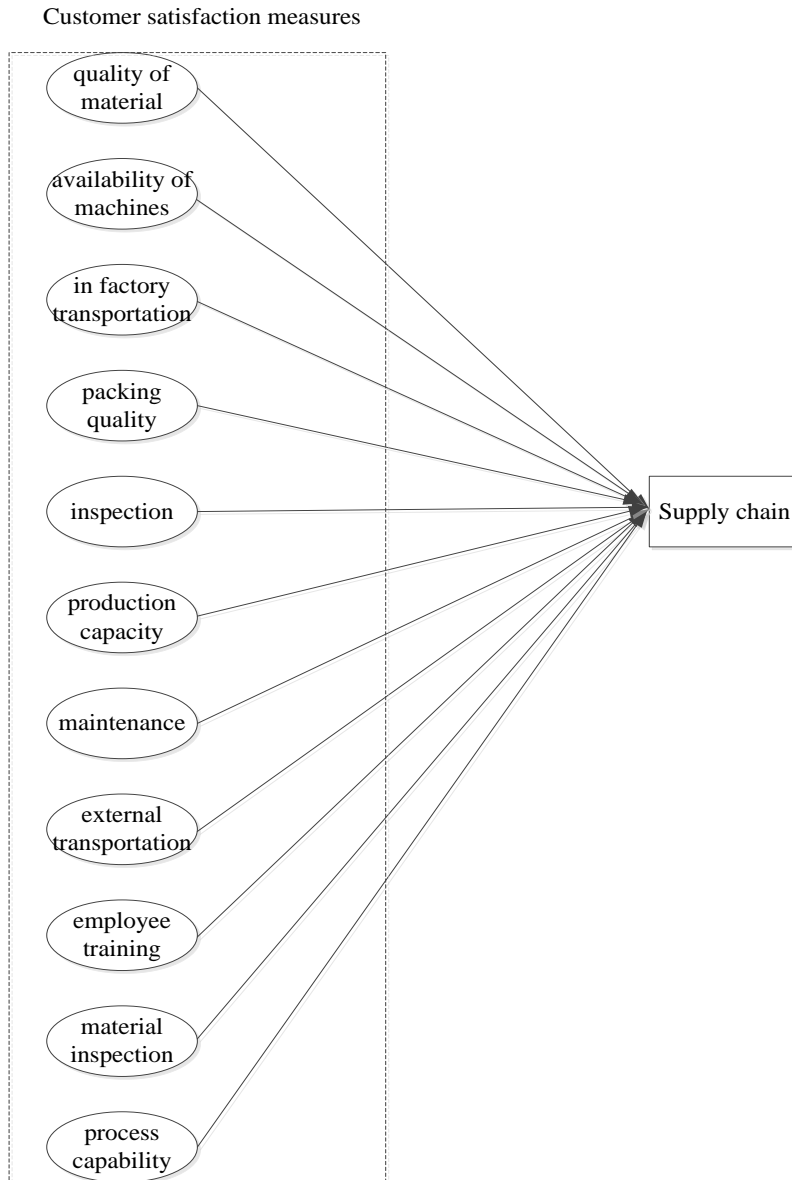


Figure 1. The research model

Survey study

Here, we determine the population to be studied and also construct the questionnaire. The questions of the questionnaire are the satisfaction measures and the answers ranges from very good to very bad (5 items likert

spectrum). The questions are also the hypothesis to be tested by statistical tests. If a hypothesis is rejected then the corresponding satisfaction measure is realized to be not important in customers' viewpoint. The satisfaction measures and the likert spectrum are given in Table 1.

Table 1. The questionnaire

Satisfaction measures	1	2	3	4	5
quality of material					
availability of machines					
in factory transportation					
packing quality					
inspection					
production capacity					
maintenance					
external transportation					
employee training					
material inspection					
process capability					

The questions are divided into main and sub-questions. The main research question is:
 What are the effective customer satisfaction factors on a multi-layer supply chain?

The sub-questions are also separated due to the layers of supply chain, namely supplier, producer, and distributor. The questions are listed follows here.

Sub-questions related to supplier layer:

- Q1: Does quality of material increase customers' satisfaction?
- Q10: Does material inspection increase customers' satisfaction?

Sub-questions related to producer layer:

- Q2: Does availability of machines increase customers' satisfaction?
- Q3: Does in factory transportation increase customers' satisfaction?
- Q4: Does packing quality increase customers' satisfaction?
- Q6: Does production capacity increase customers' satisfaction?
- Q7: Does maintenance increase customers' satisfaction?
- Q11: Does process capability increase customers' satisfaction?

Sub-questions related to distributor layer:

- Q5: Does inspection increase customers' satisfaction?
- Q8: Does external transportation increase customers' satisfaction?
- Q9: Does employee training increase customers' satisfaction?

The hypotheses

The hypotheses made here are:

- H1: quality of material increase customers' satisfaction.

- H2: availability of machines increase customers' satisfaction.
- H3: in factory transportation increase customers' satisfaction.
- H4: packing quality increase customers' satisfaction.
- H5: inspection increase customers' satisfaction.
- H6: production capacity increase customers' satisfaction.
- H7: maintenance increase customers' satisfaction.
- H8: external transportation increase customers' satisfaction.
- H9: employee training increase customers' satisfaction.
- H10: material inspection increase customers' satisfaction.
- H11: process capability increase customers' satisfaction.

The aim is to test the hypotheses using statistical tests and to determine the ones accepted employing the data collected from the customers.

Case study

Here, a case study is conducted in a car company in Iran to illustrate the applicability and effectiveness of the proposed survey study. In this car company several satisfaction measures are offered to the customers. The measures are: quality of material, employee training, material inspection, availability of machines, in factory transportation, packing quality, production capacity, inspection, maintenance, external transportation, process capability.

There are eleven satisfaction measures that the company offers to the customers. Therefore a survey study to determine the effective measures from customers' viewpoint is possible. Number of samples is 384. These samples are taken from the population of customers for a car company in Mazandaran Province, North of Iran. The descriptive statistics are given in Table 2.

Table 2. The descriptive statistics

	Number of samples	minimum	Maximum	Mean	Standard deviation
quality of material	384	1.00	5.00	3.5833	.98200
availability of machines	384	1.00	5.00	2.9427	1.07030
in factory transportation	384	1.00	5.00	3.4714	.93898
packing quality	384	1.00	4.00	2.4245	.87287
inspection	384	1.00	5.00	3.4297	1.08407
production capacity	384	1.00	5.00	2.5625	1.08455
maintenance	384	1.00	5.00	3.3255	1.16555
external transportation	384	1.00	5.00	2.2266	1.10457
employee training	384	1.00	5.00	3.3359	1.21314
material inspection	384	1.00	5.00	3.6823	1.10451
process capability	384	1.00	5.00	2.3073	1.00876

For better statistical analysis, the normal structure of the data is important. To do that, Kolmogorov-Smirnov test is performed. The results are shown in Table 3.

Table 3. The Kolmogorov-Smirnov test

	quality of material	availability of machines	in factory transportation	packing quality	inspection	production capacity	maintenance	external transportation	employee training	material inspection	process capability
Number of samples	384	384	384	384	384	384	384	384	384	384	384
Mean	3.5833	2.9427	3.4714	2.4245	3.4297	2.5625	3.3255	2.2266	3.3359	3.6823	2.3073
Standard deviation	.98200	1.07030	.93898	.87287	1.08407	1.08455	1.16555	1.10457	1.21314	1.10451	1.00876
Mos Absolute	.203	.177	.210	.275	.203	.198	.195	.219	.185	.183	.219
Positive	.203	.177	.210	.275	.151	.198	.138	.219	.133	.169	.219
Extreme Differences	-.185	-.162	-.195	-.191	-.203	-.157	-.195	-.133	-.185	-.183	-.155
Kolmogorov-Smirnov Z	3.976	3.460	4.123	5.392	3.982	3.880	3.824	4.297	3.616	3.587	4.284
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

In this study we 384 samples were collected according to the following hypotheses. Also, note that the significance level is 1% and Pearson correlation test (due to Normal distribution of data resulted from Kolmogorov-Smirnov test) is employed for accept/reject purpose.

- H1: quality of material increase customers' satisfaction. (accept)
- H2: availability of machines increase customers' satisfaction. (accept)
- H3: in factory transportation increase customers' satisfaction. (accept)
- H4: packing quality increase customers' satisfaction. (reject)
- H5: inspection increase customers' satisfaction. (accept)
- H6: production capacity increase customers' satisfaction. (reject)
- H7: maintenance increase customers' satisfaction. (accept)
- H8: external transportation increase customers' satisfaction. (accept)
- H9: employee training increase customers' satisfaction. (reject)
- H10: material inspection increase customers' satisfaction. (reject)
- H11: process capability increase customers' satisfaction. (accept)

As shown in the tests hypotheses 1, 2, 3, 5, 7, 8, and 11 are accepted and therefore are considered as effective customer satisfaction measures.

Conclusions

We conducted a case study in a supply chain to determine the effective satisfaction measures on customers. In any supply chain customers are the most significant sector since they influence the profit resulted from all activities within the supply chain. Thus, we determined the

satisfaction measures being more effective on the customers based on the data and using the statistical tests. The management of the supply chain now should concentrate on the obtained satisfaction measure to fulfill the customers' requirements and at the same time gain more profit.

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