Developing a Scale to Measure Supplier Service Quality in Indian Small & Medium Manufacturing Enterprises

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Received: *28.08.2017,* ***Accepted:*** *12.10.2017*

Abstract

The purpose of the current study is to develop a multidimensional scale to assess services delivered by suppliers working with small & medium manufacturing units. 120 executives working at top/middle level in different small-medium manufacturing units of north India responded to a questionnaire survey. The executives evaluated performance of their suppliers on the 1-5 Likert scale. Application of EFA revealed an interpretable latent structure comprising five factors. Five iterations of CFA were conducted to purify the scale and develop a valid and reliable tool having 4 final factors and 13 sub-factors. It was observed that service quality delivered by the suppliers to small-medium manufacturing units comprises of four dimensions viz., Credibility, Relationship, Understanding, and Dependability. Snowball sampling was undertaken for this research. This paper proposes a tool for the measurement of Supplier Service Quality in a previously less explored manufacturing sector. The scale developed in this research can be used as a benchmark by small-medium manufacturing units for improvements in supplier service quality. This research suggests a framework to develop more such scales in alternate situations so that generalizations can be contemplated.

Keywords - Supplier Service Quality (SSQ), Measurement Scale, Small-Medium Manufacturing Units, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Reliability, Validity.

Introduction

The fierce competition of today's marketplace is driving small & medium-sized enterprises (SMEs) to reshape their strategies in order to curtail overall cost and cut down inefficiencies. Intense competitive pressures for improving delivery performance, quality, and responsiveness, while simultaneously reducing cost, have forced them to re-examine their strategic priorities (Vijay *et al.,* 2003). Purchasing is the strategic primary point of contact with most supply-chain partners. Because of the mutual benefits they offer (Blodgett *et al.,* 1991), partnerships or strategic alliances between suppliers and manufacturers (i.e. buyers) have emerged as a popular business trend (Lorange *et al.*, 1991), and are being looked upon as the wave of the future (Carter *et al.,* 1996).

Partnerships with suppliers are recognized as a major purchasing strategy (Lisa *et al.,* 1993). Partnership is a source of competitive advantage for both the supplier and the manufacturing unit (David *et al.,* 1993; Ellram *et al.,* 1996). Successful manufacturing units leverage on the direct and indirect network of their suppliers to gain competitive advantage. Some of the typical benefits of suppliers as a manufacturing channel partner can be envisaged as:

- Helps in reducing overhead costs through involvement in design, transportation etc.
- Helps the manufacturer to focus on core issues.
- Suppliers with large supply bases can act faster and deliver better quality of material and services
- Suppliers may add on the service in the form of organizing training programmers, technical services, design inputs, etc. for better service
- Suppliers with sound financial backups may provide cushioning against fluctuating fund flows.

Managing suppliers is critical to adding value in the supply chain since this function has both intrinsic and extrinsic customers (Nitin *et al.,* 2006). In context of SMEs, supplier development is the practice of reducing the number of direct materials suppliers and forming strategic alliances with few selected suppliers and devoting resources to increase firm's performance and capabilities (Tejendra *et al.,* 2017). In the past, developing inter-firm linkages with suppliers was considered to be uneconomical for manufacturing organizations because of the large supply bases and distant relationships with suppliers (Janet *et al.,* 1996). In the recent years, some of the issues regarded critical to supplier relationship management (David *et al.,* 1989; Newman *et al.,* 1990) are as follows:

- Reliance of the manufacturing units on a few dependable suppliers.
- Consideration of quality vs. price tradeoff in selection of suppliers.
- Appropriateness of information provided to suppliers by the manufacturing units.
- Usefulness of the technical assistance provided to suppliers by the manufacturers.
- Involvement of the manufacturer in its suppliers' product development process.
- The manufacturing units entering into long-term contracts with its suppliers.
- Clarity of specifications provided to suppliers by the manufacturers.

In both marketing and logistics, the nature of interactions between buyer (manufacturer) and suppliers has been identified as an important influence on manufacturer's satisfaction and is a significant predictor of their continued relationships (Tejendra *et al.,* 2015; Patricia *et al.,* 1998).

In spite of general acceptance about the relations between 'manufacturer and supplier coordination' for improvement of service quality and supply chain performance, little empirical attempt has been madefor the measurement of supplier service quality (Stanley *et al.,* 2002;Prakash *et al.,* 2011).Most of the available studies are either conceptual in nature or based on case studies and have been conducted in large enterprises (LEs). In this light, the present chapter is an attempt to cover the gap towards measurement and modeling of supplier service quality in small-medium manufacturing units.

Supplier service quality (SSQ) refers to the manner in which staff of the supplier unit serve the requisitions made by manufacturing unit and what attitudes they hold towards the unit. Supplier partnership deals with the long-term relationship between the manufacturing unit and its suppliers, and includes make/buy decisions and global sourcing. Small-medium manufacturing units prefer to have few reliable suppliers, and are therefore reducing the number of suppliers, and sometimes relying on a sole source. In an attempt to regain their competitiveness, these units should adopt the Japanese Keiretsu system of manufacturers and suppliers working in lockstep (Macduffle *et al.,* 1997). For supply chain effectiveness, manufacturers and suppliers need to keep costs across the supply chain low so that they result in lower market prices and higher margins. This is akin to gain-sharing arrangements wherein everyone who contributes to greater profitability is rewarded.

SMEs occupy a place of prime importance in the economic growth of India. Earlier such units were in dormant stage shielded by the Government policies of reservation, quota and license etc., but due to globalization, once flourishing SME sector is facing several problems and a majority of them are suffering from a number of inefficiencies and are operating under 'diminishing returns to scale' regions (Haritha *et al.,* 2008). To remain competitive, the need for such units is to gradually shift their total offering as a manufacturer from mostly tangibles to include services, and finally, develop into a relationship-focused offering (Nix *et al.,* 2001;Prakash *et al.,* 2011) also showed that there is a need to study service quality with a wider domain considering all the processes and operations associated in delivery of supplies.

It is thus realized that manufacturing units need a reliable tool, which can enable them to identify various attributes of supplier service quality. This is essential for orientating their quality strategy and enables them to work more effectively with a few important suppliers who are willing to share responsibility for the success of the product. Thus, the purpose of this research is to highlight the importance of supplier service quality in context of small-medium manufacturing units and to derive its attributes. To meet these objectives, a focused review of literature was made; this formed the basis for subsequent development of an instrument for conducting a questionnaire survey. Various tests for validation were performed to examine these dimensions. In order to gain the insights of relative importance of these dimensions contributing to overall service quality, regression analysis was conducted. Finally, some limitations, which may become future research directives along with the concluding remarks, are presented in the final section of the paper.

Literature Review

Since last two decades, 'management of suppliers' has been established as a critical function for value addition across the service-profit chain for both products and services and hence has become the vital determinant to ensure the profitability and survival of industrial organizations. Most industries recognize that the costs of raw materials and components account for more than 70% of a product's cost (Abby *et al.*, 1993). Purchasing personnel today do much more than “buy things”. They have become relationship mangers; facilitating decision making by bringing together the pertinent parties internal and external to the manufacturing unit (Martha *et al.*,1993). Consequently, manufacturing units are putting efforts to revitalize and streamline their procurement processes.

Strategic supplier partnership is defined as the long-term relationship between the organization and its suppliers (Spekman *et al.,* 1998). It is designed to leverage the strategic & operational capabilities of individual participating organization to help them achieve significant ongoing benefits (Suhong *et al.,* 2006). A strategic partnership emphasizes direct, long term association & encourages mutual planning & problem solving. Strategic partnership with suppliers enables the organizations to work more effectively with a few important suppliers who are willing to share responsibility for the success of the product (Suhong *et al.,* 2006). (Ferry *et al.,* 2007) stated that strategic supplier partnership usually occur with a few major suppliers who are willing to contribute with more responsibility for the success of the product. Strategically aligned organizations can work closely together to eliminate waste effort & time to save money (Balsmeier *et al.,* 1996). An effective supplier partnership can be a critical component of a leading edge supply chain (Noble *et al.,* 1997).

Supplier performance can be checked by service delivery, credibility, service completeness and intra-

organizational communication (Nitin *et al.,* 2006). In other words, supplier performance is a measurement whether a supplier can fulfill order quantitatively and qualitatively. The Supplier strategy may include business models, strategic alliances, and partnership formation with the objective of developing a sustainable supply chain that is flexible and responsive to changing market requirements, (Christian *et al.,* 2000; Elahi *et al.,* 2013). Among those researches, collaborations/integration techniques between enterprises are getting more attention from researchers. The continued association with partners enhances service quality of the channel.

While there have been studies concerning to product quality, very few have worked on supplier service quality and its associates in supply chain. The first such attempt was made by (Cavinato *et al.,* 1987), who conducted study on non-purchasing personnel such as engineering, production, and accounting considered as customers of purchasing.

Parasuraman *et al.,* (1988) in their pioneering work identified five components of service quality viz. reliability, assurance, tangibles, empathy, and responsiveness. These five dimensions used to evaluate service quality are called SERVQUAL dimensions. (Lynn *et al.,*2007) proposed an important deficiency of SERVQUAL scale by stating that it does not include equity theory as the basis for any of its scales, even if it is clear from previous experience that equity (fairness) is often evaluated in service encounters. The FAIRSERV model proposed by him posits that customers do not only evaluate services against the five SERVQUAL dimensions, but also through comparisons with multidimensional norms of fairness (distributive, procedural, interpersonal, informational and systemic fairness). This will affect satisfaction with the service received.

It comes out from the literature that the services delivered by suppliers is a well explored area but fewer studies churned the attributes of service quality small-medium manufacturing units.

FAIRSERV (Lynn *et al.,* 2007), in conjunction with SERVQUAL (Parasuraman *et al.,* 1988), may be suitable for this study, due to its focus on satisfaction and re-patronage intensions. The preliminary questionnaire is on five attributes of SERVQUAL scale and "Systematic Fairness" attribute of FAIRSERV model. Taking cues from both existing scales to measure service quality, we have made a modest attempt at designing a new scale based on the combination of the two metrics.

Research Methodology

Realizing a strong need for the development of a scale to measure supplier service quality (SSQ), figure 1 shows the research methodology used for the purpose.The development of this scale followed a series of validated procedures as used by researchers for different applications.

A survey instrument was developed based on an extensive review of literature on different aspects of service quality measurement with a focus on suppliers using SERVQUAL and FAIRSERV scales. The questionnaire was refined after focus group discussion with small-medium manufacturing unis' managers and academicians. (Morgan *et al.,*1993) recommends such refinement of existing measurement instruments when the population for the research is new as in this case. The questionnaire thus emerged comprised two sections. The first section consists of 24 items related to supplier service quality and 1 item measuring overall supplier service quality whereas the second section focused on

gathering the demographic information. Prior to circulation, the questionnaire was authenticated through a pilot survey (Robson *et al.,* 2002). The pilot survey was carried out by discussing the questionnaire with five experts from the industry (at the top management levels) and academicians. This was done to know any discrepancies, duplicity or lack of understanding of the questionnaire by the respondents.

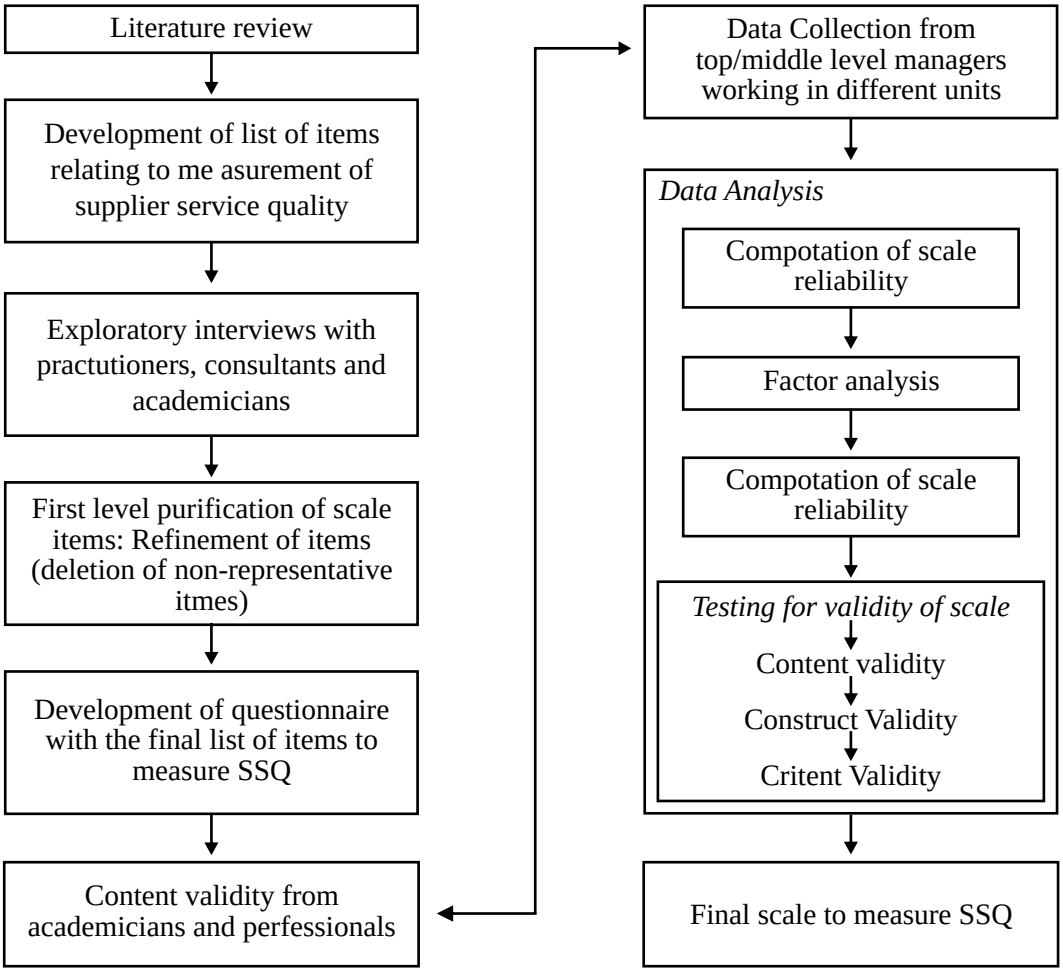

Figure 1: Research methodology for developing a scale for measuring Supplier Service Quality

Data was collected by personally visiting the respective units. There was no specific choice in selecting the industry from any specific sector. Prior to the commencement of the data collection, introductory e-mails were sent out to plant heads of respective units. Plant heads referred the researcher to the key respondents, who could be contacted for filling-in the questionnaires. The respondents were initially briefed about the questionnaire and the Likert scale besides the explanation of the items contained in questionnaire, so as to obtain more consistent responses. The respondent's own personal privacy was kept secret. This helped to achieve unbiased responses as suggested by (Robson *et al.,* 2002). Most of the respondents themselves filled-in the questionnaire at the time the researcher approached them, while other respondents kept the questionnaires, and returned them to the researcher in subsequent visits. The purpose of this approach was to enhance the response rate and improve the quality of data. This approach

has been endorsed by other scholars in the literature (Flynn *et al.,* 1990; Forza *et al.,* 2002).

The researcher approached 165 respondents serving in different small-medium manufacturing units and was able to elicit data from 120 respondents, thus fetching a response rate of 73% which was quite encouraging. This high rate of response may be attributed to involvement and commitment of unit heads of respective units and personal visits by the researcher to collect data. Majority of the respondents belonged to the top management of units including Proprietors, MDs, Unit Heads, Chief Works Managers, GMs, Purchase Managers, Executive Engineers, Heads of different departments and sections etc. Thetype of manufacturing activity being carried by the respondent units is shown in table 1.

Table 1: Type of product being manufactured by respondent units (N = 120)

Type of Manufacturing Unit	**Small Scale**	**Medium Scale**
Number & Percentage	**87 (73%)**	33 (27%)
Type of Product		
Auto Parts	26 (≈22%)	9 (≈8%)
Hand Tools	15 (≈13%)	5 (≈4%)
Casting Components	12 (≈10%)	4 (≈3%)
Valve manufacturing	9 (≈8%)	4 (≈3%)
Rolled Products	6 (≈5%)	4 (≈3%)
Machine Tools	6 (≈5%)	3 (≈2%)
Sheet Metal Components	5 (≈4%)	2 (≈2%)
Fasteners	4 (≈3%)	2 (≈2%)
Multi Products	4 (≈3%)	Nil

Parallel array configuration

Since all the 24 questions to measure supplier service quality are synthesized from the literature; the imperative is first to assess this scale through reliability test, EFA, followed by CFA.

Reliability Test

Reliability test indicates the consistency among the scales in their measurement for any issue (Shin *et al.,* 2000). Reliability can be measured through Cronbach alpha. Output of this analysis is provided by IBM SPSS v21 and indicates significantly high reliability of data (Cronin *et al.,* 1992; Lee *et al.,* 2000) and is depicted in table 2.

Table 2: Reliability Analysis of Supplier Service Quality scale (24 items)

Service Quality Measurement	Management's Perception of supplier Service Quality
Value of α	0.897
Finding	Quite Good

Factor Analysis

Exploratory Factor Analysis (EFA) of the data is carried out through a sequence of steps. First, Bartlett test of sphericity is used to verify appropriateness of factor analysis is assessed by analyzing correlation

matrix of the data (Joseph *et al.,* 2010). Simultaneously, assessment of data sufficiency (N=120, in this case) is judged by Kaiser-Meyer-Olkin (KMO) statistic which ranges from 0 to 1.
The KMO value of above 0.6 is considered significant and indicates suitability of factor analysis. The score of Bartlett test of sphericity and the KMO value is provided by SPSS v21 and is depicted in table 3. The results are significant, thus, providing indication of suitability of factor analysis (Joseph *et al.,* 2010).

Table 3: Data sufficiency and Bartlett's Test of sphericity

KMO Measure for data sufficiency		0.880
Bartlett's Test of Sphericity	Chi-Square	2221
	Df	231
	Sig.	0.000

The objective of EFA is to summarize the information asked in the 24 questions into a smaller set of new attributes that attempted to bring out the constructs for measurement of service quality offered by suppliers. This resulted in the extraction of five factors, explaining 73.301 per cent of the variance. The individual factors explained 22.524, 17.014, 12.375, 11.494 and 9.893 percent of the variance respectively. These factor loadings are consistent with the suggested factor structure of the scale. Output of EFA using is presented in table 4.

Table 4: Communalities, Factor Structure and Loadings for Items of Scale for measuring SSQ
Principal Components Method with Varimax Rotation Loading $\geq .53^{*}$

S. No.	**Factors and Associated Items**	**Commu - Nalities**	**Factor Structure & loadings**				
			F1	**F2**	**F3**	**F4**	**F5**
Credibility (F1)							
1.	Supplier has strong market reputation	.707	.766				
2.	Supplier has financial strength	.854	.866				
3.	Supplier has flexibility to change product design	.792	.864				
4.	Supplier has required knowledge/expertise/skills	.794	.843				
5.	Has competent & technically sound employees	.813	.846				
6.	Supplier is innovative in operations	.745	.797				
7.	Supplier has latest infrastructure	.792	.872				
Relationship (F2)							
8.	Supplier has long term relationship with your unit	.677		.622			
9.	Supplier agrees to flexible terms & conditions	.736		.702			
10.	Supplier has willingness to serve your unit	.645		.646			
11.	Supplier's employees are polite & courteous	.689		.698			
12.	Supplier is fair in dealings with your unit	.720		.700			
13.	Terms & conditions with your unit are fair	.763		.686			
Alignment (F3)							
14.	Supplier uses right tools/equipment/technology	.712			.812		
15.	Supplier has modern & certified facilities	.775			.859		
16.	Supplier is easily approachable	.695			.815		
17.	Supplier has quick solutions to failures/complaints	.706			.884		

Understanding (F4)							
18.	Supplier understands requirements of your unit	.689				.778	
19.	Supplier values your convenience	.726				.827	
20.	Shares work related information and knowledge	.682				.801	
21.	Honest in providing information/access to you	.646				.753	
Dependability (F5)							
22.	Delivers right quality and quantity in right time	.848					.857
23.	Supplier charges minimum price for supplies	.812					.849
24.	Supplier maintains confidentiality in operations	.766					.836
Reliability (Cronbach Alpha# Value) of identified factors			**.894**	**.951**	**.861**	**.836**	**.872**

*Cutoff point for loadings is 99 percent significant and is calculated by $2.58/\sqrt{n}$ (Pitt *et al.*,1995) where n (=24) is the number of items in the scale. F1-F5 represent individual factors.
#α values ≥ 0.70 are acceptable (Jum *et al.*, 1978).

Based upon subjective opinion of the researcher in consultation with a group of experts, the factors have been named as: *Credibility, Relationship, Alignment, Understanding,* and *Dependability.*

The communalities express the proportion of the variance of the 24 items extracted by the five factors of the scale. All the items have significant communalities (not less than 0.50) (Joseph *et al.*, 2010). The factor-item loadings represent the correlations between each item with their underlying factors. All the items have significant factor loadings (not less than 0.55) (Pitt *et al.*, 1995).

Internal reliability of the items of the various factors of the scale is examined using the Cronbach alpha coefficients. This approach is in line with that of (Richard *et al.*, 1988). In this analysis, reliability score for each factor ranges from 83.6% to 95.1% as shown in table 4 and hence is acceptable (Nunally *et al.*,1978).

Confirmatory Factor Analysis (CFA)

CFA is undertaken to further validate the scale for measuring Supplier Service Quality at supplier-manufacturing unit dyad.CFA confirms the factor structure by testing the fit of CFA model. CFA model is run using SPSS AMOS v21, for 5 individual factors with respective items. Based on the methodology of (Sureshchandar *et al.*, 2002), the model fit was examined for each factor. Table 5, shows the key model fit indices for the model.

Table 5: Key fit Indices for measurement model of scale for measuring SSQ

Factors	**(χ2)/df = Cmin/df**	**RMR**	**GFI**	**NFI**	**CFI**	**RMSEA**
F1: Credibility	.496	.007	.987	.994	1.000	.000
F2: Relationship	.968	.018	.982	1.000	1.000	.000
F3: Alignment	3.232	.018	.974	.972	.980	.037
F4: Understanding	.529	.013	.996	.994	1.000	.000
F5: Dependability	---	.000	1.000	1.000	1.000	---

All the GFI values are above 0.9, which clearly provides validation of individual factors of CFA model (Joseph *et al.*, 1995).

Scale Purification

In order to develop the measurement scale, the covariance matrix between the five identified factors was created as shown in figure 2.

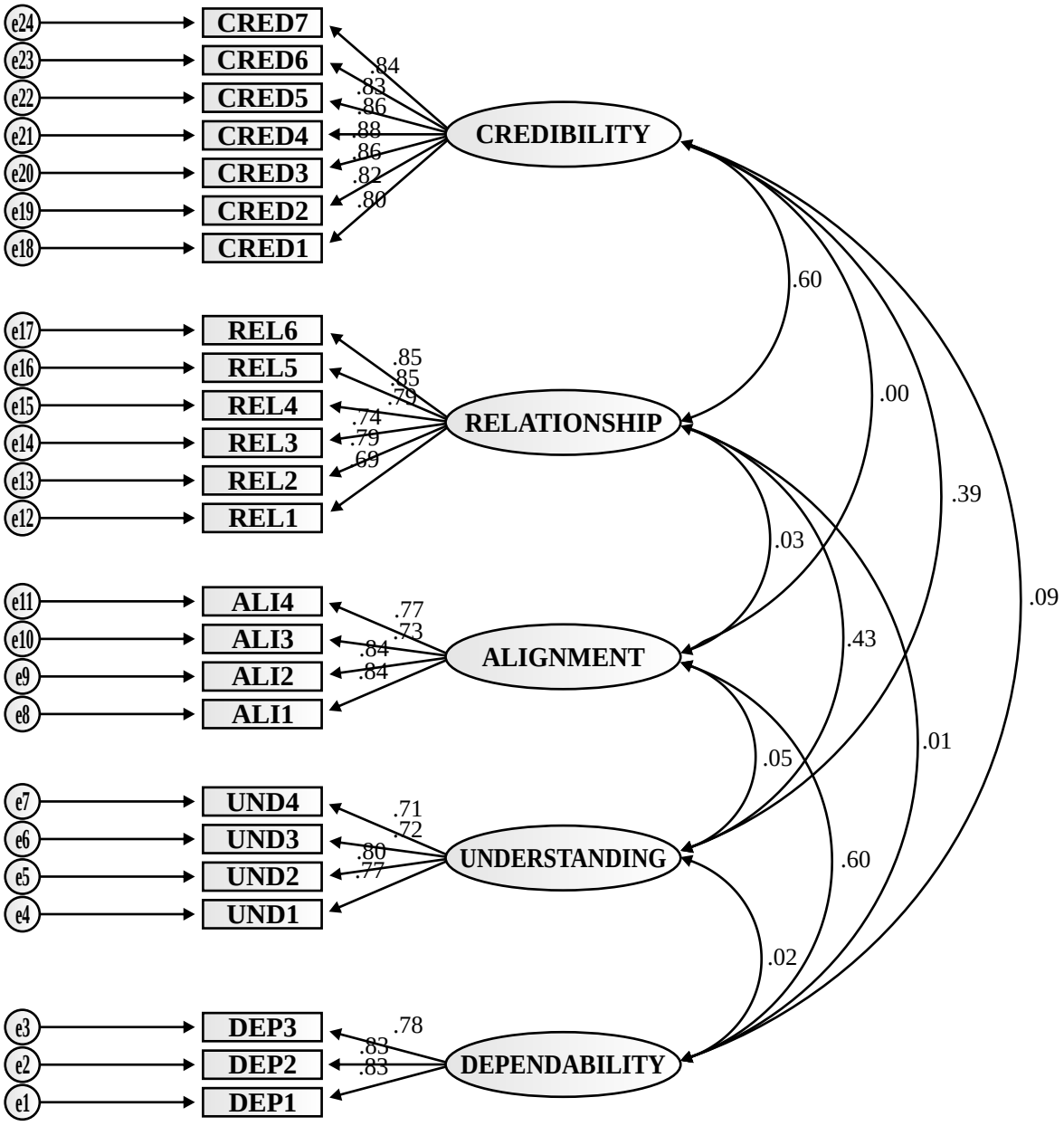

Figure 2: Theoretical framework for development of Supplier Service Quality Scale

Five iterations runs of CFA were performed to obtain satisfactory goodness of fit indices. During this

process, one dimension viz. alignment, was completely dropped. In total, 11 out of an initial 24 items were deleted, since these items were found to be inadequate on model estimates examination during CFA runs based on the amount of explained variance. The final model consisting of 4 factors and 13 sub-factors is depicted in figure 3.

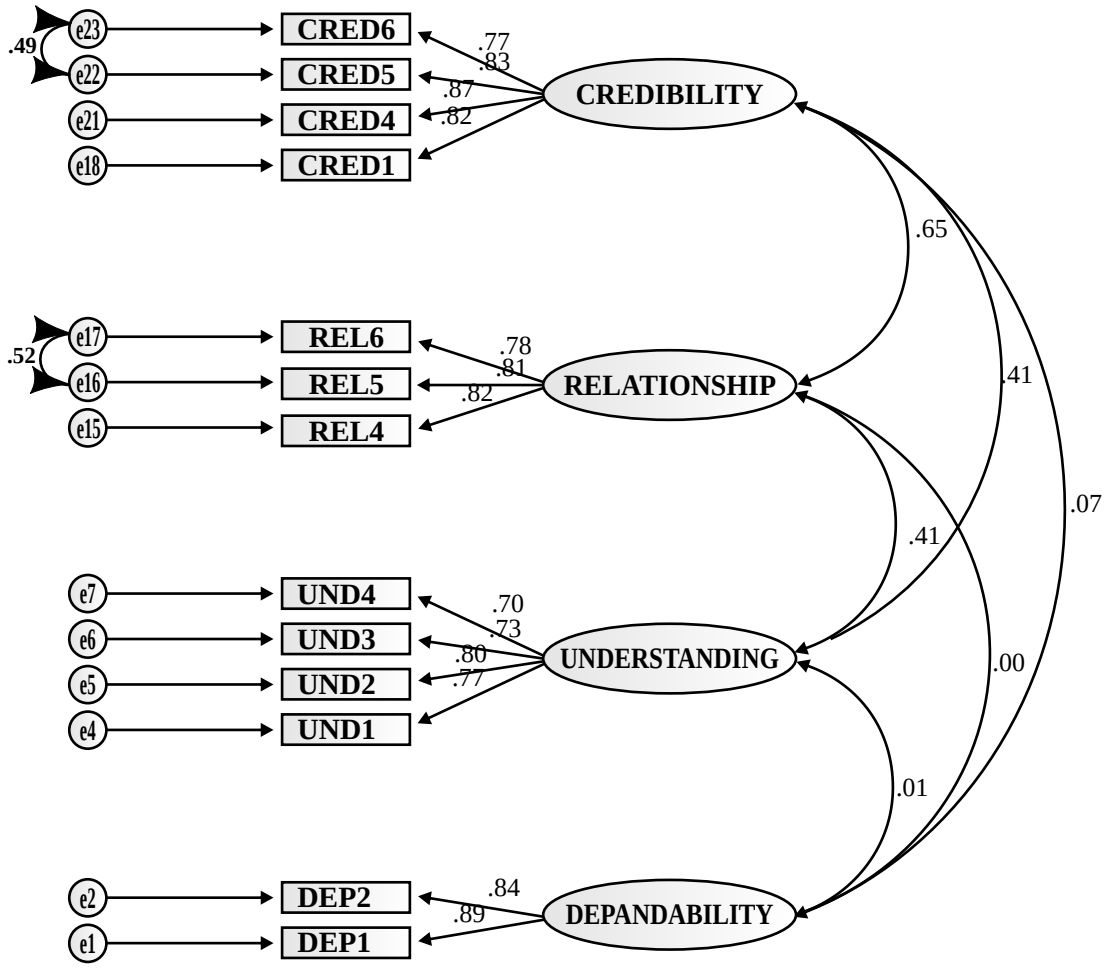

Figure 3: CFA Model Development for measuring Supplier Service Quality

Model Fit

Various goodness-of-fit indices are obtained by running the model using AMOS v21. The Normed Chi-square value for this model is 1.342, which represents a good fit. The acceptable ratio of Normed Chi-square value is up to 3 or even 5 (Bollen *et al.*, 1989). The Goodness-of-Fit Index (GFI), the Comparative Fit Index (CFI) and the Normed Fit Index (NFI) values for this model were 0.911, 0.977, and 0.918 respectively. The RMSEA value of 0.054 indicates a reasonable fit. From these values it is inferred that model represents an adequate fit.

Interpretation of Factor Structure

The four factors specify service quality delivered by suppliers to their respective manufacturing units.

The total variance explained by the four factors in the second round of factor analysis was 73.319 percent in comparison to a total variance of 73.301 percent, explained by the five factors in the first round of factor analysis. The results suggested that the four factors (dimensions) explain supplier service quality in small-medium manufacturing in a marginally better manner. Thus, the final model of supplier service quality has four dimensions, as the fifth dimension has been removed.

The first factor labeled as "Credibility (the supplier's aspect of providing honest and dependable service to manufacturer)" accounts for 26.727 percent of the variance. The four items defining this factor, with factor loadings ranging from 0.871 to 0.769 include the items namely, "market reputation of supplier", "flexibility to change product design", "innovativeness in operations", and "competent and technically sound employees". The factor draws relevance from (Abby *et al.,* 1994; Ravi *et al.,* 1999; Robert *et al.,*1995).

The second factor labeled as "Relationship (aspect of giving importance to human and behavioural factors)" accounts for 20.480 percent of the variance. The three items describing this factor, with factor loadings ranging from 0.812 to 0.757, includes the items namely, "long-term relationship," "flexible terms and conditions," and "polite and courteous employees." The factor has relevance with (Parasuraman *et al.,* 1985) from literature.

The third factor labeled as "Understanding (the aspect of appreciating the requirements of manufacturing unit, valuing its convenience, and providing timely information)" accounted for 13.883 percent of the variance. The two items defining this factor, with factor loadings ranging from 0.826 to 0.758, include the items namely, "understanding of requirements", "valuing convenience", "sharing work-related information and knowledge" and "honesty in providing information/access." The factor bears relevance with (Parasuraman *et al.,* 1985) from marketing literature.

The fourth factor labeled as "Dependability (the aspect of accuracy in performance of service provided by supplier as per commitment)." accounts for 12.228 percent of the variance. The two items defining this factor, with factor loadings 0.913 and 0.894, include the items namely, "delivering right quality in right quantity at time", and "charging minimum price for supplies. The factor bears relevance with (Parasuraman *et al.,* 1988; Cronin *et al.,* 1992) from marketing literature.

Mean scores and SDs of 13 items finally used in the scale with their underlying factors are calculated using MS Excel and are depicted in table 6.

Table 6: Summary Statistics of Factor Scores of Supplier Service Quality (N=120)

Factors underlying Extrinsic Service Quality	**Mean**	**Standard Deviation**	**Overall Score of Factor**	
	Measurement on 5-point Likert Scale		**Mean**	**Standard Deviation**
Scores of Supplier Service Quality				
Credibility				
Supplier has strong market reputation	3.54	0.952	**3.61**	**0.922**
Supplier has flexibility to change product design	3.63	0.944		

Supplier is innovative in operations	3.80	0.805		
Has competent & technically sound employees	3.48	0.987		
Relationship				
Supplier has long term relationship with your unit	3.05	0.960	**3.07**	**0.933**
Supplier agrees to flexible terms & conditions	3.09	0.961		
Supplier's employees are polite & Courteous	3.07	0.877		
Understanding				
Supplier understands requirements of your unit	2.72	0.980	**2.82**	**0.988**
Supplier values your convenience	3.26	0.957		
Shares work related information and knowledge	2.56	1.011		
Honest in providing information/access to you	2.73	1.004		
Dependability				
Delivers right quality in right quantity at time	3.82	0.830	**3.75**	**0.890**
Supplier charges minimum price for supplies	3.78	0.884		

Validity of Construct

a. *Face Validity*

Face validity is assessed by looking at the measures 'on-its-face', which gives a good reflection of supplier service quality (in line with Trochim *et al.,* 2007).

b. *Content Validity*

Content validity of the questionnaire items is satisfactorily assessed by discussions with scholars, insights derived from the literature, and the researcher's own knowledge (Trochim *et al.,* 2007). Subsequent refinement of this scale was ensured through focus group discussion with representatives from small-medium manufacturing units. The instrument thus has strong content validity.

c. *Construct Validity*

Construct validity is assessed through following three steps:

i. Unidimensionality: CFA model developed in this analysis indicates CFI value (0.977) which implies a strong unidimensionality (Barbara *et al.,* 1994).
ii. Convergent validity: Convergent validity relates to the degree to which multiple methods of measuring a variable provide the same results. Convergent validity can be established using Normed Fit Index (Bentler *et al.,* 1980). A value of 0.90 or above reflects evidence for strong convergent validity. In the purified CFA model, the NFI value of 0.918 depicts strong convergent validity.
iii. Discriminant Validity: Discriminant validity measures the degree to which a construct and its indicators are different from another construct and its indicators (Richard *et al.,* 1991). For discriminant validity to hold, square root of the average variance extracted (AVE) for a given construct, should be greater than the absolute value of the standardized correlation of the given construct with any other construct in the analysis (Claes *et al.,* 1981). The square root of AVE for each of the factor is shown in the diagonal cells, and the Correlation Coefficient of a factorwith the other factors is shown in the non-diagonal cells of the table 7. The square root of AVE for each of the factors was greater than the Correlation Coefficient of that factor with the other factors, and this supported the discriminant validity of the scale.

Table 7: Results of Discriminant Validity for the scale for measuring Supplier Service Quality

	Understanding	**Credibility**	**Relationship**	**Dependability**
Understanding	**0.750**			
Credibility	0.400	**0.887**		
Relationship	0.411	0.616	**0.816**	
Dependability	0.015	0.123	0.029	**0.839**

The $\sqrt{}$ AVE is depicted in the diagonal cells and the correlation in other cells

d. *Predictive Validity*

Predictive validity is established when a criterion external to the measurement instrument is correlated with the factor structure (Jumet al., 1978). The predictive validity of the four dimensions of employees' Service Quality was measured by finding the correlation of each one of them with mean scores of overall supplier service quality (OSSQ) (being an external criteria) using Pearson correlation. All the correlation coefficients were positive and significant at a significance level of 0.05. This assured the predictive validity of the newly developed scale. The results of correlation analysis are shown in the table 8.

Table 8: Results of correlation between dimensions and overall supplier service quality

Dimension	**Correlation with overall supplier service quality (OSSQ)**
Credibility	.360*
Relationship	.500*
Understanding	.683*
Dependability	.699*

* Correlation is significant at the 0.05 level (2-tailed).

Relative importance of factors of scale for measuring Supplier Service Quality

To bring out the order of importance of four dimensions viz. Credibility, Relationship, Understanding, and Dependability comprising the SSQ, regression analysis was conducted by taking the overall supplier service quality ratings as dependent variable and the mean scores on the four factors as independent variables. The standardized coefficient beta (β) of the individual dimension represented their importance (Parasauraman *et al.*, 1985, 1988) as presented in table 9.

Table 9: Regression results for relative importance of SSQ dimensions

Independent Variables	**R^2/Sig.**	**Beta (β)**	**Sig.**	**Order of importance**
Dependability	0.809/0.000	0.392	0.000	**1**
Understanding		0.295	0.000	**2**
Credibility		0.241	0.000	**3**
Relationship		0.099	0.003	**4**

Constant :0.047, t = 0.271 (Sig. = 0.787); Dependent variable: OverallSupplier Service Quality

The results clearly show significance of overall regression model (F = 121.800, p < 0.00), with 81% of the variance in Supplier Service Quality is explained by independent variables. The significant factors that remained in the equation in the overall service quality and are shown in order of their importance based on β co-efficient. Higher the standardized β co-efficient, the more the factor contributes to explaining dependable variable (Lee *et al.*, 2000).

The factor 'Dependability' emerges to be the most important dimension, with β coefficient = 0.392 followed by 'Understanding' (β = 0.295), 'Credibility' (β = 0.241) and 'Relationship' to have the lowest impact (β = 0.099).

Significance of Results

This study has shown how the scale was built and expressed its usefulness for the managers of small-medium manufacturing units. Figure 4 presents typical benefits gained by monitoring and control of dimensions of scale. Also, the individual benefits of each dimension are highlighted.

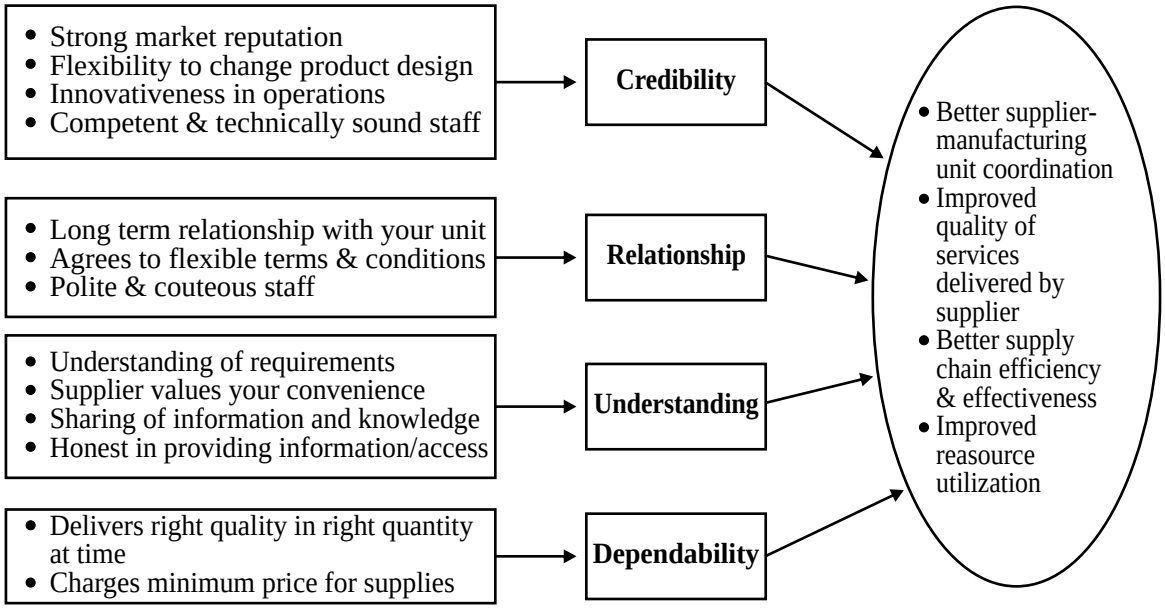

Figure 4: Proposed benefits of Supplier service quality

The scale for measuring SSQ can be utilized by managers of manufacturing units in following ways:

1. The insights provided by this study can help managers and researchers in further understanding the service quality delivered by suppliers in small-medium manufacturing units.

2. The scaleyields four useful determinants to measure supplier service quality offered to the manufacturing unit viz. Credibility, Relationship, Understanding, and Dependability. The total scale can be obtained by adding the scores on individual dimensions.

3. The scores on individual sub-dimensions indicate suggestions for improvements to suppliers' unit along those areas.The scalecan also be used as a diagnostic tool for identifying poor and/or excellent

performance to benchmark across multiple departments within a single manufacturing unit. Furthermore, any of these situations can also be compared across time.

4. Based on performance assessment using these scales, an incentive or reward system can be proposed by supplier to reward timely delivery, quickness in resolving complaints, innovation, and agility exhibited by particular employees.

Conclusion

This research has highlighted the role of service quality in supplier-manufacturer transactions and has identified four supplier service quality dimensionsnamely: Credibility, Relationship, Understanding, and Dependability to measure supplier service quality in supply chains in the context of small-medium manufacturing enterprises. The factors obtained in this study differ from the most popular service quality measurement tools, i.e. SERVQUAL as well as FAIRSERV scale used in this particular study. Thus, the study has proposed a new scale, using inputs from literature and practitioners of small-medium manufacturing enterprises. The methodology followed in the present research was very similar to the one adopted by (Nitin *et al.,* 2006). The results of this study must be interpreted by bearing in mind certain limitations. The questionnaire survey was administered on the professionals from northern India. In this study, it was not possible to derive a linkage between manufacturer's attitude and the factors deriving the supplier service quality.

SSQ can also be used at different periods of time to track the evolution of service quality delivery. Specifically, employees at supplier end should appreciate relationships with manufacturing unit and take necessary actions to improve communication, and solve delivery-related problems. Though, a strong need is realized for the empirical research linking this to the manufacturing unit's performance. Finally, this study is an attempt to understand supplier service quality and highlight the potential area for future research.

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