International Journal of Research in Engineering, Science and Management
Volume-2, Issue-9, September-2019
www.ijresm.com | ISSN (Online): 2581-5792

Assessing the Variables to Evaluate the Caliber of the Suppliers and Efficiency of Transportation in a Supply Chain through the Validity Test in E-Retail Industry

L. Sudershan Reddy[1], Parigya Kulshrestha[2]
[1]*Professor, Department of Management, Jain University, Bangalore, India*
[2]*Research Scholar, Department of Marketing, Jain University, Bangalore, India*

***Abstract*: This paper attempts to give insight into the supply chain of E-retail industry. The reliability of the suppliers and the productivity of the transportation in the supply chain network is evaluated using various variables. This paper analyzes those variables using the KMO and Bartlett's validity test. The data is captured through pilot study questionnaire. The respondents belong to the companies from the E-Retail Industry.**

***Keywords*: Supply Chain Management, E-retail, Supplier, Transportation, Pilot Study, Validity Test, KMO and Bartlett's Test**

1. Introduction

Supply chain management is the flow of products and services from the manufacturer end of the line to the customer end of the line. There are many units involved in creating a product or a service and then getting it delivered to the end customer. It is basically various sections of a business working together to create a quality product or service for the customer. Supply chain is the back bone of every industry today. It provides a systematic procedure for the industries to set their business upon. Supply chain helps to make the flow of every business easy and efficient.

Application of this concept helps in enhanced productivity as all the processes assist in delivering effective results. Implementation of the supply chain can increase efficiency only when it is entirely understood. Incomplete knowledge on this concept can provide adverse results. Application of supply chain theory depends on the need of the organization. It is of utmost importance to understand the 'need criteria' of the organization to decide the procedures that would be applicable to the particular organization [2].

E-retail provides the virtual world of convenience to the customers. It provides products from around the globe in numerous categories with an amalgamation of the intercontinental trends. It shows that 'customer is king' and customers do play a vital role in the development of the e-retail. The feedback and the complaints received from the customers gives supervision to the companies to alter their course to serve their customers in a productive manner [3].

Suppliers play a vital role in the supply chain of any company. The entire process is dependent on them because they either provide the raw materials or the product or the services on which the entire business is dependent. They are the critical elements for the efficient performance of the supply chain. Having a long-term relationship with reliable suppliers is a must. Therefore, choosing suppliers is a great task that has to be done keeping related factors under consideration [4].

Transportation is responsible for delivering or products. This delivery can be classified in two ways. First, the delivery made from the suppliers to the e-retailer. Second, the delivery made from the e-retailer to the end customers. Transportation does not only involve the delivery process but it also involves tracking process. Today, in the internet age the customers want to know every minute, the location of their ordered product. Thus, having an efficient and well tracked transportation network is mandatory to run a successful supply chain resulting in profitable business.

2. Literature Review

S. Kumar (2008) [5], supply chain management is the process of integration and coordination of all the activities involved delivering product or service from raw material to the customer into a seamless process. SCM is the integrating philosophy to manage the total flow of a distribution channel from supplier to customer. In order integrate the different partners to supply chain, all the partner have to share information.

A. Jayant, S. Kumar, P. Gupta, S.K. Garg (October 2009 – March 2010) [6], the process of supply chain management plays a key role for unorganized sector where there is very little integration of the supply chain at successive stages thus limiting the use of information sharing that could have made the entire supply chain smooth, streamlined and highly responsive to the customer needs.

Niraj S, Nageswara Rao (2015) [7], in the Indian market, the e-retailers have been growing manifold (to the tune of 200-300 per cent y-o-y) in top line but the irony is none of the e-retailers are yet profitable in India. The profit-loss ledger continues to sail deep inside the red sea.

Ashraf W. Labib (November 2011) [8], the supplier selection problem has been studied by many authors. For example, authors in this journal who have investigated supplier selection include; Jain et al. (2007), Kannan and Noorul Haq (2007), Sevkli et al. (2007), Chan et al. (2008), Lee and Ou-Yang (2008), Che (2010), Liu and Zhang (2010), Ravindran et al. (2010), Sen et al. (2010), Talluri and Lee (2010), and Yao et al. (2010).

Alexandre M. Rodrigues, Theodore P. Stank, Daniel F. Lynch (2004) [9], supply chain management can create value by synchronizing logistical activities among participants to reduce costs associated with duplication of effort and positioning the entire supply chain to better serve key customers (Bowersox, Closs, and Stank 1999; Stank, Keller, and Closs 2001). Cost effective and hard to replicate logistical capabilities involve a high degree of operational integration within the firm to link procurement, the inbound movement of raw materials, manufacturing, delivery of products and services to end-users, and processing returns from customers, in a cost-effective manner.

Virginija Kavaliauskiene, Neringa Survilaite Bagdonaviciute (2003) [10], at present, the logistical operations are heavily dependent on informational technology (IT).

Wainer and Braun (1998) [11], describe the validity in quantitative research as "construct validity". The construct is the initial concept, notion, question or hypothesis that determines which data is to be gathered and how it is to be gathered. They also assert that quantitative researchers actively cause or affect the interplay between construct and data in order to validate their investigation, usually by the application of a test or other process. In this sense, the involvement of the researchers in the research process would greatly reduce the validity of a test.

Creswell and Miller (2000) [12], suggests that the validity is affected by the researcher's perception of validity in the study and his/her choice of paradigm assumption.

Validity Test:

This test will tell us whether the measuring device is actually measuring what we are aiming for. Through this test we ensure that the knowledge which we are getting is what we intended for [13].

The validity test chosen for this study is:

KMO & Bartlett's Test

KMO test is also known as Kaiser-Meyer-Olkin test. This test measures the adequacy of the sampling for all the variables involved in the research model. [14]

Formula of KMO test is:

$$MO_j = \frac{\Sigma_{i \neq j} r_{ij}^2}{\Sigma_{i \neq j} r_{ij}^2 + \Sigma_{i \neq j} u}$$

Where,

$R = [r_{ij}]$ is Correlation Matrix

$U = [u_{ij}]$ is Partial Covariance Matrix

The KMO value can be interpreted as per the following table:

Table 1
KMO Value Interpretation Criteria

KMO Value	Interpretation of Sampling Adequacy
1 to 0.9	Very Good
0.8 to 0.9	Good
0.7 to 0.8	Medium
0.6 to 0.7	Reasonable
0.5 to 0.6	Acceptable
< 0.5	Unacceptable

3. Reliability of suppliers

Table 2
Descriptive Statistics for Reliability of Suppliers

Descriptive Statistics				
	Mean	Std. Deviation	Analysis N	Missing N
Q.18A.Stability	3.9556	0.63802	45	0
Q.18B.Cost	3.9333	0.75076	45	0
Q.18C.Performance	4.0444	0.67270	45	0
Q.18D.Transport	3.8444	0.67270	45	0
Q.18E.Loss	3.9111	0.51444	45	0
Q.18F.Product	4.3778	0.64979	45	0
Q.18G.Delivery	4.1333	0.50452	45	0
Q.18H.OrderCycleTime	4.0667	0.61791	45	0
Q.18I.Returns	4.2000	0.66058	45	0
Q.18J.Complaints	4.2000	0.81464	45	0
Q.18K.Service	4.5333	0.81464	45	0
Q.19.LongTerm	4.0444	0.47461	45	0
Q.20.VendorProductQuality	3.8667	0.62523	45	0
Q.21.Improvement	3.8667	0.78625	45	0
Q.22.Planning	3.6000	0.88933	45	0
Q.23.Problems	3.6444	0.67942	45	0
Q.24.LeadTime	3.6889	0.70137	45	0
Q.25.Delay	8.4000	17.60088	45	0
Q.40.Variations	18.2222	26.11155	45	0

International Journal of Research in Engineering, Science and Management
Volume-2, Issue-9, September-2019
www.ijresm.com | ISSN (Online): 2581-5792

Table 3
Correlation Matrix for Reliability of Suppliers

Correlation Matrix[a]

		Q.18.(A)	Q.18.(B)	Q.18.(C)	Q.18.(D)	Q.18.(E)	Q.18.(F)	Q.18.(G)	Q.18.(H)	Q.18.(I)	Q.18.(J)	Q.18.(K)	Q.19.	Q.20.	Q.21.	Q.22.	Q.23.	Q.24.	Q.25.	Q.40.
Correlation	Q.18.(A)	1.000	0.468	0.587	0.619	0.403	0.480	0.442	0.008	0.453	0.717	0.703	0.082	-0.072	0.079	-0.032	0.068	-0.286	0.040	0.127
	Q.18.(B)	0.468	1.000	0.411	0.249	0.455	0.379	0.144	0.157	0.348	0.357	0.580	0.136	0.029	0.177	0.197	0.264	-0.040	0.203	0.252
	Q.18.(C)	0.587	0.411	1.000	0.367	0.471	0.429	0.250	0.266	0.440	0.440	0.536	-0.006	0.068	0.054	0.258	0.035	-0.115	-0.009	0.093
	Q.18.(D)	0.619	0.249	0.367	1.000	0.353	0.449	0.464	0.080	0.327	0.597	0.445	0.093	-0.050	0.003	0.084	0.025	-0.201	-0.104	-0.028
	Q.18.(E)	0.403	0.455	0.471	0.353	1.000	0.307	0.134	0.448	0.522	0.369	0.387	-0.077	-0.038	-0.142	0.169	0.298	-0.015	-0.157	0.057
	Q.18.(F)	0.480	0.379	0.429	0.449	0.307	1.000	0.536	0.162	0.402	0.455	0.598	0.092	-0.209	0.056	-0.047	-0.101	-0.285	0.074	0.245
	Q.18.(G)	0.442	0.144	0.250	0.464	0.134	0.536	1.000	0.044	0.259	0.376	0.376	0.259	-0.014	0.103	-0.081	0.009	-0.201	0.160	0.060
	Q.18.(H)	0.008	0.157	0.266	0.080	0.448	0.162	0.044	1.000	0.245	0.018	0.154	0.067	0.141	0.112	0.256	0.220	0.049	0.142	0.210
	Q.18.(I)	0.453	0.348	0.440	0.327	0.522	0.402	0.259	0.245	1.000	0.473	0.557	-0.029	-0.044	0.009	0.255	0.111	-0.059	-0.058	0.020
	Q.18.(J)	0.717	0.357	0.440	0.597	0.369	0.455	0.376	0.018	0.473	1.000	0.658	-0.024	0.098	0.185	0.207	0.090	-0.127	-0.039	-0.065
	Q.18.(K)	0.703	0.580	0.536	0.445	0.387	0.598	0.376	0.154	0.557	0.658	1.000	0.055	-0.036	0.185	0.176	0.145	0.019	0.013	0.061
	Q.19.	0.082	0.136	-0.006	0.093	-0.077	0.092	0.259	0.067	-0.029	-0.024	0.055	1.000	0.480	0.382	0.097	0.473	0.247	0.232	-0.026
	Q.20.	-0.072	0.029	0.068	-0.050	-0.038	-0.209	-0.014	0.141	-0.044	0.098	-0.036	0.480	1.000	0.749	0.597	0.581	0.422	0.044	-0.346
	Q.21.	0.079	0.177	0.054	0.003	-0.142	0.056	0.103	0.112	0.009	0.185	0.185	0.382	0.749	1.000	0.670	0.462	0.212	0.196	-0.160
	Q.22.	-0.032	0.197	0.258	0.084	0.169	-0.047	-0.081	0.256	0.255	0.207	0.176	0.097	0.597	0.670	1.000	0.436	0.379	0.095	-0.177
	Q.23.	0.068	0.264	0.035	0.025	0.298	-0.101	0.009	0.220	0.111	0.090	0.145	0.473	0.581	0.462	0.436	1.000	0.573	-0.028	-0.213
	Q.24.	-0.286	-0.040	-0.115	-0.201	-0.015	-0.285	-0.201	0.049	-0.059	-0.127	0.019	0.247	0.422	0.212	0.379	0.573	1.000	-0.074	-0.336
	Q.25.	0.040	0.203	-0.009	-0.104	-0.157	0.074	0.160	0.142	-0.058	-0.039	0.013	0.232	0.044	0.196	0.095	-0.028	-0.074	1.000	0.662
	Q.40.	0.127	0.252	0.093	-0.028	0.057	0.245	0.060	0.210	0.020	-0.065	0.061	-0.026	-0.346	-0.160	-0.177	-0.213	-0.336	0.662	1.000
Sig. (1-tailed)	Q.18.(A)		0.001	0.000	0.000	0.003	0.000	0.001	0.480	0.001	0.000	0.000	0.297	0.319	0.304	0.417	0.330	0.029	0.397	0.202
	Q.18.(B)	0.001		0.003	0.050	0.001	0.005	0.173	0.152	0.010	0.008	0.000	0.186	0.425	0.122	0.097	0.040	0.396	0.090	0.047
	Q.18.(C)	0.000	0.003		0.007	0.001	0.002	0.049	0.039	0.001	0.001	0.000	0.484	0.328	0.361	0.043	0.409	0.227	0.476	0.273
	Q.18.(D)	0.000	0.050	0.007		0.009	0.001	0.001	0.300	0.014	0.000	0.001	0.271	0.371	0.493	0.293	0.434	0.092	0.248	0.428
	Q.18.(E)	0.003	0.001	0.001	0.009		0.020	0.190	0.001	0.000	0.006	0.004	0.309	0.403	0.175	0.134	0.024	0.460	0.152	0.354
	Q.18.(F)	0.000	0.005	0.002	0.001	0.020		0.000	0.143	0.003	0.001	0.000	0.275	0.084	0.357	0.379	0.255	0.029	0.315	0.052
	Q.18.(G)	0.001	0.173	0.049	0.001	0.190	0.000		0.388	0.043	0.005	0.005	0.043	0.463	0.250	0.298	0.477	0.092	0.147	0.348
	Q.18.(H)	0.480	0.152	0.039	0.300	0.001	0.143	0.388		0.052	0.453	0.157	0.331	0.177	0.231	0.045	0.073	0.375	0.177	0.083
	Q.18.(I)	0.001	0.010	0.001	0.014	0.000	0.003	0.043	0.052		0.001	0.000	0.425	0.387	0.477	0.045	0.233	0.350	0.353	0.449
	Q.18.(J)	0.000	0.008	0.001	0.000	0.006	0.001	0.005	0.453	0.001		0.000	0.439	0.261	0.112	0.086	0.278	0.202	0.400	0.335
	Q.18.(K)	0.000	0.000	0.000	0.001	0.004	0.000	0.005	0.157	0.000	0.000		0.360	0.408	0.112	0.124	0.171	0.452	0.465	0.346
	Q.19.	0.297	0.186	0.484	0.271	0.309	0.275	0.043	0.331	0.425	0.439	0.360		0.000	0.005	0.263	0.001	0.051	0.063	0.431
	Q.20.	0.319	0.425	0.328	0.371	0.403	0.084	0.463	0.177	0.387	0.261	0.408	0.000		0.000	0.000	0.000	0.002	0.387	0.010
	Q.21.	0.304	0.122	0.361	0.493	0.175	0.357	0.250	0.231	0.477	0.112	0.112	0.005	0.000		0.000	0.001	0.081	0.098	0.147
	Q.22.	0.417	0.097	0.043	0.293	0.134	0.379	0.298	0.045	0.045	0.086	0.124	0.263	0.000	0.000		0.001	0.005	0.268	0.122
	Q.23.	0.330	0.040	0.409	0.434	0.024	0.255	0.477	0.073	0.233	0.278	0.171	0.001	0.000	0.001	0.001		0.000	0.428	0.080
	Q.24.	0.029	0.396	0.227	0.092	0.460	0.029	0.092	0.375	0.350	0.202	0.452	0.051	0.002	0.081	0.005	0.000		0.314	0.012
	Q.25.	0.397	0.090	0.476	0.248	0.152	0.315	0.147	0.177	0.353	0.400	0.465	0.063	0.387	0.098	0.268	0.428	0.314		0.000
	Q.40.	0.202	0.047	0.273	0.428	0.354	0.052	0.348	0.083	0.449	0.335	0.346	0.431	0.010	0.147	0.122	0.080	0.012	0.000	

a. Determinant = 5.06E-006

The above Table 2, gives the mean and the standard deviation of the variables used to analyze the reliability of suppliers using the KMO & Bartlett’s Test. The column 'Analysis N' shows the number of respondents that is 45. The column 'Missing N' is 0 for all the variables. This states that none of the respondents missed the questions.

The reliability of suppliers is analyzed using the 19 variables as listed in the above Table 2. The variable Q.40.Variations shows the highest mean of 18.2222. This indicates that the variable Q.40.Variations is the most important variable in interpreting the reliability of the suppliers.

If column 'Mean' is observed around 10 variables have mean of 4 or above. They have a significant role in contributing a great deal towards analyzing too.

The above Table 3, showcases the correlation of every variable with each of the other variable. The correlation matrix is divided into two parts. The upper half of the correlation table represents the Pearson correlation coefficient. The lower half of the correlation table represents the one-tailed significance of the coefficients of the Pearson correlation.

The upper half of the table does not consist of any value greater than 0.9 for any of the variables. This means there is no singularity present in the data.

The determinant of the correlation matrix obtained is 5.06E-006, that is, 0.00000506 which is less than 0.00001. This indicates that the problem of multi collinearity does exist for the above data.

In this case, deleting of variables will have to be considered that have a correlation value less than 0.3.

Table 4
KMO and Bartlett's Test Value for Reliability of Suppliers

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.679
Bartlett's Test of Sphericity	Approx. Chi-Square	449.160
	df	171
	Sig.	0.000

The above shown Table 4, shows the KMO and Bartlett's test output.

The Kaiser-Meyer-Olkin (KMO) value obtained is 0.679. If we compare this value with the values in the Table 1, it is clear that the value 0.679 is an acceptable value. This means that the sum of partial correlations is not large in comparison to the sum of correlations. The sum of analysis variables is 67.9%. This indicates there is no diffusion in the correlation pattern. Hence, the factor analysis is appropriate in this case. Therefore, reliable and distinct factors would be obtained from the factor analysis of these data.

The Table 4, also contains the Bartlett's Test of Sphericity. The Approx. Chi-Square value obtained is 449.160. The significance value p of the Bartlett's Test of Sphericity is 0.000. The p-value 0.000 is less than 0.001. Thus, the correlation matrix is not an identity matrix. This indicates relationship strength amongst the variables. Thus, factor analysis is applicable for this set of data.

Table 5
Communalities for Reliability of Suppliers

Communalities		
	Initial	Extraction
Q.18A.Stability	1.000	0.763
Q.18B.Cost	1.000	0.516
Q.18C.Performance	1.000	0.567
Q.18D.Transport	1.000	0.593
Q.18E.Loss	1.000	0.803
Q.18F.Product	1.000	0.614
Q.18G.Delivery	1.000	0.647
Q.18H.OrderCycleTime	1.000	0.559
Q.18I.Returns	1.000	0.555
Q.18J.Complaints	1.000	0.743
Q.18K.Service	1.000	0.704
Q.19.LongTerm	1.000	0.804
Q.20.VendorProductQuality	1.000	0.819
Q.21.Improvement	1.000	0.863
Q.22.Planning	1.000	0.829
Q.23.Problems	1.000	0.793
Q.24.LeadTime	1.000	0.595
Q.25.Delay	1.000	0.821
Q.40.Variations	1.000	0.851

Since, all the communality extraction values are more than 0.5, all the variables will be considered for further analysis.

Table 6
Total Variance for Reliability of Suppliers

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.246	27.610	27.610	5.246	27.610	27.610	4.729	24.891	24.891
2	3.511	18.479	46.089	3.511	18.479	46.089	2.932	15.430	40.321
3	1.944	10.232	56.322	1.944	10.232	56.322	2.124	11.181	51.502
4	1.635	8.603	64.924	1.635	8.603	64.924	2.002	10.537	62.039
5	1.103	5.806	70.730	1.103	5.806	70.730	1.651	8.691	70.730
6	0.959	5.045	75.775						
7	0.719	3.785	79.560						
8	0.630	3.317	82.877						
9	0.563	2.961	85.838						
10	0.532	2.799	88.637						
11	0.443	2.333	90.971						
12	0.420	2.212	93.183						
13	0.332	1.746	94.928						
14	0.284	1.495	96.423						
15	0.179	0.941	97.364						
16	0.165	0.869	98.233						
17	0.158	0.832	99.065						
18	0.112	0.588	99.654						
19	0.066	0.346	100.000						

The above Table 6, represents the variance of the 19 components.

The three stages of the above Table 6 are:

a) Variance before extraction denoted by the column 'Initial Eigenvalues'.
b) Variance after extraction denoted by the column 'Extraction Sums of Squared Loadings'.
c) Variance after rotation denoted by the column 'Rotation Sums of Squared Loadings'.

At the first 'before extraction' stage, the total number of components is equal to the total number of variables used in the test.

In Table 6, observe the 'Total' column in the 'Initial Eigenvalues' columns. The first five components have large amount of variance as the eigenvalues for them is more than 1 with respect to the other fourteen components which have eigenvalues less than 1.

In Table 6, observe '% of Variance' column in the 'Initial Eigenvalues' columns. The deductions made from this column are as followed:

The component 1 explains 27.610% of the total variance.
The component 2 explains 18.479% of the total variance.
The component 3 explains 10.232% of the total variance.
The component 4 explains 8.603% of the total variance.
The component 5 explains 5.806% of the total variance.
The component 6 explains 5.045% of the total variance.
The component 7 explains 3.785% of the total variance.
The component 8 explains 3.317% of the total variance.
The component 9 explains 2.961% of the total variance.
The component 10 explains 2.799% of the total variance.
The component 11 explains 2.333% of the total variance.
The component 12 explains 2.212% of the total variance.
The component 13 explains 1.746% of the total variance.
The component 14 explains 1.495% of the total variance.
The component 15 explains 0.941% of the total variance.
The component 16 explains 0.869% of the total variance.
The component 17 explains 0.832% of the total variance.
The component 18 explains 0.588% of the total variance.
The component 19 explains 0.346% of the total variance.

At the second 'after extraction' stage, the components having eigenvalues less than 1 are extracted. So, only the first five components are retained at this stage as they have eigenvalues above 1. The eigenvalues of the column 'Total' in both the 'Initial Eigenvalues' column and 'Extraction Sums of Squared Loadings' remain same.

At the third 'after rotation' stage, the factor structure is optimized and all the five components are equalized. The observations at this stage are:

For component 1, it accounted for 27.610% of variance for rotation. Now it accounts for 24.891% of variance.

For component 2, it accounted for 18.479% of variance for rotation. Now it accounts for 15.430% of variance.

For component 3, it accounted for 10.232% of variance for rotation. Now it accounts for 11.181% of variance.

For component 4, it accounted for 8.603% of variance for rotation. Now it accounts for 10.537% of variance.

For component 5, it accounted for 5.806% of variance for rotation. Now it accounts for 8.691% of variance.

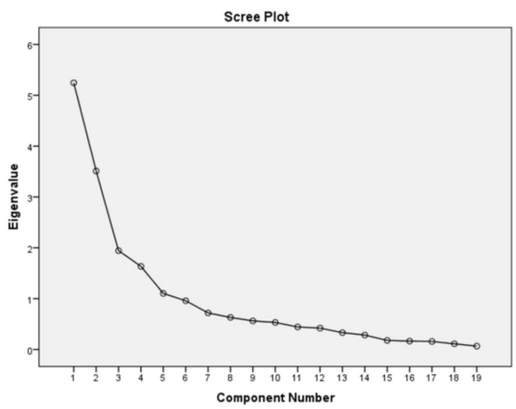

Fig. 1. Scree Plot for Reliability of Suppliers

The Figure 1 above, represents the eigenvalues of all the components as a graph. This scree plot is the representation of the Table 6. This graph will be estimated using the help of Table 6.

The Y-axis on the graph represents the 'Eigenvalues' ranging from 0 to 6. The maximum value of 6 is obtained from the column 'Total' of the column 'Initial Eigenvalues'. This column of eigenvalues has been represented as points on the curve of the scree plot in the Figure 3.

The X-axis on the graph represents the 'Component Number'. These values have been obtained from the Table 6 from the column 'Component'. The values of the 'Component Number' vary from 1 to 19.

When Figure 3 is observed, it is found that the curve in the scree plot begins to flatten between the component 5 and component 6. The curve also portrays that the eigenvalues for the components 1 to 5 are above 1. From components 6 to 19, the eigenvalues are less than 1.

Therefore, after the process of extraction only 5 factors have been retained.

The Table 7, showcases the extracted values of each of the 19 variables of the column 1 under the 5 components which were extracted in the Table 6.

This means that the 19 variables are divided into 5 components.

The extracted values represent the extent to which each component contributes towards the understanding of the respective variable.

The Table 7, shows the extracted values above 0.4 only because that criterion was chosen for the test, to read the table easily. This was done as higher the extracted value, the higher that particular component contributes towards the understanding of that particular variable. The highest value for some components is 0.4. The empty cells of the table mean that the value extracted was less than 0.4.

Table 7
Component Matrix for Reliability of Suppliers

Component Matrix[a]					
	Component				
	1	2	3	4	5
Q.18K.Service	0.833				
Q.18A.Stability	0.821				
Q.18J.Complaints	0.770				
Q.18C.Performance	0.706				
Q.18F.Product	0.693				
Q.18I.Returns	0.674				
Q.18D.Transport	0.668				
Q.18B.Cost	0.642				
Q.18E.Loss	0.620			0.544	
Q.18G.Delivery	0.536			-0.487	
Q.20.VendorProduct Quality		0.880			
Q.23.Problems		0.772			
Q.21.Improvement		0.748			
Q.22.Planning		0.716			-0.453
Q.24.Lead Time		0.679			
Q.25.Delay			0.894		
Q.40.Variations			0.775		
Q.18H.OrderCycleTime				0.599	
Q.19.Long Term		0.502			0.513

The inference made from the above Table 7 are as follows:

The loading of variable Q.18K.Service on component 1 is 0.833.\
The loading of variable Q.18AStability on component 1 is 0.821.
The loading of variable Q.18J.Complaints on component 1 is 0.770.
The loading of variable Q.18C.Performance on component 1 is 0.706.
The loading of variable Q.18F.Product on component 1 is 0.693.
The loading of variable Q.18I.Returns on component 1 is 0.674.
The loading of variable Q.18D.Transport on component 1 is 0.668.
The loading of variable Q.18B.Cost on component 1 is 0.642.
The loading of variable Q.18E.Loss on component 1 is 0.620.
The loading of variable Q.18G.Delivery on component 1 is 0.536.

The loading of variable Q.20.VendorProductQuality on component 2 is 0.880.
The loading of variable Q.23.Problems on component 2 is 0.772.
The loading of variable Q.21.Improvement on component 2 is 0.748.
The loading of variable Q.22.Planning on component 2 is 0.716.
The loading of variable Q.24.LeadTime on component 2 is 0.679.
The loading of variable Q.25.Delay on component 3 is 0.894.
The loading of variable Q.40.Variations on component 3 is 0.775.
The loading of variable Q.18H.OrderCycleTime on component 4 is 0.599.
The loading of variable Q.19.LongTerm on component 5 is 0.513.

Table 8
Rotated Component Matrix for Reliability of Suppliers

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5
Q.18A.Stability	0.869				
Q.18J.Complaints	0.823				
Q.18K.Service	0.787				
Q.18D.Transport	0.745				
Q.18F.Product	0.717				
Q.18G.Delivery	0.636				0.418
Q.18C.Performance	0.609				
Q.18I.Returns	0.562		0.458		
Q.18B.Cost	0.476		0.434		
Q.21.Improvement		0.877			
Q.22.Planning		0.862			
Q.20.VendorProductQuality		0.823			
Q.24.LeadTime		0.414			
Q.18E.Loss			0.783		
Q.18H.OrderCycleTime			0.703		
Q.25.Delay				0.881	
Q.40.Variations				0.863	
Q.19.LongTerm					0.851
Q.23.Problems		0.496	0.417		0.572

The Table 8 above represents the Rotated Component Matrix. This matrix will help in reducing the number of components on which the variables are under analysis having high loadings.

From the above table 8, we observe that,

variable Q.18AStability, Q.18J.Complaints, Q.18K.Service, Q.18D.Transport, Q.18F.Product, Q.18G.Delivery, Q.18C.Performance, Q.18I.Returns, Q.18B.Cost are loaded on component 1. This component can be used as variable for further analysis.

Variable Q.21.Improvement, Q.22.Planning, Q.20.VendorProductQuality, Q.24.LeadTime are loaded on component 2. This component can be used as variable for further analysis.

Variable Q.18E.Loss, Q.18H.OrderCycleTime are loaded on component 3. This component can be used as variable for further analysis.

Variable Q.25.Delay, Q.40.Variations are loaded on component 4. This component can be used as variable for further analysis.

Variable Q.19.LongTerm, Q.23.Problems are loaded on component 5. This component can be used as variable for further analysis.

4. Productivity of Transportation

Table 9
Descriptive Statistics for Productivity of Transportation

Descriptive Statistics				
	Mean	Std. Deviation	Analysis N	Missing N
Q.26A.OwnDelivery	4.9111	0.66818	45	0
Q.26B.OutsourceDelivery	4.5333	0.86865	45	0
Q.28.Network	1.2000	0.58775	45	0
Q.29.Trips	1.8000	1.25408	45	0

The above Table 9, gives the descriptive statistics of the factors used in the KMO & Bartlett’s Test. It depicts the mean of each variable, the standard deviation of each variable. The column 'Analysis N' shows the number of respondents who answered for these particular variable questions. This means that out of 45 respondents, all the 45 respondents had answered for the particular variable questions. The column 'Missing N' denotes the missing answers from that particular variable question. In this case, the value of column 'Missing N' is 0 for all the variables. This states that none of the respondents missed the questions.

The factor 'Transportation Planning' is analyzed using the 4 variables as listed in the above Table 25. The variable Q.26A.OwnDelivery shows the highest mean of 4.9111. This indicates that the variable Q.26A.OwnDelivery is the most important variable in interpreting the factor 'Transportation Planning'. If column 'Mean' is observed around 2 variables have mean of 4 or above. They have a significant role in contributing a great deal towards analyzing the factor 'Transportation Planning'.

Table 10
Correlation Matrix for Productivity of Transportation

Correlation Matrix[a]					
		Q.26.(A)	Q.26.(B)	Q.28.	Q.29.
Correlation	Q.26.(A)	1.000	0.514	-0.069	-0.022
	Q.26.(B)	0.514	1.000	-0.214	-0.213
	Q.28.	-0.069	-0.214	1.000	0.672
	Q.29.	-0.022	-0.213	0.672	1.000
Sig. (1-tailed)	Q.26.(A)		0.000	0.325	0.444
	Q.26.(B)	0.000		0.079	0.080
	Q.28.	0.325	0.079		0.000
	Q.29.	0.444	0.080	0.000	
a. Determinant = .377					

The above Table 10, showcases the correlation of every variable with each of the other variable. The correlation matrix is divided into two parts. The upper half of the correlation table represents the Pearson correlation coefficient. The lower half of the correlation table represents the one-tailed significance of the coefficients of the Pearson correlation.

The upper half of the table does not consist of any value greater than 0.9 for any of the variables. This means there is no singularity present in the data.

The determinant of the correlation matrix obtained is 0.377 which is greater than 0.00001. This indicates that the problem of multi collinearity does not exist for the above data.

The off-diagonal elements in the correlation part are very small and close to zero. This makes the matrix a good model.

This summarizes that all the variables correlate well with each other. The value of correlation coefficients is not large. Hence, eliminating of questions is not applicable at this stage.

Table 11
KMO and Bartlett's Test Value for Productivity of Transportation

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.526
Bartlett's Test of Sphericity	Approx. Chi-Square	40.829
	df	6
	Sig.	0.000

The above shown Table 11, shows the KMO and Bartlett's test output.

The Kaiser-Meyer-Olkin (KMO) value obtained is 0.526. If we compare this value with the values in the Table 1, it is clear that the value is 0.526 is an acceptable value. This means that the sum of partial correlations is not large in comparison to the sum of correlations. The sum of analysis variables is 52.6%. This indicates there is no diffusion in the correlation pattern. Hence, the factor analysis is appropriate in this case. Therefore, reliable and distinct factors would be obtained from the factor analysis of these data.

The Table 11, also contains the Bartlett's Test of Sphericity. The Approx. Chi-Square value obtained is 40.829. The significance value p of the Bartlett's Test of Sphericity is 0.000 less than 0.001. Thus, the correlation matrix is not an identity matrix. This indicates relationship strength amongst the variables. Thus, factor analysis is applicable for this set of data.

Table 12
Communalities for Productivity of Transportation

Communalities		
	Initial	Extraction
Q.26A.OwnDelivery	1.000	0.791
Q.26B.OutsourceDelivery	1.000	0.757
Q.28.Network	1.000	0.826
Q.29.Trips	1.000	0.837

From observing the above Table 12, the deductions are made as below:

The extracted factor has accounted for 79.1% of the variance for variable Q.26A.OwnDelivery.

The extracted factor has accounted for 75.7% of the variance for variable Q.26B.OutsourceDelivery.

The extracted factor has accounted for 82.6% of the variance for variable Q.28.Network.

The extracted factor has accounted for 83.7% of the variance for variable Q.29.Trips.

Since, all the communality values are more than 0.5, thus, all the variables will be considered for further analysis.

Table 13
Total Variance for Productivity of Transportation

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.877	46.928	46.928	1.877	46.928	46.928	1.698	42.453	42.453
2	1.334	33.360	80.288	1.334	33.360	80.288	1.513	37.835	80.288
3	0.465	11.621	91.910						
4	0.324	8.090	100.000						

The above Table 13, represents the variance of the 4 components.

The three stages of the above Table 13 are:

a) Variance before extraction denoted by the column 'Initial Eigenvalues'.
b) Variance after extraction denoted by the column 'Extraction Sums of Squared Loadings'.
c) Variance after rotation denoted by the column 'Rotation Sums of Squared Loadings'.

At the first 'before extraction' stage, the total number of components is equal to the total number of variables used in the test.

In Table 13, observe the 'Total' column in the 'Initial Eigenvalues' columns. The first two components have large amount of variance as the eigenvalues for them is more than 1 with respect to the other two components which have eigenvalues less than 1.

In Table 13, observe '% of Variance' column in the 'Initial Eigenvalues' columns. The deductions made from this column are as followed:

The component 1 explains 46.928% of the total variance.

The component 2 explains 33.360% of the total variance.

The component 3 explains 11.621% of the total variance.

The component 4 explains 8.090% of the total variance.

At the second 'after extraction' stage, the components having eigenvalues less than 1 are extracted. So, only the first two components are retained at this stage as they have eigenvalues above 1. The eigenvalues of the column 'Total' in both the 'Initial Eigenvalues' column and 'Extraction Sums of Squared Loadings' remain same.

At the third 'after rotation' stage, the factor structure is optimized and both the two components are equalized. The observations at this stage are:

For component 1, it accounted for 46.928% of variance for rotation. Now it accounts for 42.453% of variance.

For component 2, it accounted for 33.360% of variance for rotation. Now it accounts for 37.835% of variance.

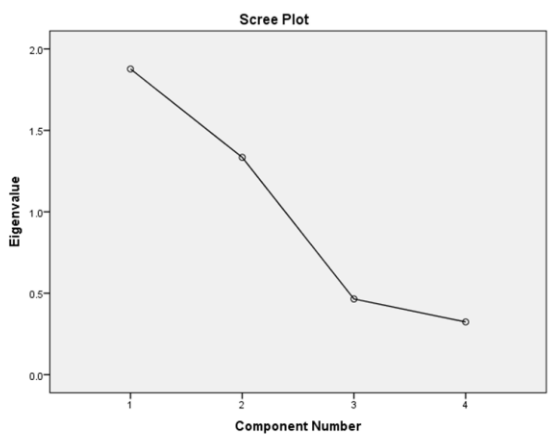

Fig. 2. Scree Plot for Productivity of Transportation

The Figure 2 above, represents the eigenvalues of all the components as a graph. This scree plot is the representation of the Table 13. This graph will be estimated using the help of Table 13.

The Y-axis on the graph represents the 'Eigenvalues' ranging from 0 to 2. The maximum value of 2 is obtained from the column 'Total' of the column 'Initial Eigenvalues'. This column of eigenvalues has been represented as points on the curve of the scree plot in the Figure 2.

The X-axis on the graph represents the 'Component Number'. These values have been obtained from the Table 13 from the column 'Component'. The values of the 'Component Number' vary from 1 to 4.

When Figure 2 is observed, it is found that the curve in the scree plot begins to flatten between the component 2 and component 3. The curve also portrays that the eigenvalues for the components 1 and 2 are above 1. For components 3 and 4, the eigenvalues are less than 1.

Therefore, after the process of extraction only 2 factors have been retained.

Table 14
Component Matrix for Productivity of Transportation

Component Matrix[a]		
	Component	
	1	2
Q.28.Network	0.792	0.446
Q.29.Trips	0.777	0.482
Q.26B.OutsourceDelivery	-0.655	0.573
Q.26A.OwnDelivery	-0.466	0.758

The above Table 14, showcases the extracted values of each of the 4 variables of the column 1 under the 2 components which were extracted in the Table 13.

This means that the 4 variables are divided into 2 components.

The extracted values represent the extent to which each component contributes towards the understanding of the respective variable.

The Table 14, shows the extracted values above 0.4 only because that criteria was chosen for the test, to read the table easily. This was done as the higher the extracted value, the higher that particular component contributes towards the understanding of that particular variable. The highest value for some components is 0.4. The empty cells of the table mean that the value extracted was less than 0.4.

The inference made from the above Table 14 are as follows:
The loading of variable Q.28.Network on component 1 is 0.792.
The loading of variable Q.29.Trips on component 1 is 0.777.
The loading of variable Q.26B.OutsourceDelivery on component 1 is -0.655.
The loading of variable Q.26A.OwnDelivery on component 2 is 0.758.

Table 15
Rotated Component Matrix for Productivity of Transportation

Rotated Component Matrix[a]		
	Component	
	1	2
Q.29.Trips	0.913	
Q.28.Network	0.905	
Q.26A.OwnDelivery		0.888
Q.26B.OutsourceDelivery		0.845

The Table 15 above represents the Rotated Component Matrix. This matrix will help in reducing the number of components on which the variables are under analysis having high loadings.

From the above table 15, we observe that,

Variable Q.29.Trips, Q.28.Network are loaded on component 1. This component can be used as variable for further analysis.

Variable Q.26A.OwnDelivery, Q.26B.OutsourceDelivery are loaded on component 2. This component can be used as variable for further analysis.

5. Conclusion

According to the analysis, in case of the reliability of suppliers the Table 3 indicates that the problem of multi collinearity does exist. Therefore, deleting of variables will have to be considered that have a correlation value less than 0.3.

The results of the rotated matrix component in both the cases gives the components as the new clubbed variables. These should be taken into consideration for further analysis.

References

[1] L. Sudershan Reddy, Parigya Kulshrestha (July 2019 – September 2019), ‘Analyzing the Reliability Test for the Pilot Study of Supply Chain Management’, International Journal of Business and Administration Research Review, Volume 6, Issue 3.
[2] L. Chen, J. Long, T. Yan (2004), ‘E-Supply Chain Implementation Strategies in a Transitional Economy’, International Journal of Information Technology and Decision Making, Volume 3, Issue 4.
[3] Sita Mishra, ‘A Conceptual Framework for Creating Customer Value in E-Retailing in India’, South Asian Journal of Management, Volume 16, Issue 4.
[4] Jason Dedrick, Sean Xin Xu, Kevin Xiaoguo Zhu (2008), ‘How Does Information Technology Shape Supply-Chain Structure? Evidence on the Number of Suppliers’, Journal of Management Information Systems, Volume 25, Issue 2.
[5] S. Kumar (2008), ‘Application of Six Sigma Concept in SCM: A Case Study’, an unpublished Master thesis to SLIET, Deemed University, Punjab.
[6] A. Jayant, S. Kumar, P. Gupta, S.K. Garg (October 2009 – March 2010), ‘An Integrated Approach for Performance Improvement in Supply Chain – A Case of Manufacturing Unit’, International Journal of Business Insights and Transformation.
[7] Niraj S, Nageswara Rao (2015), ‘Sustainability of E-retail in India’, Journal of Internet Banking and Commerce, Volume 20, Issue 2.
[8] Ashraf W. Labib (November 2011), ‘A Supplier Selection Model: A Comparison of Fuzzy Logic and the Analytic Hierarchy Process’, International Journal of Production research, Volume 49, Issue 21.
[9] Alexandre M. Rodrigues, Theodore P. Stank, Daniel F. Lynch (2004), ‘Linking Strategy, Structure, Process and Performance in Integrated Logistics’, Journal of Business Logistics, Volume 25, Issue 2.
[10] Virginija Kavaliauskiene, Neringa Survilaite-Bagdonaviciute (2003), ‘Trends in Logistics: The Impact of e-SC on Current and Future Organizational Structures’, Engineering Economics.
[11] H. Wainer H.I. Braun (1988), 'Test Validity', Hilldale, NJ, Lawrence Earlbaum Associates.
[12] J.W. Creswell, D.L. Miller (2000), 'Determining validity in qualitative inquiry', Theory into practice, Volume 39, Issue 3.
[13] https://allpsych.com/researchmethods/validityreliability/, retrieved on 10th January 2018.
[14] http://www.statisticshowto.com/kaiser-meyer-olkin/, retrieved on 10th January 2018.