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A study of performance measures and quality management system in small and medium enterprises in India

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Abstract

Purpose – The paper aims to identify causality amongst small and medium enterprises' (SMEs') performance indicators, propose an integrated index of business performance and quality practices and investigate the effect of quality management system (QMS) on business performance.

Design/methodology/approach – This study proposes a two-stage approach. In the first stage, the authors gathered responses with a questionnaire on variables affecting business performance and identified dimensions using exploratory and confirmatory factor analyses. Path analysis was carried out to identify causality between the dimensions. In the next stage, the validation of stage 1 findings was carried out to substantiate the proposition that QMS affects performance. Questionnaire survey and in-depth interviews were conducted during the second stage. The analysis was done following the case study protocol – within- and cross-case analysis and validated with supportive and conflicting literature.

Findings – The results show that the employee – dimension is crucial to process effectiveness, customer satisfaction and finances. Customer satisfaction results from employee satisfaction and processes. QMS impacts processes and employee performance, thus establishes the causality between business performance factors and QMS. QMS impacts finances in the short run but yields long-term benefits and is dependent on two factors – degree of knowledge of quality practices and its application in business.

Originality/value – This study reveals the performance dimensions of SMEs, their causality and the impact of QMS on performance. It suggests a shift from traditional approaches, correcting defects using statistical quality control approaches, to a sustainable growth path – a long-term approach. This study puts forward two associated indices – the business performance and the knowledge of quality practices and its application index.

Keywords Small and medium enterprises (SMEs), Quality management system **(**QMS), Performance measures, Quality implementation index, India

Paper type Research paper

1. Introduction

Small and medium enterprises (SMEs) are recognized as the backbone of economic development (Spicer and Sadler-Smith, 2006; Karadag, 2016). Their contribution to employment generation (Ramayah *et al.*, 2016; Ongori, 2009) makes them indispensable in all economies (Březinová, 2013). They are of great importance at the macro level and also to large organizations (Kok *et al.*, 2013; Bekeris, 2012), as they are suppliers of goods and services to them (Matt and Rauch, 2020). SMEs are facing new challenges due to the more dynamic environment, and some are threatened with closure (Tülüce and Doğan, 2014). Several studies in the Indian context delved on the issues and challenges faced by the Ministry of Micro, Small and Medium Enterprises (MSMEs) in the country (Khurana *et al.*, 2019; Ravikumar, 2013; Singh, 2019; Singh and Wasdani, 2016; Srinivasan and Kunjangad, 2019; Srinivasan and Lohith, 2017). They have mentioned the need for better technology,

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sustainability, innovation and funds; however, reference to a quality management system (QMS) was mostly scarce.

The Government of India (GoI) (2017) reported sickness and closure of MSMEs as one of the intriguing problems. Approximately 50,000 MSMEs closed in Tamil Nadu state in 2018 (Kandavel, 2018). In this pandemic, one in every three firms is likely to shut down (ET, 2020). The post-pandemic situation relates to limited demand for goods and services; these firms are further exposed to stiff competition. Thus, it transpires that the half-life period of the SMEs is low. The GoI launched the zero-defect-zero-effect (ZED) scheme to enable MSMEs to enhance quality and fund them for adaption of quality tools. However, the success of such attempts lies in understanding the extent of the QMS implementation in Indian SMEs.

QMS consists of practices and principles and is a philosophy that orientates quality management and management of quality (Brah *et al.*, 2002). It focuses on business processes in developing products/services based on customers' needs (Dale and Cooper, 1994; Welikala and Sohal, 2008; Telleria *et al.*, 2002) and takes care of internal implementation of practices (Modgil and Sharma, 2017). It helps an organization augment customer satisfaction (Zaretzky, 2008), benefits its stakeholders (Jaafreh and Al-abedallat, 2013; Yang, 2006) and stimulates continual process improvement (Welikala and Sohal, 2008; Marques *et al.*, 2013). It improves company performance (efficiency) (Ismyrlis *et al.*, 2015) and effectiveness (Leong *et al.*, 2014). Quality management practices result in reduced WIP inventory, less defectives and scrap (Modgil and Sharma, 2016) and hence improves operational performance (Sharma and Modgil, 2019). Patyal and Koilakuntla (2017), Adam *et al.* (1997) and Hendricks and Singhal (1997) reported that QMS directly affects business performance. Recently, Kamble *et al.* (2020) indicated the quality perspective in implementing Industry 4.0 and argued that QMS is a prerequisite in Indian SMEs.

Business performance, generally, is measured using outcome-based financial indicators (FI) (Hofer, 1983; Venkatraman and Ramanujam, 1986). In the modern economy, market and value-based performance measurements are more appropriate (Hax and Majluf, 1984) than traditional FI (Cumby and Conrod, 2001; Velimirović *et al.*, 2011). Mahmud and Hilmi (2014) assert that SME performance should be measured from marketing, human resource, finance, knowledge management and quality management perspective. Four classes of performance indicators, namely, finance, processes, human resource and customers, are fundamental in SMEs (Olaru *et al.*, 2014; Brem *et al.*, 2008).

Thus, the following research questions are set for study:

RQ1. What is the causality between the four classes of performance indicators?

RQ2. How does QMS affect the performance of SMEs in India?

RQ3. What prevents SMEs from implementing QMS?

This study proposes a two-stage approach. In the first stage, the authors gathered responses using a questionnaire on variables affecting business performance and identified dimensions using exploratory followed by confirmatory factor analysis. Subsequently, path analysis was carried out to arrive at the causality between the dimensions. The next stage comprises of validating findings in stage 1 and the proposition that QMS impacts performance. A survey of select eight firms using a questionnaire on QMS (items on quality knowledge level, application of quality tools and barriers to QMS implementation) and an in-depth interview with the key personnel was done. A case study protocol (CSP) (Eisenhardt, 1989; Yin, 1994) – within- and cross-case analysis followed by validation with supportive and conflicting literature, was used.

The paper is organized into eight sections. Section 2 analyses the relevant literature. Section 3 explains the design and conduct of survey and association amongst performance indicators and QMS. Section 4 describes phase II survey and within- and cross-case analysis.

Discussions on the findings, managerial implications, conclusion, limitations and scope for future work are presented in sections 5, 6, 7 and 8.

2. Literature review

Literature has two parts. One highlights the performance measurement in SMEs and the other the QMS.

2.1 Performance measurement

Performance indicators such as revenue growth, profitability growth and market share have been used to understand the organizational performance. Some studied the performance from different perspectives such as marketing, operations and human resources. The study of non-financial and less tangible factors such as quality, customer satisfaction and employee morale are also vital (Johnson and Kaplan, 1987; Ghalayini and Noble, 1996). Process performance includes operational efficiency enhancements in various processes resulting in the utilization of capacity, cost reduction and productivity improvement (Porter, 1985). The enterprises must be capable of manufacturing products of high quality at low cost and providing first-class customer service (Kaplan, 1983; Drury, 1990).

Leading manufacturers in Europe, Japan and the USA have reported the broad categories of performance as on-time delivery, product quality, customer satisfaction, employee morale, efficiency and utilization (Maskell, 1989; Otley, 1997; Ittner and Larcker, 1998). The variables that measure processes include the amount of scrap generation, quantity of rework, defectives produced, no change in the schedule and capacity utilization (Elbashir *et al.*, 2008). Abdel-Maksoud (2004) mentioned that the variables representing employee morale are staff turnover, absenteeism and lateness to work. He further mentioned that customer satisfaction variables include the number of complaints, customer retention and addition. The financial healthiness is indicated through increased profits, improvement in return on investment and enhanced market share (Dunk, 2011). Based on the above studies, the following list of variables was identified to indicate performance of the enterprise:

FI: the profits and its change rate, cash flow, return on investment, change in sales volume and market share.

Non-FI: scrap from the process; the number of defects; the amount of rework; complaints from customers; changes in the production schedule; employee turnover; absenteeism; late to work; capacity utilization; overtime; cost management; bonus to employees; and customer satisfaction, retention and addition.

2.2 Quality management system

In a growing economy, manufacturing SMEs' developments are restrained by factors such as increasing wages and scarcity of resources. In such business environment, the adoption of new management philosophy and development of QMS are very important (Yeung and Chan, 1998; García *et al.*, 2016). Deming (1986) asserts that only enterprises that can adopt the modern quality management philosophy will survive in the competitive global market.

Today's QMSs have evolved from a simple inspection function (Feigenbaum, 1991). It has grown beyond quality control and quality assurance (Carey, 2018) into a separate entity (Dedhia, 1997; Raho and Mears, 1997). The concept of total quality control (TQC) improved the QMS by enabling organizations to review product design regularly, analyze in-process results and plan for quality control activities (Feigenbaum, 1991). Total quality management (TQM) philosophy and ISO 9000 in 1980s influenced the development of QMS in modern manufacturing organizations. This development has resulted in a comprehensive set of quality management theories, tools and techniques (Juran, 1995).

QMS is a management approach comprising a set of tools and techniques (Wardhani *et al.*, 2009) that serve to structure, control and improve organizational activities (Betlloch-Mas *et al.*, 2019). A tool is a simple way to solve a problem such as brainstorming and flowchart. There are seven quality control tools: fishbone, check sheet, control chart, histogram, Pareto chart, scatter diagram and flowchart. Some new tools have emerged, which are mostly used with qualitative data: affinity diagram, relation diagram, tree diagram, matrix diagram, arrow diagram, process decision programme chart (PDPC) and matrix data analysis. A technique has a broader application than tools and may include many tools (McQuater *et al.*, 1995) such as statistical process control (SPC), strengths, weaknesses, opportunities and threats (SWOT) analysis and quality function deployment (QFD).

Implementation of quality management practices improves processes (Cho *et al.*, 2017). QMS ensures reduction in production costs and increased productivity (Dora *et al.*, 2013) and reduction of defects (Aggelogiannopoulos *et al.*, 2007) with quality assurance (Ulewicza and Nový, 2019). Other benefits include: improved capabilities to produce (Zhang *et al.*, 2014), continuous improvement (Bewoor and Pawar, 2010) in processes (van den Heuvel *et al.*, 2005), a shift from diagnostic to more interactive environment (van Iwaarden *et al.*, 2006) leading to effective actions (Richter, 2020). Adoption of QMS leads to the development of differentiated products, making it difficult for others to imitate (Tarí and Molina-Azorín, 2010). It yields intangible benefits, leading to better communication amongst human resource (Ruzevicius *et al.*, 2004). Dubey and Gunasekaran (2015) assert that human resource is an important soft dimension in the successful implementation of QMS.

It has many long-term benefits (Sanchez-Marquez *et al.*, 2020) such as improved organizational performance (Androwis *et al.*, 2018), increased competitiveness (Dubey *et al.*, 2015), customer satisfaction (Somasundarama *et al.*, 2020), higher market share (Zhou and Li, 2020) and improved corporate image (Welikala and Sohal, 2008; Jaafreh and Al-abedallat, 2013). Levine and Toffel (2010) found that the mortality rate of organizations that have implemented QMS has been quite less. It leads to a firm's sustainable development (Lukichev and Romanovich, 2016). To reap up all these befits, top management commitment is vital (Dubey *et al.*, 2018).

3. Design and conduct of survey: phase I

The survey is done in two phases. Phase I is an open survey amongst SMEs, while phase II relates to a survey of eight firms, including in-depth interviews. Phase II is done to validate phase I findings and establish the proposition: "QMS leads to performance improvement in the long run".

The authors obtained the list and addresses of SMEs from the competent government authority. Of the 270 SMEs, only 205 were functional. In the first phase, 205 SMEs were surveyed to gather responses on performance measures. The questionnaire consists of 21 variables. The variables were decided based on the research works mentioned in the literature review (section 2.1), pilot study and discussions with industry experts. The respondents have to assess the variables on a seven-point Likert scale. The respondents were also asked to provide additional information such as the organization's age, type of organization (small or medium), the number of employees currently serving and the annual turnover. The instrument used for the study is presented in Appendix 1. The survey was conducted from August 2015–March 2016. And, 205 responses were obtained, of which 200 were found suitable for analysis. The profile of respondents is presented in Tables 1 and 2.

The enterprises were grouped into five clusters using cluster analysis techniques in IBM SPSS 20 software. Though not discussed in this paper, the idea was to draw the lessons from different clusters and report managerial implications; the profile of five clusters is shown in Table 3.

3.1 Factor analysis

The purpose of conducting factor analysis (exploratory and confirmatory) was to ascertain whether the identified 21 variables fall into distinct groups (factors) cohesively. The principal component analysis method was employed to extract the factors. The initial un-rotated solution obtained using IBM SPSS 20 did not yield distinct factors. Some of the variables were loaded onto more than one factor, indicating the presence of cross-loadings. Promax rotation technique at Kappa 4 with Kaiser normalization was applied to the data. This technique tries to maximize the variance through the oblique rotation and has the advantages of being fast and conceptually simple. After eliminating two variables, a final four-factor solution containing 19 variables was obtained, and the variances extracted are presented in Tables 4 and 5.

Cronbach's alpha (measure of internal consistency) measures the cohesiveness of the factors. Nunnally (1994) asserts that the value of Cronbach's alpha of more than 0.7 is acceptable. Cronbach's alpha of the four factors were 0.92, 0.90, 0.96 and 0.93.

3.2 Confirmatory factor analysis

Confirmatory factor analysis was carried out using IBM AMOS 20 software. The chi-square value of 487 with 174 degrees of freedom was found significant at 0.01 level. The χ^2/df of 2.80 was found acceptable (Bollen, 1989; Marsh *et al.*, 1988). The goodness-of-fit value of 0.86 is at

Table 1. Profile of the enterprises based on the age of the organization

Age group	Frequency	%	Cumulative %
5–10	43	21.5	21.5
11–15	44	22.0	43.5
16–20	61	30.5	74.0
21–25	27	13.5	87.5
26–30	17	8.5	96.0
31–35	8	4.0	100.0

Table 2. Profile of the enterprises based on the annual turnover

Annual turnover (in lacs)	Frequency	%	Cumulative %
10–50	55	27.5	27.5
51–2	43	21.5	49.0
2–5	76	38.0	87.0
6–20	14	7.0	94.0
21–50	5	2.5	96.5
>50	7	3.5	100.0

Table 3. Profile of five clusters

Cluster	Number of organizations		Average age of the organization (years)	Average number of employees	Annual turnover (INR in lakhs)
	Small	Medium			
1	27	00	17.13	26.85	26.31
2	09	00	17.89	30.56	35.17
3	82	04	16.85	38.37	30.23
4	64	02	16.39	28.03	27.20
5	08	04	16.63	68.75	50.13

Attributes	Component 1	2	3	4
The scrap coming out from the process is less				*0.930*
The number of defects are less in your products				*0.954*
You carry out minimal rework				*0.832*
You receive a few/no complaints from the customers				*0.758*
There are no changes/minimal changes in the production schedules				*0.569*
Very few workers leave your organization		*0.859*		
Absenteeism is very low amongst employees		*0.886*		
Employees coming late to work is very less		*0.941*		
Facilities are being used to their fullest capacity		*0.765*		
There is no need of overtime in your organization		*0.763*		
The profits are consistent for the past five years			*0.930*	
The cash flow in the past five years is steady			*0.915*	
Return on investment is stable in the past five years			*0.902*	
Cost management measures are properly implemented across organization			*0.825*	
Employees are happy with the bonus during the past five years	*0.587*			
There has been a gradual improvement in sales volume during past five years			*0.474*	
Profit rates have improved over for the past five years			*0.549*	
Customer satisfaction has improved during the past five years	*0.944*			
Customer retention has improved over the past five years	*0.957*			
New customers have been gradually added during the past five years	*0.945*			
Market share has improved for the past five years	*0.744*			

Table 4.
The four-factor solution matrix

Component	Initial eigenvalues Total	% of variance	Cumulative %	Rotation sums of squared loadings Total	% of variance	Cumulative %
1	12.003	57.156	57.156	12.003	57.156	57.156
2	2.755	13.118	70.274	2.755	13.118	70.274
3	1.077	5.128	75.402	1.077	5.128	75.402
4	0.945	4.502	79.904	0.945	4.502	79.904

Table 5.
Variance explained by four factors

marginally acceptable level. The root mean square error of approximation (RMSEA) is estimated to be 0.091, which is again at a marginally acceptable level (Pössel and Black, 2014). The model fit results confirmed a four-factor solution consisting of 19 variables as detailed below:

Process indicators (PI): the scrap coming out from the process is less (PI1), the number of defects is less in your products (PI2), there are no changes/minimal changes in the production schedules (PI3), you receive a few/no complaints from the customers (PI4) and you carry out minimal rework (PI5).

Employee indicators (EI): very few workers leave the organization (EI1), absenteeism is very low amongst employees (EI2), there is no need for overtime in your organization (EI3) and employees coming late to work is very less (EI4).

FI: the profits are consistent for the past five years (FI1), the cash flow in the past five years is steady (FI2), return on investment is stable in the past five years (FI3), market share has improved for the past five years (FI4) and profit rates have improved over for the past five years (FI5).

Customer indicators (CI): cost management measures are correctly implemented across the organization (CI1), employees are happy with the bonus during the past five years (CI2),

new customers have been gradually added during past five years (CI3), customer retention has improved over the past five years (CI4) and customer satisfaction has improved during the past five years (CI5).

The performance of the organization was measured for each factor as follows:

$$X_i = \sum_i \left(\frac{X_{ij}}{n_j} \right) \tag{1}$$

where X_i are the different indicators – PI, EI, FI and CI expressed as arithmetic mean of individual (jth) variable scores associated with each variable. For example,

$$\text{Process Indicator(PI)} = (\text{PI1} + \text{PI2} + \text{PI3} + \text{PI4} + \text{PI5})/5$$

Similarly, the score for the other three factors for each organization is computed.

3.3 Path analysis

The path analysis was conducted to explore the cause-and-effect relationships amongst the factors. The result is shown in Figure 1. The standardized regression weights estimated by AMOS 20 for the path diagram indicate the following relation to be either supportive or not at 0.05 level. This is presented in Table 6. The standardized total effect between the factors is shown in Table 7.

It can be observed from the path diagram that the influence of EI on CI is positive; however, it is insignificant. As the research was limited to manufacturing industries, there is no direct contact between the employees and customers, unlike service industries. When one looks at the total effect, EI moderately affects CI.

All three factors influence FI significantly. This result indicates that whenever there are improvements in all three measures, FI improves significantly. The improvement in PI can be

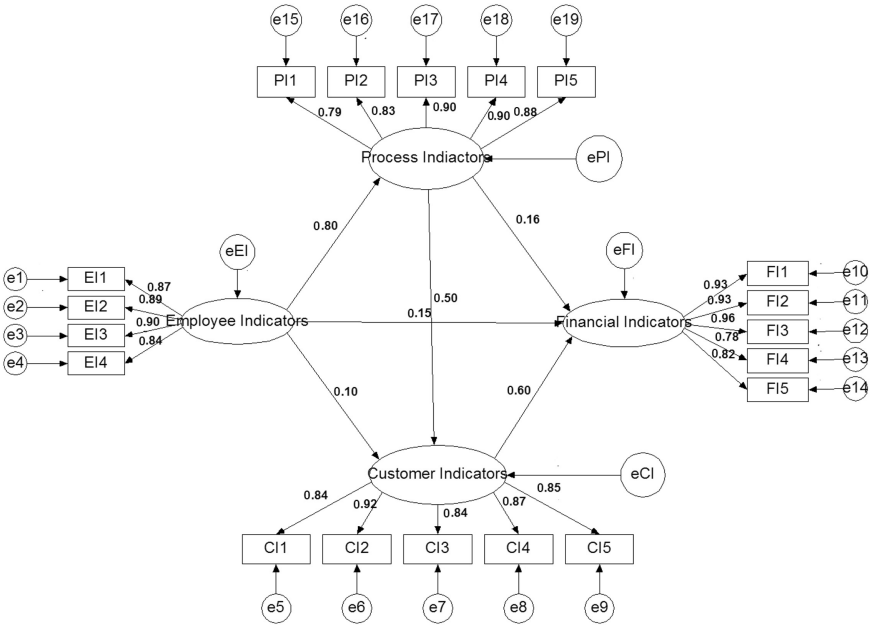

Figure 1.
Path diagram

brought about by hiring skilled workers, training the employees and investing in modern machinery and equipment. As improvement in employee measures improves customer measures, in the long run, financial status is also expected to improve. This conclusion is indicated by the standardized total effect of the other three indicators on FI.

4. Design and conduct of survey: phase II (case study)

This part of the research deals with a survey of selected eight firms using a structured questionnaire followed by in-depth interviews. The authors used a CSP to blend the two forms of the survey in this phase.

CSP: Research based on multiple case studies need a protocol to ensure homogeneity of approach across the cases, the analysis of cases – within and across, their validation with conflicting and similar literature (Eisenhardt, 1989; Yin, 1994; Miles and Huberman, 1994).

Selection of cases: The authors approached 20 firms, across five clusters, in the study area. This region has witnessed the closure of industries over the years (DCMSME, 2012). This region is situated in the northern part of Karnataka, a state in Southern India. Eight firms agreed to participate in the research process.

4.1 Knowledge of quality practices and its application (KIQP) index development

The questionnaire had two sections – one capturing the degree of knowledge of quality practices (DoK) and the other degree of application of the knowledge of quality practices (DoA). Organizations were asked to respond against five options (five-point Likert scale) under each section described in Table 8.

Table 6. Influences of one factor on the other

Sl. No	Influences	Yes/No
1	EI influences PI	Yes
2	EI influences CI	No
3	EI influences FI	Yes
4	PI influences CI	Yes
5	PI influences FI	Yes
6	CI influences FI	Yes

Table 7. Standardised total effect amongst the factors

Sl. No	Indicator/factor	EI	PI	CI
1	PI	0.80	0.00	0.00
2	CI	0.50	0.50	0.00
3	FI	0.59	0.46	0.60

Table 8. Scale to measure the DoK and DoA

	DoK		DoA	
Sl. No	Description	Score	Description	Score
1	No knowledge	0	Never used	0
2	Poor knowledge	1	Rarely used	1
3	Theoretical knowledge	2	Moderately used	2
4	Good knowledge	3	Frequently used	3
5	Excellent knowledge	4	Extensively used	4

There are 37 quality practices listed in the survey instrument, and the maximum score that can be obtained in each section is 148 (i.e. 37 × 4). Thus, the degree of knowledge (DoK) and degree of application (DoA) indices are computed as:

$$\mathrm{DoK}_i = \mathrm{SDoK}_i + \mathrm{MDoK}_i \tag{2}$$

$$\mathrm{DoA}_i = \mathrm{SDoA}_i + \mathrm{MDoA}_i \tag{3}$$

where

DoK_i is the DoK index for the ith organization;

SDoK_i is the DoK score for the ith organization;

MDoK_i is the maximum DoK score for the ith organization;

DoA_i is the DoA index for the ith organization;

SDoA_i is the DoA score for the ith organization;

MDoA_i is the maximum DoA score for the ith organization;

These two sub-indices have been used to compute the composite index indicating the extent of knowledge of quality practices and its application (denoted as KIQP).

$$\mathrm{KIQP}_i = \sqrt{(\mathrm{DoK}_i.\mathrm{DoA}_i)} \tag{4}$$

Equation (4) denotes the geometric mean of two sub-indices, as these are in ratios.

The study: The authors conducted a detailed study in eight organizations, two each in clusters 2, 3 and 4 and one each in clusters 1 and 5. They observed the activities and modified the questionnaire adopted by Aichouni *et al.* (2014) to gather the responses. The questionnaire is shown in Appendix 2. The questionnaire consists of mainly three parts: quality knowledge level (38 items), application of quality tools (38 items) and barriers to QMS implementation (13 items).

The eight organizations' profile is presented in Tables 9 and 10. A detailed study carried out in eight organizations is presented in the following sections.

In terms of the protocol followed by the authors, the findings of phase II surveys were subjected to within- and cross-case analysis.

4.2 Within-case analysis

Each case begins with the analysis of company background, knowledge and implementation quality practices and then discusses top management decisions. The authors use a structured

Table 9. The profile of the respondents

Sl. No	Organization	Cluster	Position in the company	Professional experience	Educational qualification
1	1	1	Owner	6–10 years	BE
2	2	2	Owner	6–10 years	MBA
3	3	2	Manager	6–10 years	BE
4	4	3	Owner	11–20 years	BE
5	5	3	Owner	11–20 years	Diploma in Engineering
6	6	4	Manager	11–20 years	BE
7	7	4	Manager	1–5 years	MBA
8	8	5	Owner	6–10 years	Diploma in Engineering

questionnaire for computing the composite index on knowledge of quality practices and its application (denoted as KIQP) and very specifically seek an answer to two questions of each case (CQ):

CQ1: Does the firm have a QMS or a strategy in place?

Yes, Somewhat or No

CQ2: What importance does the firm assign to QMS?

The scale used: very high, high, to some extent, low, and very low

The relationship between QMS and business performance was arrived based on in-depth interviews and references to similar and conflicting literature.

4.2.1 Organization 1. This firm is more than four decades old. Initially, for two decades, they were doing odd jobs exclusively for Karnataka State Road Transport Corporation. Currently, they are manufacturing fasteners and valve components for large organizations in the region. Keeping abreast of the changing needs, they went in for ISO certification five years ago. Their turnover is about INR 50m per annum and the firm has less than 20 employees. The owner is an engineering graduate with ten years of experience. His perception of the quality knowledge and application of quality strategies and tools is shown in Table 11.

The quality strategy for this organization is ISO 9000. They opted for certification because their customers were exporting valves and demanded the certification. They are not aware of other quality management strategies such as TQM and six sigma. The personnel in this organization are aware of a few necessary quality tools, while they are completely ignorant of management and planning tools (MPT).

In this organization, flow charts are employed for describing the workflow of the products. However, at the worker level, they are in terms of process instructions (without flow chart symbols). They are using histogram alongside the X-bar chart to accept or reject the fasteners and valve components and bring the process under control. They are using failure mode and effects analysis (FMEA) for managing the quality. For example, detection of the cause of failure of the bolts used in valves with the help of FMEA. Quality circles recently mulled over the brittleness of the bolt after heat treatment and resolved it successfully. In this organization, scrap from the processes and the number of defects is less, and the amount of rework is minimal. They do not have the knowledge of modern concepts and tools associated with lean, green and six sigma. Such implementation can reduce defect rates, less use of resources and energy and instil customer confidence-enhancing competitiveness.

The performance of the organization was computed as mentioned in section 3.1. The value of each of the factors is shown in Figure 2.

CI and FI seem to be better. EI is moderate due to disproportionate incentives to the employees for their initiatives. The use of 14 tools provides an advantage to the firm, and performance measures are satisfactory.

Organization	1	2	3	4	5	6	7	8
Small/medium	Small	Small	Medium	Small	Medium	Small	Medium	Small
Number of employees	<20	20–50	51–100	20–50	20–50	20–50	101–250	<20
Presence of quality manager	Y	Y	Y	Y	Y	N	Y	N
ISO certified	Y	N	Y	N	Y	Y	N	N
Do you apply quality improvement methods	Y	Y	Y	Y	Y	Y	Y	Y
QMS	Y	N	N	Y	Y	Y	Y	N
Cluster	1	2	2	3	3	4	4	5

Table 10. The profile of the organizations

Quality improvement strategies and tools	DoK					DoA				
	NK	PK	TK	GK	EK	NU	RU	MU	FU	EU
Quality management strategies										
ISO 9001				√					√	
TQM	√					√				
Six sigma	√					√				
Lean management	√					√				
Kaizen	√					√				
Basic quality tools										
Flow chart				√					√	
Check sheet				√					√	
Pareto analysis/diagram	√					√				
Histogram				√					√	
Cause-and-effect diagram	√					√				
Scatter plot	√					√				
Control charts				√					√	
MPT										
Affinity diagram	√					√				
Relations diagram	√					√				
Tree diagram	√					√				
Matrix diagram	√					√				
Prioritization matrix	√					√				
PDPC	√					√				
Activity network diagram	√					√				
Other tools and techniques										
Brainstorming				√					√	
5 whys	√					√				
Force-filed analysis	√					√				
Nominal group technique	√					√				
Survey and questionnaire	√					√				
Benchmarking	√					√				
QFD	√					√				
5S technique				√					√	
Fault tree analysis	√					√				
Design of experiments				√					√	
FMEA				√					√	
Process capability analysis				√					√	
SPC				√				√		
Quality costs				√					√	
Internal audit				√					√	
Hoshin planning	√					√				
Just-in-time	√					√				
Quality circles				√					√	
Standard time				√					√	

Note(s): NK: no knowledge; PK: poor knowledge; TK: theoretical knowledge; GK: good knowledge; EK: excellent knowledge; NU: never used; RU: rarely used; MU: moderately used; FU: frequently used; EU: extensively used

Table 11.
DoK and DoA of quality management strategies and tools in organization 1

The firm reported that the variety is less and manufactured using a batch production system. QMS enables a robust process, ensuring flexibility to be in place. In the long run, without a QMS, it would be challenging to change order qualifiers to order winners. Choudhari *et al.* (2012) list the characteristics required to be order winners and stress the need for the adoption of quality practices.

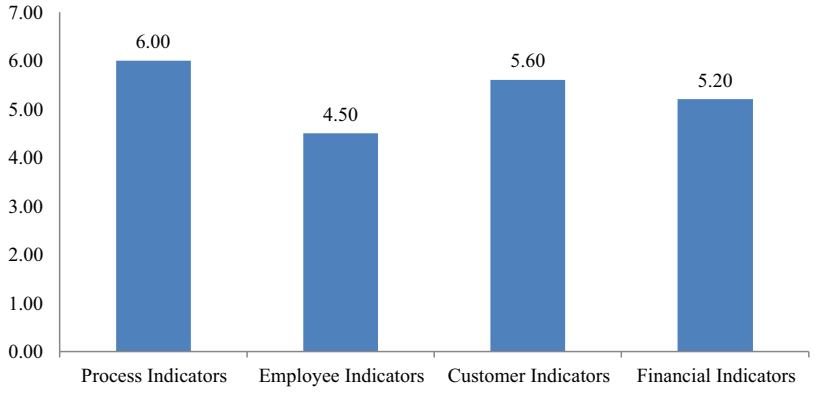

Figure 2.
Values of four factors for organization 1

There is a continuous flow of orders into the organization; hence, it runs without interruption. The type of orders is well known, and only the quantity varies. With modern facilities and QMS in place, the CI and FI are found to be better. They feel that QMS requires more resources and also costs more and hence is a barrier. It is widely proven that the implementation of quality measures costs more initially but yields long-run benefits.

4.2.2 Organization 2. This organization was started in 2006. Apartments' construction was on the rise after 2000 in this region, and hence, there was a need for modular kitchens. The management thought to cash in on the opportunity and started manufacturing modular kitchen items. They have employed a make-to-order type of manufacturing system. The owner is an MBA graduate and has employed five engineers and 25 labours. Their turnover during the previous financial year was about INR 30m. They do not follow any specific quality model, such as ISO. The owner's perception of the quality knowledge and application of quality strategies and tools is shown in Table 12.

The organization has not employed any specific quality strategy and is not aware of quality management strategies such as TQM and six sigma. They are making frequent use of the basic quality tools and similar techniques.

As there was a considerable demand for modular kitchen with no local manufacturers, the organization just resorted to meeting the demand. With time, the problems associated with units started to crop up. They identified lots of waste and dust generating from the processes. The owner hired five engineers two years back. Only during the past financial year, they have resolved the issues scientifically.

The typical problem that arose in modular kitchen units was improper sticking of the adhesive between plywood and laminate while using a hot press machine. This issue was identified using check sheets, while it was resolved using FMEA. The machine idle time was another issue in the organization. They worked out the machine time and person-hours scientifically and improved machine utilization time through quality circles. Computation of standard time for some of the jobs was also done. They conduct meetings regularly, wherein the engineers and the marketing people are invited. They try to get feedback to identify the problems and brainstorm to resolve them. The performance of the organization on four factors was computed and is shown in Figure 3.

It is evident from Figure 4 that PI, EI and FI are below average, and CI is just above the average. Lots of waste, defects and rework were observed during the study. Ravichandran and Rai (2000) suggest that piecemeal adoptions of select quality management practices are not likely to be effective. Organizations need to adopt a comprehensive QMS policy and implement them to remain competitive.

Quality improvement strategies and tools	DoK NK	PK	TK	GK	EK	DoA NU	RU	MU	FU	EU
Quality management strategies										
ISO 9001				√		√				
TQM			√			√				
Six sigma	√					√				
Lean management			√			√				
Kaizen			√			√				
Basic quality tools										
Flow chart					√				√	
Check sheet					√				√	
Pareto analysis/diagram	√					√				
Histogram					√				√	
Cause-and-effect diagram	√					√				
Scatter plot	√					√				
Control charts					√				√	
MPT										
Affinity diagram	√					√				
Relations diagram	√					√				
Tree diagram	√					√				
Matrix diagram	√					√				
Prioritization matrix	√					√				
PDPC	√					√				
Activity network diagram	√					√				
Other tools and techniques										
Brainstorming					√					√
5 whys	√					√				
Force-filed analysis	√					√				
Nominal group technique	√					√				
Survey and questionnaire	√					√				
Benchmarking	√					√				
QFD	√					√				
5S technique			√			√				
Fault tree analysis	√					√				
Design of experiments	√					√				
FMEA				√						√
Process capability analysis			√							√
SPC			√						√	
Quality costs					√				√	
Internal audit				√					√	
Hoshin planning	√					√				
Just-in-time		√				√				
Quality circles				√					√	
Standard time					√					√

Table 12.
DoK and DoA of quality management strategies and tools in organization 2

4.2.3 Organization 3. This firm is a two-decade-old organization. It is a medium-scale enterprise with a turnover of INR 60m and has 100 employees. They manufacture motors, brake coils, brake magnets and generators. They are suppliers to large enterprises such as KEC Limited, Crompton Greaves Limited and OTIS Elevators Company (India) Limited. They had obtained ISO certification ten years back, and after that, there is no re-certification. The respondent's perception of the quality knowledge and application of quality strategies and tools is shown in Table 13.

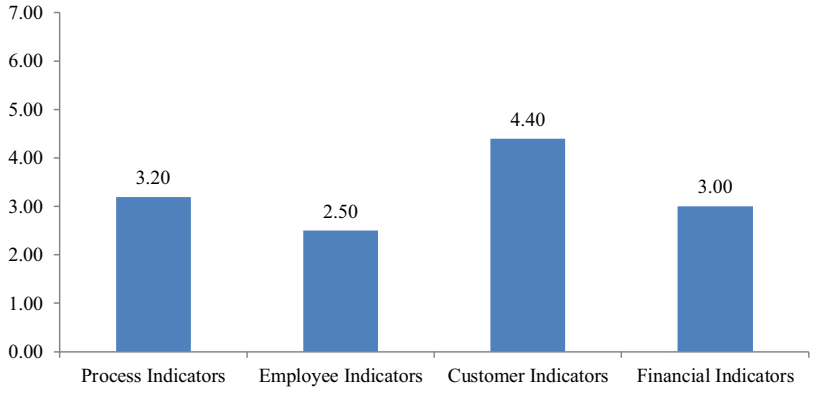

Figure 3.
Values of four factors for organization 2

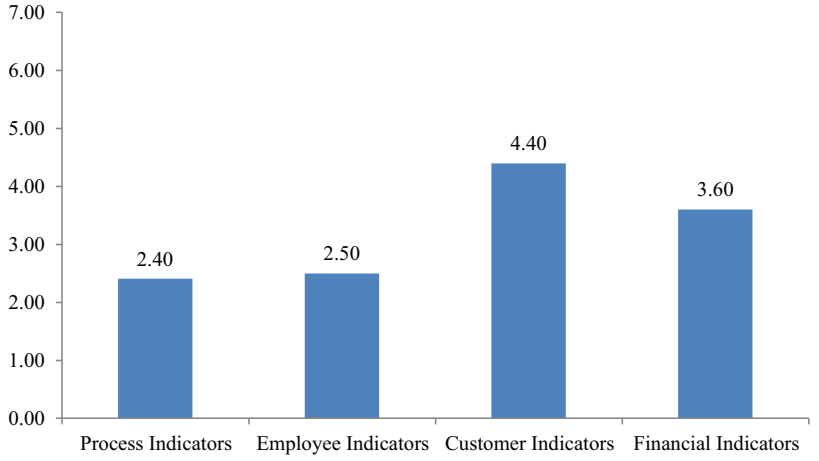

Figure 4.
Values of four factors for organization 3

The organization has adopted ISO 9000 quality strategy. However, the activities for re-certification are absent. They are entirely ignorant of MPT. They say that they are making frequent use of some of the necessary quality tools. They are not seen in reality. One can see the standard times being established for some of the activities long ago. Quality circles and brainstorming are prevalent in addition to flow charts, check sheets and histograms. The performance of the organization on four factors was computed and is shown in Figure 4.

It is evident from Figure 4 that PI, EI and FI are below average, and CI is above the average. The authors found internal issues in the organization. Prima facia appears that they are carrying on the activities with the legacy of a decade-old certification.

The firm has no usage of MPT, as such decisions made cannot be pre-evaluated and have to wait for the outcome. As the firm delivers customized products, the need for flexibility and quality is crucial (Choudhari *et al.*, 2012). The workforce in this organization has more focus on setup times and found to be worked up with routine jobs. A low employee satisfaction score suggests that the application of MPT such as "prioritization matrix" and "process decision programme chart" is expected to improve productivity and motivation.

4.2.4 Organization 4. It is more than 35 years old small enterprise. It has a turnover of INR 60m with 25 employees. They produce various types of castings for valve and automotive

Quality improvement strategies and tools	DoK						DoA			
	NK	PK	TK	GK	EK	NU	RU	MU	FU	EU
Quality management strategies										
ISO 9001				√					√	
TQM	√					√				
Six sigma	√					√				
Lean management	√					√				
Kaizen	√					√				
Basic quality tools										
Flow chart				√					√	
Check sheet					√				√	
Pareto analysis/diagram	√					√				
Histogram				√					√	
Cause-and-effect diagram	√					√				
Scatter plot	√					√				
Control charts					√				√	
MPT										
Affinity diagram	√					√				
Relations diagram	√					√				
Tree diagram	√					√				
Matrix diagram				√		√				
Prioritization matrix	√					√				
PDPC	√					√				
Activity network diagram	√					√				
Other tools and techniques										
Brainstorming				√						√
5 whys	√					√				
Force-filed analysis	√					√				
Nominal group technique	√					√				
Survey and questionnaire	√					√				
Benchmarking	√					√				
QFD	√					√				
5S technique				√				√		
Fault tree analysis	√					√				
Design of experiments				√		√				
FMEA				√				√		
Process capability analysis				√					√	
SPC				√					√	
Quality costs				√					√	
Internal audit				√					√	
Hoshin planning	√					√				
Just-in-time	√					√				
Quality circles			√						√	
Standard time				√					√	

Table 13.
DoK and DoA of quality management strategies and tools in organization 3

component manufacturers. Recently, they have started manufacturing polyvinyl chloride (PVC) pipes. They follow typical castings grading management quality model. They produce other varieties of castings as well. The owner's perception of the quality knowledge and application of quality strategies and tools is shown in Table 14.

The organization has employed castings grading quality strategy. They are aware of the ISO 9000 quality management strategy, while not aware of other quality strategies such as TQM and six sigma. They are making frequent use of three of the seven basic quality tools,

Quality improvement strategies and tools	DoK NK	PK	TK	GK	EK	NU	DoA RU	MU	FU	EU
Quality management strategies										
ISO 9001				√		√				
TQM	√					√				
Six sigma	√					√				
Lean management	√					√				
Kaizen	√					√				
Basic quality tools										
Flow chart				√					√	
Check sheet				√					√	
Pareto analysis/diagram	√					√				
Histogram	√					√				
Cause-and-effect diagram	√								√	
Scatter plot	√					√				
Control charts	√					√				
MPT										
Affinity diagram	√					√				
Relations diagram	√					√				
Tree diagram	√					√				
Matrix diagram	√					√				
Prioritization matrix	√					√				
PDPC	√					√				
Activity network diagram	√					√				
Other tools and techniques										
Brainstorming				√					√	
5 whys	√					√				
Force-filed analysis	√					√				
Nominal group technique	√					√				
Survey and questionnaire	√					√				
Benchmarking	√					√				
QFD	√					√				
5S technique	√					√				
Fault tree analysis	√					√				
Design of experiments				√		√				
FMEA				√		√				
Process capability analysis				√					√	
SPC	√					√				
Quality costs				√					√	
Internal audit				√					√	
Hoshin planning	√					√				
Just-in-time				√					√	
Quality circles	√					√				
Standard time				√		√				

Table 14.
DoK and DoA of quality management strategies and tools in organization 4

brainstorming, FMEA, quality costs, process capability analysis, internal audits and just-in-time. They are also entirely ignorant of MPT.

They have employed flow charts not only to describe the process flow but also in business documentation. For example, flow charts are used for order processing of castings for automotive components. Check sheets are used in three different forms: defective item check sheet, defect location check sheet and defect cause check sheet. Most of the time, this provides input for the cause-and-effect diagram. One can notice the regular use of check sheets and cause-and-effect diagrams in handling and tackling the defects and defectives.

There is a lack of clarification as to what is brainstorming and quality circles. A quality circle recently took up the issue of hot cracks and hot spots in the castings. They mulled over the issue and found improper mould design to cause hot cracks, and proper cooling as the solution for hot spots. In this case, they resort to brainstorming, while it was a quality circle activity. They carry out an internal audit regularly and have a check on quality costs.

The performance of the organization on four factors was computed and is shown in Figure 5.

It is evident from Figure 5 that PI, EI and FI are all 6 and above on a seven-point scale. CI and FI score 7, while PI and EI score 6.2 and 6, respectively. This score indicates a happy bunch of customers and sound financial status. Hence, PI calls for continuous improvement.

The above state is a good fit for the case described by Sandoval-Chávez and Beruvides (1998). The authors say a company may be working at maximum capacity, the processes are in harmony and the customers are satisfied at a minimum cost. Any improvement in quality will mean additional cost, so why should a firm adopt the quality tools not done so far. The authors suggest that a firm loses on account of intangible factors such as inadequate material handling, breakdown of plant and equipment leading to non-availability and underutilization of resources or shipment delays. The quality should be under a holistic view, and thus, a QMS can lead to a reduction in opportunity losses or cost, enhancing firms' competitiveness over time. The cost of quality should include opportunity cost (OC) arising outsourcing, production, delivery, maintenance and interconnected services. Without a QMS, there is no way to determine the OC.

4.2.5 Organization 5. It is more than 35 years old medium enterprise. It has a turnover of INR 150m with 48 employees. They produce valves and pumps. They are also suppliers to large enterprises in the region. It got its first ISO 9000 certification a decade ago, and it is re-certified periodically. The respondent's perception of the quality knowledge and application of quality strategies and tools is shown in Table 15.

The organization has employed an ISO 9000 quality strategy. They are also following lean management practices. They are making frequent use of three of the seven basic quality tools, brainstorming, design of experiments, process capability analysis, quality costs, internal audits and standard time. They are aware of and employing a matrix diagram, an MPT.

In this organization, frequent use of histogram alongside process capability was observed. The alignment of flanges is critical in the proper functioning of the valve. The perpendicularity of the face of the flange is checked and also measured. The histogram is then prepared, and the process capability is then analyzed for settings in the processes. Sometimes, brainstorming is also carried out to find solutions to handle the misalignment.

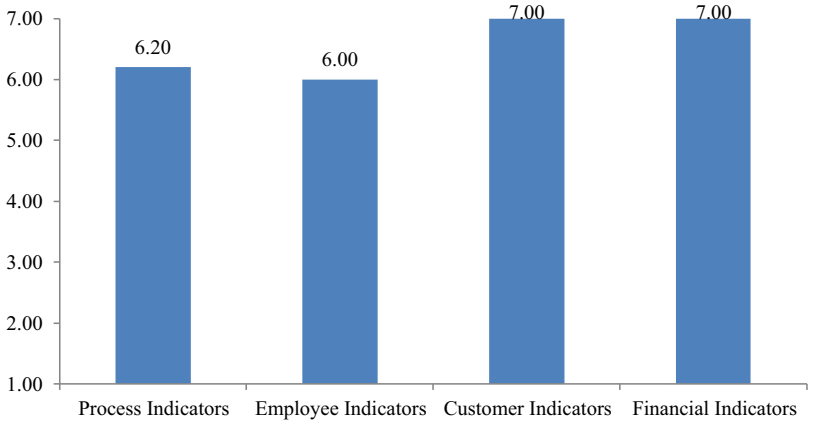

Figure 5.
Values of four factors for organization 4

Quality improvement strategies and tools	DoK NK	PK	TK	GK	EK	NU	RU	DoA MU	FU	EU
Quality management strategies										
ISO 9001				√					√	
TQM	√					√				
Six sigma	√					√				
Lean management	√					√				
Kaizen	√					√				
Basic quality tools										
Flow chart			√						√	
Check sheet			√						√	
Pareto analysis/diagram	√					√				
Histogram	√								√	
Cause-and-effect diagram	√					√				
Scatter plot	√					√				
Control charts			√			√				
MPT										
Affinity diagram	√					√				
Relations diagram	√					√				
Tree diagram	√					√				
Matrix diagram			√						√	
Prioritization matrix	√					√				
PDPC	√					√				
Activity network diagram	√					√				
Other tools and techniques										
Brainstorming					√				√	
5 whys	√					√				
Force-filed analysis	√					√				
Nominal group technique	√					√				
Survey and questionnaire	√					√				
Benchmarking	√					√				
QFD	√					√				
5S technique	√					√				
Fault tree analysis	√					√				
Design of experiments					√				√	
FMEA				√		√				
Process capability analysis	√								√	
SPC	√					√				
Quality costs				√					√	
Internal audit	√								√	
Hoshin planning	√					√				
Just-in-time	√					√				
Quality circles					√	√				
Standard time					√				√	

Table 15.
DoK and DoA of quality management strategies and tools in organization 5

The matrix diagram is employed for two reasons here. The skill matrix is developed for workers, which forms the basis for training and incentives. QFD type of a matrix is developed to check the functioning of the pumps and valves. This tool helps in developing new products. During the study period, the researcher observed the usage of the design of experiments for testing of discharge and suction rates of pumps.

The performance of the organization on four factors was computed and is shown in Figure 6.

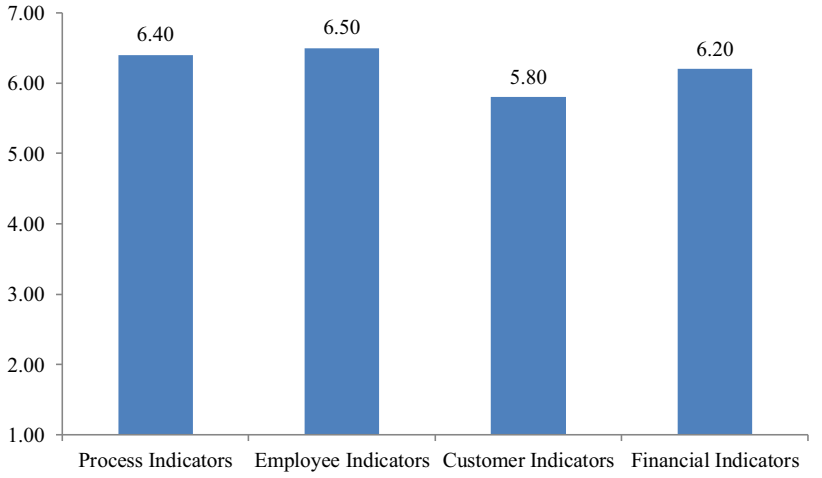

Figure 6.
Values of four factors for organization 5

It can be seen from Figure 6 that PI, EI and FI are above 6, while CI is just below 6. This unit was earlier supplying its products to large enterprises while recently marketing their products in the open market.

The firm's age is more than 30 years, which implies it is in the mature stage. A typical problem in this stage is the loss of agility and satisfaction over incremental improvements (Carnes *et al.*, 2017). The managers aim at exploitation rather than exploration. This approach is evident from the firm's offerings of the same product in the open market in addition to business-to-business (B2B) supplies. That is, it is prone to exploiting the currently successful product and short-term leverage success. The use of QFD to capture customer voice along with survey and Nominal Group Technique (NGT) or Delphi tools leads to identification of new opportunities, innovations in products and services, and thus, leading to organic growth.

4.2.6 Organization 6. It is more than 30 years old small enterprise. It has a turnover of INR 150m with 40 employees. They produce AC generators. They are also suppliers to large enterprises such as Kirloskar Oil Engines Limited, Kirloskar Brothers Limited. It got its first ISO 9000 certification four years ago, and it is re-certified periodically. The respondent's perception of the quality knowledge and application of quality strategies and tools is shown in Table 16.

The organization has employed an ISO 9000 quality strategy. They are making frequent use of flow charts, check sheets, 5S techniques and FMEA. They moderately use brainstorming, process capability analysis, SPC, quality costs, internal audits, just-in-time, quality circles and standard time. They are not aware of any of the MPT.

It is the only organization amongst the ones studied where 5S techniques are employed extensively. One can see a neat and clean work environment. The workplace, assembly area is ergonomically designed, and there is no unnecessary inventory. The testing procedure and safety precautions are laid down. The respondent asserted reduction in waste, and minimization of human errors achieved through 5S techniques. The reduction of hazards through proper storage and organization of items has also been achieved. During the study period, the researchers observed the use of the FMEA technique to solve bearing failure and high vibration levels of the generators. They have established standard times for routine activities through which line balancing is done. Quality costs and internal audits are carried out regularly.

The performance of the organization on four factors was computed and is shown in Figure 7.

Quality improvement strategies and tools	DoK NK	PK	TK	GK	EK	DoA NU	RU	MU	FU	EU
Quality management strategies										
ISO 9001				√					√	
TQM	√					√				
Six sigma	√					√				
Lean management				√		√				
Kaizen	√					√				
Basic quality tools										
Flow chart				√					√	
Check sheet			√						√	
Pareto analysis/diagram				√		√				
Histogram				√		√				
Cause-and-effect diagram				√		√				
Scatter plot			√			√				
Control charts				√		√				
MPT										
Affinity diagram	√					√				
Relations diagram	√					√				
Tree diagram	√					√				
Matrix diagram	√					√				
Prioritization matrix	√					√				
PDPC	√					√				
Activity network diagram	√					√				
Other tools and techniques										
Brainstorming		√						√		
5 whys		√				√				
Force–filed analysis	√					√				
Nominal group technique	√					√				
Survey and questionnaire	√					√				
Benchmarking	√					√				
QFD	√					√				
5S technique				√					√	
Fault tree analysis	√					√				
Design of experiments	√					√				
FMEA			√						√	
Process capability analysis			√					√		
SPC			√					√		
Quality costs			√					√		
Internal audit			√					√		
Hoshin planning	√					√				
Just-in-time				√				√		
Quality circles			√					√		
Standard time			√					√		

Table 16.
DoK and DoA of quality management strategies and tools in organization 6

It can be seen from Figure 7 that PI, EI are 5, while CI and FI are 6 on a seven-point scale. CI and FI appear better. After enjoying the success through 5S techniques, they still feel substantial improvements in processes are possible.

This firm is a matured with basic principles of quality control intact but lacks in employee and process scores or performance. The results of path analysis show that employee influence processes, as such, shallow knowledge on quality practices have affected both employee and the process. In the long run, like any mature organization, the performance may be affected

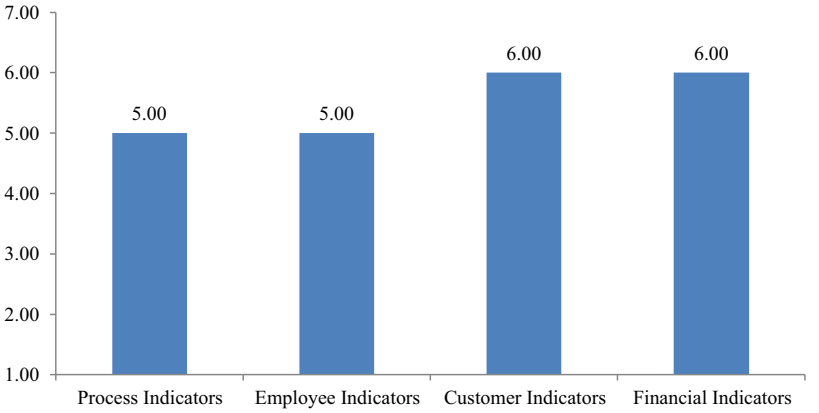

Figure 7.
Values of four factors for organization 6

due to less agility and innovations. The resource orchestration (RO) (Sirmon *et al.*, 2007, 2011) should lead to innovation in a mature organization (Carnes *et al.*, 2017). The quality tools under a holistic planning approach can aid organizations in enabling effective RO and maintaining its growth path.

4.2.7 Organization 7. It is more than 40 years old medium enterprise. It has a turnover of INR 520m with 165 employees. They produce structural steel such as TMT bars and angles. They do follow the ISO 9000 quality strategy but, not certified. They are in the process of getting the certification. The respondent's perception of the quality knowledge and application of quality strategies and tools is shown in Table 17.

Their quality strategy is ISO 9000. They are aware of many of the tools and techniques but are using three of the seven basic quality tools, some of the MPT.

This organization has employed an L-shaped matrix diagram to map customer requirements. Another use of an L matrix diagram was found for steel grades to map carbon percentage with various mechanical properties. PDPC was found in use for probable problems during hot rolling of angles; for example, corrugation can be avoided by proper heating using induction coils. The activity chart was employed for mapping the flow of material from the initial stage to the final stage.

An accident had occurred near the furnace. To identify the cause and remedy the problem, a brainstorming session was conducted. The workers used check sheets and cause-and-effect diagrams to explain and solve the problem. Force field analysis was conducted on whether to produce steel using scrap or iron ore. The pros and cons of both were drafted down and decided to produce 40% steel from scrap and the reaming using ore. They are using internal audits and quality costs extensively.

The performance of the organization on four factors was computed and is shown in Figure 8.

The PI is better than other indicators in this organization. The firm's use of quality tools corroborates the score and suggests that the processes are robust. However, the FI is weak compared to others. On discussion with authority, it is learnt that the firm invested in modernizing their furnaces and electricity generation plant two years back. Such financial investments generally have a long payback period.

However, the firm does not have a structured approach to identify the cost and cause of failure, losses caused by opportunity factors and consistency in quality. The tools employed check the failures, but not the cause. Being a 40-year-old organization, utilization of assets and existence in perpetuity become a priority over explorations (Loderer *et al.*, 2017).

Quality improvement strategies and tools	DoK NK	PK	TK	GK	EK	NU	RU	DoA MU	FU	EU
Quality management strategies										
ISO 9001				√					√	
TQM	√					√				
Six sigma	√					√				
Lean management	√					√				
Kaizen	√					√				
Basic quality tools										
Flow chart				√					√	
Check sheet				√					√	
Pareto analysis/diagram	√					√				
Histogram	√					√				
Cause-and-effect diagram	√							√		
Scatter plot	√					√				
Control charts				√					√	
MPT										
Affinity diagram			√			√				
Relations diagram	√					√				
Tree diagram	√					√				
Matrix diagram	√								√	
Prioritization matrix	√					√				
PDPC			√						√	
Activity network diagram	√								√	
Other tools and techniques										
Brainstorming				√					√	
5 whys				√					√	
Force-filed analysis	√								√	
Nominal group technique					√	√				
Survey and questionnaire				√				√		
Benchmarking			√					√		
QFD			√			√				
5S technique			√						√	
Fault tree analysis	√					√				
Design of experiments	√					√				
FMEA	√							√		
Process capability analysis	√								√	
SPC				√						√
Quality costs				√						√
Internal audit				√						√
Hoshin planning	√					√				
Just-in-time	√					√				
Quality circles	√					√				
Standard time				√				√		

Table 17.
DoK and DoA of quality management strategies and tools in organization 7

A QMS takes care of defects, causes, optimal use of resources, opportunity losses and innovations to augment opportunities and the rate of growth.

4.2.8 Organization 8. This organization started ten years ago. It is a small enterprise having a turnover of INR 300m with 17 employees. They produce mainly tractor trailers. The owner holds diploma in mechanical engineering. The respondent's perception of the quality knowledge and application of quality strategies and tools is shown in Table 18.

The organization does not have any quality strategy and little knowledge of the quality tools and other tools. They tackle the problems on an *ad hoc* basis employing brainstorming.

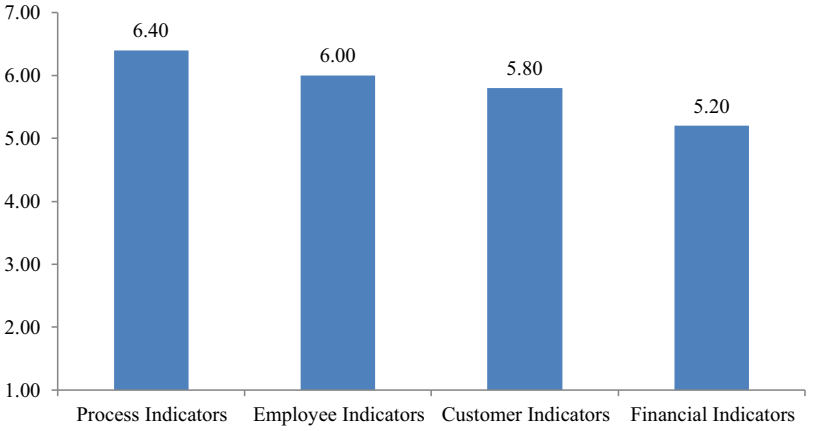

Figure 8.
Values of four factors for organization 7

The performance of the organization on four factors was computed and is shown in Figure 9.

It can be seen from Figure 9 that only EI is above the average level, while others are below average level.

This organization does not function as a regular company. Its demand is seasonal, i.e. from February to May, and so is its manufacturing. On discussion, it was learnt that despite their knowledge of quality tools, their attitude towards implementing QMS is poor. The scores on all the dimensions of performance are low and thus require attention.

4.3 Cross-case analysis

Here the authors focus on identifying patterns of commonalities and differences across case companies (McCutcheon and Meredith, 1993). Subsequently, a possible correlation between the knowledge and implementation quality practices (KIQP) index and business performance was examined using the support of literature and conceptual reasoning as the case may be. Table 19 gives the comparison of firms relating to the answers to the case questions (CQ1 and CQ2), DoK, DoA (of knowledge), the KIQP index, the business performance indicator (BI) and the sub-indicators – PI, EI, CI and FI.

The KIQP indices for all organization are low and between 0.06 and 0.35 (on a scale of 0–1). The in-depth interviews with the decision makers suggest that most of them are engineers and have sound knowledge of engineering quality control, but either they are not aware of strategic tools or systems or they do not want to invest in implementation of a QMS, being expensive and are content with existing revenue flows, or both. The study shows a mixed association between KIQP and BI. Firms 4 and 5 have low KIQP but high BI, whereas firm 8 has low KIQP and BI as well. As each case has been discussed in detail, the conclusions that can be drawn are twofold: firms fail to recognize the opportunity losses and long-term benefits or implementation of QMS requires willingness and ability of the firm. As most of the firms rely on one or two primary managers for almost everything, even if there is willingness, the ability to introduce structural changes may be less. The firms may use of GoI's ZED scheme to induce experts for implementation of QMS.

5. Discussions

This study reveals that four performance dimensions, namely, the employee, customer, process and financial performance, impact the overall business performance. The BI has been

Quality improvement strategies and tools	DoK NK	PK	TK	GK	EK	NU	RU	DoA MU	FU	EU
Quality management strategies										
ISO 9001		√				√				
TQM	√					√				
Six sigma	√					√				
Lean management	√					√				
Kaizen	√					√				
Basic quality tools										
Flow chart			√					√		
Check sheet	√					√				
Pareto analysis/diagram	√					√				
Histogram	√					√				
Cause-and-effect diagram	√					√				
Scatter plot	√					√				
Control charts	√					√				
MPT										
Affinity diagram	√					√				
Relations diagram	√					√				
Tree diagram	√					√				
Matrix diagram	√					√				
Prioritization matrix	√					√				
PDPC	√					√				
Activity network diagram	√					√				
Other tools and techniques										
Brainstorming			√					√		
5 whys	√					√				
Force-filed analysis	√					√				
Nominal group technique	√					√				
Survey and questionnaire	√					√				
Benchmarking	√					√				
QFD	√					√				
5S technique	√					√				
Fault tree analysis	√					√				
Design of experiments	√					√				
FMEA	√					√				
Process capability analysis	√					√				
SPC	√					√				
Quality costs			√					√		
Internal audit			√					√		
Hoshin planning	√					√				
Just-in-time	√					√				
Quality circles	√					√				
Standard time			√					√		

Table 18.
DoK and DoA of quality management strategies and tools in organization 8

developed considering the arithmetic mean of the sub-indicators. The path analysis provides the causality amongst the dimensions.

The employees play a critical role as they affect processes, customers and finance, while processes, in turn, affect customers and finance. Customers affect finance in a way that sales enhance revenue. There are a few indirect influences, too. Surprisingly, finance is not affecting processes, customers and employees. This result implied that even firms with a sound financial state do not invest in quality improvement or employee welfare, which is an indication of a traditional mindset.

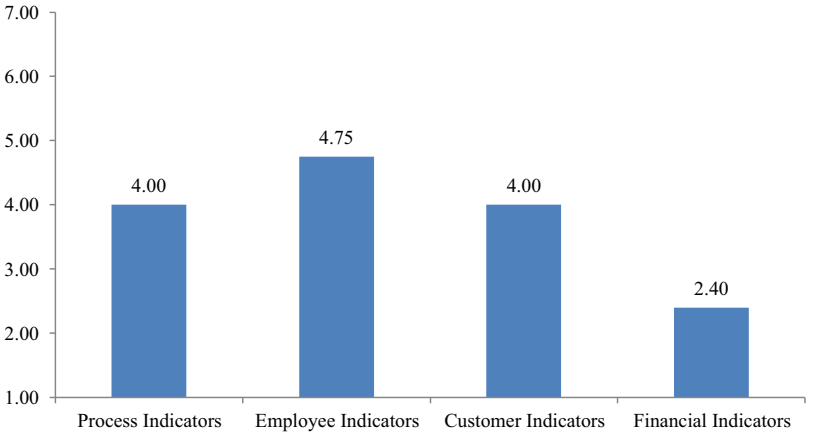

Figure 9.
Values of four factors for organization 8

Firm	CQ1: QMS in place	CQ2: QMS importance	DoK_i	DoA_i	KIQP	BI	PI	EI	CI	FI
1	No	High	0.30	0.29	0.30	21.30	6.00	4.50	5.60	5.20
2	No	High	0.33	0.24	0.28	13.10	3.20	2.50	4.40	3.00
3	No	Low	0.31	0.27	0.29	12.90	2.40	2.50	4.40	3.60
4	No	Very low	0.22	0.16	0.19	26.20	6.20	6.00	7.00	7.00
5	No	High	0.22	0.22	0.22	24.90	6.40	6.50	5.80	6.20
6	No	High	0.29	0.20	0.25	22.00	5.00	5.00	6.00	6.00
7	No	High	0.31	0.39	0.35	23.40	6.40	6.00	5.80	5.20
8	No	Very low	0.06	0.07	0.06	15.15	4.00	4.75	4.00	2.40

Table 19.
Comparison of firms – an across-case analysis

Regarding customers, the products are mostly low-differentiated ones, and as such, the need to enhance variety, i.e. spent on product attractiveness, is not felt mandatory. Thus, this orientation towards make-to-stock for non-essential products is likely to lead to a firm's early decline when the number of manufacturers increase or substitutes enters the market. QMS apart from reducing defects and opportunity losses enables differentiation in sustainable features such as low power consumption, weight, volume and durability.

For firms serving as sub-contractors to medium and large enterprises, the design inputs for converting raw material are provided by the contracting firm. The focus of these SMEs revolves around the conversion process and the skillset of the workers. The objective is achieved based on the acceptance of the recipient firm. The SME leaders fail to identify the intangibles that cause long-run downturn effects. For example, in the absence of a measure of process capability (Cpk), i.e. without a six sigma orientation, the outputs may exceed the tolerance limits. At this stage, the firm's incremental effort would not help; rather, a complete overhaul of the machinery and the process may be necessary. It is time-consuming, expensive and may lose orders for failing to meet the specifications and timeline.

The process performance charts demonstrate a process's ability to meet specifications. The traditional engineers rely on SPC charts, which fail to illustrate the process's ability to produce acceptable outputs and perform to capability. At present, the quality levels are human dependent to some extent as well. The results show that commitment of the workforce leads to better performance. However, consistency in their performance on a day may vary

with day-to-day factors such as weather, interaction at home, co-workers and seniors and similar issues. In the absence of a system such as QMS, errors could be high sometimes.

From the above discussions, the authors answer the first research question – RQ1, i.e. establishes the causality between the four classes of performance indicators.

Phase II of the study reveals that firms with no or poor quality practices also scored low in an employee dimension measure of business performance. This observation can be substantiated through comparison to the performance of organizations 2 and 3. These firms did possess ISO certification, but did not appear to make an impact. Several authors (Chiarini, 2015; İlkay and Aslan, 2012) point out that getting one-time ISO certification is as good as not having any QMS. Thus, the work provides evidence to the established fact that quality management is a continuous process.

However, employee relations in organization 1 were found weak compared to organization 8 due to some of the human resource (HR) policies. Thus, good employee relations are dependent on institutional factors, primarily the quality and HR policies. This dimension is vital, as it affects other indicators, as found in the path analysis.

The results show that firms with good quality practices scored high in their customer dimension. This finding is validated from the works of Rezaei *et al.* (2011), i.e. a QMS has a positive effect on the performance of an organization. This study does not objectively show that QMS improves the financial state of a company. However, the findings illustrate that QMS affected the employee, process and customers, and the causality shows that these factors, in turn, impact financial performance. Pun *et al.* (1999) showed that FI is better in organizations where the QMS is in place. It has also been concluded that a QMS will not bring immediate financial improvements (Farinha *et al.*, 2016). Hence, the proposition that "QMS impacts firms' financial performance in the long run" can be made.

When an organization employs a quality strategy, there seem to be improvements in the processes. The strategy brings reduction in the defects, minimizes the scrap and rework. The results are consistent with what Egera *et al.* (2018) asserted. When an organization does not have any strategy, processes get severely affected (Jain and Kiran, 2012), as evident from organizations 2, 3 and 8. Mere certification is inadequate to bring in improvements in processes over time. Process improvements are to be carried out continually, as evident from organization 3.

In medium enterprises, quality management practices have brought in more improvements in processes and employee relations than small enterprises. However, it is not true with the other two indicators. The presence of a sound QMS in a small enterprise has resulted in higher performances on FI and CI.

Thus, the second research question (RQ2) is answered. It is established, and the outcome of the study confirms that SMEs' performance, from all perspectives, improves with the adaption of quality practices. A sound QMS results in better processes, improves employee morale, enhances and establishes a strong customer base and healthy finances of an organization.

The third research question (RQ3) called for identifying the factors preventing SMEs from implementing a QMS. The most crucial one is the priority for allocating funds for replacement/modernization of plant and equipment, leaving no funds for implementing quality practices such as six sigma or similar. Implementation of these practices requires in-depth training and handholding, followed by regular third-party auditing. Thus, the GoI scheme – ZED, is likely to encourage the SMEs to develop a quality management strategy and plan its execution.

This study puts forward two indices: the business performance index, the knowledge of quality practices and its application (KIQP) index. The KIQP indicates that employee education is a crucial requirement, as, without employee knowledge, the adaption of quality practices cannot be successful. These indices can be used by researchers or agencies to assess

the performance and quality capabilities of an SME. It also calls for change in decision-makers' traditional mindset of focussing only on FI. A mandate from the regulatory authority, such as the National Manufacturing Competitiveness Council of India, to adopt different tiers of quality practices to get access to different benefits in the short run and degradation or closure notices, in the long run, may be considered as a policy decision.

This study aligns itself with the define-measure-analyze-improve-control (DMAIC) approach of six sigma implementation. It considers customers' perspective and other performance parameters and hence is in line with the framework suggested by Patyal *et al.* (2020). The performance indicators (X_i) and KIQP help improve and control SMEs' performance and achieve the desired process performance capability index (Cpk). The monitoring of KIQP aims to achieve sustainable growth. It suggests a shift from short- and mid-run approaches, correcting defects using statistical quality control approaches to a sustainable growth path – a long-term approach. QMS involves cost and time to get assimilated into a system and may not reflect immediate gains. The findings show it has long-term impacts, enhancing the half-life of SMEs.

6. Managerial implications

This study's findings have implications for managers in pointing out their style of operations, priorities and weaknesses. SMEs need to perceive the utility of QMS, else may suffer a reduction in business or closures. Managers hesitate to invest in the implementation of QMS being unsure of its returns and due to the long gestation period. The managers need to recognize the importance of process capability charts in place of SPC, a way to achieve six sigma levels of performance. The technological capabilities of a product do not alone ensure its long-term competitiveness. The managers need to enable non-technological or soft innovations that deliver additional utility to customers creating an exit barrier. QMS can address both aspects.

Training is an essential component of improvement; managers need to spare resources to achieve this objective. Employees impact all other three performance criteria – the process, customer and financial; hence, its well-being needs to be a key thrust area. Salary or financial incentives are not the only motivators, a well laid-down process, a sound HR policy, environment for innovations and up-to-date training are the crucial requirements. QMS takes into account these aspects, as QMS is more of a phenomenon than a toolset. It leads to the development of the quality ecosystem.

The customer base reduces not only because of technologically inferior goods but also because of the availability of more options arising out substitutes and increased producers. This factor is valid unless a firm's product has features that lead to retention of customers' loyalty. The findings show that QMS can address this issue as well. SMEs should take advantage of government schemes and lay down their QMS.

7. Conclusions

The contribution of SMEs to the country's economy is growing, but rampant closures are going undetected and unchecked. The appeal of SME products outside the country has not shown much promise. One point has been realized – the need for quality commensurate with the requirements of global customers. In this paper, the authors carry out a clinical study determining the dimensions of SME performance, the organizational behaviour, the importance of QMS and ways and means to implement QMS.

There are four performance indicators: PI, EI, CI and FI, and its mean value indicates the overall business performance. However, individual indicators do not seem to impact a certain level of business performance linearly. The employee dimension affects the other three, but

the reverse causality does not exist. The process influences customers and company finances, and customers influence finances. This causality spells out the priority; it is the employee and the processes that impact the customers and finances.

The top management gives priority to technical skills, technology and financial returns. Their degree of knowledge about best quality practices is low, and even with the knowledge they have, the application has been minimal. The three primary traits of the managers include: change only when financial returns are low; change focussed on hardware, non-technological or soft innovations is missing (Cecere, 2012); and change where the returns are visible in the short run. Thus, these traits act as barriers to implement QMS.

The ways and means to implement QMS include: draw up a tier-based national plan on the adaption of QMS. The different levels of quality practices are based on an adaption of the Malcolm Baldrige National Quality Framework (MBNQA). A national programme needs to be drawn up to raise the SMEs' quality maturity (Chung, 2001). Further, provide incentives similar to the ZED scheme laid down by the GoI and introduce a quality accreditation system for an SME, with a mandate to run with minimum quality standards. The KIQP index can be used for this purpose. Lay down enforcement policies for non-compliance to quality declarations such as ISO certifications. At present, ISO calls for audits and provides non-conformance reports. These non-conformances are paper-based and may only lead to the cancellation of certification. The impact on the environment and other harms due to such non-compliances are not dealt with specifically.

The forums such as MSME councils, or India Council of Small industries or Chambers of Commerce, should lay stress on zero defects, carry out leadership programmes and build a quality ecosystem.

7.1 Limitations and scope for future work

SMEs located in one industrial area have been part of the study. Only manufacturing units were part of the study. It can include different industrial clusters as identified by the GoI to draw broader conclusions. This paper finds the need for QMS, and further research can substantiate that a QMS is a prerequisite to the implementation of Industry 4.0. In medium enterprises, quality management practices have brought in more improvements in processes and employee relations than small enterprises. However, it is not true with the other two indicators. The presence of a sound QMS in a small enterprise has resulted in higher performances on FI and CI. This needs a detailed study.

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Appendix

Appendix is available online for this article.

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