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M 2

TECHNOLOGIES

The Next Level of Manufacturing – Industry 4.0

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Knowledge Partner: ABB

Introduction

With its focused approach and evolving policy framework, India is leading emerging economies in the transition to the next level of manufacturing. The country is strengthened with its skilled young population and already displayed an aptitude for software and services. Achieving the next level of manufacturing, and becoming a manufacturing hub, will involve combining world class productivity, while reducing environmental footprint.

The Industrial Revolutions

A steady evolution and breakthroughs have brought us to where we are today. The first industrial revolution was ushered in with the power of mechanization with steam. Manufacturing shifted from cottages (homes) by individual artisans to factories (1712 AD).

The second industrial revolution (1870 AD) is characterized by advent of electricity and mass assembly line production systems.

The advent of computers and automation led to the third industrial revolution (1969 AD). At the same time, Total Quality Revolution began, which went beyond mere inspection to improvement of processes. The ISO9001 quality management standards were born in this era. Total Quality Control became the thought revolution management.

Industry 4.0 or the fourth industrial revolution is defined:

a collective term for technologies and concepts of value chain organization' which draws together cyber-physical systems, the Internet of Things, Service and the People (IoTSP).

There are many reasons why today's transformations qualifies as a revolution. The speed at which things are changing and the enormous scope of the affected systems is very distinct. When compared to its predecessors, the fourth industrial revolution is advancing at an exponential pace. Moreover, it is disrupting almost every industry in every country. The breadth and depth of these changes herald the transformation of entire systems of production, management, and governance.

In the impending fourth industrial revolution, internet is closely integrated in to physical systems (things, service and people) to create a global industrial enterprise. This enterprise is characterized by;

- High volume data
- Advanced analytics
- Human machine interface
- Digital to physical transfer

Companies use this to create manufacturing networks which transcend continents. The system has high interdependence and the co-operation of cyber and physical things in real time means it learns and reacts at lightning speeds.

The main characteristics of an Industry 4.0 environment is that it can deliver high degree of customization through highly flexible mass production.

Modern Manufacturing and Log

The world of production is highly integrated and networked across regions. This makes logistics a critical part of the system. The co-ordination between suppliers will grow to maintain low inventory levels and delivery mechanism will require a high level of control. Seamless exchange of information between manufacturers and suppliers over the internet will blur the boundaries between them, making them partners in the true sense.

Fusing of Processes and Information

Components and parts already know what project and product they are intended for; machines and workstations generate quality and traceability information themselves – all contributing towards a man-independent system that is and therefore robust.

Opportunity and benefit

Integration of industry and internet would result in

- High operational efficiency - higher asset utilization which means better return on investment
- The new connected systems will erase the industrial boundaries. Higher collaboration between humans and machines will lead to ease of work unlocking productivity

Modern tools and techniques

Modern day systems allow enterprises to track its components from suppliers, to in house manufacturing processes, to customers and up to the end of life-cycle.

e-Sourcing is used by the industry to communicate all data with suppliers through the net.

Manufacturing Execution System **(MES)** is a control system for managing and monitoring work-in-process on a factory floor. MES tracks all manufacturing information in real time, receiving up-to-the-minute data from robots, machine monitors and employees.

Remote Factory Acceptance Test **(RFAT)** is a system that suppliers can offer to their customers to demonstrate the attributes and quality of delivered goods. RFAT is a system that eliminates the need for a customer inspector to travel for final inspection, while still maintaining a high quality of the process.

Smart sensors sense and collect data. These devices also have built in computational power to and can undertake a wide variety of predefined functions for monitoring and control.

Such features have helped companies develop **Remote Service.** Such service is not limited to failure intervention but also includes preemptive diagnostics

Yumi® Robot

ABB has developed a collaborative, dual arm, small parts assembly robot with flexible hands, parts feeding systems, camera-based part location and state-of-the-art robot control. YuMi will change the way we think about assembly automation. YuMi is “you and me”, working together to create endless possibilities.

Some examples of how ABB uses IoTSP

- Monitoring more than 5,000 robots in service around the world from our center of competence in Bangalore, India, since 2006
- Monitoring Gearless Mill Drives in mines from a center of competence in Europe since 2011
- Transforming Boliden AB's Garpenberg mine in central Sweden into one of the world's most efficient and productive mines in 2015
- Route-optimization software solution for 140 vessels of the Maersk Line
- Monitoring more than 500 vessels globally through our Integrated Marine Operations Center
- In developing smart grid technologies
- Monitoring 20,000 substation transformers and breakers in the network of American Electric Power with an Asset Health Center to analyze asset health, recommend maintenance actions and prioritize replacements

Challenges to reach Industry 4.0

To truly realize the benefits of Industry 4.0, concerted top-driven change management must be applied by all organizations across all levels. Employees must not only undergo a mindset change but they may need to be re-trained to work with the new concepts and systems.

Moving to the next level of manufacturing will necessitate sound and robust IT infrastructure. IT snags and IT security will be major concerns.

Pervasive use of IT use can also make certain jobs redundant. However in general the industry will move from labor orientation to high skill orientation, leading to the positive effects of improved quality.

Manufacturing processes they have to be very stable and reliable to seamlessly function in globalized environment.

Continuous Improvement Process

Continuous Improvement Process (CIP)- The survival baseline

For industries to thrive, it is imperative they embed philosophies and strategies of continuous improvement across value chain and empower the people who relentlessly drive the same. The most practiced and proven philosophies are listed below and must be selected and applied by an organization based on requirement.

- LEAN for waste elimination
- TOC to manage constraints
- Six sigma to reduce variation

These philosophies remain indispensable to solve management and technical problems in this complex and ever changing environment.

Conclusion

The fourth manufacturing revolution has the right ingredients to propel the industry to another level of productivity and quality and India is well positioned to become the preferred supplier to global markets in the manufacturing sector.

Module M2: Manufacturing Technologies — Date: 8th October 2016

Sequence	Topic	Speaker	Duration (Mins)	From	To
Introduction	**Welcome & Inaugural Address**	**C H Prahallad, ABB**	15	9:30	9:45
Key Note Address	**Industrial revolution: The next level of manufacturing**	Markus Bachmann, ABB	30	9:45	10:15
	Historical walkthrough the three industrial revolutions				
	Glance of the upcoming fourth industrial revolution				
	Opportunities and challenges for manufacturing industries with fourth revolution				
Session 1	**Quality - Foundation for growth**	Ragothman Hanumantha-Rao, ABB	30	10:15	10:45
	Quality as foundation and backbone for businesses.				
	New Gen Customer's expectation change and expectation high!				
	Failures can happen – resolve it fast!!				
	Continuous Quality Improvement shall be "End to End" and truly "Continuous".				
	Cost of Poor Quality – measure, manage and reduce to survive!				
	Engage every resource at disposal – Everyone has ideas and can contribute!				
	How Quality will be viewed in the coming days?				
	Tea Break		15	10:45	11:00
Session 2	**Made in India: Made for the world**	Giandomenico Testi, ABB	30	11:00	11:30
	India's economic drivers				
	Export/Import balance – local competitive landscape vs. other geographies				
	Industry development pattern, opportunities and challenges				
	ABB's technology contribution to Indian Society				
	ABB's manufacturing set up in India				
	Export opportunities and challenges				

Session 3	**Automation in Manufacturing**	Egil Stryken, ABB	30	11:30	12:00
	Presentation of practical examples of automation in transformer manufacturing				
	Examples on existing automation				
	Future opportunities				
Session 4	**The Lean Revolution**	Markus Bachmann, ABB	30	12:00	12:30
	Lean implementation with a holistic approach				
	People as the key factor of success				
	Specific ABB examples				
	Brilliant Factory	Aditya Venkaraman, GE	30	12:30	13:00
	Defining the scope of Industry 4.0 from Virtual Manufacturing to Predictive Maintenance. What is the India advantage?				
	Breaking the barrier with the financial teams – the war between Capex and Opex.				
	The first biggest question – How does it show on my KPI?				
	The second biggest question – Am I replacing people with machines?				
	"The three unsaid critical factors for Industry 4.0 / Brilliant Factory to work: Persistence with technology, Persistence with people, Persistence with management!"				
	Lunch Break		60	12:30	14:00
Session 5	**The internet of Things, Services and People (IoTSP)**	Akilur Rahman, ABB	30	14:00	14:30
	What is IoTSP?				
	Insight into the concept and technologies of IoTSP				
	Current challenges of manufacturing industries for cost, quality & productivity				
	How advancement in automation, monitoring, diagnostics andanalytics is enabling IoTSP to be a collaborative platform				
	Achieving operational goals by addressing chalenges and risk with IoTSP				
	One of the important enablers of smart factory how it can support Make in India initiative, not only for India, but also for the world.				
Session 6	**Panel discussion and Open House : Development of World Class Indigenous Vendor Base for Electrical Industries**	[1] C H Prahallad, ABB [2] Murgendra Koujalagi, ABB [3] M. R. Rao, IreFrame, [4] V. Ranganathan, GE [5] Nital Zaveri, Concept Business Excellence Pvt Ltd	60	14:30	15:30
	Tea Break		15	15:30	15:45
Session 7	**Technical Paper Review and Q&A Session**	Shekhar Kothari, ABB	120	15:45	17:45
Closing	**Vote of thanks from knowledge partner**	**Rupinder Singh, ABB**	15	17:45	18:00

SPEAKERS

Mr. Markus Bachmann,
Global Operation Excellence & Business Development Manager

Markus Bachmann is the Global Operation Excellence & Business Development Manager for Gas-insulated switchgear (GIS) and Generator circuit-breaker (GCB) in ABB Switzerland.

He is responsible for the implementation of the new global GIS production network, lean enterprise program and change management for High Voltage Products. He was previously the operations manager of the GCB factory in Switzerland that won Europe's best factory of the year in 2010.

Markus has more than 10 years of experience in operational excellence, lean and change management in production and administration in ABB. He is an industrial engineer by profession from the Polytechnic University of Milan, Italy.

ABB Group profile

ABB (www.abb.com) is a leading global technology company in power and automation that enables utility, industry, and transport & infrastructure customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in roughly 100 countries and employs about 135,000 people.

Mr. Ragothman Hanumantha-Rao,
Business Application Owner OpEx Analyzer & Relentless Execution Dashboard

Ragothman H Rao is the business application owner for OPEX Analyzer and Relentless Execution Dashboard. These are the backbone of Global Operational Excellence – Next Level Strategy “measure, monitor and manage”.

He has worked in the field of Quality Management for last 18 years in Indonesia, Switzerland and Singapore, with special focus on Quality Strategies for high customer value creation. He has travelled widely across globe establishing quality fundamentals across ABB's Power Grids Division.

He has more than three decades of experience in ABB in various fields from commissioning power stations to leading Quality Management. He has also spoken at industry forums and university education programs on quality.

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Mr. Giandomenico testi,
Chief Technology Officer - ABB India Ltd., and Head of Engineering Council - ABB Group

In his role as CTO for India, Giandomenico contributes to the country's profitable growth by leveraging local R&D processes and resources in line with the global technology strategy of the Group entity.

Such local R&D resources are also driving the next generation of products for the entire Group. India is the largest R&D and Engineering Hub in ABB with 3,000+ engineers and scientists.

He has a doctorate in electrical engineering from Rome University.

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Mr. Egil Stryken,
Global Manager - Production Innovation Team, Transformers, ABB

Egil Stryken is the Production Innovation Team Manager for ABB Transformers (BU PGTR) globally.

Egil has more than 30 years of experience in the transformer business, spanning across technology, product and process development in ABB. He and his team are responsible for scouting, studying, prototyping and bringing new production processes, methods, equipment and tools to ABB's transformers business.

He is an electrical engineer, with a masters in electrical engineering from the Technical University of Trondheim, Norway.

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Mr. Aditya Venkatramanan,
Advanced Manufacturing Engineer GE India-Supply Chain Management

Aditya Venkatramanan is an Instrumentation Engineer with an MSc Degree in Manufacturing Systems Engineering from Warwick Manufacturing Group, University of Warwick. Currently Aditya leads the digital initiative in the GE multimodal factory in Pune, as part of what GE calls the Brilliant Factory initiative. Multiple projects in Virtual Manufacturing, Tool Management Systems, Online Statistical Process Control, Manufacturing Execution Systems and Predictive Maintenance analytics are being planned at this plant.

He has served different roles in companies such as Honeywell, Schneider and a Rolls Royce joint venture before becoming a part of GE's digital journey.

He currently believes, Augmented Reality, Metallic Additive Manufacturing and Predictive Big Data Analytics on shop floor are 3 technologies which will revolutionize the manufacturing world.

Overview of the presentation:

Title: Brilliant Factory - Making IT one of the foundations for Core Industries - Fantasies, Challenges and the Ground Realities

- Defining the scope of Industry 4.0 from Virtual Manufacturing to Predictive Maintenance. What is the India advantage?
- Breaking the barrier with the financial teams – The war between Capex and Opex.
- The first biggest question – How does it show on my KPI?
- The second biggest question – Am I replacing people with machines?
- The three unsaid critical factors for Industry 4.0 / Brilliant Factory to work: Persistence with technology, Persistence with people, Persistence with management!

Mr. Akilur Rahman,
Head of Corporate Research Center, Bangalore

Akilur Rahman, Head of ABB's Global Corporate Research Center in Bangalore has more than 27 years of experience in R&D, Technology Management, Engineering, Business and Product Development in ABB.

Akilur was responsible for setting up and establishing global software product development and integration in India for power and process automation products and systems. Had lead global initiative of Engineering Improvement and Cyber Security in Process Automation division of ABB.

In addition to his current role of leading corporate research in Bangalore, he is deeply involved in creating IoT use cases for plants and factories. Akilur has a master's degree in technology (electrical engineering) from IIT Kharagpur.

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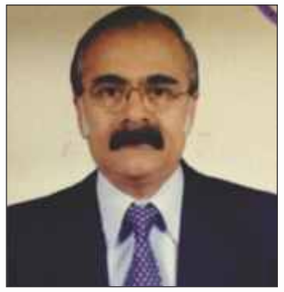

Mr. C H Prahallad,
Vice President.
Head of Corporate Quality & Operation Excellence

C H Prahallad is Head of Corporate Quality & Operation Excellence.

He is responsible for the implementation of Quality & OPEX for the entire INABB factories situated across the country. He was previously held many responsible positions in manufacturing, looking after the entire manufacturing operations of Drives & power electronics. He was also leading the entire supply chain activities for the drives business including the lead SCM position in erstwhile TOPS program for INABB. During this period he also set up the ACS550 global VFD drives module factory at Bangalore.

Later he was shifted to set up the Logistic centers across India at three different locations followed by setting up large factories. The biggest automation division hub consisting of 7 factories ,was set up during 2008-2009, at Bangalore for which he was the project manager. Later he was moved to monitor the execution of Delhi International Airport – DIAL. The project was delivered "On cost & on time".

C H prahallad has total 34 years of experience and out of which around 20 years of experience in manufacturing, quality . He is an electrical engineer by profession from the Bangalore university India.

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Mr. Murgendra Koujalagi,
Vice President, Country Supply Chain Manager

Ragothman H Rao is the business application owner for OPEX Analyzer and Relentless Execution Dashboard. These are the backbone of Global Operational Excellence – Next Level Strategy "measure, monitor and manage".

He has worked in the field of Quality Management for last 18 years in Indonesia, Switzerland and Singapore, with special focus on Quality Strategies for high customer value creation. He has travelled widely across globe establishing quality fundamentals across ABB's Power Grids Division.

He has more than three decades of experience in ABB in various fields from commissioning power stations to leading Quality Management. He has also spoken at industry forums and university education programs on quality.

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Mr. V Ranganathan,
Regional Managing Director-PTR-India, Grid Solutions, GE.

Ranganathan or Ranga he is better known as has a total of 30 years of experience in Operations. Ranga is RMD-PTR-India for both PTI (Allahabad) and LTI (Vadodara) Transformer products since September 2012. Presently he is also a Director in GE-Prolec board with an additional responsibility as an Occupier of the Unit.

India's first indigenous 800 KV HVDC transformer flagged off from Alstom unit of Vadodara on 27th Feb 2015 by the Chief Minister of Gujarat.

Prior to joining Alstom, Ranga has served at Bharat Bijlee in the positions of Vice President-Power Transformers and General Manager –Operations. Prior to that he was at GEC (erstwhile Areva and Alstom) with operations, SCM and Projects functions.

Ranganathan holds a degree in Production Engineering from Regional Engineering collage-Tiruchirappalli.(1982-86)

Mr. M R Rao,
Executive & Business Coach; Facilitator & Mentor

a Brief

Current

M R Rao is currently an Executive and Business Coach, Facilitator and Business Mentor.

Helps **corporates** in:

Executive Productivity, Conflict Management, Goal-EffortAlignment & Ownership, Executive Engagement, CEO as Leader & Gen Y to Leader CEO

Helps **SMEs** in:

Manufacturing(Industrial)Process &Productivity, Quality Consistency & Certainty, Non-Quality Costs & Control, Planning & On-time Delivery, Cost Control, Uncertainty to Certainty, Growth & Growth Management, Business Process Diagnosis and Adaption,People Development/Engagement.

M R Rao is a Management Resource for Corporates and SMEs.

Past

Areva T&D (Alstom T&D) 1992-2010

Established a greenfield high technology Business Unit in India (Chennai), manufacturing High Voltage Switchgear right upto 800kV. With several firsts to its credit, this business unit under his leadership was a game changer in Indian market in every sense and turned on its head, the mindset of western world about the ability of Indian enterprise to manage sustained quality, productivity and high technology.

During the period, as the **Managing Director** of the High Voltage products business in India, led the business to rapid profitable growth, to be the market leader in India and a reliable exporter. Cost Management along with Strategy and Execution were key success factors effectively deployed.Additionally, expertise utilised includes industrialisation of High technology products having sustained quality, operator and executive productivity, business development in fiercely competitive market, development of competent team of people and profitable growth management.

Vendor development and management was a key challenge, particularly in an environment driven by high volume automobile manufacturers, and the approach adapted to was unique.

BHEL 1975-1992

Joined as Graduate Engineer Trainee in Jan 1975 and has rapidly grown to level of Senior Manager by 1992.

Mr. Rao was responsible for Technical marketing, Product Promotion of High Voltage Switchgear. Played key role in Product launching, technology transfer, product qualification, High power testing.

Mr. Rao represented BHEL in National/International committees on technology and standardization.

Was **head of Design** at time of leaving BHEL at Hyderabad.

Through the years...

- Known in Indian T&D sector
- Expertise in Business & Industrial Strategy Development and Execution.
- Contributed to Indian Standards thro' BIS.
- Represented India in SC A3 (High voltage equipment) of CIGRE for 3 years.
- Chairman of Switchgear division of IEEMA for two years (2002-2004).SWICON2004 triggered International organizations like IEC, CIGRE choosing India as the venue for some of their meetings.
- A natural coach and a team builder
- Cultural bridge between Indian &European Business Managers
- Likes to make positive difference to the people associated

Academics: Post GraduateEngineer in Electrical Power Systems (BE- Govt. College of Engg, Anantapur (AP) & ME- Andhra University College of Engg. Visakhapatnam (AP)morlarrao@yahoo.co.in

Mr. Nital Zaveri,
CEO & Director

- Selected for 40 New Voices of Quality by ASQ in Nov 2011 Quality Progress Magazine issue. (http://asq.org/qualityprogress/tools resources/new-voices-of-quality/index.html)
- Winner of Shingo Video Contest 2014 on Enterprise Excellence
- Certified Manager for Quality and Organizational Excellence, ASQ, USA
- Internationally Certified Management Consultant (CMC) from ICMCI
- Recipient of Young Entrepreneur AWARD from Economic Development Forum
- QCI Approved Sr. QMS Consultant (QCI-NRBPT - 2003 to 2012)
- NPC Approved Lean Management Consultant
- Certified Business Excellence Award Examiner for RBNQA.
- Six Sigma Black Belt (ISI-SQC-OR)
- Lean Management Champion (AMA)
- QMS Lead Auditor (IRCA – UK)
- TS 16949 Internal Auditor (TUV)
- Secretary of ASQ, LMC, Ahmedabad, India
- Ex. Co-Chairman (Quality Committee-SGCCI)
- Ex. Member of IMCI, Ahmedabad Chapter
- Ex. Member of Manufacturing and Innovation Panel, CII, Vadodara, Gujarat (2012)
- Invited to Japan by JPC to study Quality Awards
- Selected by Malcom Baldridge Award Committee, USA for study of Quality awards.
- Invited as Chief Guest (South Guj. Prod. Council)
- Invited as Session Chairman (QCFI Award 2008)
- Invited as Judge at CII Kaizen Competition in 2012 and 2014
- Life Member (ASQ, IMCI, AAAI, QCFI, BMA, SEVA, SGCCI)
- Visiting Faculty to various colleges i.e. MSU, SPU.
- Invited for talk by CII, BMA, QCI, MSME & Ind. Association

Specialties:

» **Organization Transformation**
» **Business Excellence**
» **Six Sigma**
» **Lean Management**
» **Quality Management System**
» **Training and Consultancy Service**

Mr. Shekhar Kothari,
Manager-Operations Excellence and Information Services,
Power Grids High Voltage,
ABB India Ltd.

Shekhar Kothari is Operations Excellence & Information Services Manager for Power Grids High Voltage local business unit of ABB India Ltd.

He is responsible for driving improvement programs in the area of LEAN, value chain excellence, quality and supply chain, for high voltage products' factories in India.

Previously he was Operations manager for GIS and Hybrid Switchgear factory in Savli and he led the green field project to set up this state of the art manufacturing facility.

Shekhar has more than 10 years of experience in operational excellence, LEAN and change management in production and administration in ABB. He is also power user for PP and MM module of SAP.

He is a Production Engineer by profession from the University of Pune and holds professional certifications in the area of six sigma, project managment and LEAN.

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