

CLUB POWER ELECTRONICS PRIVATE LIMITED

On April 14, 2016, Pratik Verma, a master's of business administration (MBA) student intern, began reviewing the information he had collected over the past two weeks on the production process at the CLUB Power Electronic Private Limited (CLUB) facility in Gandhinagar, Gujarat. Verma had just begun his two-month internship with CLUB's operations excellence division (OED). During his orientation on April 1, Verma had spoken with V.S. Vasanth, the firm's deputy general manager of operations. For the first time in its history, CLUB had been unable to fill customer orders, resulting in some cancellations. Vasanth had directed Verma to study CLUB's production process, to write a report, and to present his findings to Vasanth on April 18. Verma now had four days to prepare his report and presentation.

VERMA'S FIRST DAY AT CLUB

Verma joined CLUB as a part of his internship on April 1, 2016; on that day, he had the following discussion with Vasanth:

Vasanth: Hello Pratik. Glad that you are here. I have an interesting challenge for you to solve as a part of your internship. We will be discussing it in the meeting today. So, be there at the meeting room sharp at 1:00 p.m.

Pratik: Thank you sir! I would like to know more about it. I will put my best efforts to meet your expectations.

Later, at the meeting, Aditya Mishra, head of sales and marketing, initiated the discussion about current problems. He said,

For the first time in the history of CLUB Power Electronics Private Limited, we are facing difficulty in fulfilling the demand for transformers. Though the demand has been steadily increasing over the last few years, it had never bothered us. However, during January to March 2016, the production facility was not able to complete the orders of some of our customers. Though

our customers have always been generous at times with deadlines, I believe this is not a good practice and can dilute our relationship with them in the long run.

Amit Shah, head of production planning, responded:

The company has been fulfilling the demand by executing the given schedule for production of transformers every time, but during the last quarter, we have had to cancel around 5 per cent of the orders despite 100 per cent process utilization. I am still wondering if availability of raw material is a concern here.

However, this concern was refuted by Vasanth, who mentioned the actual problem could be something else and further investigation may be necessary.

After the discussion, Vasanth turned to Verma and said,

Why don't you meet Mr. Ghonghane, the plant manager, tomorrow and study the processes and identify our weak areas? Also, create a roadmap for capacity expansion, if necessary. Meet me on April 18 with your findings and suggestions.

CLUB POWER ELECTRONICS PRIVATE LIMITED (CLUB)

Founded in 1989, CLUB was a pioneer in power electronics products in India. Backed by three decades of experience, the company was a market leader in the domestic market for power electronics products, and had state-of-the-art manufacturing facilities in the country. Its well-established supply chain all over India had a dedicated and decentralized 24/7 after-sales service. The company had witnessed significant growth over the past four years (see Exhibits 1 and 2). The company's core component (the transformer) was manufactured at its transformer plant and then used in various product assemblies. The company operated across India, served the entire market through its four regional offices, and had around 300–400 business-to-business clients including various banks, educational institutes, and railways.

The transformer plant located at Gandhinagar was part of Gujarat Industrial Development Corporation (GIDC). GIDC was formulated with a vision¹ to support industries by establishing an industrial corridor. Almost all the manufacturing companies of the district, including both upstream and downstream units of CLUB, were situated in this region. Consequently, the plant was never short of raw materials, and the plant maintained long-term contracts with the suppliers; the orders were always filled in priority sequence.

Initially, India's transformer market had been predominantly unorganized, with many small players catering to the smaller markets. Subsequently, several players graduated to the medium-sized category and expanded the organized participants' base. At one time, more than 300 transformer companies in India had an overall installed capacity of over 370,000 megavolt amperes per annum.² The major players included Bharat Heavy Electricals Limited, ABB Ltd., Crompton Greaves Ltd., Bharat Bijlee Ltd., Transformers and Rectifiers India Limited, and Voltamp Transformers Ltd.³ The transformer market in India was estimated to be worth

¹ "GIDC at a Glance: GIDC Vision," GIDC Gujarat Industrial Development Corporation, accessed November 16, 2016, http://gidc.gujarat.gov.in/GIDC_At_A_Glance_Key_Indicators.html.

² Amol Kotwal, "On a Threshold of Transformation—India's Transformer Industry," *Electrical India: India's Oldest Magazine on Power and Electrical Products Industry*, July 5, 2015, accessed January 12, 2017, www.electricalindia.in/blog/post/id/5624/on-a-threshold-of-transformation-indias-transformer-industry.

³ India Infoline News Service, "Indian Transformer Industry: Capitalizing on Changing Current," February 7, 2007, accessed January 12, 2017, www.indiainfoline.com/article/news-sector-others/indian-transformer-industry-capitalizing-on-changing-current-113111400489_1.html.

more than ₹120 billion.⁴ Power transformers contributed 45 per cent of the total market and distribution transformers, 55 per cent. Owing to growing demands (domestic and overseas), the transformer industry had doubled its capacity over five years. This growth led to an enormous pricing pressure scenario, which impacted the profitability of the players. The primary challenges faced by manufacturers were poor supply of prime quality cold-rolled grain-oriented steel (CRGO) and the high failure rate of distribution transformers. However, the CRGO requirement was completely met through imports.

THE PROCESS AT THE TRANSFORMER PLANT

Verma was so excited about his first exposure to the transformer manufacturing process that on the scheduled date, April 2, 2016, he reached the plant half an hour before the start of the plant's general shift (9:00 a.m. to 5:00 p.m.) to explore it on his own. At 9:15 a.m., he reported to Sailesh Ghonghane, the plant manager, who had been with CLUB for over a decade. During this interaction, Ghonghane was impressed by the proactiveness shown by Verma, and he handed over an uncontrolled copy of the plant layout (see Exhibit 3) so that he could better understand the plant functioning. The plant consisted of eight different sections: winding, assembly, varnish, oven, termination centre, testing, quality control, and packing. Ghonghane suggested that Verma should begin the visit to the transformer plant right then, according to his process study schedule (see Exhibit 4).

Winding

The winding department produced windings for transformer assemblies, for which the raw materials—aluminum and copper strips—were procured from the local suppliers. These windings were designed to optimize various dynamic stresses (e.g., thermal, mechanical, and electrical) depending upon the current and voltage needs of various clients. Two workers together worked for two hours on a winding machine to produce a winding. Six winding machines were installed in the plant; the raw materials—aluminum and copper strips—were usually kept adjacent to these machines (see Exhibit 3).

Assembly

This process involved two steps: core making and assembly of windings on the core. The core of the transformer was manufactured from lamination plates kept near the assembly table and sourced from local suppliers. The winding, which was obtained from the windings inventory located at the centre of the shop floor, was assembled by two workers. The entire process of making the core and assembling the winding on it (including material handling time) took about two hours.

Insulation

After assembly, transformers were soaked in varnish for an hour. This was a standard procedure that improved insulation and made the transformers moisture-proof. It also ensured that all components were held together tightly to prevent rattling, and it provided improved thermal transfer. The machine could process six units of assemblies at once and required only one worker to monitor the pressure level.

⁴ ₹ = INR = Indian rupee; All currency amounts are in ₹ unless otherwise specified; ₹1 = US\$0.0150 on April 14, 2016.

Heat Treatment

After the varnishing process, the assemblies entered the oven, where they were heated at 110–120 degrees Celsius for eight hours to remove moisture and to reduce the most important parameter of transformer, the dielectric strength. The two ovens in the plant each had the capacity to process 12 assemblies simultaneously. No worker was required to monitor the process. This was the only process that usually continued beyond the regular hours (until approximately 11:00 p.m.).

Brazing

The electrical connections (star and delta type) were made at the termination centre using brazing bars, insulation tapes, and other auxiliary material. Two brazing machines were used in this process, and these connections were formed to reduce the voltage or current, depending on the requirement specified by the customer. Each brazing operation to process one unit of assembly required one hour and two workers.

Testing

The transformer was then taken to the testing machine, which tested the transformer on electrical parameters. The electrical testing made sure that the transformer operated according to the given requirements of voltage, current, resistance, impedance, and dielectric strength. This area had one testing machine, which carried out the given tests for six transformers per hour and was operated by a single worker.

Quality Control

Quality control (QC) ensured that the parts of the transformer were tightly connected to each other, its dimensions were in accordance with the design given by the planning department, and it had the required strength and toughness to withstand any damage. The task of QC was assigned to one worker, who manually tested each transformer on these parameters, and took 10 minutes to complete.

Packing

The packing machine was used to make plastic covers for transformers to protect them from dust. One worker was needed to pack each transformer, and each packing process took 10 minutes. The transformers were then dispatched to their destinations.

The last three activities (testing, QC, and packing) were carried out by one worker because the activity time was insignificant for these activities. Since these were independent activities, workers could be separately assigned to them.

Other Relevant Details

After observing the processes and collecting the data, Verma met Ghonghane and asked for other relevant details of the plant that could help him analyze the situation better.

Ghonghane gave details of the machines, including their costs and expected useful life (see Exhibit 5), and their maintenance requirements. Ghonghane also explained that the company used a straight-line method

for calculating depreciation and that the number of workers required per machine was optimal. Additional workers for any machine would not increase throughput, but fewer workers would affect the output.

When asked about the rules and policies regarding working hours of the plant and workers, Ghonghane explained:

At CLUB, we follow eight hours a day and six working days per week for a normal shift. The overtime can only be introduced if Amit Shah approves it. The overtime wages are 1.5 times the hourly wage of ₹66.52. If any change is proposed in the current layout, it must be routed through the operations excellence department. The OED works on a principle of minimum men and material movement.

Verma then asked Ghonghane about the inventory management in the plant. Ghonghane said,

Every month, the production planning department provides a weekly master production schedule. We procure the material every Saturday depending upon the production plan the next week. Our warehouse can handle the inventory levels up to 1.5 times the weekly requirement. Just-in-time procurement is practiced owing to the vicinity to the suppliers. We usually order 5 per cent additional material than what is needed, considering the defects in procured material and damages during production process. The raw material gets reduced as the week progresses; on average, we operate with 32 per cent as work in process inventory and 4 per cent as finished goods inventory.

To obtain the details of demand, Verma went to the production planning department for the monthly demand data of the last two years (see Exhibit 6) for the transformer plant.

THE DECISION

Verma needed to analyze the data and determine possible solutions to present to Vasanth on April 18. He knew that he needed to present both short-term and long-term suggestions. He also needed to detail all possible challenges that could emerge during their execution.

**EXHIBIT 1: CLUB POWER ELECTRONICS PRIVATE LIMITED'S INCOME STATEMENT, 2013–2016
(IN ₹ MILLIONS)**

	2013	2014	2015	2016
Gross sales	1,164.40	1,293.20	1,660.90	2,190.00
Less: customer rejects	20.30	19.80	19.60	18.10
Net sales	1,144.10	1,273.40	1,641.30	2,171.90
COGS:				
Raw materials and spares	699.00	751.00	1,136.01	1,336.00
Utilities	0.91	1.01	1.30	1.72
Repairs and maintenance	1.00	1.30	1.70	3.10
Taxes and rentals	11.60	12.40	18.70	21.90
Other manufacturing overheads	40.00	44.43	57.06	75.23
Total COGS	752.51	810.14	1,214.77	1,437.95
Gross profit	391.59	463.26	426.53	733.95
Selling expense	49.80	63.96	84.33	111.20
Admin expense	43.57	55.96	73.79	97.30
Total selling and admin. expenses	93.37	119.92	158.12	208.50
Net profit before tax	298.22	343.34	268.41	525.45
Tax @35%*	104.38	120.17	93.94	183.91
Profit after tax	193.84	223.17	174.47	341.54

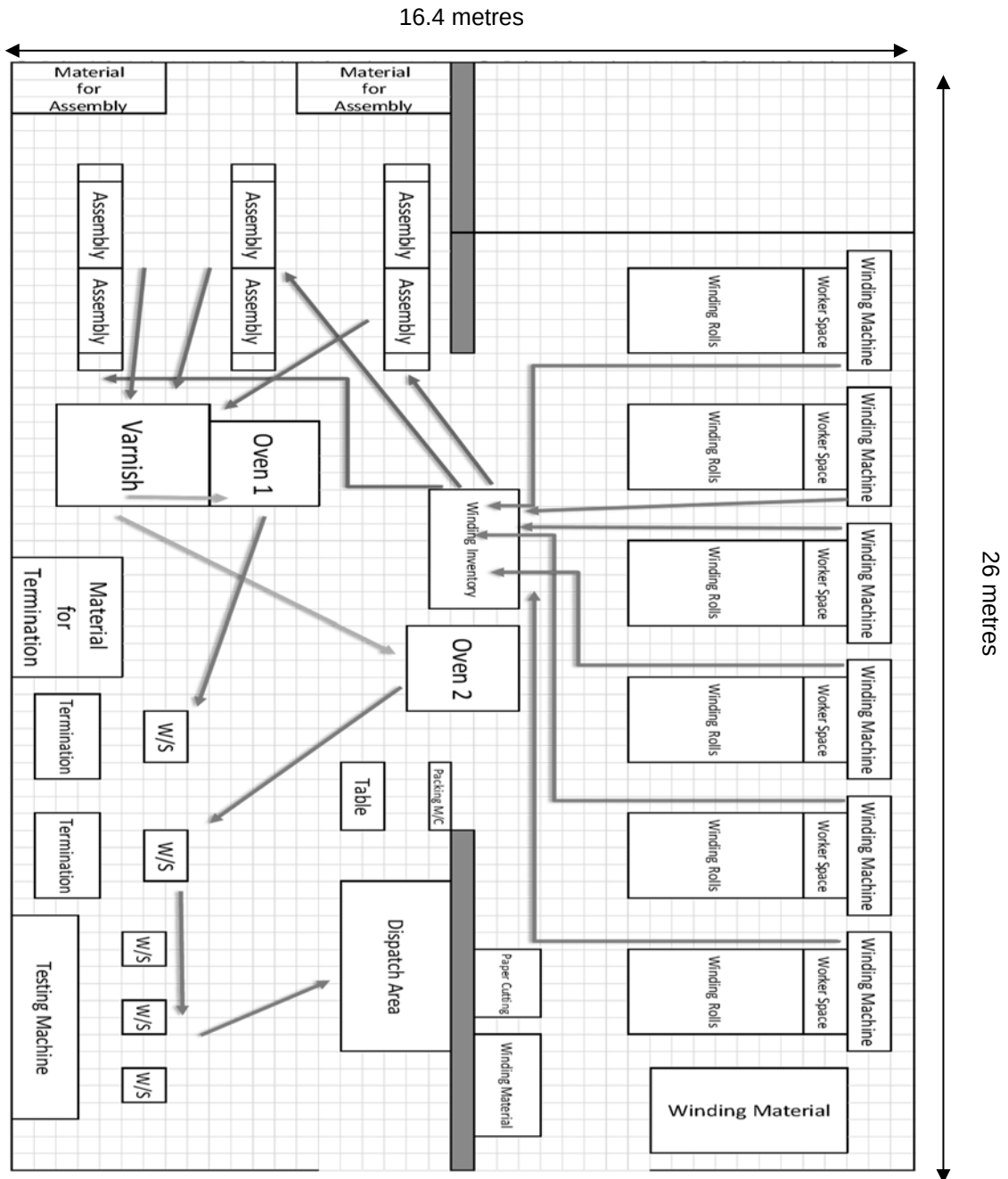
Note: COGS = costs of goods sold; *assumed corporate tax rate in India

Source: Created by authors.

**EXHIBIT 2: CLUB POWER ELECTRONICS PRIVATE LIMITED'S BALANCE SHEET, 2013–2016
(IN ₹ MILLIONS)**

ASSETS	2013	2014	2015	2016
Cash	56.40	117.81	209.10	163.90
Accounts receivable	1.80	3.20	5.70	9.90
Inventories	210.60	301.20	329.80	393.40
Current assets	268.80	422.21	544.60	567.20
Property, plant, and equipment (net)	559.80	723.76	831.24	1,183.48
TOTAL ASSETS	828.60	1,145.97	1,375.84	1,750.68
LIABILITIES AND STOCKHOLDERS' EQUITY				
Accounts payable	287.50	383.50	226.50	301.80
Current portion of long term debt	7.50	6.60	19.40	12.40
TOTAL CURRENT LIABILITIES	295.00	390.10	245.90	314.20
Long-term debt	7.50	6.60	206.20	171.20
TOTAL LIABILITIES	302.50	396.70	452.10	485.40
TOTAL STOCKHOLDERS' EQUITY	526.10	749.27	923.74	1,265.28

Source: Created by authors.



Note: Each square in the grid above represents 0.4 x 0.4 square metres in the actual plant.
Source: Created by authors using company documents.

**EXHIBIT 4: CLUB POWER ELECTRONICS PRIVATE LIMITED'S INTERNSHIP STUDY SCHEDULE,
APRIL 2016**

April 2016						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 Quarterly Review Meeting	2 Winding
3	4 Winding	5 Winding	6 Assembly	7 Assembly	8 Insulation	9 Heat Treatment
10	11 Brazing	12 Brazing	13 Testing	14 Quality Control and Packing	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

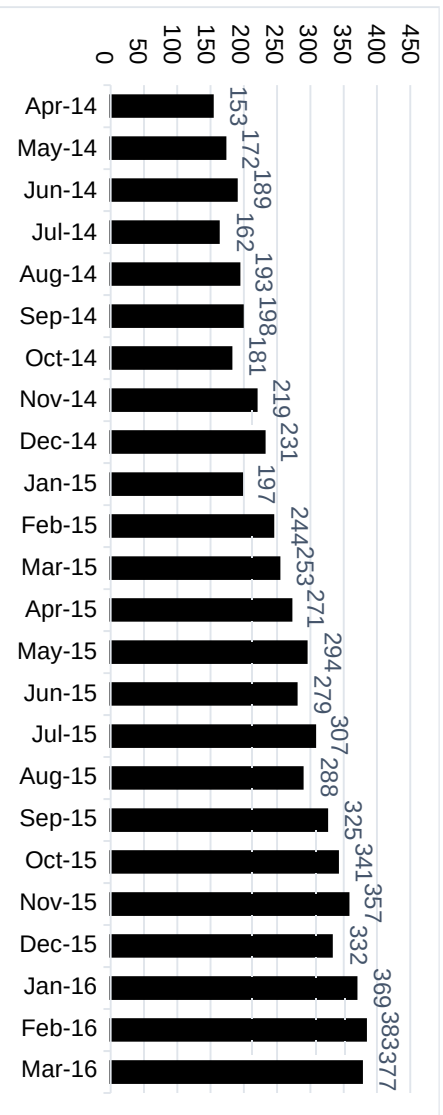
Source: Created by authors.

EXHIBIT 5: DETAILS OF CLUB POWER ELECTRONICS PRIVATE LIMITED'S EQUIPMENT

Machine	Cost (₹)	Expected useful life (years)
Winding	332,600	5
Varnish	199,560	5
Oven	997,800	10
Brazing	665,200	4
Testing	532,160	4
Packing	166,300	5

Source: Created by authors using company documents.

**EXHIBIT 6: CLUB POWER ELECTRONICS PRIVATE LIMITED' S MONTHLY DEMAND, APRIL
2014– MARCH 2016**



Source: Created by authors using company documents.