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受賞報告講演要旨

Elgi Equipments Limited

# **DTQMP ABSTRACT: ELGI EQUIPMENTS LTD.,**

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# 1. Company Profile

## 1.1 Introduction

Established in 1960, Elgi Equipments Limited is a leading air compressor manufacturer with a broad line of innovative and technologically superior compressed air systems. ELGi has earned worldwide distinction for designing efficient and durable solutions that help companies achieve their productivity goals while keeping the total cost of ownership low. With a portfolio of 400+ products, ELGi’s compressed air solutions range from oil-lubricated and oil-free rotary screw, centrifugal and reciprocating compressors, to dryers, filters and downstream accessories. ELGi’s products serve a wide variety of applications across industries ranging from manufacturing, food & beverage, construction, pharmaceuticals and textiles across a global customer base of over 2 million.

## 1.2 About air compressors

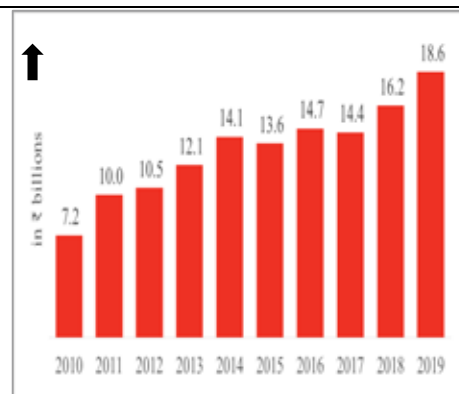
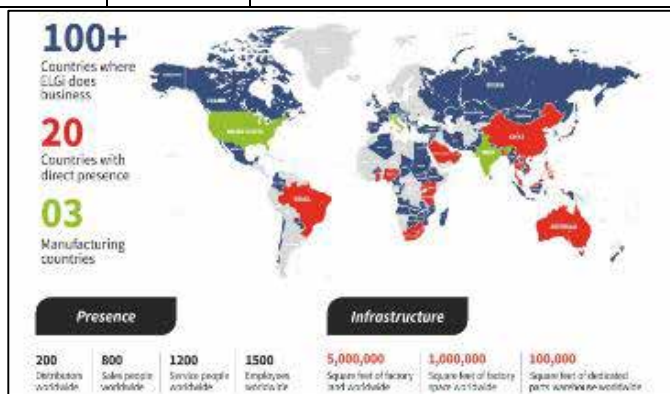
Compressed air is the fourth utility in industries (after electricity, natural gas and water) and is used in various applications across different industrial segments. The advantages of compressed air over other utilities are

- It is safe to store and transport
- It can be produced onsite.
- With a global emphasis of renewable energy, compressed air is the cheapest form of storing energy.
- With worldwide shortage of water, compressed air can be used to produce water in the future.

## 1.3 History

**Table 1-1 - Timeline of Key Milestones**

The Origins	1960 to 1990	<ul style="list-style-type: none"> <li>▪ Incorporated in 1960 starting with automotive service equipment</li> <li>▪ Entered the compressor business with piston compressors and expanded to screw compressors</li> <li>▪ Diversified into many disparate businesses such as drip irrigation systems and automotive brake systems</li> </ul>
Portfolio Clean-up Phase	1990 to 1998	<ul style="list-style-type: none"> <li>▪ Retained the compressor and automotive service equipment businesses</li> <li>▪ Progressively sold or shut down all the other businesses - totally 7 businesses</li> </ul>
Preparation Phase	1998 to 2018	<ul style="list-style-type: none"> <li>▪ Indigenous aircend development program initiated</li> <li>▪ Introduced a series of lubricated screw compressors, developed fully in-house</li> <li>▪ Introduced oilfree screw compressors under licensed production</li> <li>▪ Introduced EG series of lubricated screw compressors that matched the best in the world</li> <li>▪ Introduced oilfree screw compressors fully developed in-house</li> <li>▪ Introduced EN series of lubricated screw compressors to expand customer base</li> <li>▪ Designed in-house a range of centrifugal compressors</li> <li>▪ Inaugurated a state of the art manufacturing facility to produce aircends</li> <li>▪ Integrated backwards into foundry to produce castings for captive use</li> <li>▪ Introduced the most advanced oilfree compressor technology in the world</li> <li>▪ Introduced a new generation of EG series lubricated screw compressors</li> </ul>



**Figure 1-1 and 1-2 Global Presence and Total Revenues**

## 1.4 Technology and Product Development

Compressors consume a significant amount of energy and increased energy efficiency benefits the customers in the long run. The cost of energy has been found to be in the range of 70-75% of the life cycle cost of the compressor (capital cost and maintenance costs being the others). This makes the design of airend, the heart of the compressor, extremely critical. Over the last two to three decades, the company has developed capability to design 83% of the oil lubricated compressor market and 56% of the oil free compressor market.

The company's technology team comprises of 185 members with varying levels of education and professional experience. The team has two patents awarded, three patents awaiting final approval and over fifty publications in both national and international journals. ELGi is recognised by the Department of Scientific Research, Government of India at Level II for technical achievements and contributions.



Figure 1-3 Product Portfolio



Figure 1-4 Compressor Applications

## 1.5 System and Product Certifications

ELGi conforms to global systems and standards which adds credence to the organization's ability to compete in competitive markets. This is of strategic importance, especially considering the company's increased global focus.

## 1.6 Manufacturing Facilities and Quality Control:

- In 2011-12, a state-of-the-art campus at Kinathukadavu, near Coimbatore was established with total area of over 100 acres, 5 times the current size. The new campus, called the Air Centre Plant (ACP) incorporates some of the best practices used in manufacturing facilities globally.
- To enhance the quality of its products, in 2013-14 ELGi integrated backward and established a world class foundry which supplies castings for its rotors and housings.
- To enhance the efficiency of its compressors, ELGi started producing its own valves and motors.

## 1.7 Corporate Social Responsibility (CSR)

The CSR activities at ELGi are primarily focused on Education, Health and Environment with education at the forefront. The Company runs two schools, in and around Coimbatore where approximately 2000 students are studying. ELGi plans to invest Rs.260 Mn to develop infrastructure of these schools which will enable quality education to economically weaker sections of society.

ELGi's other key educational and empowerment initiative is ELGi Vocational Training School (EVTS), which selects and trains students from economically weaker sections preparing them for future.

- 50% of new workmen are from lower income group and from remote villages
- 32% of new workmen are either orphans or have single parents.

#### **1.7.1 Health – Support to Coimbatore Cancer Foundation through Marathon**

The Coimbatore Marathon is organised annually to raise funds for Coimbatore Cancer Foundation (CCF). The objective of CCF is to promote awareness on cancer prevention and rehabilitation of cancer survivors and their families. Employees and their family members are encouraged to actively participate and volunteer in the event and the participation is growing year on year.

#### **1.7.2 Environment- Carbon emission reduction**

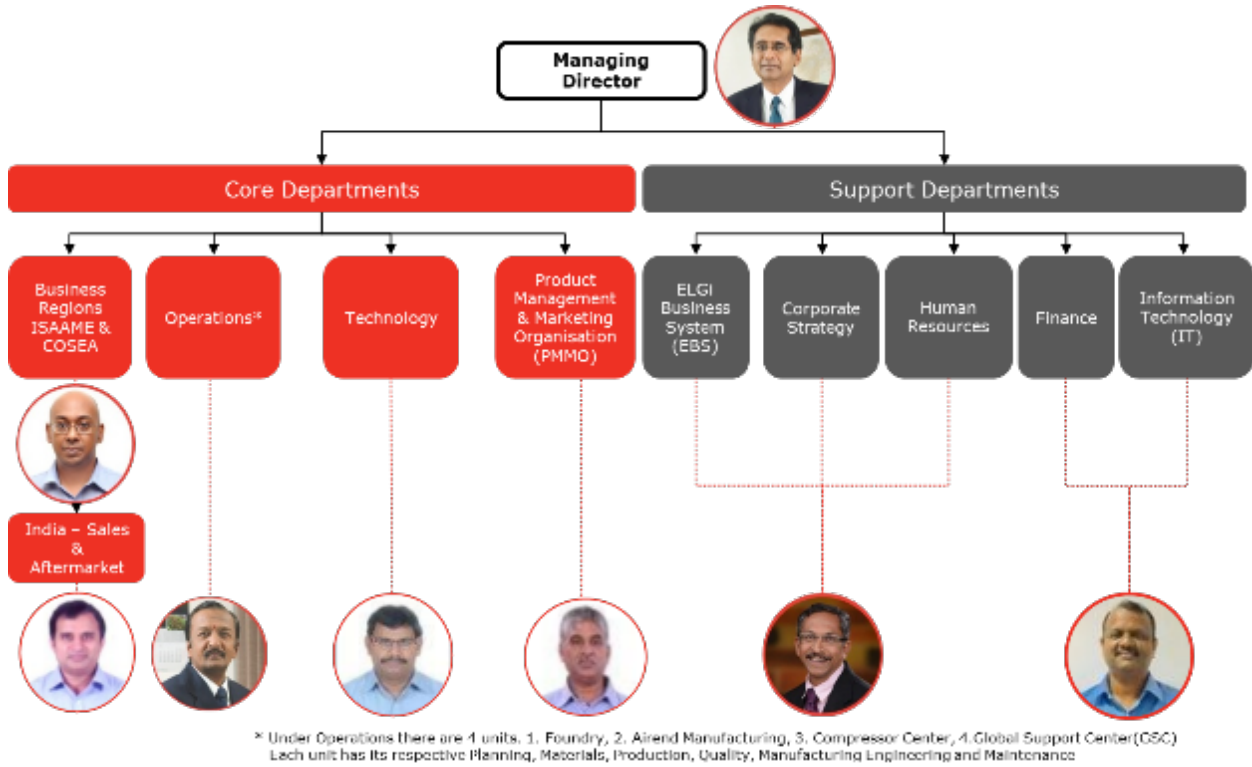
Carbon emission is the amount of carbon dioxide that is released into the atmosphere because of the use of electricity and fuel. Electricity is the major contributor (67%) for carbon emission in air compressor manufacturing and hence, the need to conserve it.

Conservation of energy is one of the important initiatives towards being a socially responsible organisation. Some of the measures include reduction of undesirable energy using controllers, energy efficient lighting, installation of movement detector circuit with solar panels in hi-rack stores, elimination of coolant motors and utilising renewable energy sources. ELGi has installed energy metres in its machinery and they are monitored using IoT devices. ELGi utilises wind energy to the extent of 15% of its total energy consumption. Internal studies show that these efforts have resulted in a 23% reduction in CO<sub>2</sub> emission in the last 4 years.

## 2. Organisation

### 2.1 Organisation Structure

ELGi Equipments Limited is a public limited company registered under the Indian Companies Act., 1956. The Company is headed by the Managing Director who reports to the Board of Directors, constituted by the shareholders.



**Figure 2-1 Key Management Personnel**

The company also has wholly owned subsidiaries in Australia, Indonesia, UAE, Brazil, Italy and USA, which are not included in the scope.

## 3. Aspiration, Strategy and Objectives

### 3.1 Background

Prior to the 1990s, the Indian market was regulated by manufacturing licenses and it was a relatively easy proposition to survive in the industry, once the license to manufacture was obtained. The economic liberalization in 1991 brought with it several challenges. Competition was now not limited to known Indian players but major global players. Customers' expectations from suppliers increased and there was a need to innovate to stay competitive. The business was re-organized to focus on compressors, and invest in technology and quality. ELGi's production facilities were upgraded and focused priority was placed on quality. These initiatives during the period 1992-2013 have helped ensure ELGi not just strengthened its foothold in India but also enable its foray into markets outside of India.

### 3.2 Aspiration: Conquer K-2 (CK2)

In 2014-15, based on the assessment of external opportunities arising out of the changes in the competition landscape, and the company's strength and capabilities, the company defined a new aspiration: *"To be No. 2 in the Global Air Compressor Market by 2027."* The aspiration was christened **"Conquer K-2 (CK2)"** – named after Mount K2, the second highest peak in the world and arguably, the toughest peak to climb. To succeed in the air compressor industry, it is important to possess technology that spans the full width of the market. ELGi is one of the few companies that not only possesses the know-how, but also the know-why, which helps it design and build *state-of-the-next-art* products. This forms the primary basis for setting the challenging aspiration.

#### 3.2.1 Why No. 2?

The Air compressor market is dominated by a handful of companies to the left of ELGi (as in figure 3.1) with an estimated market share of 69%; to the right of ELGi, there are over 400 companies in 150 countries with a market share of 27%, largely comprising of domestic players in China. Among the major players, top five companies account for 62% of the total market size.

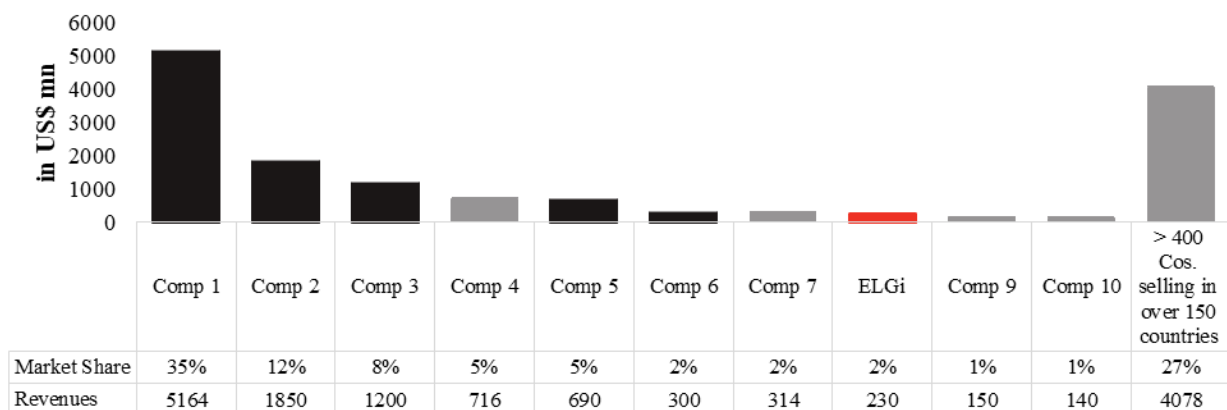


Figure 3-1 Market share and revenues

The global air compressor market is dominated by Atlas Copco with an estimated market share of about 35%. This industrial structure presents a large skew, with the market leader being significantly ahead of others. This is atypical of an industrial structure in a mature capital goods business where the market follower is way behind the market leader. And thus there is a credible opportunity to occupy a strong No.2 position.

#### 3.2.2 Need to play in Global Air Compressor market

In 2012-13, ELGi earned approximately 70% of its revenues from the Indian market, which represented only 5% of the global air compressor market. Though ELGi was the second largest player in India, being dominant in India alone was not enough since the investment required to compete requires much larger scale. Thus there is a compelling need to enlarge the presence beyond India.

#### 3.2.3 Setting a timeframe

The choice of a time frame for the goal was based on ELGi's previous track record and also on the evidence of mature organisations which have achieved similar growth. During the 12 years prior to setting up of our aspiration (CK2), ELGi grew at a CAGR of 18%. Targeting continued growth at such a high percentage was both ambitious and achievable. This translated into a 12-year horizon to achieve the intended goal of \$1.6 Bn.



### 3.2.4 Linear growth vs. Non-linear growth

The time frame of 12 years was broken into three phases to enable the definition of interim milestones. ELGi’s choice of growth pattern was non-linear, with lower growth in the initial years and achieving higher growth in later years. The aspiration, being far-sighted, required a considerable amount of preparation before the goals can be realised. Hence, the plan was divided into three phases - Preparation Phase (5 years), Launch Phase (4 years) and Growth Phase (4 years), with a greater thrust on the preparation phase.

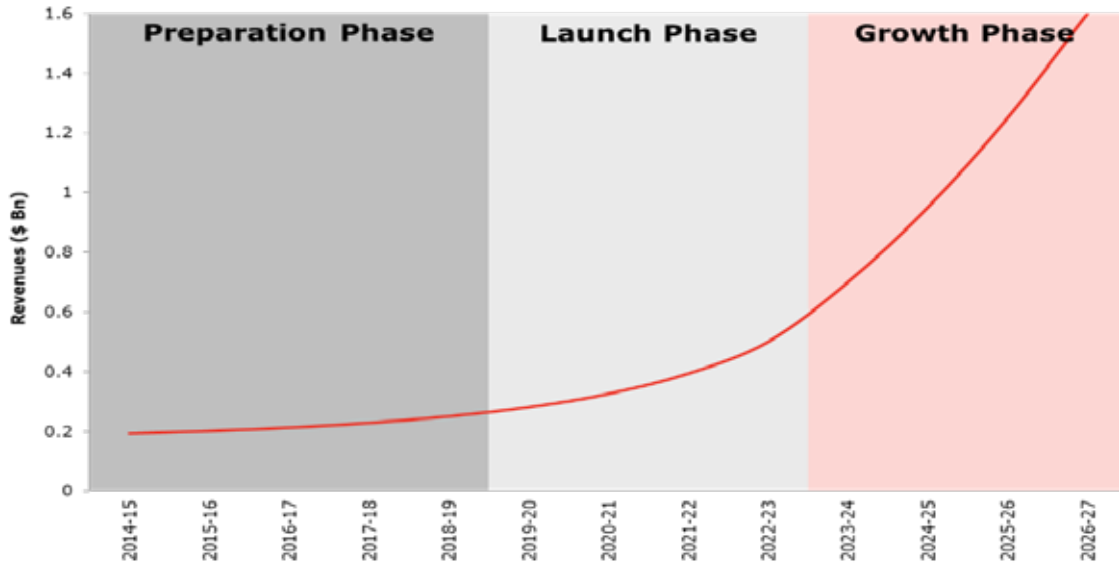


Figure 3-2 Three phases of CK2

In the preparation phase, ELGi’s strategy foundation was based on two dimensions – “where to play?” and “how to win?”. “Where to play?” was about identifying the markets and products to focus for growth. “How to win?” was about defining the key requirements to succeed in the identified product/market segments. The “How to win” part was initially focused on product development.

### 3.3 Strategy foundation – Market Development – “Where to play?”

ELGi sells compressors across five major product groups in over 100 countries. To ensure better focus of resources and effort, the products and markets needed to be prioritized for concentrated attention. Based on the markets size, size of the product segment and its readiness to participate, ELGi identified the core products and markets. ELGi’s initial experience in terms of acceptance by the markets of its products, was also taken into account.

#### 3.3.1 Identifying Core Products

Globally, the largest selling compressors are oil-lubricated Electric Powered Screw Air Compressor (EPSAC) constituting 39% of the market (~\$6 Bn). In the Indian market, EPSAC constitutes 35% of the market size. EPSAC was identified as the core product that would help in realising the aspiration of becoming no. 2 in the global air compressor industry.

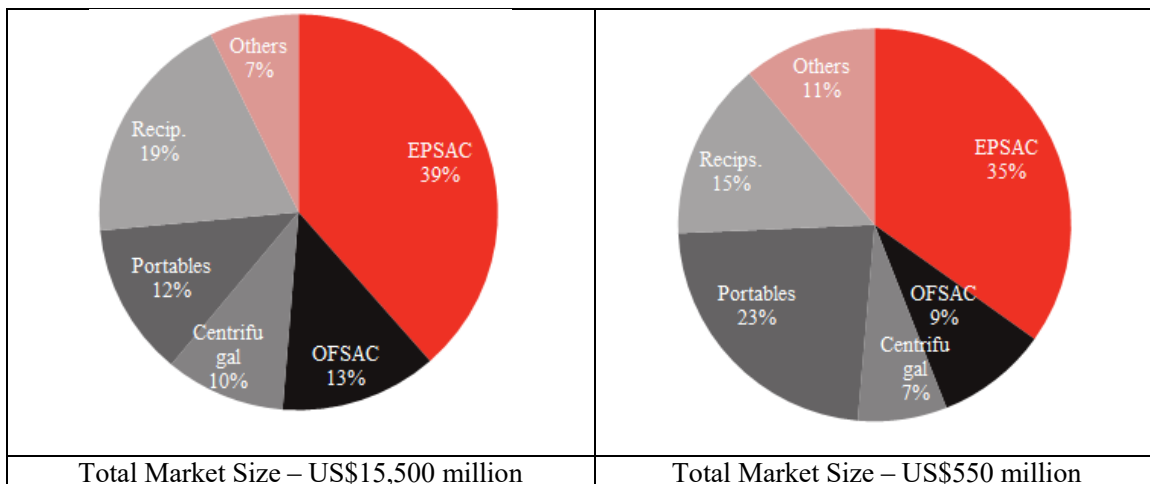


Figure 3-3 Global market size - product wise

Figure 3-4 India market size - product wise



### 3.3.2 Identifying Key Markets

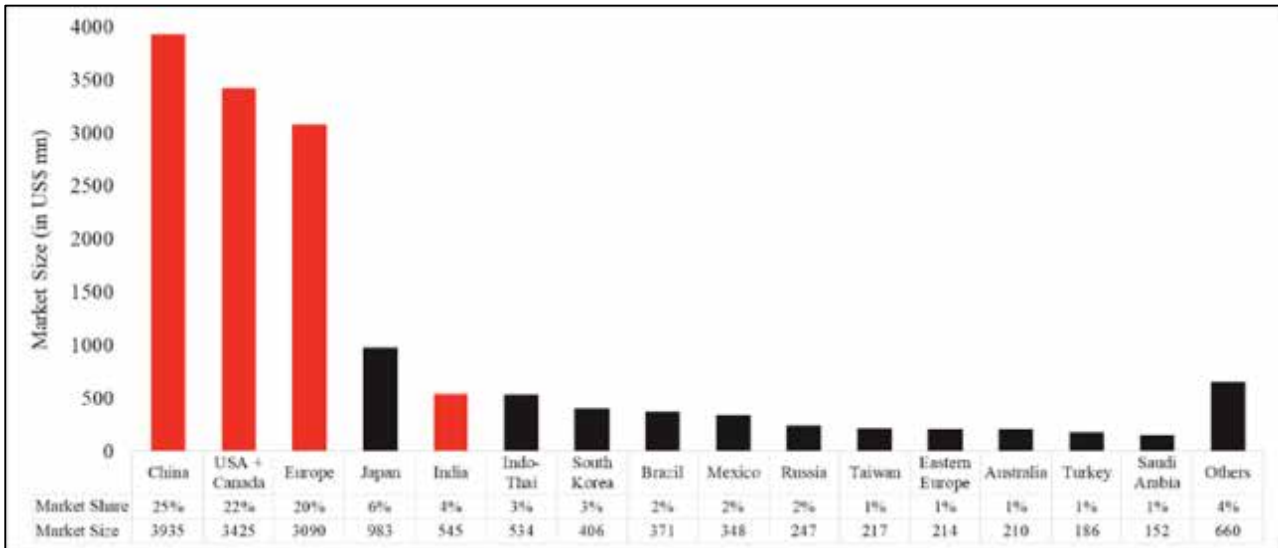


Figure 3-5 Market size of different geographical areas

To become a global player, it was important to first dominate the home market, India. In 2013-14, ELGi was the second largest player in Indian market, only next to Atlas Copco. Growth in domestic market will ensure financial stamina which will help in managing the risks of entering new markets. Considering ELGi’s challenging experience in expanding in China, it chose the next two biggest markets, US and Europe. In these markets, the initial acceptance of its brand, country of origin and products, were very positive.

### 3.4 Strategy foundation – Product Development – “How to win?”

The second dimension of the strategy was to develop products that met the expectations of the customers as well as fulfilled the unstated wants of the customer. In Product Development, the focus areas were efficiency (SPC) and quality (defects).

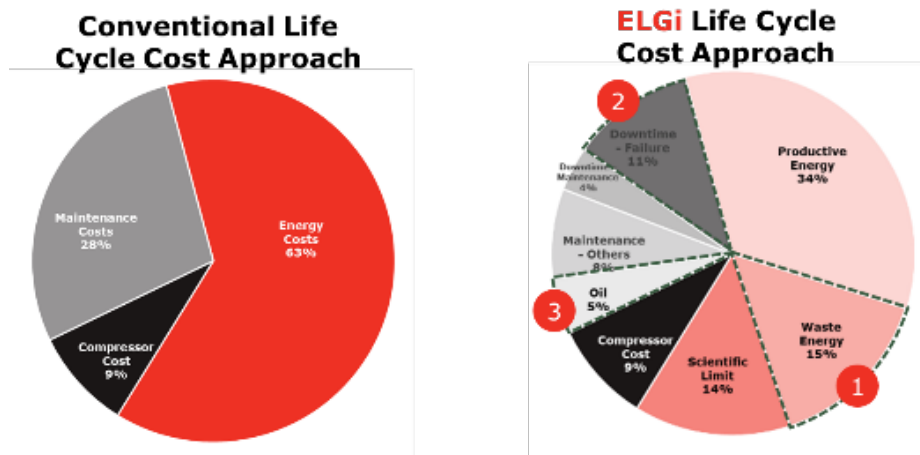


Figure 3-6 How to win? - Market approach vs. ELGi approach

Being an unknown brand with a “made in India” label, it was important to establish market presence in developed markets. In the US and Europe, customers have high expectations and therefore ELGi’s offering should not only be the best in what they expect – must be quality, but also exceed their expectations – attractive quality.

Customers stated expectations are captured in the Conventional Life Cycle Cost circle, which includes only energy cost, maintenance cost and cost of the compressor. This is an industry standard in terms of assessing competitiveness and used by all competitors.

ELGi expanded this life cycle cost to include a more granular definition of the costs. By focusing on these granular definition of costs, an opportunity was created to exceed the customer’s expectation.

Based on this unique perspective, the top 3 actionable costs was picked – energy cost (1), downtime cost due to failure (2) and maintenance cost due to oil (3).

### 3.5 Objectives

Since 2013-14, ELGi has been implementing and evaluating these strategies using different metrics. ELGi's primary focus during the initial years was largely in the areas of technology, operations, and quality focusing on creating a substantial value for the customer. This effectively constitutes the preparation phase towards the CK2 journey. Currently, ELGi is also rolling out initiatives focused on sales and service to enhance customer reach and satisfaction. The objectives are listed in the table below:

**Table 3-1 List of objectives**

Strategy foundation	Objectives	Control Points	2014-15	2015-16	2016-17	2017-18	2018-19
Market Development	1 Dominate sales of EPSAC, first in India through structured sales process (Go-to-market process); Further deployment of sales process as a universal model	EPSAC Sales value (INR Million.)				✓	✓
Product Development	2 Develop EPSAC products with Specific Power Consumption (SPC) lower than 'best in CAGI' to offer lowest lifecycle value	Products within top 3 positions in CAGI (%)		✓	✓	✓	✓
	3 Develop products with lowest Life cycle cost for Oil Free Screw Air Compressor (OFSAC) - Water injected	Product range completion (%)				✓	✓
	4 Achieve lowest defect levels	Warranty complaints (DPMU)	✓	✓	✓	✓	✓
		Intolerable defects (DPMU)				✓	✓
	5 Prevent defects through Characterisation	Defects prevented (Nos.)			✓	✓	✓
	6 Predict failures through AiR~ALERT (IOT)	Failures predicted (%)				✓	✓

✓ Applicable for that year

The implementation of the objectives and their PDCA is explained in the subsequent chapters.

## 4. TQM Promotion

### 4.1 Need for TQM

In 2007-08, an internal assessment with the senior management team of all functions revealed that significant time was spent by them in routine activities instead of ones that would bring directional change. The root cause analysis suggested the lack of a structured approach in their functioning which hampered actual improvement. Some of the major issues identified were:

- Role clarity – Lack of alignment between organisational goals and individual priorities
- Cross-functional coordination – Priorities of different functions were in siloes, thus preventing cooperation between them.
- Standardisation – Presence of non-standard practices that have evolved due to an experience led rather than a process driven approach.
- Lack of reviews and structured evaluation process at different levels

To address these issues systematically, ELGi started using TQM as a vehicle to focus on daily work management and policy management. The guidance of an eminent TQM Sensei from Japan was sought.

### 4.2 EBS philosophy

After studying various TQM models, ELGi developed its own TQM model and christened it as the **ELGi Business System (EBS)**. The objective of EBS is *“To satisfy the customers’ implicit and explicit requirements through continuous improvements in the performance of the company across all functions, on QCDSM and growth parameters, by adopting systematic work practices”*

#### 4.2.1 House of EBS

The key foundations of EBS are – 1. Business processes, 2. Measurement based management, and 3. Alignment of individual goals with company goals. Business processes are a set of activities related to business (core or support) that create, transfer, or transform an asset, information or knowledge. The objective of business processes is to bring reliable, repeatable, effective and efficient outcomes.

Through measurement based management, the performance of each individual in the organisation is defined in the form of objectives and control points, which are then measured and reviewed at defined frequencies. The objectives are clearly linked to the annual performance management system, conducted through *myEBS*, an IT-enabled system.

The third dimension of EBS is to help the alignment of individual goals with the company’s goals and aspirations. This helps the individual to understand the importance of their roles and responsibilities in satisfying the customer and other stakeholders’ expectations.

The pillars of the EBS house are the ELGi Work Management (EWM) and ELGi Policy management (EPM), which were derived from the principles of Daily Work Management and Policy Management of TQM respectively.

The objectives of EWM are to reduce variation in routine activities, sustain the present condition and improve progressively towards achieving the intended results. The objective of EPM is to enable the senior management to identify and deploy initiatives to realise company-wide or departmental objectives. EPM and EWM together will enable us to improve continuously.

All the above structured activities will drive us towards achieving our CK2 aspiration.

There always exists a challenge with differentiating between EPM and EWM. Taking input from JSQC standards and inputs from management reviews, ELGi differentiated EPM and EWM as below,

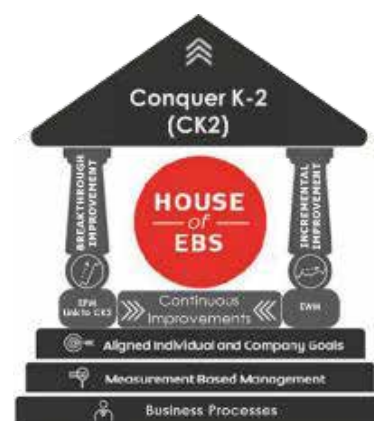


Figure 4-1 – House of EBS

Table 4-1 Differences between EPM and EWM

	Existing process/practices will get results	Existing process/practices will NOT get results
Know how to get results	<b>EWM:</b> 1. For routine activities based on defined processes 2. Incremental improvements through CAPD rotation <b>Example:</b> On-time material procurement, On-time closure of production	<b>EWM +</b> 1. Horizontal deployment of EPMs in applicable areas <b>Example:</b> Horizontal deployment of demand estimation model for production planning in other products
Don't know how to get results	Not applicable	<b>EPM</b> 1. Objectives which are critical/challenging 2. Objectives are clearly deployed with an initiatives/action plan to achieve targets 3. Evidence of “New” initiatives/action plan to achieve targets <b>Example :</b> Implementation of demand estimation model for production planning in SEPSAC products

### 4.3 Overview of EBS journey

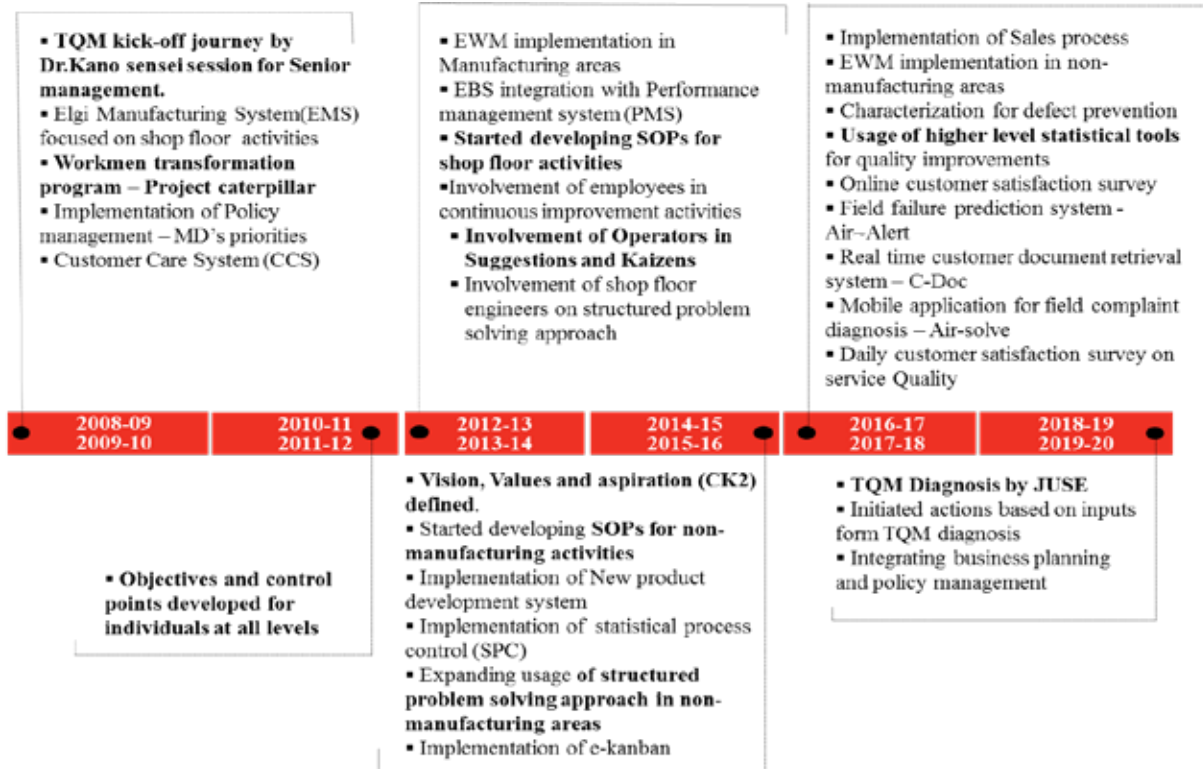


Figure 4-2 EBS journey

### 4.4 EBS implementation

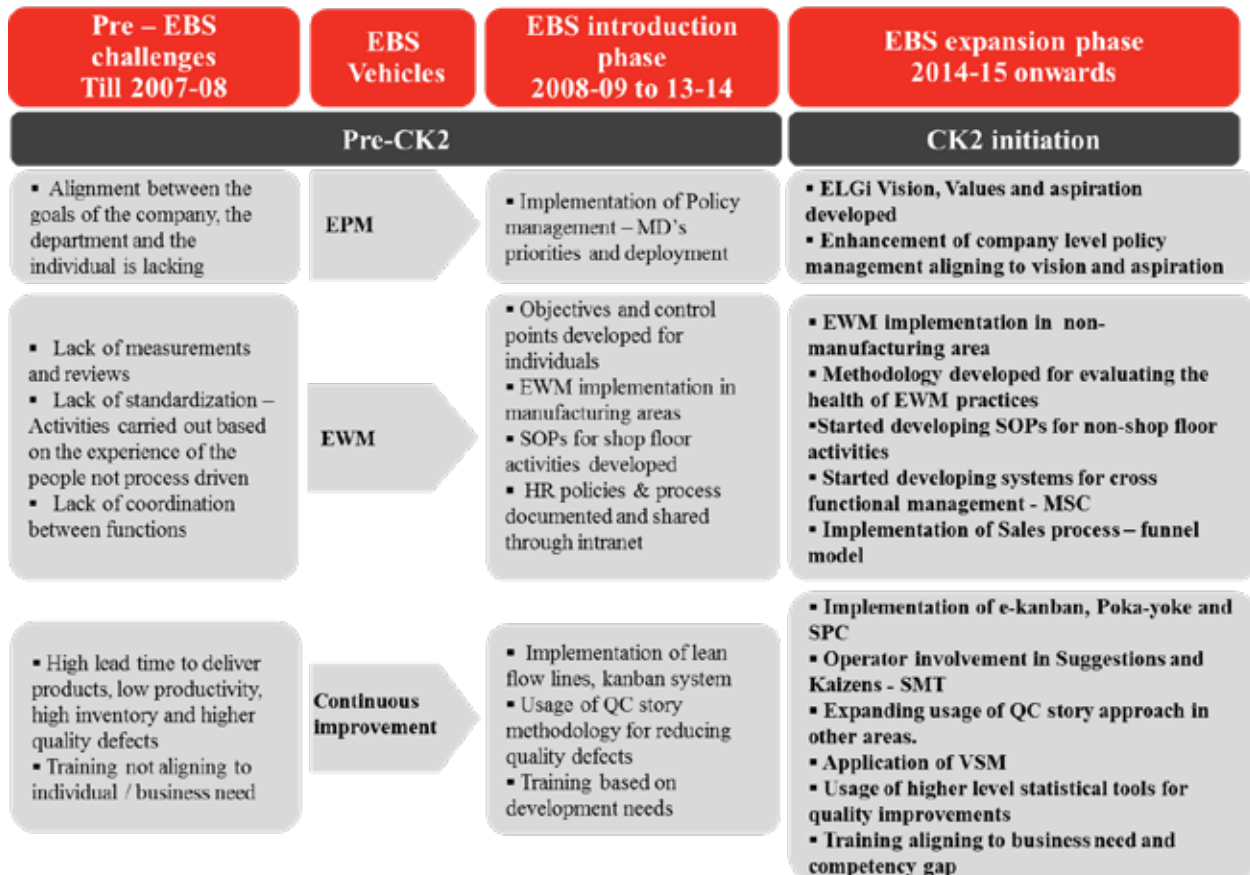


Figure 4-3 EBS implementation

EBS was implemented to overcome the key challenges faced during the pre-EBS phase. EPM, EWM and continuous improvement were the key vehicles used as a change agent in the EBS implementation.

## 4.5 ELGi Policy Management (EPM)

### 4.5.1 Background

Prior to the EBS implementation, the ELGi annual business plan, consisted of targets for sales, profit, and cash turns, which were predominantly considered as company level objectives. The focus was on results and not on the process of how to achieve. There was no systematic process to align individual objectives with company level objectives.

### 4.5.2 Policy Management System

In the year 2008-09, Policy Management was first introduced in the form of Managing Director’s Priorities (MDP). MDP comprised of key strategic initiatives that had to be undertaken during the year. MDP was deployed to different levels of management through objectives and control points.

In 2014-15, following the launch of CK2, MDP was oriented towards fulfilling the objectives outlined in CK2. All the objectives were deployed across functional teams. In 2016-17, departments like technology, product management, operations, human resource and finance started developing their departmental vision and objectives, aligned to the company’s vision and CK2. Subsequently, in 2017-18, a new process, outlined in figure 4-4 was established to arrive at the MDP. The departmental objectives identified by respective departments, sales objectives by different regions that were oriented towards achieving CK2 and strategic objectives were considered to arrive at the MDP. The time frame of the MDP was shifted from one year to two years to enable sustained focus on these objectives. The two-year plans, presented in table 4-2, would have annual targets through control points and would be reviewed at regular frequencies. Policy management was at company level or department level. MDPs were considered as company level policy items. Department objectives which are critical and challenging based on business or customer need were considered for department level policy items.

Table 4-2 MDP 2017-18 to 2018-19

Function	Stakeholders	Objectives	
Quality	Customer	1	Reduction of intolerable defects
India – Business Region	Customer	2	Achieve xx% market share in water well sales in India
	Customer	3	Achieve xx% market share in OFSAC in India
Technology	Customer	4	Develop full range of water injected compressors
	Customer	5	Develop failure prediction system (AiR~ALERT)
Finance	Company	6	Creation of cost and profit centres

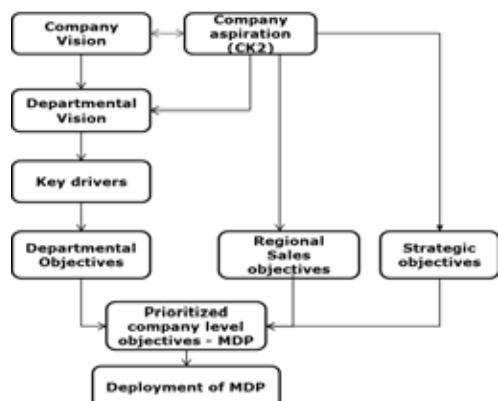
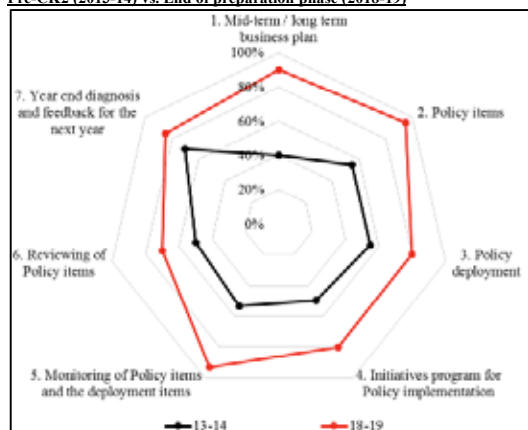


Figure 4-4 Approach to MDP (17-18 & 18-19)

### 4.5.3 Health of Policy management – Preparation phase:

Pre-CK2 (2013-14) vs. End of preparation phase (2018-19)



\*Evaluation criteria(1 to 7) referred from JIS

Figure: 4-5 Evaluation\* of policy management

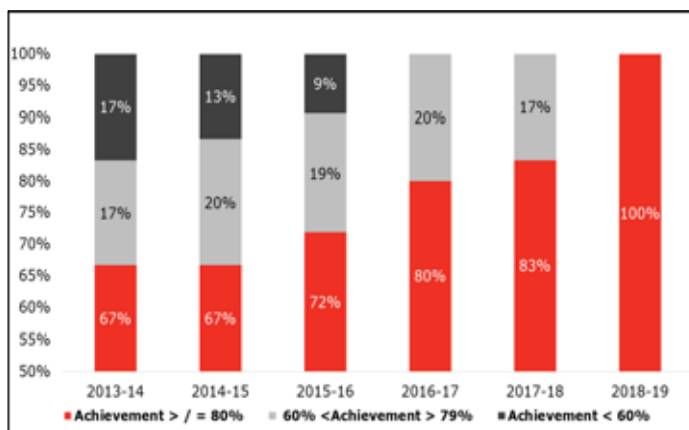


Figure: 4-6 Results of Policy items (MDP)



**4.5.4 Business planning and Policy management for launch phase:**

At the end of the preparation phase, the mid-term goal was derived for the launch phase, from which the Key Strategic Indicators (KSI) were arrived. KSIs were identified on the strategic foundation of “Where to play” and “How to win”. The KSIs are otherwise termed as MD’s Priorities (MDP). The integration of business planning and policy management has been carried out based on TQM diagnosis feedback. The launch phase plan, with a time frame of four years, would have annual targets through control points and would be reviewed at regular frequencies.

The overall policy management system has been shown in figure 4.7.

Elgi Business System - Policy management system										ELGI
Sl. No.	Step	Input	MD	Directors	HODs	Middle / Junior management team	Operators	Output	Doc. Ref.	
			Activities							
P  D  C  A	1	Company aspiration						- CK2 aspiration	CK2 document	
	2	Mid term goals						Launch phase goals		
	3	Identify key strategic indicators to achieve the mid term goals						KSI - MD's Priority & Departmental Objectives	MDP - Policy table Policy Deployment table	
	4	Implementation Strategic indicators						- Actions / Initiatives	Action plan Trend graph	
	5	Monthly business review						- Directions and guidelines from MD - Revised targets / initiatives (if required)	Minutes of the meeting (MOM)	
	6	Year end diagnosis						Learning from year end diagnosis	Year end diagnosis form	
EBS / Form 01										
	R1	15-10-2018	Mid-term (launch phase) goals included, Risk assessment and mitigation plan included.							
	R0	16-05-2016	Newly created				Krishnamoorthy M	Sundarrajan P	Jayakanthan R	
	Revision No.	Revision date	Revision History				Prepared by	Reviewed by	Approved by	

**Figure: 4-7 Policy Management System**

**4.6 ELGi Work Management (EWM)**

Prior to the EBS implementation, routine activities were not tracked in a systematic manner. With a lack of a process driven review mechanism, senior management inadvertently spent significant time in routine activities.

**4.6.1 EWM Process**

Between 2008 and 2014, EWM was largely implemented on the shop-floor - daily production, rework and material availability. The first step was to define objectives and control points for individuals at all levels. Control points were established for evaluation at defined frequencies. Standard Operating Procedures (SOPs) were developed for routine activities and reviewed for adherence and effectiveness. Gaps were identified in the reviews and Corrective Actions and Preventive Actions (CAPA) were undertaken to strengthen the EWM process.

In 2015-16, two major gaps were identified in the existing EWM practices, during review of EWM processes by TQM sensei.

- Unable to differentiate normal and abnormal defects
- Unable to measure the effectiveness of implementation of EWM practices in different areas of the organisation, referred as “health of EWM.”

With guidance from the TQM sensei and framework of JSQC standard, the EWM practices were reviewed and the gaps were mitigated as explained below.

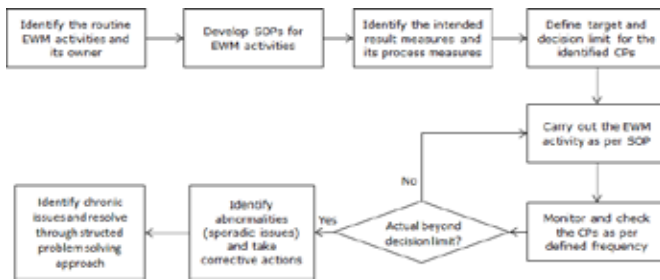


Figure 4-8 EWM process flow

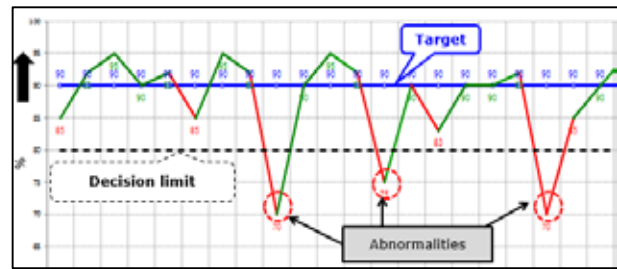


Figure 4-9 EWM monitoring

### 4.6.2 Understanding the health of EWM

The EWM practices are reviewed on a quarterly basis using the framework developed with the help of the TQM sensei. In the framework, EWM is measured at four different levels.

At the first level, EWM is measured for availability of and adherence to control points for individuals. The second level of the framework is oriented towards aligning EWM result measures with process measures and its regular tracking. Abnormalities, if any, are highlighted at this level. The third level measures the ability to identify the root causes and mitigate abnormalities through a structured problem solving approach. At the fourth level, the “stability-capability” of EWM practices of a function/department is measured. Stability is measured by analysing the variations in actual performance parameters and capability is measured by achievement of targets for a given time period.

### 4.6.3 Results

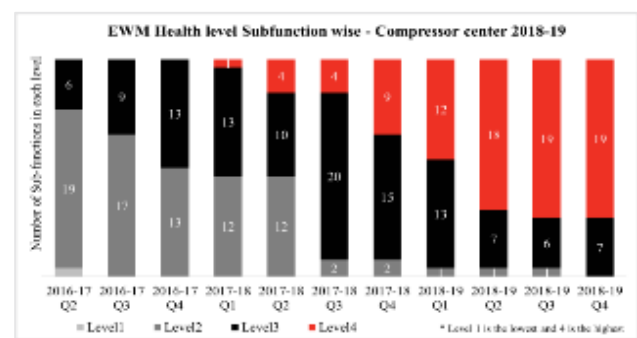
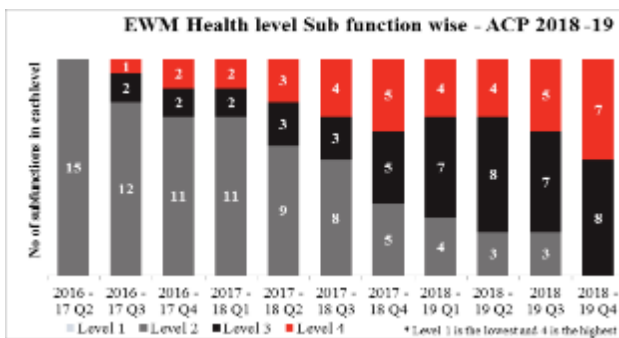


Figure 4-10 EWM health levels

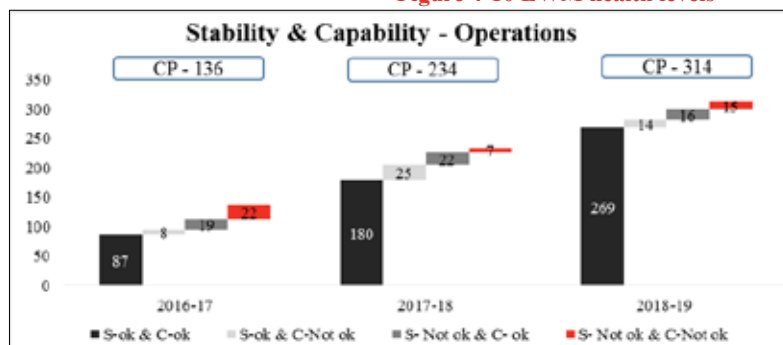


Figure 4-11 Stability-Capability matrix

### 4.6.4 Benefits of EWM – Examples

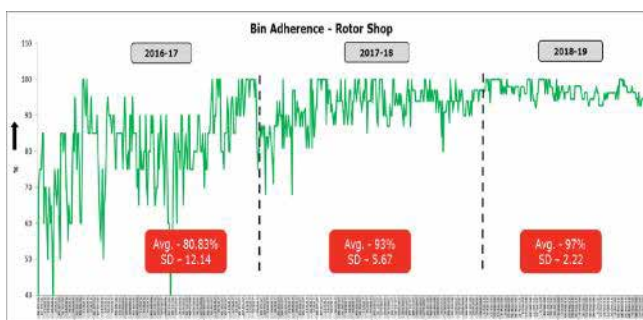


Figure 4-12 Bin Adherence – Rotor Shop

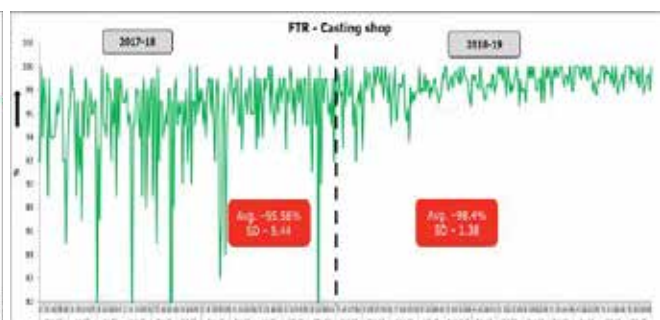


Figure 4-13 FTR – Casting Shop



### 4.7 Continuous improvement processes

Continuous improvement was stratified into three categories namely JDI, KKD and QC stories.

#### 4.7.1. Continuous improvement framework:

Improvement type	Scope of application	Mapping of Employee involvement vs. Improvement level					Time frame	Impact	Document reference																
JDI - Just Do It	Work area improvements in PQCDSDM	<table border="1"> <tr> <td rowspan="3">Continuous improvement methodology ↓</td> <td colspan="5">Team composition</td> </tr> <tr> <td colspan="2">Individual</td> <td colspan="3">Team</td> </tr> <tr> <td>Operator</td> <td>Staff</td> <td>Operator &amp; Staff (SMT)</td> <td>Staff (CFT)</td> <td></td> </tr> </table>					Continuous improvement methodology ↓	Team composition					Individual		Team			Operator	Staff	Operator & Staff (SMT)	Staff (CFT)		1 week	1. Incremental improvements in EWM activities 2. Elimination of sporadic issues in EWM activities 3. Variation reduction in EWM activities 4. Ease of carrying out routine activities 5. Enhancement of morale of employees	Kaizen sheet - JDI
Continuous improvement methodology ↓	Team composition																								
	Individual		Team																						
	Operator	Staff	Operator & Staff (SMT)	Staff (CFT)																					
KKD(Keiken, Kan & Dokyo) - Problem solving using Experience, Intuition and Gut feeling	Eliminating defect in the system which are sporadic in nature and to reduce/eliminate the gap with respect to target.	Low	JDI					Kaizen sheet - KKD																	
	BPS - Basic Problem Solving QC Story using basic QC tools	Eliminating defect in the system which are chronic in nature and to reduce/eliminate the gap with respect to target.	Medium	KKD					1. Improvement in functional and sub-functional indicators 2. Elimination of chronic issues in EWM activities 3. Improvement in EWM health levels 4. Enhancement of employees problem solving competency	Problem solving QC story presentation / A3 sheet															
				High	BPS																				
QC story	APS - Advanced Problem Solving QC story using higher level statistical tools like DOE, MRA etc.	Process optimization, design optimization, performance improvements, defect reduction/elimination, arriving optimum specification for new products etc.,	High	QC story	APS			1. Breakthrough improvements in business indicators (eg. Market share increase) 2. Reduce business risk on key decisions 3. Enhancement of leadership competency	DOE project presentation / A3 sheet																
	TA - Task achieving			Opportunity for improvement in existing area and exploring opportunity in new territory (New task that have not been experienced in the past, non-availability of past data)		TA																			
		BPS - Basic Problem Solving; APS - Advance Problem Solving(using higher level statistical tools) ; TA - Task Achieving					3 to 6 months																		

Figure 4-14 Continuous improvement framework

The EBS promotional office is conducting training programs, workshops and competitions to promote continuous improvement activities. Operators were recognised in different forums for their participation in continuous improvement activities. Shining CAPA and QC story competitions are conducted for engineers and managers to promote KKD and QC story. Focused training programs on the application of higher level of statistical tools for Quality and Design team members are also provided.

#### 4.7.2. Expanding continuous activities across the organization:

Table 4-3 Continuous improvement scope

Year	JDI	KKD	QC Story
2013-14 to 15-16	- Kaizens contributed by Operators on QCD parameters	- Shining CAPAs from Manufacturing	- QC story(BPS) from Manufacturing
2016-17 to 2017-18	Above scope + - Kaizens contributed by Trainees - Safety kaizens	Above scope + - Improvements carried out to eliminate abnormalities in Operations	Above scope + - QC story(BPS) from non- manufacturing - Task achieving QC stories
2018-19 onwards	Above scope + - Kaizens contributed by contract workmen	Above scope + - Improvements from HR, IT, Finance and Technology	Above scope + - DOE projects(APS) from Technology and Manufacturing - QC story and Task achieving projects from Sales, HR and Finance

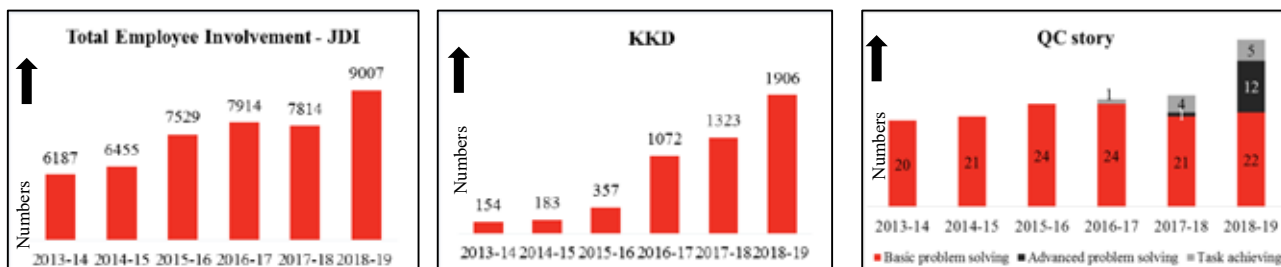


Figure 4-15 Results – Continuous improvements

### 4.8 Future plans

- Mitigate gaps and implement improvement points identified in the Deming exam by JUSE examiners.
- Define systems to sustain and improve best practices demonstrated in the Deming exam.
- Expand EBS practices beyond the India region.

## 5. Application of TQM

### 5.1 Sales Process Evolution

#### 5.1.1 Why?

ELGi experienced stagnation of sales growth in India. While India’s industrial segment grew significantly, the company missed the annual sales targets.

#### 5.1.2 How?

In order to gain market share in EPSAC, a new Go to Market initiative was designed with the help of an external consultant.

#### 5.1.3 Sales funnel Model:

Prior to development of this model, the earlier sales process was focussed on conversion. The new model, based on CAPD, brought in the dimensions of awareness and consideration leading to the creation of the funnel model. This model, besides clearly defining accountability and responsibility for the sales team, was also designed to identify and assign cross functional responsibilities. The complete model is represented in Figure 5-1 below. The significant improvements that were achieved since implementation of the model is represented in Figures 5-2 and 5-3 below. India EPSAC besides achieving their annual target, has also registered an impressive yearly growth of 13% for last 3 years.

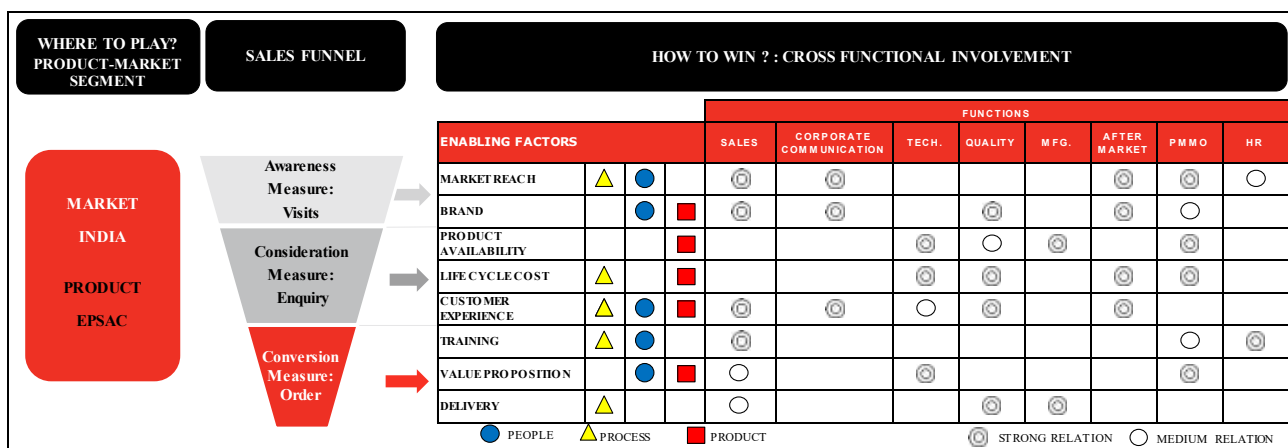


Figure 5-1: Sales Funnel Model

#### 5.1.4 Effects:

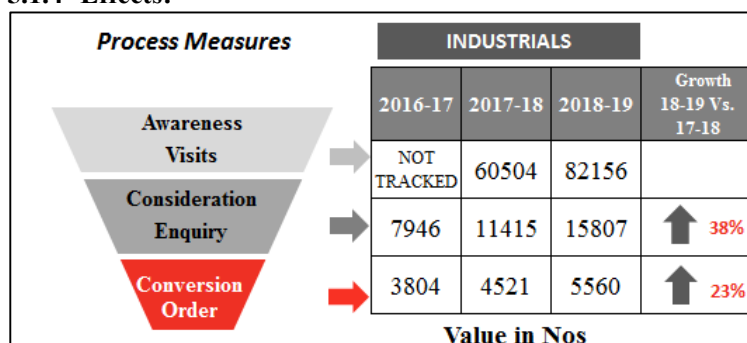


Figure 5-2 Funnel management

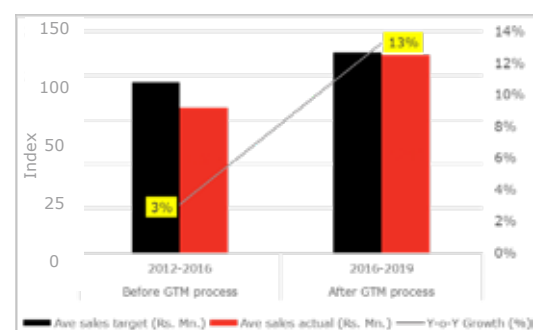


Figure 5-3 EPSAC Sales in India

The objective of the revamped sales process was to dominate sales of core products first in India through structured sales process and further deployment of sales process as a universal model.

ELGi’s GTM process, which evolved through continuous improvement, has helped grow sales consistently in recent years

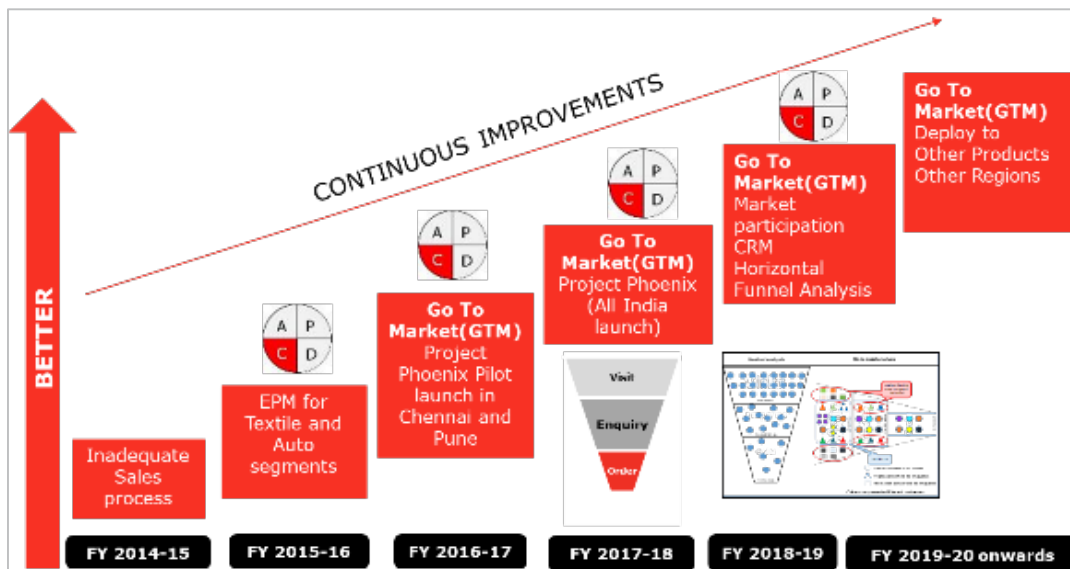


Figure 5-4: Continuous improvements in sales process

## 5.2 Technology Development and Product Innovation

### 5.2.1 Background

Air compressors are used in a variety of industries to meet process requirements to operate tools, equipment and instrumentation needs. Delivering compressed air is an expensive operation as it requires costly equipment (air compressor) which consumes energy and needs frequent maintenance. Due to the criticality of its contribution to revenues with associated financial expenditures in any industry, compressor is categorised as a capital equipment. For making a purchase decision on any capital equipment, ROI (Return on Investment) is critical. Life Cycle Cost of a compressor is a significant contributor for its ROI, hence Life cycle cost is often used in the compressor industry to determine the most cost effective option among different competing alternatives at the time of compressor purchase. The life cycle cost element includes the initial cost, energy cost, maintenance cost and down time cost. The energy cost contributes to 63% of total lifecycle cost. Lowering the energy cost by reducing the waste energy will contribute significantly in lowering the life cycle cost.

As consciousness on energy consumption and its impact on environment is increasing across the globe, the statutory and regulatory bodies have brought in regulations to improve the efficiencies of energy consuming equipment. In addition to the cost to the customer, these regulations have created a compulsion to improve the compressor energy efficiency.

The customer and regulatory perspective factors leading to the necessity of lower energy cost in compressor business scenario, is represented in the figure-5-5.

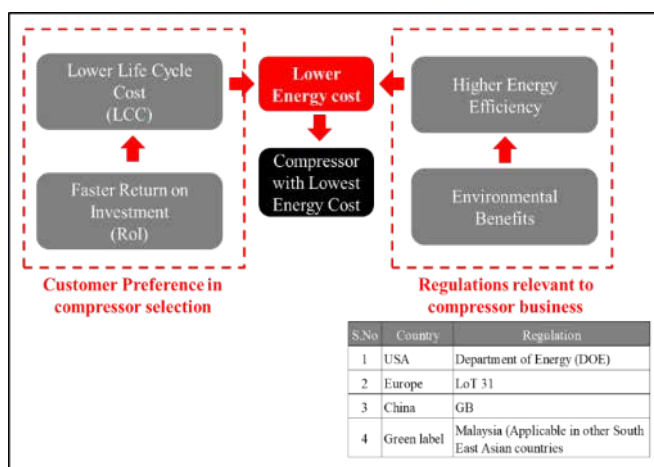


Figure 5-5 SPC improvements in other models

The lowest energy cost is directly related to the power consumption of the compressor. Specific power consumption (SPC) is the industry standard measure of compressor energy consumption. The specific power consumption (SPC) of a compressor is the energy consumed per unit air flow and in industrial practice it is represented in terms of kW/100CFM. Reducing waste energy will reduce the SPC and hence the energy cost.

### 5.2.2 Objective and initiatives

After CK2 inception, the SPC values of ELGi were bench marked against best in competition to understand the position of ELGi compressors. The competitor details are taken from CAGI (Compressed Air and Gas Institute) as CAGI is the authentic source for benchmarking SPC values of compressors of different manufactures for USA & USA like markets. The study indicated that the SPC values of ELGi compressors need to be improved as they are not among the best.

This necessitated the need for focused initiatives to enhance ELGi products to meet the SPC values lower than the best published values in CAGI. Hence the strategic objective was to Develop products with Specific Power Consumption (SPC) lower than 'best in CAGI'

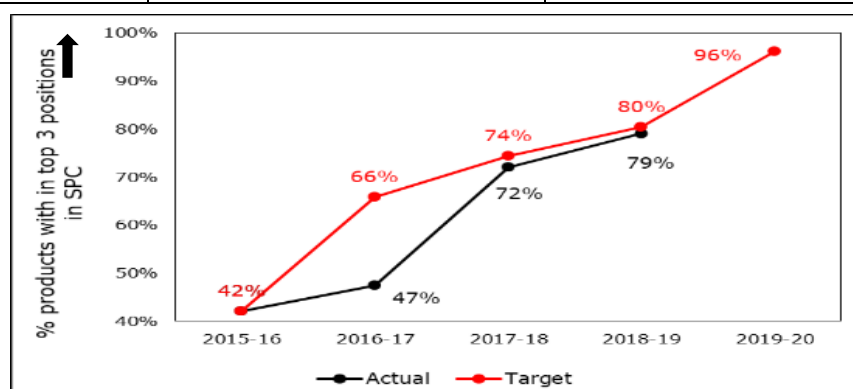
The initiatives and their subsequent explanations mentioned here are mainly focussed on identifying and developing the technologies / means for reducing the SPC. The implementation of these initiatives into product will be planned during product development / enhancement which is not covered in the scope of this chapter.

### 5.2.3 Focused Initiatives

The target setting, opportunity identification, identifying the means to realise opportunities, executing these means into products are identified as critical enablers for meeting this objective. Hence initiatives are taken towards these enablers.

**Table- 5.1 Target Setting Approach**

S.No	Initiative	Existing Practice	New Approach
1	Benchmark and set a future best SPC target	<b>Benchmark:</b> India centric. <b>Target setting:</b> Short term based on present actuals.	<b>Benchmark:</b> Global centric <b>Target setting:</b> Long term based past trends and current best
2	Opportunity identification and realisation for efficiency improvement	Discrete improvement points and idea based Executed as part of product development	- Comprehensive opportunity analysis - Identification of means to realise opportunities - Establishment through parallel project and realisation during product development
3	Manufacture products with narrow band (< 75% of the tolerance) of tolerance	- CTQs monitored through run chart. - Low focus on process capability - Design specification based on manufacturing feasibility.	- Design specification optimisation through statistical tools. - Focus on improving the process capability of CTQs.



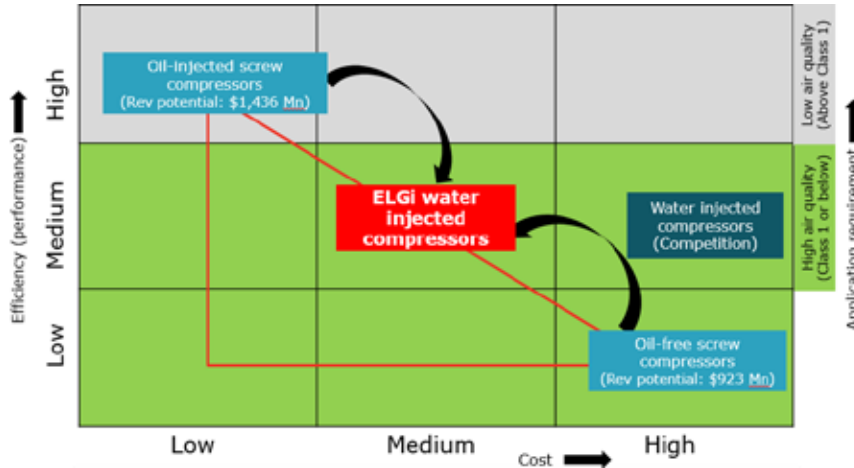
**Figure 5-6 ELGi Products Position in CAGI with respect to SPC**

ELGi products are enhanced by using the developed tools and processes, resulted in achieving 79% of products in top 3 position of CAGI with respect to SPC. The developed tools and processes can be extended to all ELGi models for achieving similar benefits

**5.2.4 Product Innovation**

**Water injected compressor**

There is a growing demand for oil-free air to meet stringent environmental regulations. A product innovation is a disruption opportunity in the market when ELGi delivers oil-free air, nearly at the cost and efficiency of an oil contaminated air. ELGi has developed a disruptive product that was launched in the “Hannover” expo in April 2019, the largest expo for compressor products.



**Figure 5-7 Market positioning: Water injected compressor**

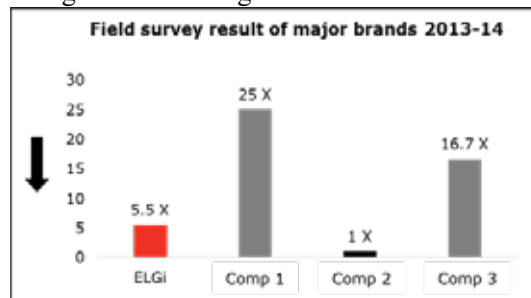
**5.3 Quality assurance**

**5.3.1 Background**

ELGi Quality Assurance (QA) system encompasses the management of the products through its life cycle. It has major components such as design quality, supplier quality, manufacturing quality and customer quality.

**5.3.2 Quality Assurance Objectives:**

As ELGi is not a well-known brand in overseas markets” ensuring lowest product defects gives ELGi the right to play in the market. We need to provide quality which is “Better than the Best” to overcome the “made in India” tag. To benchmark quality, ELGi conducted a field survey of competition installations. Based on the findings from the survey, presented in figure 5-8, the target for achieving lowest defects was set.



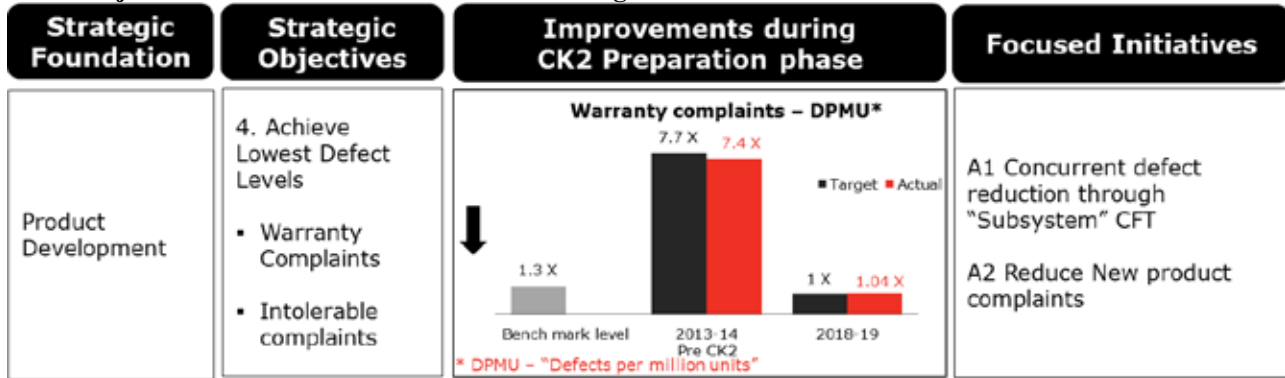
**Figure 5-8 Quality benchmarking: Defect levels among top competitors**

ELGi’s Strategy foundation on “How to win” is based on “Life Cycle Cost (LCC)”. The “down time cost due to failure” (part of LCC) is approached through the following model and objectives.



**Figure 5-9 Quality assurance: functional responsibilities**

5.3.3 Objective: Achieve lowest defect levels through “Defect resolution”



Detailing the initiative

A1 Concurrent defect reduction through “Subsystem CFT”

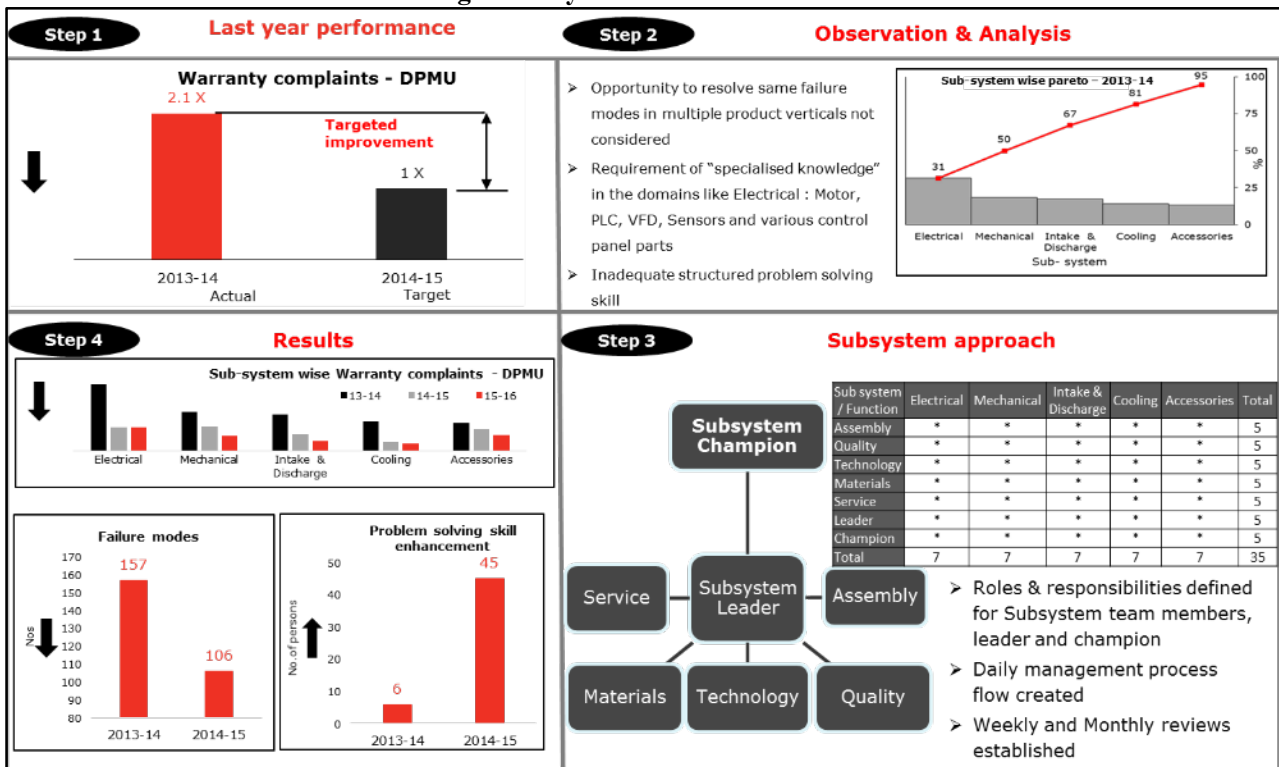
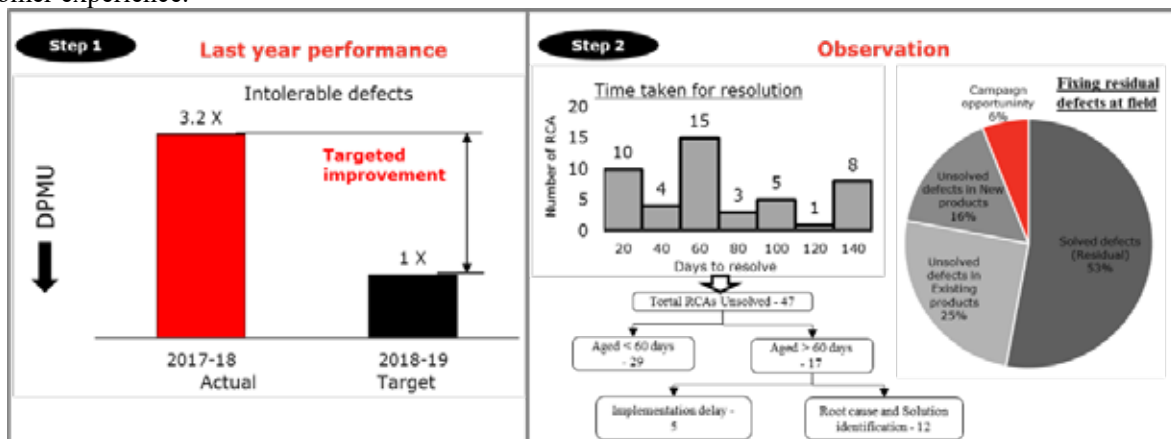


Figure 5-10 Process to reduce defects

5.3.4 Evolution of new measure: Intolerable defects

Why intolerable defects

During monthly Quality Review meeting in June 2017, it was realised that the quality measure must reflect true “customer experience” dissatisfaction on account of non-availability of compressed air. The challenge was to find a specific measure to understand the customer experience. ELGi decided to categorise on the basis of severity and customer experience.





Step 4 Initiatives						Step 3 Analysis & Inference	
Source of opportunity	Scope	Initiatives / Action	Expected improvement	Resp.	When	Defect resolution phases	Inferences
RCA delay	CFT engagement	Speed up the RCA progress in CC and ACP	40%	NT	Q2	Root cause and Solution identification	12 RCA's (defects) taken more than 60 days and it contributes to '0.19 X' DPMU. Special focus required to improve the speed.
Implementation delay	CFT engagement	Implement ECR in short timeline and speed up RCA in New products	35%	Venu	Q1	Solution implementation	5 RCA's (defects) delayed for solution implementation and it contributes to '0.55 X' DPMU. Need to revisit the engineering change process.
Campaign delay	Before installation and field machines	Execute on time field campaign activities	25%	Gopal	Q1	Fixing residual defects at field	Opportunity available for '0.17 X' DPMU to fix in the field through campaign.
Controls at Manufacturing	Detection controls and Poka-Yoke	Implement controls - detection and poka-yoke	25%	Gopal	Q1		

Figure 5-11 Process to reduce intolerable defects

### 5.3.5 Objective: Prevent defects through Characterisation

ELGi's approach of resolving identified complaints based on Pareto principle was not adequate to maintain defect reduction trajectory. The defect level was stagnant as the response to the defects were after it had occurred. Need for "Defect Prevention" was recognised.

To meet the strategic objectives of lowest defect levels, ELGi had to find unique ways to eliminate defects. Characterisation is a unique approach in ELGi where root cause analysis is done and resolution is deployed vertically. This is over and above the conventional methodology of horizontal deployment.

#### Evolution of Characterisation

The normal RCA exercises ended up with the standardisation and check for opportunity of horizontal deployment of identified counter measures. During the reviews it could be sensed that there was opportunity of deploying (checking the presence) of root cause of the defects in other parts. ELGi formulated a *unique* practice of characterisation and the "Character" causing the defect was first identified. Then, other parts were carefully examined for the presence of similar character and eliminated.

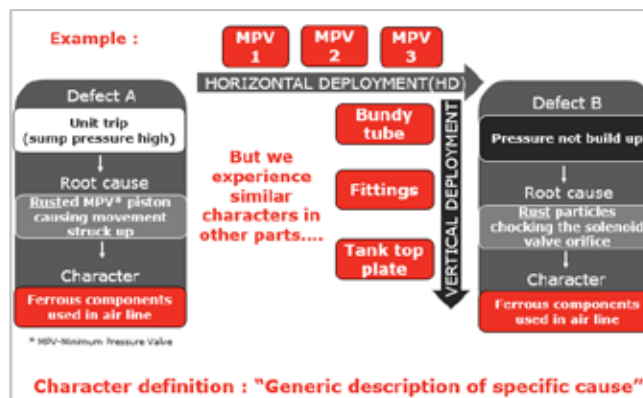


Figure 5-12 Character identification – an example

#### Characterisation Process:

Characterisation process represented here.

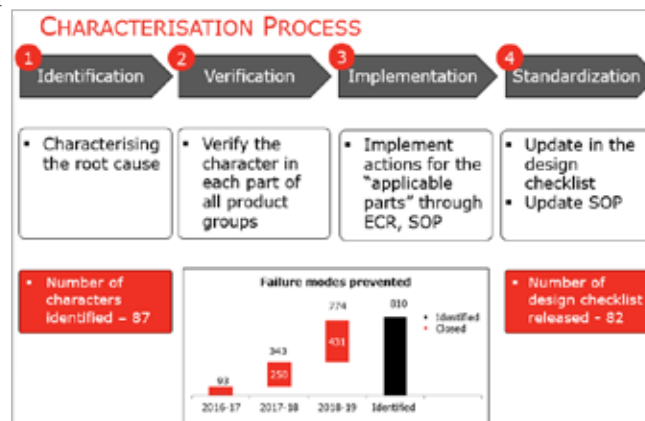


Figure 5-13: Characterisation phases and result: an example



### 5.3.6 Objective: Defect prediction by AiR~ALERT

The objective of AiR~ALERT system is to prevent the failures by detecting the symptoms and predicting the potential defects, thereby improving the UPTIME of the compressor. The analysis on the defects in compressors registered in CCS (Customer Care System) for one year indicated 1.64% of compressor down time were associated with tolerable and in-tolerable defects. This corresponds to 11% of compressor life cycle cost. The details are represented in figure 5-14.

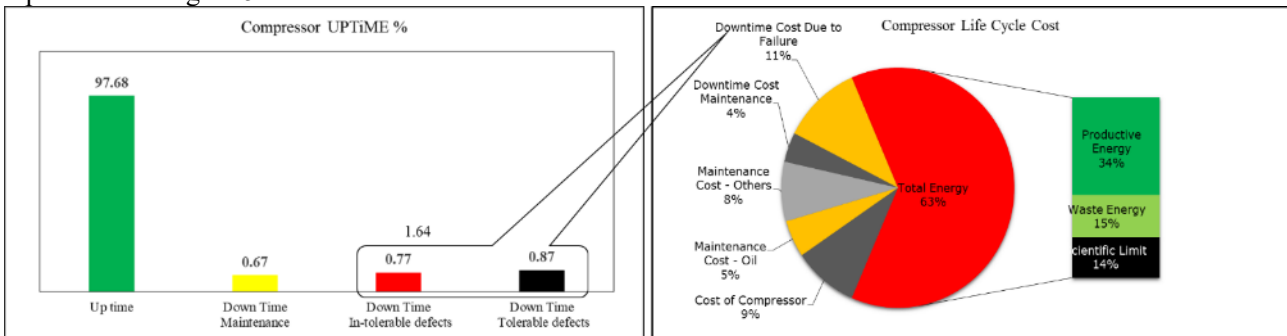


Figure 5-14 Scope of AiR~ALERT

AiR~ALERT system continuously acquires the operating parameters of a compressor and transmits the data to ELGi server.

### 5.3.7 Effects

Achieve lowest defect levels

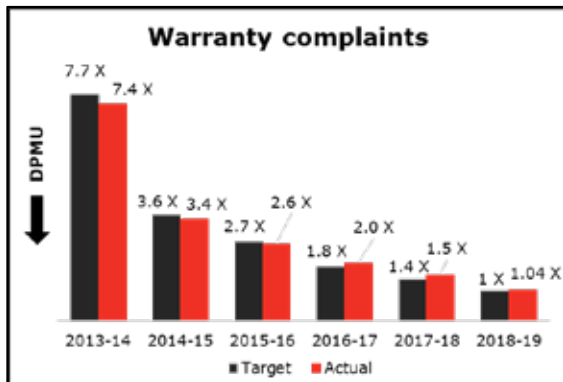


Figure 5-15 Reduction in warranty complaints

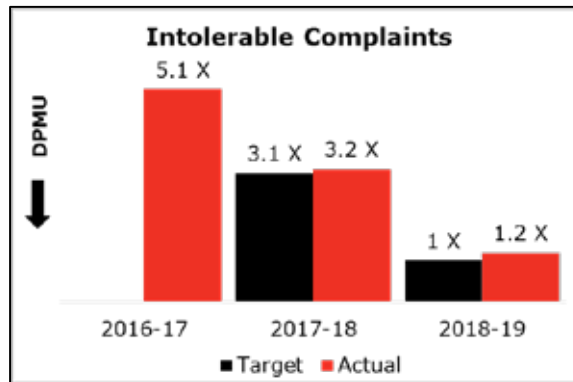


Figure 5-16 Intolerable defects

Prevent defects through Characterisation

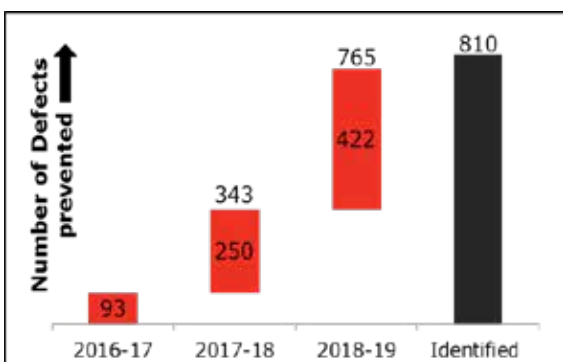


Figure 5-17 Defects prevented

Predict failures through AiR~ALERT (IOT)

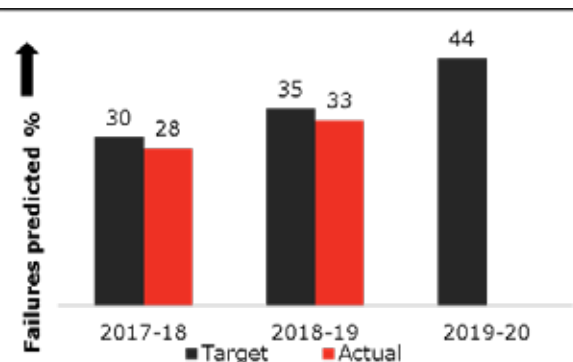


Figure 5-18 Failures predicted (%)

## 5.4 Delivery Management

### A. On time product availability (OTA):

With ELGi expanding its global foot print, the need to deliver products “on time” was becoming a critical need. A deep analysis of on time performance clearly revealed the defect in the forecasting system that was used for planning production. The forecasts given by sales function based on a combination of recent past trend and their assessment of market needs of immediate future months, resulted in planning accuracy levels ranging from 40-65% only. Besides not meeting on time availability to customers (OTA~52%), this resulted in excess finished goods inventory.

In 2014-15, ELGi developed a demand estimation model that predicted market need based on a combination of 2 years demand, trend in the recent 3-6 months, known seasonal demand and added a buffer (fear delta) to address market demand. A deep analysis of 10 years demand was carefully studied before designing this demand estimation model and since inception, the model has been improved to address changing market dynamics for different products and Geographies. Today ELGi manufactures nearly all units, including standard products only against customer orders resulting in significant improvement in OTA and reduction in Inventory.

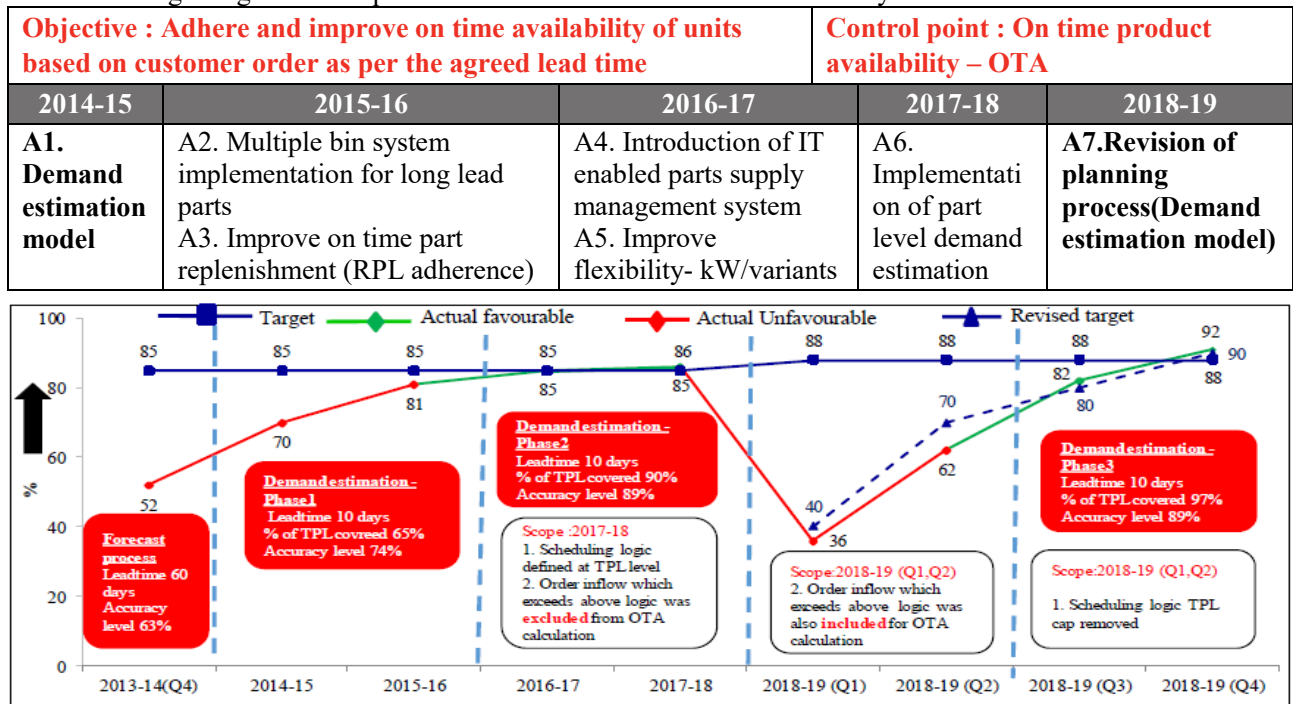


Figure 5-19 Otime product Availability (OTA)

**Methodology used to identify initiatives and target for 2018-19**

**Briefing on the 4Q approach**

We use 4 Quadrant approach to identify target and initiatives for the forthcoming year ('P' of PDCA)

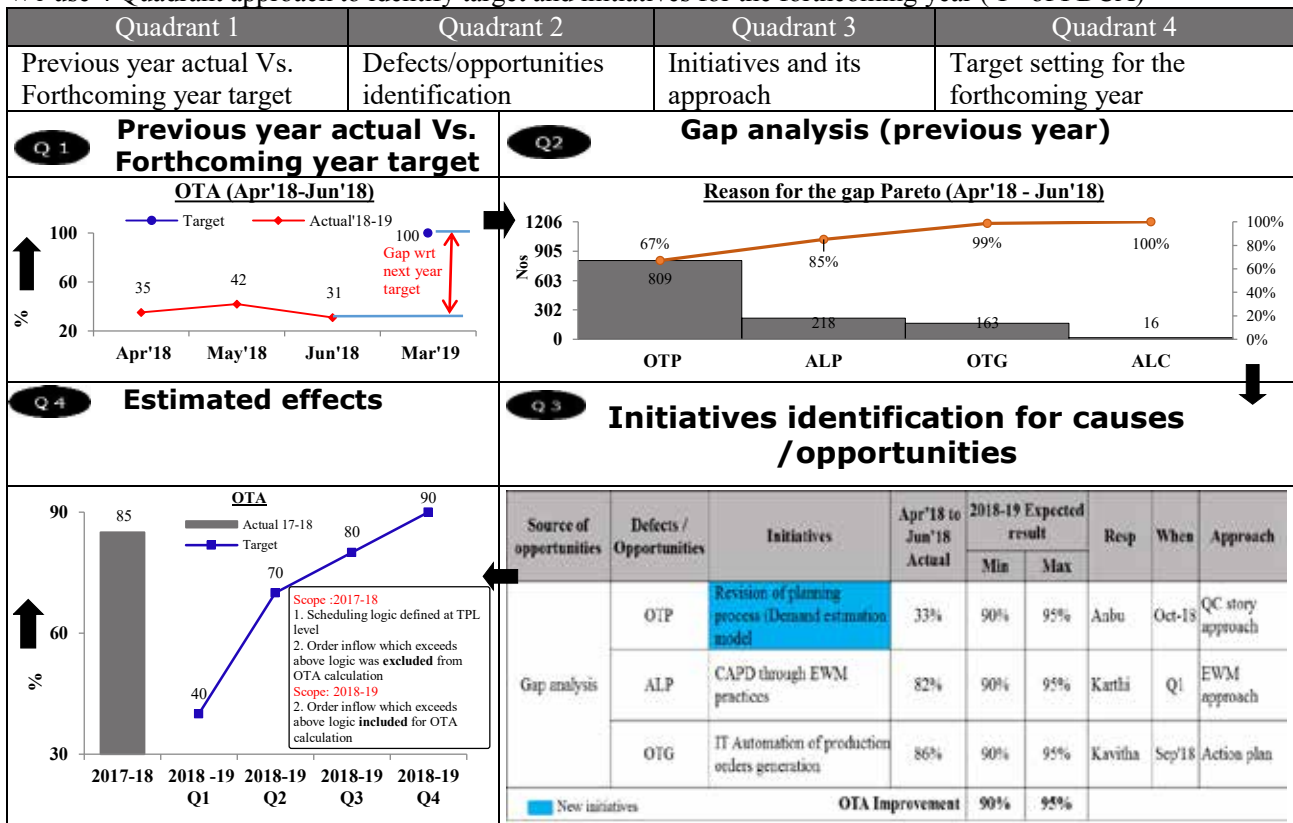


Figure 5-20 4Q Otime product Availability

**A1. Demand estimation model**

To enhance the product availability, this model was continuously improved which increased On Time Availability (OTA) to 81%. However, it was observed that this improvement was not completely meeting the customer demand as the planning was done at individual product level (TPLs). After a PDCA, family of products were grouped for planning raw material inventory and leverage availability of common parts across products and invest in inventory of unique parts. This system offered more flexibility in manufacturing various products with in the same family based on market pull. This improved planning model resulted in OTA of 86%.

**A7. Revision of planning process (Demand estimation model)**

A further PDCA at the end of the year 2017-18, revealed the gap in OTA was largely due to delay in releasing and scheduling production order. The IT system was releasing the order based on a logic which defined production line capacity and raw material availability at a product level (TPL – example EG22-CD) while the constraint actually existed only at product family level (example F2). After a careful review and pilot run, this constraint was removed and production order release was defined at product family level. This has improved OTA to 92%. PDCA rotation of planning process is demonstrated in the figure – 5-21.

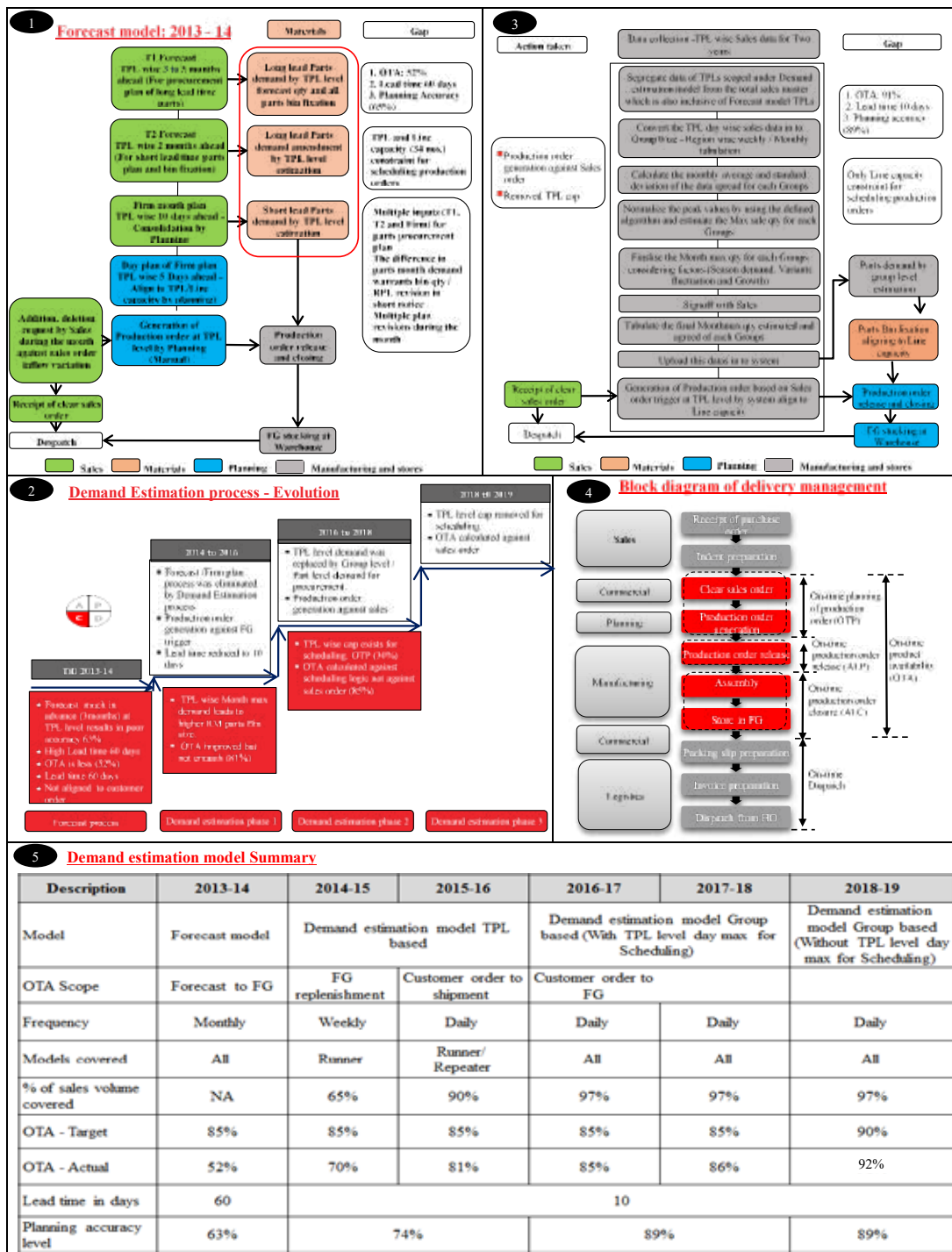


Figure 5-21 Demand estimation model

## 5.5 Human Resources

### 5.5.1 Background

ELGi is a 59-year old organisation that has transformed over the years, from arbitrating low labour cost as a means of competitive advantage to building technology as a differentiator; from supervisor driven to self-managed; from traditionally opaque and hierarchical to transparent and egalitarian in its policies. This transformation process accompanied by trust building has created a flexible work-force, without the presence of a trade union.

Key objectives taken up by HR from time-to-time are closely aligned to policy items relevant to respective periods. While the focus during pre-CK2 preparation phase was focused on skill enhancement and workmen transformation programmes, the focus during the preparation phase has been on competency development of sales force. Training on quality, total employees involvement and CSR initiatives have been consistently pursued for many years now.

### 5.5.2 Focused initiatives

**Table 5-2: Focused initiatives**

Focus area	Objectives
Skill and competencies development	Skill enhancement program for existing workmen
	Skill building of new workmen
	Competence building for Sales and After Market team
	Training programs to support quality improvements
Total Employee Involvement (TEI)	Continuous improvement activities
	Employee engagement and welfare activities
Corporate Social responsibility (CSR)	Education - Recruitment from disadvantaged strata of society
	Health – Support to Coimbatore Cancer Foundation
	Support to the people affected by natural calamity
	Environment

### 5.5.3 Shining HR practices

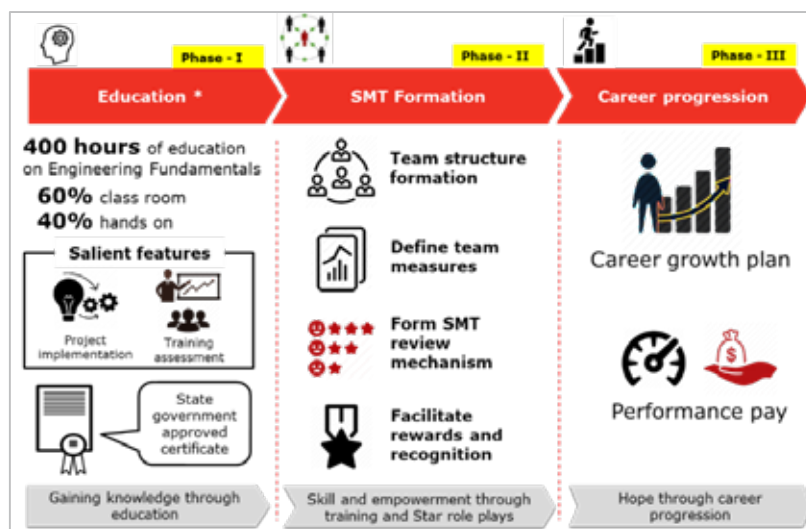
There exists a very healthy employee relationship and high level of engagement as a result of strong people processes. This is well represented by some shining practices, as illustrated below.

#### Employee engagement and welfare activities:

#### Workmen Transformation: Project Caterpillar, Skill enhancement program for existing workmen (*ELGi Unique initiative*)

The key objectives of the workmen transformation program were to raise the standards of the workmen and to give them hope for career advancement. Raising the standard was addressed by imparting knowledge through a leading engineering college in Coimbatore and enhancing skills and empowerment through Self-Managed Teams (SMT). Giving hope is addressed through a career growth.

An SMT is a group of workmen which manages day to day work and improvement activities without supervision. Twenty three SMTs were formed in production. Team members were provided behavioural skills training like team building, change management etc., besides on-the-job training



**Figure 5-22: Workmen transformation: Project Caterpillar: key phases**

**Workmen Compensation:**

ELGi follows a *unique* practice in revision of workmen compensation, different from the prevailing industrial practices which typically follows government notified cost of living index, bargains hard with trade unions and arrives at a long term wage settlement after a time lapse. These practices had often led to constant uncertainty, conflicts between management and workforce, distractions from work, industrial unrest and low morale.

At ELGi, every year, a survey is conducted on a defined basket of items to arrive at the price of the commodities involving workmen representatives. These prices are compared with the previous year to arrive at cost of living increase. After the management review, the compensation is revised. The basket of items is reviewed and revised once in five years with workmen participation. This *unique* collaborative practice at ELGi has led to a transparent, consistent and predictable system of wage increase.

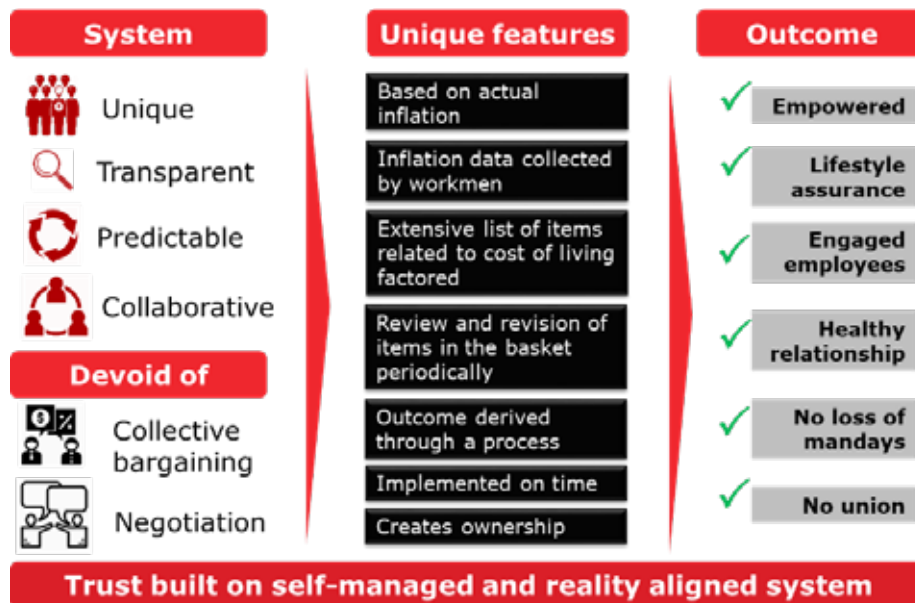


Figure 5-23: Workmen transformation: Project Caterpillar: key phases

**Total Employee Involvement (TEI)**

Total employee involvement has been a key success factor in the growth that ELGi has been achieving over the past many years and sustaining and enhancing employee engagement is now even more critical to meet its CK2 aspiration. ELGi uses a healthy mix of on and off work programmes.

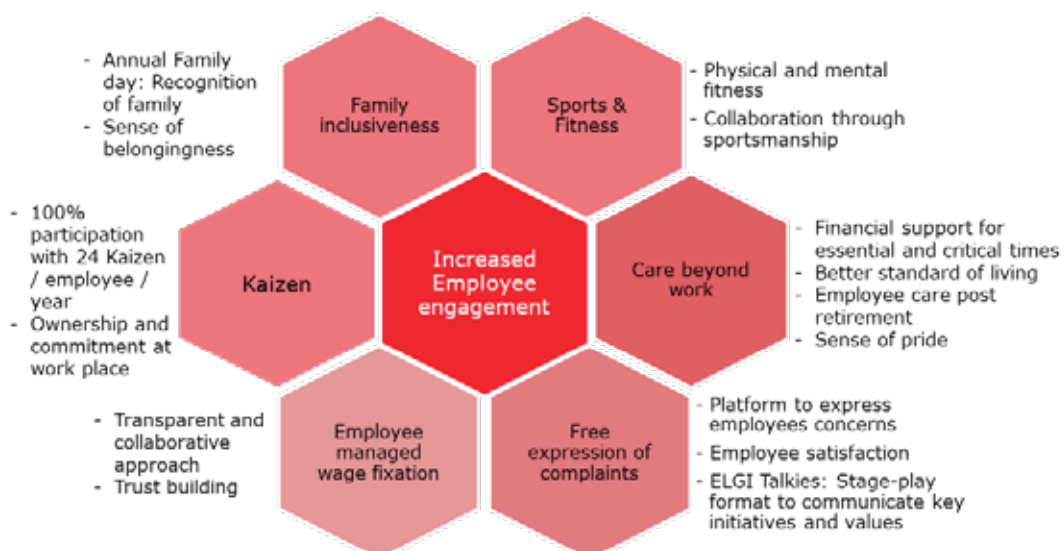


Figure 5-24: Total employee involvement (TEI)



## 5.6 Information Technology

### 5.6.1 Background

ELGi is one of the early adopters of Enterprise Resource Planning (ERP) system, having implemented it in as early as 1996. As the company expands its global footprint, the Information Technology (IT) organisation is gearing up to ensure a secure, standardized and integrated IT platform to facilitate seamless exchange of information. As the future is moving towards convergence of Social, Mobile, Analytics and Cloud (SMAC) platforms, IT is actively working with different business functions in identifying and implementing solutions that are aligned with the SMAC needs.

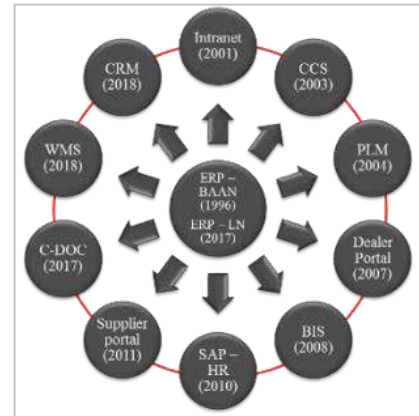


Figure 5-25: IT Landscape in ELGi

### 5.6.2 Key Objective: IT enablement of key business processes

Key objective	Control point	Initiatives
IT enablement of key business processes	A. Number of IT enabled business processes	A1. C-DOC (Customer document) A2. Outbound process automation in GSC A3. Integrated delivery management

C-Doc is a web-based document portal that was developed in-house. The portal allows access to key documents like product manuals and drawings, facilitates real-time printing, and enables version control.

**Background:** With the roll-out of our Go-To-Market initiative (Project Phoenix) to enhance the sales process, availability of customer related documents was identified as a critical need that was fulfilled by IT.

**Challenges:**

- Front end sales engineers had to contact multiple team members for documents
- Documents stored on disparate systems and difficult for retrieval resulting in delays
- Document thus retrieved may be obsolete or outdated resulting in inaccurate response to customer

**Mitigation:** IT created a new information sharing portal called the C-DOC (Customer Documentation) where approved product related documents are made available on a real time basis and in one platform which can be viewed and downloaded.

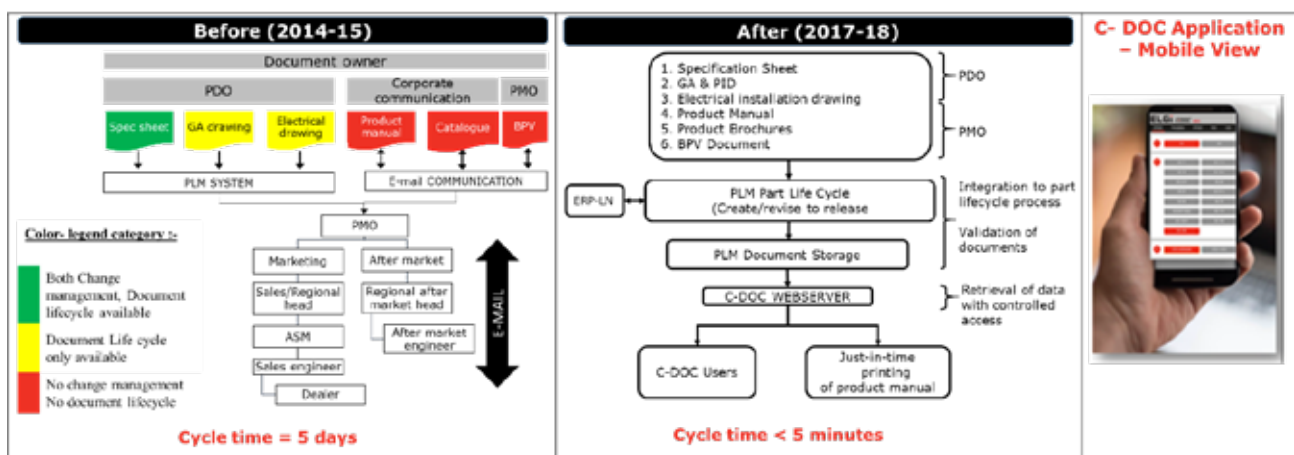


Figure 5-26: C-DOC: Unique practices and effects

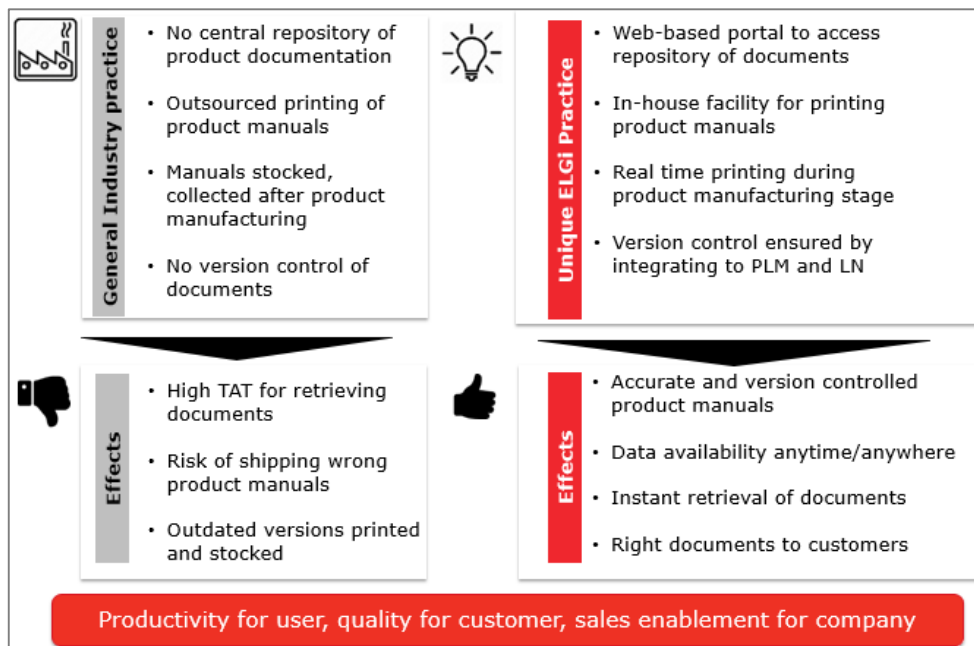


Figure 5-27: C-DOC benchmarking vs. Industry practice

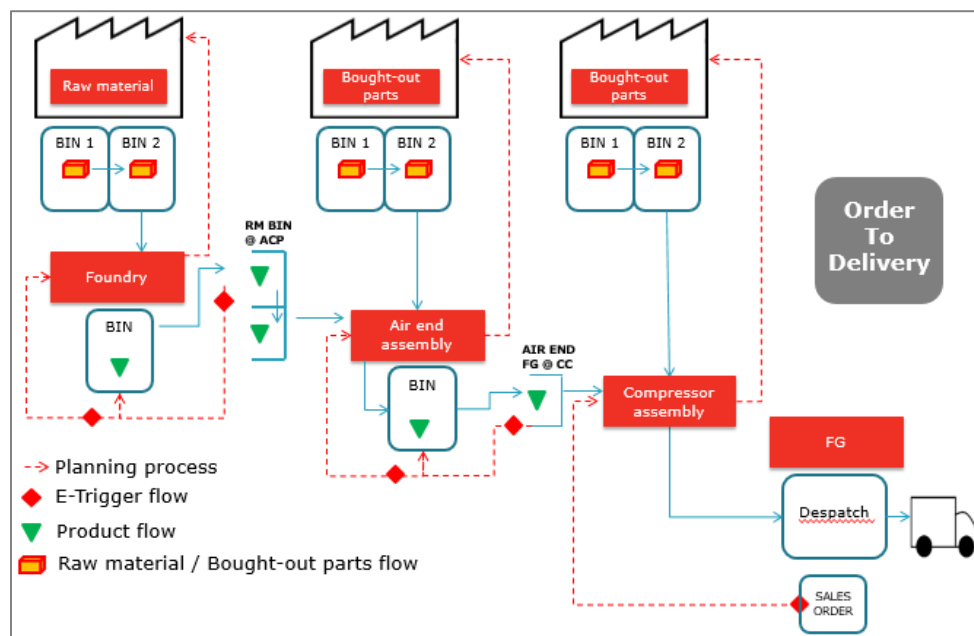


Figure 5-28: Integrated delivery management system

The production, procurement, and delivery processes across the company’s facilities were integrated into one unified delivery management system. The result was superior on-time execution of orders.



## 6. Effects of TQM

### 6.1 Tangible effects

Summary of all objectives on a 4-student model

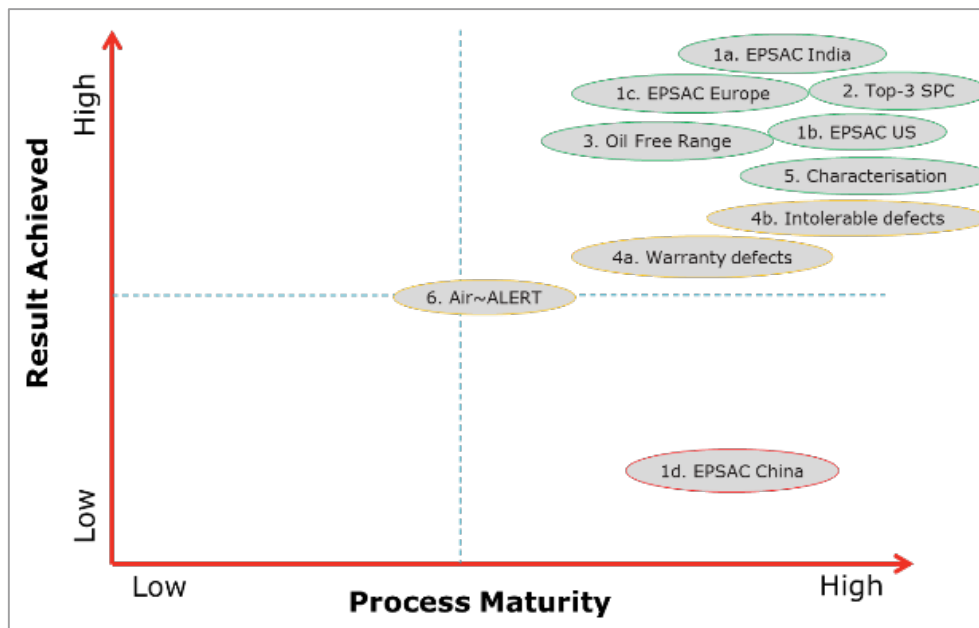


Figure 6-1: Tangible effects

In summary, this is where we stood in terms of our objectives of the preparation phase, when looked through the lens of the 4-student model.

### 6.2 Intangible effects

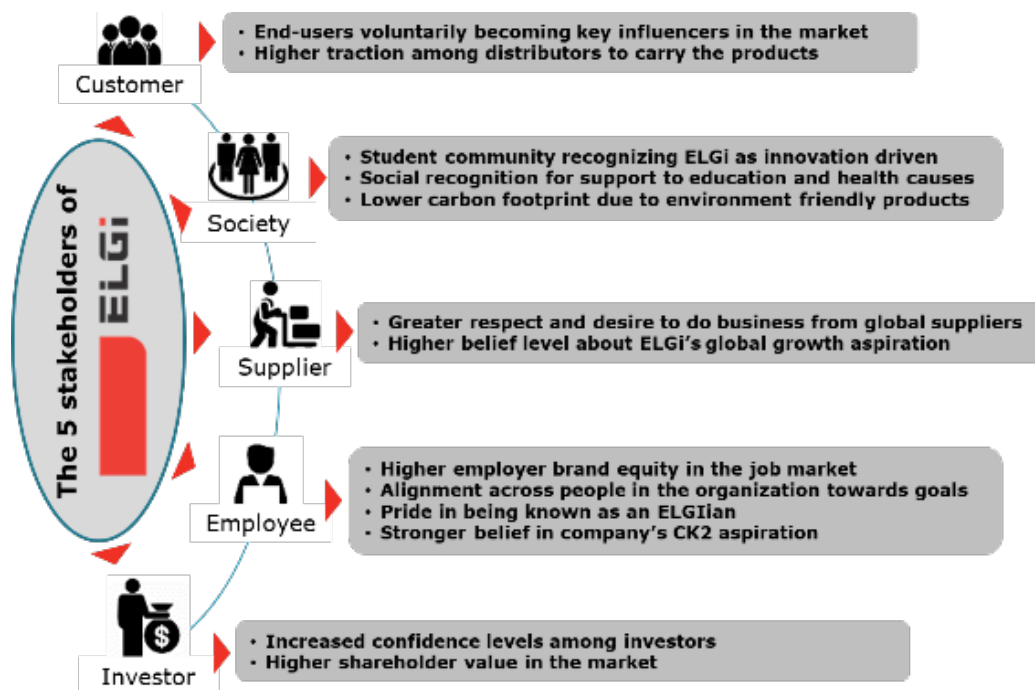


Figure 6-2: Intangible effects

The above figure presents some intangible benefits that ELGI has gained through the use of TQM in our journey.

Besides the business results, across all of its stakeholders, ELGI's reputation has improved significantly. The consistency and credibility with which ELGI has been able to engage with stakeholders is the key reason. ELGI will work further towards strengthening its process orientation.

## 7. Future Plans – CK2 Launch Phase (2019-23)

### 7.1 Why ELGi's aspiration is unique

ELGi's ambition and performance to date is very unique in the history of Indian business. ELGi is the only company in India that has moved forward in its ambition to sell **critical capital equipment** in its **own brand** to demanding end users **in developed markets**. Most other Indian companies either sell their products to markets in developing countries or sell components to producers of equipment worldwide. This is a significant achievement and it is a matter of pride for our people as Indians to have moved ahead with this. ELGi in its journey would become the Toyota or Honda or Sony of India, starting from a very challenging position to become a respected brand worldwide. Hence, to be no.2 in the world for air compressors, ELGi aspires not only to be dominant in its home market, but also be a significant market player in key global markets. This is evident in its phase wise approach to CK2 aspiration.

### 7.2 Review of Preparation Phase

The results and effects of the preparation phase was reviewed both internally as well as with the help of external consultants. The learnings from Project Phoenix has helped ELGi launch similar initiatives for other product groups in India as well as for EPSAC in other markets like USA. Towards the end of preparation phase, ELGi decided to revisit the strategic foundations (Market and Product development) and revalidate strategic choices with the help of an independent consultant, the Boston Consultancy Group (BCG). The exercise helped ELGi to re-define the "Where to Play" (Markets and products) and "How to Win" dimensions of strategy and to set the direction for the next phase of CK2 (launch phase). The objectives and initiatives for the launch phase have been derived from the strategy project and outlined below

#### Where to Play?

During the preparation phase, ELGi identified the core product and key markets based on the market size. This process was further refined following a review by BCG. For the launch phase, ELGi identified 113 product-market clusters and evaluated them on two key parameters:

1. The first level attractiveness was based on market size and profitability parameters of the product-market segment.
2. At second level, ELGi's capabilities were evaluated for its ability to win in the segment.

The process helped ELGi to prioritise the product-market segments to focus during the launch phase and classify them as priority markets, business-as-usual and deprioritised markets. This resulted in establishing a revenue target of more than double the current level by the end of launch phase. This would primarily come from focusing on the Indian, US and European markets besides a few important markets like Australia, Indonesia and Thailand, as explained below. Details of this is available in the strategic planning documents.

#### How to win?

Having prioritised where to play, it was pertinent that ELGi formulated a plan to outline the strategy to win. The 'How to win' strategy has objectives that would help the organisation in two areas – 1. Expand market reach and 2. Functional programs that would enhance the organisation's competitiveness. With its strategic foundation focusing on best-in-class SPC, defect resolution, defect prevention and defect prediction, being well established in the preparation phase; ELGi aims to continue to further develop initiatives along these lines for the launch phase also.

Product expansion will also be undertaken through major initiatives including

- Relentless focus on energy efficiency and best-in-class performance across different compressors
- Disrupt the oil-free market with the range of water injected oil free compressors
- Expansion of the range of products across all compressors and the addition of accessories to the range.

### 7.3 Objectives

The objectives and control points for the launch phase are summarised in table 7-1.

**Table 7-1 MD's Priority (2019-20 to 2022-23)**

Strategy Foundation	Key Strategic Indicators (KSI)*	
	Objective	Control Point(s)
Market Development - WHERE TO PLAY	Dominate India market	Sales value - India
	Grow in prioritized global markets	Sales value - US
		Sales value - Europe
Product Development - HOW TO WIN?	Achieve SPC 'best in CAGI' to reduce waste energy	Products within top 3 positions in CAGI- (%)
	Develop full range of Oil Free Screw Air Compressor (OFSAC) with lowest Life cycle cost - Water injected	Product range completed (%)
	Reduce defect levels by resolution and prevention to reduce downtime cost	Warranty defects (DPMU)
		Number of opportunities eliminated (Characterisation)
Reduce defect levels by prediction and prevention to reduce down time cost	Failures predicted - AiR~ALERT (%)	