

TQM-Manufacturing and Services
DM-541/IB-516

Trimester – V, End-Term Examination: December 2019

Time allowed: 2 Hrs 30 Min
Max Marks: 50

Roll No: _____

Instruction: Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means**. All other instructions on the reverse of Admit Card should be followed meticulously.

Sections	No. of Questions to attempt	Marks	Total Marks
A	Minimum 3 question with internal choices and CILO (Course Intended Learning Outcome) covered	3*10	30
	Or Maximum 6 questions with internal choices and CILO covered (as an example)	Or 6*5	
B	Compulsory Case Study with minimum of 2 questions	20	20
			50

Section A

Q1. (CILO 01)

- a. What is "Six Sigma"? When and how is it implemented? (5 marks)
- b. Process standardization requires an organization to write down their processes in the form of documented SOPs (Standard Operating Procedures).You have been requested to develop a documented SOP for the process "Registration for campus placement" for your placement cell. Develop the SOP as requested? (5 marks)

Q2. (CILO 03)

- a. Explain 3 differences between Affinity diagram and Arrow diagram. (2 Marks)
- b. Assume you are a mess coordinator of an institution. You have been asked to reduce the daily waste of the college mess by 5%.
 1. Create a cause & effect diagram to identify the causes of waste generation. (4 Marks)
 2. Create a Tree diagram to identify the solutions to reduce the waste to achieve the desired result. (4 Marks)

Q3. (CILO 02)

- a. What is RPN (Risk Priority Number)? Explain the definition and key parameters. (2 Marks)
- b. Identify 3 key differences between Process FMEA and Design FMEA? Explain each difference with example of any industry or product perspective. (2 Marks)

- c. Assume you are shift supervisor of Firecrackers factory. You have been asked to identify top 3 risk causes and action plan for it. .
- Create FMEA table assuming range of RPN number from 1 to 1000 involving Minimum 10 process steps in it. (3 marks)
 - Create Action plan for all causes for prevention or correction of possible failures. (3 Marks)

Section B

Sona Koyo Steering Systems Limited (SKSSL) is a technical and financial joint venture company of Koyo Seiko Company, Japan-the global technology leader in steering systems. With a market share of 50%, the company is the largest manufacturer of steering gears in India and is the leading supplier of

- hydraulic power steering systems,
- manual rack and pinion steering systems, and collapsible, tilt, and rigid steering columns for passenger vans and MUVs

The company's product range also extends to rear axle assemblies and propeller shafts. Named as a Global Growth Company by the World Economic Forum in 2007, the company is now well positioned to lead the Indian automotive component industry to global standards in the new millennium. Sona Koyo Steering Systems has three plants located in Gurgaon and two plants located in Chennai. Its customers include Maruti Udyog Limited, Tata Motors, Hyundai Motors, Toyota Kirloskar Motors, and Honda Siel. 'The Deming process is like getting a doctorate. One has to choose an area that has not been researched previously by somebody else and come out with your own findings', says Dr Surinder Kapur, Chairman and Managing Director, Sona Koyo Steering Systems Limited. The Rs. 286-crore- Turnover Company won the prestigious Deming quality medal last year from JUSE. A great admirer of the Toyota Production System (TPS), Dr Kapur yearns for Sona Koyo to be able to resemble the Japanese auto company. He knows, however, that the journey will be a long one. At Sona Koyo, quality was built into process right from its inception. Machines were arranged into a cellular layout (product layout). Quality checks were made part of the process and were conducted by the operators. From 2009-2012, when its net profit came down to a record low, the company was determined to do something about it. There was a marked change in the quality process when Toyota Production Systems' (TPS) expert- M. Tanaka from Koyo Seiko, Japan-started guiding the company in the early '2000s. Many poka-yoke (fool proofing) systems were installed to avoid operator mistakes. That is when the company started gaining a real understanding of TPS. Problem-solving was made a necessary process in production management. The company learnt how to become capable of supplying products just-in-time to customers. Its quality system was strengthened in line with 150-9002 in 2004. In 2007, Maruti Udyog Limited suggested that Sona Koyo should join the first total quality management (TQM) cluster of 10 suppliers to be trained in the TQM methodology.

When it began to implement and experience TQM, the managers' model lines, daily work

management, gap analysis, and root cause analysis with scientific tools were introduced. Guidance and education from Prof. Yoshikazu Tsuda, a JUSE counsellor and member of the Deming 'prize committee', and learning and sharing with other cluster companies provided Sona Koyo with a great learning opportunity, especially in learning to focus more on customers' requirements. The policy deployment exercise with 'management for objectives' (MFO) helped the organization to focus on the company's objectives, thus helping all the employees look at one direction. The teachings of TQM with emphasis on 'learning through experiencing' began to give the company a direction towards customer focus. The quality visits by top management and reviews of MFOs clearly defined the accountability of senior and divisional managers. The company formed a separate team to coordinate TQM activities. Initially, a team of three engineer-level persons was formed in 2007. In 2010, this was upgraded to a Quality System Division under a General Manager. Under this division, four departments- TQM, Total Productivity Maintenance (TPM), Quality Management Systems (QMS), and Environmental Management Systems (EMS) were formed, which were to be headed by a manager. There were three noticeable roadblocks. These were: (1) understanding about TQM across the organization, (2) involvement of all the employees, and (3) obtaining the commitment of managers, These were overcome by imparting training at all levels and making 'quality visits' to all the divisions by the top management. Sona Koyo started implementing Toyota Production System (TPS) techniques in 2012, taking guidance from a TPS expert through its collaborator. The techniques helped in increasing its productivity and reducing waste. To speed up the process of shop floor activities, in 2012, Sona Koyo decided to take the assistance of the Japanese Institute of Plant Maintenance (JIPM) to implement TPM techniques. TPM has helped Sona Koyo to reduce rejects as well as the breakdown of machines. It has helped in achieving zero defects in various areas. This integrated approach in Sona Koyo's quality journey, lead by TQM and supported by TPS and TPM, is helping it to involve all the members of the Sona Pariwar (family) with education and training. The development of new products like the actuator and the cost-effective collapsible column gave it the confidence to apply for the Deming award. The benefits the company started deriving after it started practicing TQM have been outlined in Table 01. given below. TQM and the Deming medal have helped the company collect customer/market information post sales. Earlier, the company was collecting information on the product quality in the field from the customers. Later, it started visiting car dealers to gather this information. Apart from these two sources, today, the company collects this information from end users (drivers). It has been learning to implement quality function deployment (QFD) techniques; to capture and utilize the customer voice.

Table 01.

Area	Before (F2007)	After (F2009)	Now (F2014)	World Class
Management Objectives	Target Setting	Management for Objective (MFO)	Management for Objectives (MFO)	MFO, BSC
Business Scope	Manual Steering, 5 Customers, 24 Products	Hydraulic Power Steering, 18 Customer, 56 Products	Electric Power Steering (Order Development), 20 Customers, 67 Products	NA
In-house Rejection	17300 ppm	2241 ppm	876 ppm	50 ppm
Customer Returns	1579 ppm	213 ppm	112 ppm	5 ppm
Warranty Returns	3800 ppm	1579 ppm	3209 ppm	NA
Supplier Rejections	35000 ppm	1318 ppm	932 ppm	100 ppm
Manufacturing				
Expenses	7.5% of Sales	5.2% fo Sales	4.9% fo Sales	NA
Schedule vs Supply	92%	99%		100%
Gross Sales per Employee	Rs. 32 Lacs	Rs. 45 Lacs	Rs. 58 Lacs	NA
Accidents	18	1	1	0
Absenteeism	11.30%	7.10%	5.90%	0 (Unauthorized)
Training per Employee	36 Hrs	57.4 Hours	60 Hours	70 Hours
Suggestions per Employee	2	10.4	20.6	24

The lessons learnt by the company during its TQM journey were as follows:

- TQM helps in identifying the weaknesses in an organization and in working to eliminate these weaknesses.
- Improvement techniques are very simple to understand, persistence in implementation is important.
- Involvement of all employees is vital to get extraordinary results.
- Developing its own product and production technology helps in improving competitiveness.
- Setting up challenging goals is the first step of achieving great results.
- Change will always bring resistance; one has to learn how to cope with it.
- Complacency after achieving good results brings the performance down. The company has, therefore, set even higher goals.

- One has to continuously search new ways of keeping people energized.

The Deming award has helped the company to enhance the brand equity of Sona Koyo. Customers, prospective employees, shareholders, industry observers, and the general public now take it more seriously. The biggest impact will be on its export plans. The award has catapulted Sona Koyo into the radar screens of global auto majors looking for low-cost but world-class suppliers.

The company can now leverage the Deming Prize to rapidly scale up exports. While bidding for export orders, it no longer needs to convince prospective customers about its business practices and product quality. Prior to receiving the Deming medal, the company was confident of achieving an export volume of, perhaps, Rs 40-50 crore by 2013-14. Now it is confident that it can cross Rs 100 crore by that year.

The automobile industry is expected to maintain its strong growth momentum. Much of its future growth prospects will depend on its ability to deliver on orders in the future. The company intends to continue making investments in enhancing capacity to fulfil the orders-in hand. Apart from manufacturing excellence, Sona Koyo also plans to harness its design and development capabilities. In accordance with its vision of becoming a 'supplier of choice' to global customers, the management is focusing on

- developing and retaining the company's human capital,
- de-risking the business by diversifying to different markets in terms of geography, products, and clients,
- strengthening its platform as a specialized player in steering systems, and
- building infrastructure to service overseas clients

As a part of its strategy, the company has plans to invest Rs. 125 crore in expanding its capacities. It has established an export-oriented unit with a capacity of 2,50,000 manual steering gears and 1,20,000 power steering gears for catering to the requirements of overseas customers. In addition, it has acquired a minority stake in a French company.

Q1. How has the application of just-in-time (earlier called the Toyota Production System) helped Sona Koyo reduce the number of defects? Kindly elaborate your reasons?

Q2. Table 01. shows that the numbers of warranty returns have now increased drastically compared to just after implementing TQM. What reasons can you attribute to this deterioration?

Q3. The Deming award has catapulted Sona Koyo into the radar screens of global auto majors looking for low-cost but world-class suppliers. What lessons can Indian auto component suppliers take from this revelation?