Interconnection between implementation and competitive dimensions of SCM and combined approach (TQM–SCM) in context of Indian manufacturing industry

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Abstract

Purpose – The purpose of this paper is twofold. Firstly to check the reliability between and within the parameters of total quality management–supply chain management (TQM–SCM) questionnaire and distribution of data collected through questionnaire from SCM and combined approach (TQM–SCM) companies. Secondly, to analyze the correlation connection among dependent and independent parameters of both SCM and combined approach in order to check and increase confidence in the data obtained before conducting actual research.

Design/methodology/approach – In the present study, 45 Indian manufacturing organizations have been extensively surveyed to check the reliability of the data and then ascertain the inter-relationships between various independent factors and competitive dimensions of SCM alone and for combined approach (TQM–SCM).

Findings – Firstly, the data for both the approaches are reliable. Secondly, independent variables ($X1$–$X8$) possess more strong correlation with business performance parameters of combined approach (TQM–SCM) companies as compared to only SCM companies.

Originality/value – TQM and SCM are considered as performance improvement techniques by the manufacturing organizations. As far as the author knows, this is the first study that is designed to find the interconnection between implementation factors as well as competitive dimensions of SCM approach and TQM–SCM approach in the context of Indian manufacturing organizations.

Keywords Total quality management (TQM), Supply chain management (SCM), Combined approach (TQM–SCM), Indian manufacturing industries, Competitive dimensions

Paper type Research paper

1. Introduction

The extreme global competition and the changing needs and demands of consumers have created intense pressure on manufacturing firms (Singh *et al.*, 2010; Randhawa and Ahuja, 2018). Moreover, nowadays, customers' major considerations are product quality and service quality; they want high-quality products and fast delivery (Randhawa and Ahuja, 2018). All such factors have created a pressure on Indian organizations to search new methods to enhance profitability and sustainability in today's market (Sundharam *et al.*, 2013; Govindan *et al.*, 2016). Such challenges faced by Indian manufacturing organizations can be addressed through synergy of TQM and SCM. As both TQM and SCM share the ultimate goal which is, "customer satisfaction," their integration enhances the influence of both, resulting in enhanced organizational customer satisfaction levels (Mahdiraji *et al.*, 2012). Further, it is observed that customer satisfaction in terms of product availability, delivery, innovation and

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quality dimensions can be achieved through the implementation of TQM and SCM strategies (Sharma and Modgil, 2015). Hence, organizations emphasized the importance of adopting different improvement strategies such as TQM and SCM on synergistic basis for boosting business performance (Kaur *et al.*, 2019).

Abundant literature is available on performance improvement through TQM and SCM on individual basis. For example, supply chain management (SCM) has emerged as improvement practice for gaining competitive advantage, especially through networks with suppliers and customers (Ou *et al.*, 2010; Janvier-James, 2012). Likewise, total quality management (TQM) contributed as a key strategy for the betterment of performance of the firms in terms of organizational excellence (Goetsch and Davis, 2013), better competitiveness in the global marketplace (Altayeb and Alhasanat, 2014) by reducing costs and improving productivity of the firms (Psomas *et al.*, 2014). Therefore, keeping in view the literature and individual benefits of TQM and SCM approaches, researchers have diverted their energy on the synergies of quality management and SCM in order to enhance supply chain performance (Robinson and Malhotra, 2005; Quang *et al.*, 2016; Zhong *et al.*, 2016; Gu *et al.*, 2017; Fernandez *et al.*, 2017; Kaur *et al.*, 2019). This area has been formally termed as supply chain quality management (SCQM).

Furthermore, it is found from the literature that this synergistic approach is very fruitful for the uninterrupted growth and better sustainability of position in the world market not only for firms but of the whole supply chain. For example, integration of TQM and SCM results in improved supply chain integration (Mahdiraji *et al.*, 2012; Quang *et al.*, 2016; Zhong *et al.*, 2016; Gu *et al.*, 2017), customer satisfaction (Mahdiraji *et al.*, 2012; Sharma and Modgil, 2015; Quang *et al.*, 2016; Gu *et al.*, 2017), firm performance (Mahdiraji *et al.*, 2012; Quang *et al.*, 2016; Sarrico and Rosa, 2016; Sharma and Modgil, 2015; Zhong *et al.*, 2016) and improved supply chain performance (Mahdiraji *et al.*, 2012; Sarrico and Rosa, 2016; Zhong *et al.*, 2016). Therefore, in practice, by getting inspiration from prior research on SCQM and its practices (e.g. Flynn *et al.*, 1995; Flynn and Flynn, 2005; Foster *et al.*, 2011; Lin *et al.*, 2013; Quang *et al.*, 2016; Zhong *et al.*, 2016; Gu *et al.*, 2017), the current study heeds the suggestions offered by several researchers who commonly argue that SCQM is still in the definitional stage and that it requires empirically validated SCQM measures (Foster *et al.*, 2011) by making an attempt to respond to these shortcomings with both theoretical and empirical contribution in the context of Indian manufacturing industry.

The research objectives addressed in the present study include:

(1) To check the reliability of data each for SCM and combined approach (TQM–SCM).

(2) To check the distribution of data collected for both the approaches.

(3) To examine the connections among a set of multiple dependent and independent factors each for SCM approach as well as for combined approach.

The paper is organized as follows. It starts with a review of the literature pertinent to SCM and combined approach (TQM–SCM)'s significant factors. The next section discusses the adopted quantitative methodology followed by an analysis of the data. The final section deals with conclusion of the study.

2. Literature review

This section presents a review of the literature on significant factors for SCM approach as well as combined approach (TQM–SCM).

2.1 SCM approach and its critical practices for manufacturing industry

There exist various definitions of SCM because of interdisciplinary approach. SCM concept is defined by Shimchi-Levi *et al.* (2000) and Park and Krishnan (2001) as a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and stores, so that merchandise is produced and distributed in the right quantities, to the right location and at the right time, in order to minimize system-wide costs while satisfying service-level requirements.

Further, the literature reveals that the successful implementation of SCM strategy in the organizations requires various significant factors like customer relationship, strategic supplier partnership, corporate culture, material management, information and communication technologies and close supplier partnership (Talib *et al.*, 2011; Sundram *et al.*, 2011; Kumar *et al.*, 2015; Shrikant and Kant, 2017; Kaur *et al.*, 2019).

2.2 Integration of TQM–SCM (SCQM) and its significant factors

The integration of TQM and SCM is termed under the concept of supply chain quality management – SCQM (Lin and Gibson, 2011). A range of different definitions of SCQM have so far been offered by different authors. These definitions reflect different theoretical, empirical and, more importantly, the focus and scope of the scholars' own research interests. For example, Robinson and Malhotra (2005) defined SCQM as the formal coordination and integration of business processes involving all partner organization in the supply chain to measure, analyze and continually improve products, services and processes in order to create value and achieve satisfaction of intermediate and final customers in the marketplace. Later on, Kuei *et al.* (2008) consider SCQM as an SCM extension which is designed to establish a competitive supply chain with the application of quality management practices.

Various researchers have suggested various significant factors for the successful implementation of SCQM program in order to achieve optimum level of business excellence in manufacturing organizations (e.g. Flynn *et al.*, 1995; Lin *et al.*, 2013; Quang *et al.*, 2016; Zhong *et al.*, 2016; Fernandes *et al.*, 2017, Gu *et al.*, 2017; Kaur *et al.*, 2019). For example, Quang *et al.* (2016) proposed structural model consisting of three factors, namely, internal process, supplier management and information as second- order latent constructs. Further, Fernandes *et al.* (2017) have purposed a conceptual model in terms of five major practices, namely, leadership, management and strategic planning, stakeholders' involvement and commitment, information, continuous improvement and innovation, which is considered to be of great importance for the integration of both TQM and SCM. More recently, Kaur *et al.* (2019) have purposed a conceptual model on the basis of literature review and found that management support and commitment, customer focus, information, workforce development and supplier partnership are the most common factors found in both TQM and SCM practices for their synergistic benefits and issues related to integration of TQM and SCM throughout the supply chain have the strongest impact on the organizational performance.

Based on the theoretical framework, two major hypotheses were proposed:

H1. Independent variables ($X1$–$X8$) of only SCM companies possess more strong correlation with competitive dimensions as compared to combined approach (TQM–SCM) companies.

H2. Independent variables ($X1$–$X8$) of combined approach (TQM–SCM) companies possess more strong correlation with competitive dimensions as compared to only SCM.

3. Research methodology

The research methodology involved formulation of detailed TQM–SCM questionnaire through extensive literature review (Talib *et al.*, 2011; Kumar *et al.*, 2015; Zhong *et al.*, 2016; Shrikant and Kant, 2017) and validation through peer review from academicians, consultants, TQM councilors and SCM practitioners from the industry. The questions framed are based on four-point scale, ranging from 1 to 4 (Singh and Ahuja, 2014). This questionnaire has been designed so as to cover each significant factor essential for the successful implementation of TQM–SCM program and engulfed all the business excellence performance parameters accrued through stated program's implementation. In order to ascertain the benefits realized by an effective TQM and SCM approaches, the present study deploys eight significant TQM–SCM implementation success factors (*X*1, *X*2, *X*3, *X*4, *X*5, *X*6, *X*7 and *X*8) and seven significant TQM–SCM competitive dimensions enhancement parameters as shown in Figure 1.

Further, in order to conduct this pilot study, finalized TQM–SCM questionnaire was sent to around 500 industries which have implemented TQM and SCM with other related lean manufacturing practices. More than 400 calls were made to interact with the coordinators of TQM and SCM, and around 400 mails, 60 personal interviews and 100 postages regarding questionnaire were sent to various industries across the country that were at different stages of implementing TQM and SCM practices. In response to above total 45 useable questionnaires has been received out of which 24 questionnaire are from companies those are working on only SCM approach and 21 from companies working on combined approach (TQM -SCM). Here, it is pertinent to mention that most of the respondents belonged to the top management executive class that includes several vice presidents, heads of operations, heads of quality assurance, general managers (GM), heads of supply chain, chief managers, manufacturing managers, GM technical, quality managers and president operations, HR manager and so forth. The systematic methodology used in the research is portrayed in Figure 2.

Finally, the data collected from the manufacturing organizations have been compiled and analyzed critically through various data examination techniques like test for skewness and kurtosis for checking the normality of the data, test for reliability of the data (Cronbach's α) and covariance test for determining the reliability between the groups, Pearson correlation test to check connection among dependent and independent factors each for SCM as well as combined approach (TQM–SCM) so as to check and increase confidence in the data obtained before conducting actual research.

4. Analysis of data

4.1 Test of distribution of data

The data obtained from various manufacturing organizations through a TQM–SCM questionnaire have been firstly subjected to "Skewness and Kurtosis" data examination technique to evaluate the normality of collected data. The skewness which is related to the symmetry of the distribution, and kurtosis which determines the spread of data with respect

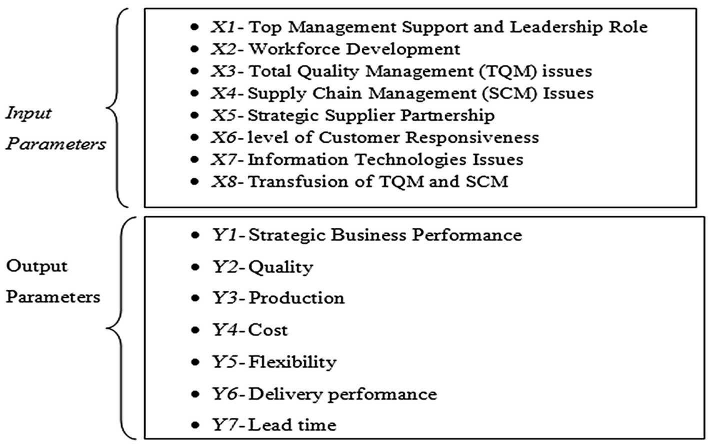

Figure 1.
Input and output parameters employed

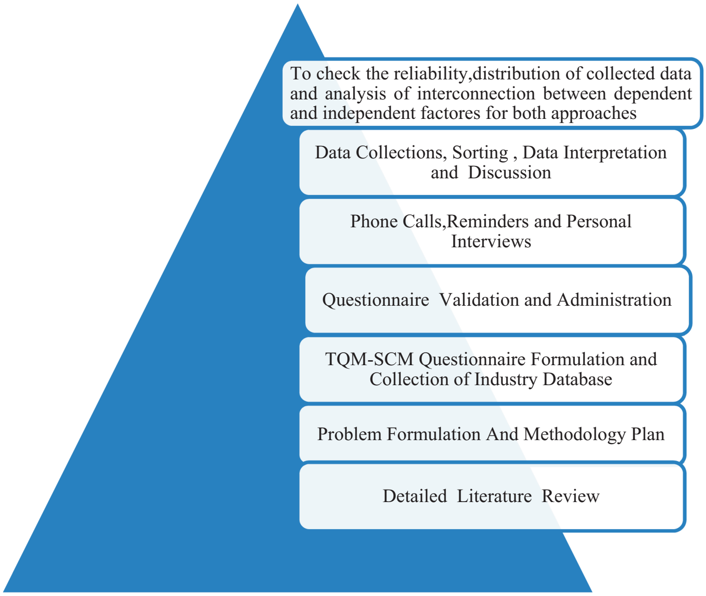

Figure 2. Methodology adopted in the current research

to normal distribution (Kaur *et al.*, 2015; Singh and Khamba, 2015; Dandagi *et al.*, 2016), are applied on the data for SCM and combine approach as shown in Tables 1 and 2 respectively, in which the acceptable values of skewness (<±2) and kurtosis (<±7) are within the range according to Currie *et al.* (1999). Thus, the distribution of data does not depart from normality.

4.2 Tests of reliability and validity of factors

Test of reliability on a measurement instrument is carried out to determine its ability to yield consistent measurements. Internal consistency reliability is the most commonly used psychometric measure in assessing survey instrument and scales. Cronbach's α is the basic formula for determining the reliability based on internal consistency. Therefore, The

	Skewness		Kurtosis	
Variables	Statistic	Std. error	Statistic	Std. error
*X*1	−1.726	0.472	2.758	0.918
*X*2	−1.377	0.472	1.476	0.918
*X*3	0.209	0.472	0.308	0.918
*X*4	−0.530	0.472	1.755	0.918
*X*5	−0.283	0.472	−0.111	0.918
*X*6	−0.021	0.472	−0.866	0.918
*X*7	0.104	0.472	−0.112	0.918
*X*8	0.744	0.472	0.873	0.918
*Y*1	−2.072	0.472	7.042	0.918
*Y*2	−2.013	0.472	5.465	0.918
*Y*3	−1.829	0.472	6.337	0.918
*Y*4	0.244	0.472	−0.010	0.918
*Y*5	−1.310	0.472	5.249	0.918
*Y*6	−2.007	0.472	5.257	0.918
*Y*7	−0.623	0.472	1.752	0.918

Table 1. Skewness and kurtosis for SCM approach

Variables	Skewness Statistic	Skewness Std. error	Kurtosis Statistic	Kurtosis Std. error
*X*1	0.182	0.501	−0.539	0.972
*X*2	−0.647	0.501	0.681	0.972
*X*3	−1.213	0.501	2.684	0.972
*X*4	−0.095	0.501	−1.270	0.972
*X*5	−0.023	0.501	−0.479	0.972
*X*6	−0.953	0.501	0.743	0.972
*X*7	−0.207	0.501	−0.580	0.972
*X*8	0.069	0.501	−1.058	0.972
*Y*1	−1.532	0.501	3.343	0.972
*Y*2	−1.461	0.501	3.281	0.972
*Y*3	−0.140	0.501	0.440	0.972
*Y*4	−0.876	0.501	0.842	0.972
*Y*5	−1.203	0.501	2.899	0.972
*Y*6	−0.631	0.501	0.304	0.972
*Y*7	−1.437	0.501	3.096	0.972

Table 2.
Skewness and kurtosis for combined (TQM–SCM) approach

Cronbach's α statistical test has been deployed in the data collected from various manufacturing organizations regarding various inputs and outputs, that is, implementation dimensions (independent variables) and performance parameters (dependent variables) of SCM alone and combined approach (TQM–SCM) companies in order to ascertain the reliability of data collected through the "TQM–SCM questionnaire" as shown in Tables 3 and 4. The Cronbach's α values for all the input and output categories have been observed to be greater than 0.6, which clearly validates the high reliability of data for various input and output categories.

Further, for determining the reliability between the groups, covariances of all input and output variables (both for SCM and combined approach companies) are computed. Tables 5 and 6 show results of the inter-item covariance test for SCM as well as (TQM–SCM) companies, respectively, which clear the test by calculating covariances of all input and output variables as the covariance within the group is higher than covariance outside the group.

Further, in order to establish relationships between performance parameters (dependent variables) and factors of implementation (independent variables), bivariate correlation technique is used. The correlations have been worked out to ascertain the significant factors contributing in the success of the implementation programs in the organizations. Only those pairs with Pearson correlation greater or equal to 40% and statistically significant at 1% level of significance are considered as having a strong association.

Various input dimensions	*X*1	*X*2	*X*3	*X*4	*X*5	*X*6	*X*7	*X*8
Cronbach's α values	0.956	0.894	0.949	0.926	0.849	0.888	0.897	0.799
Output parameters	*Y*1	*Y*2	*Y*3	*Y*4	*Y*5	*Y*6	*Y*7	
Cronbach's α values	0.837	0.774	0.654	0.648	0.695	0.771	0.601	

Table 3.
Cronbach's α for input and output category of SCM companies

Various input dimensions	*X*1	*X*2	*X*3	*X*4	*X*5	*X*6	*X*7	*X*8
Cronbach's α values	0.840	0.806	0.861	0.838	0.844	0.613	0.868	0.734
Output parameters	*Y*1	*Y*2	*Y*3	*Y*4	*Y*5	*Y*6	*Y*7	
Cronbach's α values	0.601	0.686	0.639	0.601	0.731	0.687	0.625	

Table 4.
Cronbach's α for input and output category of combined approach (TQM–SCM) companies

Table 5. Inter-item covariance matrix for SCM companies

	X1	X2	X3	X4	X5	X6	X7	X8	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X1	0.022	0.018	0.009	0.010	0.011	0.011	0.011	0.003	0.018	0.014	0.012	0.006	0.006	0.015	0.010
X2	0.018	0.019	0.009	0.009	0.011	0.009	0.010	0.001	0.016	0.017	0.011	0.007	0.008	0.013	0.010
X3	0.009	0.009	0.017	0.007	0.007	0.011	0.008	0.000	0.007	0.006	0.006	0.003	0.004	0.006	0.005
X4	0.010	0.009	0.007	0.010	0.009	0.012	0.010	0.000	0.009	0.007	0.010	0.008	0.007	0.007	0.008
X5	0.011	0.011	0.007	0.009	0.011	0.011	0.011	0.001	0.010	0.009	0.011	0.008	0.010	0.008	0.011
X6	0.011	0.009	0.011	0.012	0.011	0.019	0.014	0.001	0.009	0.007	0.011	0.011	0.010	0.007	0.010
X7	0.011	0.010	0.008	0.010	0.011	0.014	0.016	0.001	0.010	0.008	0.011	0.014	0.014	0.007	0.010
X8	0.003	0.001	0.000	0.000	0.001	0.001	0.001	0.006	0.003	0.001	0.001	0.001	0.001	0.003	0.000
Y1	0.018	0.016	0.007	0.009	0.010	0.009	0.010	0.003	0.020	0.017	0.015	0.008	0.008	0.016	0.011
Y2	0.014	0.017	0.006	0.007	0.009	0.007	0.008	0.001	0.017	0.020	0.014	0.008	0.008	0.014	0.011
Y3	0.012	0.011	0.006	0.010	0.011	0.011	0.011	0.001	0.015	0.014	0.016	0.012	0.011	0.012	0.013
Y4	0.006	0.007	0.003	0.008	0.008	0.011	0.014	0.001	0.008	0.008	0.012	0.015	0.015	0.006	0.010
Y5	0.006	0.008	0.004	0.007	0.010	0.010	0.014	0.001	0.008	0.008	0.011	0.015	0.020	0.006	0.013
Y6	0.015	0.013	0.006	0.007	0.008	0.007	0.007	0.003	0.016	0.014	0.012	0.006	0.006	0.014	0.009
Y7	0.010	0.010	0.005	0.008	0.011	0.010	0.010	0.000	0.011	0.011	0.013	0.010	0.013	0.009	0.014

Table 6.
Inter-item covariance matrix for combined approach (TQM–SCM) companies

	*X*1	*X*2	*X*3	*X*4	*X*5	*X*6	*X*7	*X*8	*Y*1	*Y*2	*Y*3	*Y*4	*Y*5	*Y*6	*Y*7
*X*1	0.005	0.004	0.005	0.003	0.004	0.003	0.004	0.004	0.004	0.007	0.004	0.006	0.005	0.002	0.006
*X*2	0.004	0.008	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.005	0.003	0.004	0.004	0.002	0.004
*X*3	0.005	0.003	0.009	0.004	0.002	0.003	0.005	0.005	0.007	0.007	0.006	0.008	0.009	0.002	0.009
*X*4	0.003	0.003	0.004	0.004	0.002	0.002	0.004	0.003	0.006	0.004	0.003	0.006	0.004	0.004	0.006
*X*5	0.004	0.003	0.002	0.002	0.009	0.004	0.004	0.004	0.002	0.005	0.003	0.004	0.002	0.003	0.003
*X*6	0.003	0.003	0.003	0.002	0.004	0.005	0.003	0.002	0.002	0.003	0.003	0.003	0.003	0.002	0.003
*X*7	0.004	0.003	0.005	0.004	0.004	0.003	0.005	0.003	0.005	0.005	0.004	0.006	0.005	0.003	0.006
*X*8	0.004	0.004	0.005	0.003	0.004	0.002	0.003	0.004	0.004	0.006	0.004	0.006	0.005	0.002	0.006
*Y*1	0.004	0.003	0.007	0.006	0.002	0.002	0.005	0.004	0.010	0.006	0.006	0.009	0.008	0.004	0.010
*Y*2	0.007	0.005	0.007	0.004	0.005	0.003	0.005	0.006	0.006	0.012	0.005	0.009	0.008	0.003	0.010
*Y*3	0.004	0.003	0.006	0.003	0.003	0.003	0.004	0.004	0.006	0.005	0.005	0.006	0.006	0.002	0.007
*Y*4	0.006	0.004	0.008	0.006	0.004	0.003	0.006	0.006	0.009	0.009	0.006	0.011	0.009	0.004	0.012
*Y*5	0.005	0.004	0.009	0.004	0.002	0.003	0.005	0.005	0.008	0.008	0.006	0.009	0.009	0.002	0.010
*Y*6	0.002	0.002	0.002	0.004	0.003	0.002	0.003	0.002	0.004	0.003	0.002	0.004	0.002	0.005	0.005
*Y*7	0.006	0.004	0.009	0.006	0.003	0.003	0.006	0.006	0.010	0.010	0.007	0.012	0.010	0.005	0.013

4.3 Analysis and results for SCM-alone companies

Table 7 represents the Pearson's correlations among various performance parameters (*Y*) and implementation factors (*X*) to depict the level of association between these parameters. Pearson correlations (*r*) highlight the critical implementation factors mainly responsible for accruing strategic improvements in performance parameters in manufacturing organizations. The correlation coefficients (*r*) are found to be moderate and significant at $p = 0.05$ significance level and $p = 0.01$ significance level in most of the cases like *X*1, *X*2, *X*4, *X*5, *X*6 and *X*7. Although this clearly confirms the good correlation between various SCM implementation dimensions and performance parameters involved in the present study, performance parameters have not found associated with implementation dimensions which address issues related to quality and smooth functioning of supply chain, that is, *X*3 and *X*8.

4.4 Analysis and results for combined approach (TQM–SCM) companies

In order to find the level of intercorrelation among performance parameters (*Y*) and factors of implementation (*X*) variables for combined approach, the Pearson correlation test is applied on the collected data. The correlation coefficients (*r*) are found to be high, that is, 0.90, 0.85. . . 0.82, 0.79 and so forth, and significant at $p = 0.05$ and $p = 0.01$ significance level in all of the cases. This indicates that all of the factors are significantly related to improvement in performance parameter, and this confirms the high correlation between various implementation dimensions and performance parameters of combined approach (TQM–SCM). The correlation (*r*) values through exploratory method using SPSS 25.0 are represented in Table 8.

	*X*1	*X*2	*X*3	*X*4	*X*5	*X*6	*X*7	*X*8
*Y*1								
r	0.874**	0.797**	0.378	0.621**	0.676**	0.477*	0.558**	0.255
p	0.000	0.000	0.068	0.001	0.000	0.018	0.005	0.228
*Y*2								
r	0.700**	0.873**	0.353	0.524**	0.580**	0.344	0.444*	0.069
p	0.000	0.000	0.090	0.009	0.003	0.100	0.030	0.749
*Y*3								
r	0.614**	0.633**	0.368	0.746**	0.809**	0.610**	0.696**	0.083
p	0.001	0.001	0.077	0.000	0.000	0.002	0.000	0.700
*Y*4								
r	0.358	0.397	0.218	0.650**	0.655**	0.640**	0.888**	0.121
p	0.085	0.055	0.307	0.001	0.001	0.001	0.000	0.572
*Y*5								
r	0.285	0.418*	0.197	0.492*	0.646**	0.527**	0.783**	0.064
p	0.177	0.042	0.355	0.014	0.001	0.008	0.000	0.768
*Y*6								
r	0.887**	0.797**	0.367	0.596**	0.652**	0.449*	0.496*	0.319
p	0.000	0.000	0.078	0.002	0.001	0.028	0.014	0.128
*Y*7								
r	0.549**	0.627**	0.346	0.691**	0.888**	0.582**	0.678**	0.039
p	0.005	0.001	0.098	0.000	0.000	0.003	0.000	0.856

Note(s): **Correlation is significant at the 0.01 level (two-tailed)
*Correlation is significant at the 0.05 level (two-tailed)

Table 7. Pearson's correlation between input and output parameters for SCM companies

Table 8.
Pearson's correlation between input and output parameters for combined approach (TQM–SCM) companies

	X1	X2	X3	X4	X5	X6	X7	X8
Y1								
r	0.543*	0.332	0.793**	0.856**	0.204	0.332	0.749**	0.655**
p	0.011	0.141	0.000	0.000	0.376	0.141	0.000	0.001
Y2								
r	0.906**	0.488*	0.701**	0.516*	0.513*	0.370	0.644**	0.811**
p	0.000	0.025	0.000	0.017	0.017	0.099	0.002	0.000
Y3								
r	0.795**	0.515*	0.854**	0.693**	0.458*	0.490*	0.737**	0.885**
p	0.000	0.017	0.000	0.000	0.037	0.024	0.000	0.000
Y4								
r	0.743**	0.465*	0.821**	0.809**	0.401	0.418	0.762**	0.812**
p	0.000	0.034	0.000	0.000	0.072	0.059	0.000	0.000
Y5								
r	0.701**	0.411	0.990**	0.623**	0.257	0.465*	0.665**	0.794**
p	0.000	0.064	0.000	0.003	0.262	0.034	0.001	0.000
Y6								
r	0.460*	0.348	0.309	0.838**	0.386	0.300	0.580**	0.395
p	0.036	0.122	0.173	0.000	0.084	0.186	0.006	0.076
Y7								
r	0.703**	0.415	0.850**	0.789**	0.238	0.320	0.713**	0.762**
p	0.000	0.061	0.000	0.000	0.298	0.157	0.000	0.000

Note(s): **Correlation is significant at the 0.01 level (two-tailed)
*Correlation is significant at the 0.05 level (two-tailed)

After comparing the results of Tables 7 and 8, it is found that all the input variables(*X*1–*X*8) have strong association with all competitive dimensions (*Y*1–*Y*7) only in the case of combined approach. Thus, Hypothesis H2: independent variables (*X*1–*X*8) of combined approach (TQM–SCM) companies possess more strong correlation with competitive dimensions as compared to only SCM, comes to be true with the outcome that if TQM–SCM drives are used together by the Indian manufacturing industries, their synergistic effect can improve business performance in a better way than applying these drives on isolation basis.

5. Interpretations and conclusions

The present study in context of Indian manufacturing organizations reveals that the leading Indian manufacturing organizations have taken proactive initiatives to effectively improve the manufacturing by transfusing various lean manufacturing philosophies like TQM, TPM, SCM 5S, Six Sigma and so forth for realizing enhanced manufacturing system performance. Further, the study validates the existence of significant associations between different SCM initiatives and combined approach (TQM–SCM) initiatives and strategic competitive dimensions enhancement attributes. The inter-relationships between success factors and manufacturing performance parameters can be used to develop an understanding of contributions of various TQM–SCM factors toward realization of organizational objectives of growth and sustainability. The manufacturing managers must be aware of existing interdependencies within these two improvement strategies to be able to manage strategic TQM–SCM initiatives effectively toward achieving world-class manufacturing performance standards. The findings suggest that effective initiatives of these two drives on transfusion basis (TQM–SCM) can significantly contribute toward improvements for competing in the highly dynamic global marketplace.

The detailed inter-relationships between various predictor parameters and manufacturing performance parameters for SCM companies depict that only some of the implementation factors, namely, $X1$ – top management involvement and leadership , $X2$ – workforce development issues, $X4$ – SCM issues, $X5$ – strategic supplier partnership, $X6$ – level of customer responsiveness and $X7$ – information technologies issues, are strongly correlated with competitive dimensions. While in the case of combined approach (TQM–SCM), all the implementation factors($X1$–$X8$) have strong correlation with all competitive dimensions ($Y1$–$Y7$).

5.1 Contributions and practical implications

There are several features that allow considering this research as a real contribution toward the promotion of the synergistic implementation of (TQM–SCM) in medium- and large-scale manufacturing industry. Following are main contributions of this study:

(1) Firstly, by comparing correlation among dependent and independent factors each for SCM and combined approach, this study contributes to supply chain and quality management literature by proving the more strong impact of combined approach's implementation parameters on business performance parameters as compared to only SCM approach.

(2) Secondly, the results of the study may be helpful for managers in order to decide their solutions implementation priorities while developing strategies for the promotion of the implementation of this integrated approach (TQM–SCM) in their companies and will instill positive competition among companies which have implemented only SCM approach as they will have quantifiable objectives (just like combined approach) to work upon and improve.

5.2 Limitations and scope for future research

Although this study has been quite useful in promoting synergistic implementation of TQM–SCM, it is not without some limitations. The main limitation is the scope of this study which is limited only to medium- and large-scale Indian manufacturing organizations. Therefore, the results obtained from this empirical investigation will need some modifications before applications to other demographic locations and applications in other types of industries like service industries.

In spite of the limitations and managerial implications presented so far, there are a variety of extensions to this research that can be considered as future research, for example, performance of different supply chains that have adopted combined approach can be compared.

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Further Reading

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