A RESEARCH STUDY ON "IMPACT OF ISO 9000:2000 ON SELECTED KEY PERFORMANCE INDICATORS OF MANUFACTURING ORGANIZATIONS IN INDIA.

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Abstract
The ISO-9000 quality systems certification is pre-requisite for industrial units, which are interested to export their goods/services or goods and services, from any part of the glob to European countries. Around 5, 00,000 plus industrial units got the ISO-9000 quality system certification, after spending a good amount of money and time (labor hours) for standardized systems documentation and its implementation.
Any new system/procedure/methods must have its own merits and demerits but the professionals must maximize the merits and minimize the demerits, which are known as optimization of resource utilization. Hence the people who are dealing with the systems should know the positive and negative impacts, qualitatively and quantitatively on all Key performance indicators; hence the author had conducted a research study and made the following observation:
with the implementation of ISO 9000, 11.33% of average turnover growth rate increased to 19.52%, 9.34% of average wastage & rejection reduced to 6.39%, 1.6016% of average machine breakdown reduced to 0.5078%, 9.46% of average net profits increased to 15.3%, 58.69% of point rated employees' benefits increased to 81.92, 62.25% of point rated customers' benefits increased to 84.97%, 49.19% of point rated Government & Society benefits increased to 65.44%, and 51.50% of point rated overall benefits increased to74.02%,. It shows that the ISO 9000 has significant positive effect on manufacturing companies. The researcher would like to conclude that there is no doubt that the ISO 9000 contributed significantly to the Indian manufacturing Industry Growth. The detailed conclusions are given in full paper.

1. Introduction to ISO 9000

ISO 9000 is a series of quality management systems standards created by the International Organization for Standardization (ISO), a federation of 132 national standards bodies. The ISO 9000 quality management systems (QMS) Standards are not specific to products or services, but apply to the processes that create them. The Standards are generic in nature so that they can be used by both manufacturing and service industries. First released in 1987 and revised in a limited manner in 1994, they underwent a major revision in 2000. The approval Standard, ISO 9001:2000, uses a simple process-based structure, which fits easily the process management structure of most businesses.
ISO 9000:2000 series: The ISO 9000:2000 series consists of: fundamentals and vocabulary, ISO 9001:2000 – Requirements and ISO 9004:2000 - Guidelines for performance improvement. ISO 9000 is an introduction to the philosophy of quality management and also contains the definitions used in ISO 9001 and ISO 9004.
There are 8 sections in ISO 9001:2000 that are Scope, References, Terms and definitions, Quality management system, Management responsibility, Resource management, Product realization and 'Measurement, analysis & improvement'

2. Significance of the study

As we know the ISO-9000 quality systems certification is pre-requisite for industrial units, which are interested to export their goods/services or goods and services, from any part of the glob to European countries. Around 5, 00,000 plus industrial units got the ISO-9000 quality system certification, after spending a lot of money and time (labor hours) for standardized systems documentation and its implementation. But so far there is no much study to give feed back of the new system standards on whether they are helpful/beneficial to industrial units if so what is the quantum of Impact on Key Performance Indicators (Total Turnover, wastage & rejection, Machine Break Down, Foreign Exchange growth, Profitability, Employees Benefits, Suppliers benefits, Customers benefits, Government benefits, Society Benefits etc.,).
As we know, any new system/procedure/methods must have its own merits and demerits but the professionals must maximize the merits and minimize the demerits, which are known as

optimization of resource utilization. Hence the people who are dealing with the systems should know the positive and negative impacts, qualitatively and quantitatively on all Key performance indicators and on all stake holders. Under present economic policies like globalization and liberalization the industrial units should serve only on optimum utilization of all the resources and systems. Again the optimum utilization of resources depends on the use of the ISO 9000 system standards. We know the optimum utilization of all resources will reduce the idleness, minimize the wastage, minimize the rejection, and maximize the productivity of all the resources that leads to high productivity & profitability.

Hence a research study is very much needed for giving feed- back to the users & beneficiaries about merits and demerits of the system standards and the quantum of positive or negative effect on each 'Key Performance Indicator' (KPIs) to take appropriate action to maximize the merits and minimize the demerits of systems.

3. Objectives of the Study:

1. To know and understand the impact of ISO 9000:2000 on Selected KPIs
2. To Examine the Quantum of Impact of ISO 9000:2000 on each of the selected KPIs
3. To Estimate the impact of ISO 9000:2000 on overall performance of manufacturing companies.
4. To find out general draw backs/deficiencies in ISO-9000:2000 quality systems

4. Hypotheses of the Study:

To estimate the impact of ISO 9000:2000 on selected KPIs, the required data had been collected from 300 manufacturing companies across various industries in India through well designed questionnaires and sampling design to test the following Hypotheses:

1. **H1:** A positive impact of ISO 9000 is shown on Turnover Growth Rate
2. **H2:** A positive impact of ISO 9000 is shown on reduction of Wastage & Rejection
3. **H3:** A positive impact of ISO 9000 is shown on Machine Break Down reduction
4. **H4:** A positive impact of ISO 9000 is shown on Profitability
5. **H5:** A positive impact of ISO 9000 is shown on Employees' benefits
6. **H6:** A positive impact of ISO 9000 is shown on Suppliers' benefits
7. **H7:** A positive impact of ISO 9000 is shown on Customers' benefits
8. **H8:** A positive impact of ISO 9000 is shown on Government and socity benefits
9. **H9:** The overall performance of manufacturing industry in India has been Improved with the implementation of ISO 9000

5. Scope and Universe of the Study:

The universe of study is confined to 300 Indian manufacturing companies which have implemented ISO 9000:2000. The scopes of the study covered all functional areas of selected 300 companies in which ISO 9000:2000 Quality systems implemented. The topical scope covered the ISO-9000: 1994, and ISO 9000:2000. The analytical scope covered the fulfillment of objectives and testing of Hypotheses set out for the study. The functional scope is confined to offering meaningful observations and conclusions for improving overall performance of manufacturing companies with the implementation of ISO 9000.

6. Research Methodology

The study involved collection of two types of data namely primary data and secondary data, analysis and interpretation for meaningful conclusion.

The primary data had been collected by direct observations of various work places, machines, materials, tools, equipments, products etc., in the selected industrial units and by interviewing concerned people and also by the questionnaire to understand the changes taken place in various operations, methods, systems, procedures etc., with the implementations of ISO 9000 Quality Systems.

The secondary data had been collected from the following records and reports pertaining to pre implementation and post implementation of ISO 9000 Quality Systems from selected 300 manufacturing companies.

- Annual report
- Production reports
- Monthly reports
- Training reports & records
- Marketing reports & records
- Purchase reports & records
- Engineering department reports & records
- Personnel deportment reports & records
- Accounts records & reports
- Sales records & reports etc.,

Some of records and report are used for validating the required data collected from main source.

Ex. Purchase records & reports and store record & reports helped the researcher to validate the turnover growth rate by counter checking major raw materials' rate of 'purchase increase' and consumption rate etc.

7. Sampling Design for Collecting Primary Data:

The proposed sampling method is stratified random sampling. The entire universe is divided in to the following strata namely employers' strata, employees' strata, customers' strata, suppliers' strata etc., Most of the strata will be divided in to sub-strata & sub-sub-strata, for getting proportionate representation from all section of people who are dealing or affecting ISO-9000 Quality systems. Quantitative & Qualitative analytical techniques have been used for sampling design and data collection.

The required data for testing HYPOTHESES has been collected from 5 stack holders of 300 selected manufacturing companies, Employees, Employers, Customers, Suppliers and Government & Society with the help of well- designed questionnaire of 30000 no., from which 23745 validated answered questionnaires have been identified through properly validated techniques. These 23745 validated questionnaires are used for Scientific Analysis and testing of hypotheses.

The data collection had been through mailed questionnaire & direct questionnaire and through appropriate sampling design for the same. The Overall Sampling Design has been shown in table 01-02.

Sampling Design for collecting data from 300 companies that have implemented ISO 9000 is as follows:

The 13 member experts committee constituted by including industry experts, academic experts and Quality consultants for designing sampling size for each Strata, sub-strata and sub- sub strata.

The total population is divided into mainly 4 sub strata that are East India, West India, South India & North India. Each sub stratum is allotted 25% of sample size and divided into 5 sub strata. Each stratum is allotted 5% of sample size. The sampling design is shown in the tables 01 and 02.

The detailed Sampling design runs 20 pages and all 5 types of Questionnaires for 5 stake holders' runs 17 pages.

79.15% of validated answered questionnaires are considered for analysis

100% companies (300 companies) have contained minimum of 32 validated answered questionnaires.

8. Analysis and interpretation of secondary data

H1: A positive impact of ISO 9000 is shown on Turnover Growth Rate:

Minitab software had been used for analysis of data that had been collected, filtered tested for its normality and validated for its usefulness.

After the above process the researcher has finalized 273 companies' data for testing H1. Accordingly the 'average turnover growth rate after implementation of ISO 9000' for 273 companies is entered in 'c1' column and 'average turnover growth rate before implementation of ISO 9000' for same 273 companies is entered in c2 column of file 1 of Minitab. The researcher tested the significance of variance in turnover growth rate before and after implementation of ISO 9000 through one-way ANOVA and significance of mean difference between two turnover growth rates that are before and after implementation of ISO 9000. The out-come of analysis is shown below:

One-way ANOVA: C1, C2 (Output of Minitab Softer)

C1 represents the turnover growth rate after implementation of ISO 9000.

C1 represents the turnover growth rate before implementation of ISO 9000.

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	1	9153.78	9153.78	1690.77	0.000
Error	544	2945.20	5.41		
Total	545	12098.98			

				Individual 95% CIs For Mean Based on Pooled StDev
Level	N	Mean	StDev	——+——+——+——+
C1(After)	273	19.523	2.213	(*)
C2(Before)	273	11.334	2.435	(*)
				——+——+——+——+
Pooled StDev =		2.327		12.5 15.0 17.5 20.0

Two-Sample T-Test and CI: C1, C2 (Output of Minitab Softer)

Two-sample T for C1 vs C2

	N	Mean	StDev	SE Mean
C1(After)	**273**	**19.52**	**2.21**	**0.13**
C2(Before)	**273**	**11.33**	**2.44**	**0.15**

Difference = mu C1 - mu C2

Estimate for difference: 8.189

95% CI for difference: (7.798, 8.580)

T-Test of difference = 0 (vs not =): T-Value = 41.12 P-Value = 0.000 DF = 539

Conclusion: Based on above analysis it is clear that

there is a significant difference in Turnover growth rate before and after implementation of ISO 9000.

The Average percentage of turnover growth rate before implementation of ISO 9000 is **11.33**
The Average percentage of turnover growth rate after implementation of ISO 9000 is **19.52**
Improvement in turnover growth rate with the implementation of ISO 9000 is (19.52 –11.33)= 8.19 which is significant.

Conclusion: Based on above analysis it is clear that there is a significant difference in Turnover growth rate before and after implementation of ISO 9000.

Hence, H1: is true.

H2: A positive impact of ISO 9000 is shown on reduction of wastage & rejection

In the case of wastage and rejection related data, the researcher finalized only 268 companies validated data out of 300 companies for testing H2.

Accordingly the 'average percentage of wastage and rejection after implementation of ISO 9000' for 268 companies is entered in column marked as 'W&R After' and 'average percentage of wastage and rejection before implementation of ISO 9000' for same 268 companies is entered in column marked as 'W&R Before' of file 1 of Minitab. The researcher tested the significance of variance in % of wastage and rejection reduction before to after implementation of ISO 9000 through one-way ANOVA and significance of mean difference between two percentages of wastages & rejection that are before and after implementation of ISO 9000. The out-come of analysis is shown below:

One-way ANOVA: W&R After, W&R Before (Output of Minitab Softer)

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	1	1167.07	1167.07	152.50	0.000
Error	534	4086.73	7.65		
Total	535	5253.80			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	——————+——————+——————+———
W&R% After	268	6.388	2.508	(—*—)
W&R% Befo	268	9.339	3.003	(—*—)
				——————+——————+——————+———
Pooled StDev =		2.766		7.0 8.0 9.0

Two-Sample T-Test and CI: W&RAfter, W&R Before (Output of Minitab Softer)

Two-sample T for W&RAfter vs W&R Before

	N	Mean	StDev	SE Mean
W&R% After	268	6.39	2.51	0.15
W&R% Befo	268	9.34	3.00	0.18

Difference = mu W&RAfter - mu W&R Before
Estimate for difference: -2.951
95% CI for difference: (-3.421, -2.482)
T-Test of difference = 0 (vs not =): T-Value = -12.35
P-Value = 0.000 DF = 517

Conclusion: Based on above analysis it is clear that there is a significant reduction in average percentage of wastage and rejection from before to after implementation of ISO 9000.

The Average percentage of wastage and rejection before implementation of ISO 9000 is 9.34
The Average percentage of wastage and rejection after implementation of ISO 9000 is 6.39
Reduction in percentage of wastage and rejection with the implementation of ISO 9000 is (9.34 – 6.39)= 2.95 which is significant.

Hence, H2: is true.

H3: A positive impact of ISO 9000 is shown on Machine Breakdown reduction

In the case of Machine Breakdown reduction, the researcher estimated the average percentage of breakdown before Implementation and after Implementation of ISO 9000 for all the 239 companies for which considerable validated breakdown data available, by using the following formula:

Percentage (%) of breakdown = (Total breakdown time of all the critical machines ÷ Total available time of all the critical machines)*100

Accordingly the 'average % of breakdown after implementation of ISO 9000' for 239 companies is

entered in column marked as '% of BD-A' and average % of breakdown before implementation of ISO 9000' for same 239 companies is entered in column marked as '% of BD-B' in file 1 of Minitab. The researcher tested the significance of variance in % of BD before to after implementation of ISO 9000 through one-way ANOVA and significance of mean difference between two % of BDs that are before and after implementation of ISO 9000. The out-come of analysis is shown below:

One-way ANOVA: % of BD-A, % of BD-B (Output of Minitab Softer)

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	1	142.9683	142.9683	2294.64	0.000
Error	476	29.6573	0.0623		
Total	477	172.6256			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	——+——+——+——+-
% of BD-A	239	0.5078	0.2062	(*
% of BD-B	239	1.6016	0.2865	(*)

——+——+——+——+-

Pooled StDev = 0.2496 0.70 1.05 1.40

Two-Sample T-Test and CI: % of BD-A, % of BD-B (Output of Minitab Softer)

Two-sample T for % of BD-A vs % of BD-B

	N	Mean	StDev	SE Mean
% of BD-A	239	0.508	0.206	0.013
% of BD-B	239	1.602	0.286	0.019

Difference = mu % of BD-A - mu % of BD-B
Estimate for difference: -1.0938
95% CI for difference: (-1.1387, -1.0489)
T-Test of difference = 0 (vs not =): T-Value = -47.90
P-Value = 0.000 DF = 432

Conclusion: Based on above analysis it is clear that there is a significant reduction in average percentage of BD from before to after implementation of ISO 9000.
The Average percentage of BD before implementation of ISO 9000 is 1.602
The Average percentage of BD after implementation of ISO 9000 is 0.508
Reduction in percentage of BD with the implementation of ISO 9000 is (1.602 – 0.508)= 1.094 which is significant.
Hence, H3: is true.

H4: A positive impact of ISO 9000 is shown on Profitability

'Average percentage of net profit after Tax' After Implementation of ISO 9000 (A%ONPAT-A)
'Average percentage of net profit after Tax' Before Implementation of ISO 9000 (A%ONPAT-B)

The researcher has finalized 273 companies' data for testing H4. The '**A%ONPAT-A'** for 273 companies is entered in column 12 and '**A%ONPAT-B**' for same 273 companies is entered in column 13 of Minitab work sheet. The researcher tested the significance of variance in percentage of Profits before and after implementation of ISO 9000 through one-way ANOVA and significance of mean difference between two average percentages of profits that are before and after implementation of ISO 9000. The out-come of analysis is shown below:

One-way ANOVA: A%ONPAT-A, A%ONPAT-B (Output of Minitab Softer)

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	1	4651.51	4651.51	563.98	0.000
Error	544	4486.70	8.25		
Total	545	9138.21			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	——+——+——+——+-+-
A%ONPAT-A	273	15.301	2.945	(-*
A%ONPAT-B	273	9.463	2.797	(*-)

——+——+——+——+-+-

Pooled StDev = 2.872 10.0 12.0 14.0 16.0

Two-Sample T-Test and CI: A%ONPAT-A, A%ONPAT-B (Output of Minitab Softer)

Two-sample T for A%ONPAT-A vs A%ONPAT-B

	N	Mean	StDev	SE Mean
A%ONPAT-A	273	15.30	2.94	0.18
A%ONPAT-B	273	9.46	2.80	0.17

Difference = mu A%ONPAT-A - mu A%ONPAT-B

Estimate for difference: 5.838
95% CI for difference: (5.355, 6.320)
T-Test of difference = 0 (vs not =): T-Value = 23.75
P-Value = 0.000 DF = 542

Conclusion: Based on above analysis it is clear that there is a significant increase in average percentage of profits from before to after implementation of ISO 9000.

The **A%ONPAT-A** is 15.30
The **A%ONPAT-B** is 9.46
Improvement in average percentage of profits with the implementation of ISO 9000 is (15.30 – 9.46) = 9.84% which is significant.

9. Analysis and interpretation of primary data

H5: A positive impact of ISO 9000 is shown on Employees Benefits

The employees' benefits such as relative increase in salary, work life, morality, goodwill to employees, credibility to employees etc., have been assessed through 360^0 assessment format. Finally the employees' benefits ratings on 100 point scale with respect to each selected company were estimated before implementation of ISO 9000 and after implementation of ISO 9000 and these were fed in to Minitab and analyzed. The researcher tested the significance of variance in employee benefits before to after implementation of ISO 9000 through one-way ANOVA and significance of mean difference between two ratings of employees' benefits that are before and after implementation of ISO 9000. The out-come of analysis is shown below:

Consolidated Employee benefit Rating before Implementation of ISO 9000 **(CEBRBII)**
Consolidated Employee benefit Rating after Implementation of ISO 9000 **(CEBRAII)**

One-way ANOVA: CEBRAII, CEBRBII (Output of Minitab Softer)

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	1	80978	80978	580.57	0.000
Error	598	83409	139		
Total	599	164388			

Level	N	Mean	StDev	Individual 95% CIs For Mean Based on Pooled StDev
CEBRAII	300	81.92	10.61	(*-
CEBRBII	300	58.69	12.90	(*-)

Pooled StDev = 11.81 64.0 72.0 80.0

Two-Sample T-Test and CI: CEBRAII, CEBRBII (Output of Minitab Softer)

Two-sample T for CEBRAII vs CEBRBII

	N	Mean	StDev	SE Mean
CEBRAII	300	81.9	10.6	0.61
CEBRBII	300	58.7	12.9	0.74

Difference = mu CEBRAII - mu CEBRBII
Estimate for difference: 23.235
95% CI for difference: (21.341, 25.129)
T-Test of difference = 0 (vs not =): T-Value = 24.10
P-Value = 0.000 DF = 576

Conclusion: Based on above analysis it is clear that there is a significant increase in employees' benefits from before to after implementation of ISO 9000.

Consolidated Employee benefit Rating before Implementation of ISO 9000 **(CEBRBII)** is 58.69
Consolidated Employee benefit Rating after Implementation of ISO 9000 **(CEBRAII)** is 81.92

Improvement in average consolidated employee benefit rating with the implementation of ISO 9000 is (81.92-58.69) = 23.23 which is significant.

H6: A positive impact of ISO 9000 is shown on Suppliers benefit

The Suppliers' benefits such as in-time payments, price to the product supplied, morality, goodwill to supplier, credibility to supplier etc., have been assessed through 360^0 assessment format. Finally the supplier' benefits ratings on 100 point scale with respect to each selected company were estimated before implementation of ISO 9000 and after implementation of ISO 9000 and these were fed in to Minitab and analyzed. The researcher tested the significance of variance in suppliers' benefits before to after implementation of ISO 9000 through one-way ANOVA and significance of mean difference between two ratings of suppliers' benefits that are before and after implementation of ISO 9000. The out-come of analysis is shown below:

Consolidated Suppliers' benefit Rating before Implementation of ISO 9000 **(CSBRBII)**

Consolidated Suppliers' benefit Rating after Implementation of ISO 9000 **(CSBRAII)**

One-way ANOVA: SEBRAII, SEBRBII (Output of Minitab Softer)

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	1	174.5	174.5	2.68	0.102
Error	598	38913.5	65.1		
Total	599	39088.0			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	-+———+———+———+——-
CSBRAII	300	55.515	9.375	(———*———)
CSBRBII	300	54.436	6.501	(———*———)
Pooled StDev =		8.067		53.60 54.40 55.20 56.00

Two-Sample T-Test and CI: SEBRAII, SEBRBII (Output of Minitab Softer)

Two-sample T for SEBRAII vs SEBRBII

	N	Mean	StDev	SE Mean
CSBRAII	300	55.51	9.37	0.54
CSBRBII	300	54.44	6.50	0.38

Difference = mu SEBRAII - mu SEBRBII
Estimate for difference: 1.079
95% CI for difference: (-0.215, 2.372)
T-Test of difference = 0 (vs not =): T-Value = 1.64 P-Value = 0.102 DF = 532

Conclusion: Based on above analysis it is clear that there is no significant increase in suppliers' benefits from before to after implementation of ISO 9000.
Consolidated Suppliers' benefits rating before Implementation of ISO 9000 **(CSBRBII) is 54.44**
Consolidated Suppliers' benefits rating after Implementation of ISO 9000 **(CSBRAII)** is **55.51**

Improvement in average consolidated employee benefit rating with the implementation of ISO 9000 is (55.51 – 54.44) = 1.079 which is not significant at á =0.05.

(Note: The standard deviation has been increased considerable from 6.5 to 9.37, and no change in means at 5% significance level (á =0.05), it show that there are some companies' for which suppliers' benefits have been increased and some companies' for which suppliers' benefits have been decreased and for some companies no change. But as on average no change. It should be verified by observing individual company data.)

H7: A positive impact of ISO 9000 is shown on Customers benefits

The Customers' benefits such as Quality, reliability, durability, maintainability, reparability, portability and safety of the products, price of the product, in-time delivery, morality of customer, goodwill to customer, credibility to customer etc., have been assessed through 360^0 assessment format. Finally the customer' benefits ratings on 100 point scale with respect to each selected company were estimated before implementation of ISO 9000 and after implementation of ISO 9000 and these were fed in to Minitab and analyzed. The researcher tested the significance of variance in customer' benefits before to after implementation of ISO 9000 through one-way ANOVA and significance of mean difference between two ratings of customers' benefits that are before and after implementation of ISO 9000. The out-come of analysis is shown below:

Consolidated customers' benefit Rating before Implementation of ISO 9000 **(CCBRBII)**
Consolidated customers' benefit Rating after Implementation of ISO 9000 **(CCBRAII)**

One-way ANOVA: CCBRAII, CCBRBII (Output of Minitab Softer)

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	1	77402.1	77402.1	1175.50	0.000
Error	598	39376.1	65.8		
Total	599	116778.1			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	—+———+———+———+—-
CCBRAII	300	84.968	6.781	(*-)
CCBRBII	300	62.252	9.258	(*)
Pooled StDev =		8.115		63.0 70.0 77.0

84.0

Two-Sample T-Test and CI: CCBRAII, CCBRBII (Output of Minitab Softer)

Two-sample T for CCBRAII vs CCBRBII

	N	Mean	StDev	SE Mean
CCBRAII	300	84.97	6.78	0.39
CCBRBII	300	62.25	9.26	0.53

Difference = mu CCBRAII - mu CCBRBII
Estimate for difference: 22.716
95% CI for difference: (21.414, 24.017)
T-Test of difference = 0 (vs not =): T-Value = 34.29
P-Value = 0.000 DF = 548

Conclusion: Based on above analysis it is clear that there is a significant increase in customer' benefits from before to after implementation of ISO 9000.
Consolidated Customer benefit Rating before Implementation of ISO 9000 **(CCBRBII)** is 62.25
Consolidated Customer benefit Rating after Implementation of ISO 9000 **(CCBRAII)** is 84.97
Improvement in average consolidated Customer benefit rating with the implementation of ISO 9000 is (84.97 – 62.25) = 22.72 which is significant.

H8: A positive impact of ISO 9000 is shown on Government and Society benefits

The Government and Society' benefits such as production of quality goods and services to meet domestic needs, production of goods and services to export, generation of foreign-exchange, prompt payment of taxes, Serving society through CSR, promoting government programmes and policies etc., have been assessed through 360^0 assessment format. Finally the Government and Society' benefits ratings on 100 point scale with respect to each selected company were estimated before implementation of ISO 9000 and after implementation of ISO 9000 and these were fed in to Minitab and analyzed. The researcher tested the significance of variance in government & Societies' benefits before to after implementation of ISO 9000 through one-way ANOVA and significance of mean difference between two ratings of government & Societies' benefits that are before and after implementation of ISO 9000. The out-come of analysis is shown below:

Consolidated Government and Society' benefit Rating before Implementation of ISO 9000 **(CGSBRBII)**

Consolidated Government and Society' benefit Rating after Implementation of ISO 9000 **(CGSBRAII)**

One-way ANOVA: CGSBRAII, CGSBRBII (Output of Minitab Softer)

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	1	39601.5	39601.5	576.02	0.000
Error	598	41112.6	68.8		
Total	599	80714.1			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	——+————+————+————+—
CGSBRAII	300	65.436	8.477	(-*-)
CGSBRBII	300	49.187	8.102	(-*-)
				——+————+————+————+—
Pooled StDev =		8.292		50.0 55.0 60.0 65.0

Two-Sample T-Test and CI: CGSBRAII, CGSBRBII (Output of Minitab Softer)

Two-sample T for CGSBRAII vs CGSBRBII

	N	Mean	StDev	SE Mean
CGSBRAII	300	65.44	8.48	0.49
CGSBRBII	300	49.19	8.10	0.47

Difference = mu CGSBRAII - mu CGSBRBII
Estimate for difference: 16.248
95% CI for difference: (14.919, 17.578)
T-Test of difference = 0 (vs not =): T-Value = 24.00
P-Value = 0.000 DF = 596

Conclusion: Based on above analysis it is clear that there is a significant increase in Government and Society benefit from before to after implementation of ISO 9000.

Consolidated Government and Society benefit Rating before Implementation of ISO 9000 **(CCBRBII)** is 49.19
Consolidated Government and Society benefit Rating after Implementation of ISO 9000 **(CCBRAII)** is 65.44

Improvement in average consolidated Government and Society benefit rating with the implementation of ISO 9000 is (65.44 – 49.19) = 16.25 which is

significant.

Consolidated Report of outcome of above analysis ia shown in table 3

H9: The overall performance of manufacturing industry in India has been improved with the implementation of ISO 9000.

Modified binning method was used to transform percentage of improvement of key performance indicators.

With the help of expert committee, pair-wise comparison technique, the researcher estimated the weight-ages for each KPI and used these weight-ages in weighted rating method to estimate overall performance. The entire process of estimating overall performance is shown in table 4

The overall performance Improvement is significant, from (51.5% to 74.02 = 22.52%) which is equivalent to improvement rate {(22.52/51.5)*100} = 43.7% with the implementation of ISO 9000.

10. Observations and Conclusions

The following observations and conclusions are made on "Indian Manufacturing Industry" based on above analysis:

with the implementation of ISO 9000, 11.33% of average turnover growth rate increased to 19.52%, 9.34% of average wastage & rejection reduced to 6.39%, 1.6016% of average machine breakdown reduced to 0.5078%, 9.46% of average net profits increased to 15.3%, 58.69% of point rated employees' benefits increased to 81.92, 62.25% of point rated customers' benefits increased to 84.97%, 49.19% of point rated Government & Society benefits increased to 65.44%, and 51.50% of point rated overall benefits increased to74.02%,. It shows that the ISO 9000 has significant positive effect on manufacturing companies. The researcher would like to conclude that there is no doubt that the ISO 9000 contributed lot to the Indian manufacturing Industry Growth.

The above analysis shows that there are considerable breakdowns, rejections, wastages etc. even after implementation of ISO 9000 effectively. It shows that there is large scope for improving Indian Manufacturing Industry with the help of other change initiatives such as Six Sigma, Balance Scorecards, Benchmarking, Reengineering etc., hence the researcher strongly recommends to introduce and implement the concepts mentioned above.

54.44% of point rated supplier' benefits increased to only 55.51% which is insignificant improvement even at Alpha 10%, hence the researcher concludes that the ISO 9000 quality systems have not focused much on suppliers' benefits and growth. The researcher would like to request Lead Auditors, and Experts in the area, to find the reasons & root causes for the same and to influence the Technical Committee of ISO 9000 of ISO, Geneva, for appropriate inclusions in next revision ISO 9000.

11. References

Subject Related References:

B.V Dagnino, Suggest Improvements for the ISO 900 Standards, Quality Assurance, (1989),

a. Bajaj Vinod ISO 9000 the Standard for 1992 and Beyond, Part I, Creative Communication and Management Centre, Bombay.

b. Bajaj Vinod, ISO 9000 the Standard 1992 and Beyond, Part II, Creative Communication and Management Centre, Bombay.

c. Bajaj Vinod, ISO 9000 the Standard for 1992 and Beyond Part – III Creative Communication and Management Centre, Bombay.

Donald Dzus Marquandt and others, Vision 2000 – The Strategy for the 90's Quality Progress (1991)

Emory, C.W., 1976 Business Research Methods, Richard D. Irwin, inc. Homewood.

Ferber, R.(ed.), 1974 hand book marketing research, Mcgraw Hill Book Co. New York

Guidance on the Documentation Requirements of ISO 9001:2000

ISO 9004 – 2000, Quality management systems – Guidelines for performance improvements.

ISO 9000 + ISO 14000 News (a bimonthly publication which provides comprehensive coverage of international developments relating to ISO's management system standards, including news of their implementation by divers organizations around the world) various useful volumes.

ISO 9000 Study Material of National Institute of Labour Education & Management – Chennai

IS/ISO 9001:2000 Indian Standard Quality Management Systems Requirements BIS 2000 NEW DELHI 110002

Kothari, C.R. "Research Methodology – Method and Techniques ", Wiley Eastern Ltd.

Mustafi, C.K. 1981. Statistical Methods in Managerial Decisions, Macmillan : New Delhi.

Precourse Course Material for ISO 9000 Internal Quality Auditing, Zandng TQM Solutions PVT. LTD., BANGLORE.

QS 9000 Study Material of National Institute of Labour Education & Management – Chennai

Quality Control Study Material of National Institute of Labour Education & Management – Chennai

Quantitative Analysis for managerial application (MS – 8) A study material of IGNO School of Management Studies.

References of Quality Control and Statistical Quality Control

Rothery, Brain, ISO 9000, Productivity and Quality Publishing Private Limited, Madras, 1991.

Statistical Quality Control Study Material of National Institute of Labour Education & Management – Chennai

Snedecor, George W, " Statistical Methods" The IOWA State University Press AMES, IOWA, USA (6th Edition).

Tull, D.S and Albaum, 1973, Survey Research a Decisional Approach, Intext Education Publishers:USA.

Wilkinson, T.S and P.L. Bhandarkar. 1979. Methodology and Techniques of Social

Reference Websites:

http://www.iso.ch

http://www.bsi.org.uk/iso-tc176-sc2

Visited 279 companies web sites for collecting some of the secondary data. Ex.

http://www.hindulatex.com

http://www.menonpistons.com etc.

Appendix

Tables 01: Sampling Design for collecting data from customers

Sl.No	Strata/Sub Strata/stratum	300 Sample size of companies selected from the following quantities from following region	The no. of Questionnaires approximately circulated for collecting primary data	The no. of Validated Questionnaires used for primary data analysis
I.	East India	75	7500	5252
1.	Orrisa, W.B	15	1500	1121
2.	Bihar,Sikkim	15	1500	989
3.	Meghalaya,	15	1500	1068
4.	M.pur, Ar.P,Nagaland,	15	1500	1098
5.	Mizorum, Tripura	15	1500	976
II	West India	75	7500	6319
1.	Rajasthan	15	1500	1304
2.	Madhya Pradesh	15	1500	1218
3.	Gujarat	15	1500	1112
4.	Dadra & Nagar Haveli	15	1500	1367
5.	Diu, Daman & Other part	15	1500	1318
III	South India	75	7500	5892
1.	Maharastra	15	1500	1278
2.	Andhra Pradesh	15	1500	1254
3.	Karnataka	15	1500	1145
4.	Tamilnadu	15	1500	1176
5.	Kerala & other part	15	1500	1039
IV	North India	75	7500	6282
1.	J & K and Delhi	15	1500	1298
2.	Uttar Pradesh	15	1500	1205
3.	Himachal Pradesh	15	1500	1112
4.	Punjab	15	1500	1315
5.	Haryna & Chandigarh	15	1500	1352
		300	30000	23745

Table 02: Overall Sampling Design

Sl. No.	Name of the company and Sample Size (Sample size varies from company to company from 50 -150, depending on company size.)	Employees' strata Sample size Varies from 15 -45. Average =30	Employers' strata Sample size Varies from 10 -30. Average= 20	Costumers' strata Sample size Varies from 15 -45. Average=30	Suppliers' strata Sample size Varies from 5 -15 Ave. =10	Government and Society's strata Sample size Varies from 5 -15 Ave. =10
1	HLL TVM (150)	45	30	45	15	15
2	L&T Powai (100)	30	20	30	10	10
..	…	…	…	…	…	…
..	…	…	…	…	…	…
300	ACC CU (50)	15	10	15	5	5
Total	30000 (Average Sample size designed per Company = 100)	9000	6000	9000	3000	3000

Table 3: Consolidated Report of Outcome of Analysis

Sl. No.	Key Performance Indicator	Status		Improvement	Percentage of Improvement	P Value	Improvement is Significant Yes/No
		Before Implementation of ISO 9000	After Implementation of ISO 9000				
1	% of Average Turnover Growth Rate	**11.33**	**19.52**	8.19	72.3 (I)	0.000	Significant
2	% of Average wastage & rejection	9.34	6.39	2.95	31.60(D)	0.000	Significant
3	% of Average Machine Break Down	1.6016	0.5078	1.0938	68.29 (D)	0.000	Significant
4	% of Average net Profits	9.46	15.30	5.84	61.73 (I)	0.000	Significant
5	Employees Benefits in 100 point scale	58.69	81.92	23.23	39.58 (I)	0.000	Significant
6	Suppliers benefits in 100 point scale	54.44	55.51	1.07	1.96	0.102	Not Significant
7	Customers benefits in 100 point Scale	62.25	84.97	22.72	36.49	0.000	Significant
8	Government & Society benefits in 100 point scale	49.19	65.44	16.25	33.04	0.000	Significant

Table 4: Estimation of Overall performance

Sl. No.	Key Performance Indicator	Before Implementation of ISO 9000	Binning size and range for each 'KPI'	Statue Before Implementation of ISO 9000 in '5'**Point scale**	Percentage of Improvement And Improvement in '5' point Scale	Status after Implementation of ISO 9000 in '5'**Point scale**
1	Percentage of Average Turnover Growth Rate	**11.33**	0.1-1 = 01-05 1.1-2 = 06-10 2.1-3 = 11-15 3.1-4 = 16-20 4.1-5 = 21-25	2.2	72.3% (2.2*0.723) =1.59	2.2+1.59 =3.79
2	percentage of Average wastage & rejection	9.34	0.1-1 = 13-15 1.1-2 = 10-12 2.1-3 = 07-09 3.1-4 = 04-06 4.1-5 = 00-03	2.7	31.60% (2.7*0.316) =0.85	2.7+.85 =3.55
3	percentage of Average Machine Break Downs	1.6016	0.1-1 = 2.5-3.0 1.1-2 = 1.9-2.4 2.1-3 = 1.3-1.8 3.1-4 = 0.7-1.2 4.1-5 = 00-0.6	2.2	68.29% (2.2*0.6829) =1.5	2.2+1.5 =3.7
4	Percentages of Average net Profits	9.46	0.1-1 = 01-04 1.1-2 = 05-08 2.1-3 = 09-12 3.1-4 = 13-16 4.1-5 = 17-20	2.2	61.73% (2.2*0.6173) =1.36	2.2+1.36 =3.56
5	Employees Benefits in 100 point scale	58.69	0.1-1 = 1-20 1.1-2 = 21-40 2.1-3 = 41-60 3.1-4 = 61-80 4.1-5 = 81-100	2.9	39.58% (2.9*0.3958) =1.15	2.9+1.15 =4.05
6	Suppliers benefits in 100 point scale	54.44	0.1-1 = 1-20 1.1-2 = 21-40 2.1-3 = 41-60 3.1-4 = 61-80 4.1-5 = 81-100	2.7	1.96% (2.7*0.0196) =0.053	2.7+.053 =2.753
7	Customers benefits in 100 point Scale	62.25	0.1-1 = 1-20 1.1-2 = 21-40 2.1-3 = 41-60 3.1-4 = 61-80 4.15 = 81-100	3.2	36.49% (3.2*0.3649) 1.68	3.2+1.68 =4.88
8	Government & Society benefits in 100 point scale	49.19	0.1-1 = 1-20 1.1-2 = 21-40 2.1-3 = 41-60 3.1-4 = 61-80 4.1-5 = 81-100	2.5	33.04% (2.5*0.3304) 0.825	2.5+.825 =3.325
9	Overall performance in '5' point and 100 point scale			Aggregate= (20.6/8) = 2.575 51.5%	Aggregate= (9.008/8)= 1.126 22.52%	Aggregate= (29.608/8)= 3.701 74.02%