Block-VII

Project & Operations Management

Current Trends in Operations Management

Block

VII

CURRENT TRENDS IN OPERATIONS MANAGEMENT

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BLOCK VII: CURRENT TRENDS IN OPERATIONS MANAGEMENT

The seventh block of the course on Project & Operations Management deals with current Trends in Operations Technology, Globalization and Sustainability in Operations Management. The block contains three units. The first unit explains current Trends in Operations Technology. The second unit brings out different dimensions of Globalization and Operations Management. The third unit focuses on the importance of Sustainability in Operations Management.

The first unit, Trends in Operations Technology addressing trends in operations technologies covers topics such as The changing landscape of Operations Technologies, Manufacturing Intelligence, Flexible Manufacturing Systems, Intelligent Value-chains and Supply-chains, Sustainability and Operations Technology, Operations Technology and Competitive Advantage, Innovation in Operations, Customization and Operations Technology, Disruptive Technologies, Technology Trends for Indian Companies, Role of Information Technology and ERP and Operations

The second unit, Globalization and Operations Management addresses the ongoing paradigm shift in operations management as a result of globalization. The topics covered in the unit include Meaning and Significance of Globalization, Emerging trends in Operations Management, Globalization of Manufacturing Operations, Globalization of Servicing Operations, Location Choices in Operations Strategy, Globalization of Operational Competencies, Resources and Processes, Key Imperatives for Business Leaders, Globalization and Sustainability, Challenges in Managing Globalization, New National Manufacturing Policy, Corporate Social Responsibility and Approaches to Globalization

The third unit, Sustainability and Operations Management explains sustainability, the subject of global concern. The topics covered in this unit are Meaning and Concept of Sustainability, Globalization and Sustainability, Sustainability Objectives, Sustainability and Operational Planning, Sustainability and Supply Chain Management, Sustainability and Resource Management, Sustainability and Operational Stakeholders, Sustainability and Innovation and Framework for Sustainable Operations Strategy.

Unit 31

Trends in Operations Technology

Structure

31.1 Introduction

The advent of globalization brought breath-taking developments in manufacturing due to a host of reasons. The main reasons are global competition, depleting resources and growing climate change concerns. By upgrading people's skills, focusing on empowerment, and streamlining processes, organizations can realize substantial improvements in quality, cost, delivery, safety, morale, and ultimately, their competitive position. This onerous task calls for analyzing and upgrading operations technologies. Global studies by renowned institutes confirm that:

- Manufacturers will continue their focus on attaining and maintaining competitive advantage through operations technologies.
- They will start moving their IT priorities from the back end to the shop floor, to enable a much higher return in business value and business optimization opportunities.

- So far, investments in manufacturing and supply chain systems have not yielded anticipated results in productivity improvements and cost reduction.
- Companies will deploy real-time manufacturing technologies to handle processes.
- Manufacturing is destined to become capital intensive with modern technologies.

31.2 Objectives

In this unit, we will discuss the following topics:

- Manufacturing Intelligence
- Flexible Manufacturing Systems
- Intelligent Value-chains and Supply-chains
- Sustainability and Operations Technology
- Operations and Competitive Advantage
- Innovation in Operations
- Customization and Operations Technology
- Disruptive Technologies
- IT in Operations Management
- ERP and Operations

31.3 The Changing Landscape of Operations Technology

In the globalization of firms, operational processes like supply chain management, technology management; revenue management and risk control are globalized. The supply chain is globalized to

- Meet dynamic needs of growing markets and new consumer segments
- Balance risks caused by economic and political uncertainties and
- Manage costs` complexity.

Product development and R&D processes are globalized, driven by market or technology factors across regions. Global product development strategy considers global manufacturability, different staff learning approaches, customer heterogeneity and product standardization versus localization to apply and open innovation approaches and manage global R&D activities. Global manufacturing needs continual innovation to sustain its competitive position in the future. While global manufacturing from developed countries to developing ones is typically supported by advanced technologies, global manufacturing from developing countries to developed ones may seek technological resources.

Apple builds a complicated global supply chain with the design in the US, components and parts being purchased in Korea and Japan, assembly in China, distribution in China and the US and global retailing. Suitable operations technologies are deployed accordingly.

31.4 Manufacturing Intelligence

Manufacturing Intelligence is an effective tool for decision making in Operations Management. It enables automatic data capture from the shop floor, which in turn

- Delivers real-time visibility
- Provides analytics on key performance indicators (KPIs) to optimize business performance and
- Facilitates a real-time collaborative enterprise (stretching to other business units, and to supply chain partners).

The shop floor is more intelligent today; such devices as remote sensors, RFID, real-time location systems (RTLS) and the like, often on wireless networks, have created ultra-sophisticated shop floor networks. Following figure shows a modern shop floor:

31.4.1 New paradigms

- Simplify implementation by focusing upon real-time manufacturing intelligence to speed implementation and drive down costs.
- Satisfy the strategic requirements of management, the visibility requirements of the supply chain, and the tactical requirements of the shop floor.
- Treat supply chain visibility as customer-supplier relationships and partner relationships.

At the heart of all of these benefits is real-time Manufacturing Intelligence (MI). Following are some ways that real-time MI improves management, on-time delivery, quality and throughput, revenue growth, and drive down costs.

31.4.2 Real-time supplier intelligence

Supplier intelligence is equally important. Part of the promise of RFID has always been end-to-end visibility, which would supposedly benefit both the customer (for example, Wal-Mart or the Department of Defense) as well as the vendor, with rich informatics.

31.5 Flexible Manufacturing Systems

A flexible manufacturing system (FMS) is a manufacturing system in which there is some amount of flexibility that allows the system to react in case of changes, whether predicted or unpredicted. There are two categories of flexibility- machine and routing flexibility

Most **FMS** consist of three main systems:

i. The work machines (which are often automated CNC machines , are connected by a material handling system to optimize parts flow)

ii. The central control computer (which controls material movements) and

iii. Machine flow

Advantages: The main advantage of an FMS is its high flexibility in managing manufacturing resources like time and effort in order to manufacture a new product. The best application of an FMS is found in the production of small sets of products like those from a mass production.

- Reduced manufacturing cost
- Lower cost per unit produced
- Greater labour productivity
- Greater machine efficiency5
- Improved quality
- Increased system reliability
- Reduced parts inventories
- Adaptability to CAD/CAM operations
- Shorter lead times

Disadvantages

- FMS is a highly complex system
- Requires highly skilled technicians
- Needs high level of planning
- Demands high initial investments

31.5.1 Industrial Flexible Manufacturing System (FMS)

FMS consists of

- Robots, computer-controlled machines, numerical controlled machines (CNC), instrumentation devices, computers, sensors, and systems such as inspection machines.
- The use of robots in the production segment of manufacturing industries promises a variety of benefits ranging from high utilization to high volume of productivity.
- Each Robotic cell or node will be located along a material handling system such as a conveyor or automatic guided vehicle.
- The production of each part or work-piece will require a different combination of manufacturing nodes.
- The movement of parts from one node to another is done through the material handling system.
- At the end of part processing, the finished parts will be routed to an automatic inspection node, and subsequently unloaded from the Flexible Manufacturing System.

31.6 Intelligent Value Chains and Supply Chains

- Supply chain analytics combines technology with human effort to identify trends, perform comparisons and highlight opportunities in supply chain functions.
- The technology helps decision-makers in supply chain areas such as sourcing, inventory management, manufacturing, quality, sales and logistics.
- Supply chain analytics solutions leverage investments made in enterprise applications, web technologies, data warehouses and information obtained from external sources to locate patterns among transactional, demographic and behavioral data.
- The typical approach to business analytics involves creating data-marts organized by functions such as customer, procurement, finance, planning and quality. Business intelligence tools are used to extract the data through standard queries, ad-hoc reports and online analytical processing (OLAP) tools—sometimes via a managed reporting environment or executive dashboard interface

What industry requires is a vastly simplified, more plug-and-play method of both gathering shop floor intelligence and sharing that intelligence among partners.

31.7 Sustainability and Operations Technology

- Industry leaders are addressing sustainability in operations through technology.
- Climate change and environmental management have become top priorities of enlightened managements as competitive weapons. Automobile MNCs are intensifying efforts towards developing engines for alternative fuels like electric and hydrogen.
- Energy consumption remains the major resource guzzler in operations and infrastructure decisions and make/buy decisions are based on sustainability considerations.
- Resource management is a major concern due to their fast depletion and global competition. Deployment of technology in green designs and entire value chain are the common initiatives being taken across the industrial world.

31.7.1 Occupational health and safety of workforce

Employee safety has become a very serious concern in view of the wide ramifications of an unsafe work environment.

- It is now a mandatory requirement and the companies are responsible for ensuring safety even at vendors' and subcontractor's premises.
- Global standards have been formulated to facilitate implementation of safety management.

- Technological solutions are also available to ensure occupational safety and health throughout the product life cycle.
- Operational Technologies are being deployed for risky and hazardous processes.

31.8 Operations Technology and Competitive advantage

Competitive advantage in the global competitive business environment focuses on all competitive dimensions, viz., quality, speed, flexibility, delivery and cost. All the dimensions, if selected and managed efficiently can lead to competitive advantage.

For example, zero-defect is the requirement in a fault-free operational environment as in a Space programme, speed may be required in transportation services, flexibility in reengineering may be required in volatile customer requirements and delivery may be insisted for critical time-bound large programmes.

- Efficient supply chain management can ensure excellence in all dimensions and deployment of technology like ERP will make supply chains more efficient. All these will lead to cost advantage, which largely influences competitive advantage in general.
- Lean manufacturing, Six-Sigma process management and Total Quality Management, Balanced Score Card are some of the approaches being taken by firms to ensure operational excellence thereby gaining competitive advantage. These tools, techniques and philosophies are relevant at every stage of the process chain and when implemented effectively, can lead to sustainable growth through competitive advantage.

Check Your Progress - 1

Indicate your choice of the answer from the options given by putting a √ mark.

1. To what extent is Globalization effecting operations?
   a. no effect
   b. moderate
   c. high
   d. severe
2. Manufacturing Intelligence provides automatic shop floor data for
   a. real-time visibility
   b. performance management
   c. helping supply chain partners
   d. all a, b and c

3. Flexible Manufacturing Systems help in
   a. changing plans as per changing priorities
   b. reducing manufacturing cost and time
   c. improving productivity
   d. all a, b and c
4. Flexible manufacturing systems call for
   a. huge investments
   b. high skills
   c. meticulous planning
   d. all a, b and c

31.9 Innovation in Operations

Both production and servicing operations provide immense scope for innovation for achieving operational excellence. As a firm's major investments are in operations, innovation in the entire value chain is a top priority in operations management. The areas of innovation are:

- Operational Innmovation
- Product Innovation
- Strategy Innovation
- Exosystem Innovation
- Management Innovation

31.10 Customization and Operations Technology

Global market trend is customization of even consumer products. This necessitates adoption of new and innovative ways to address specific customer needs and deliver them.

- Mass customization in marketing, manufacturing, call centres and management, is the use of flexible computer-aided manufacturing systems to produce custom output, which combine the low unit costs of processes with the flexibility of individual customization.
- Mass customization is the new frontier in business competition for both manufacturing and service industries. At its core is a tremendous increase in variety and customization without a corresponding increase in costs. At its limit, it is the mass production of individually customized products and services, popular in automobiles.

Technology is moving so quickly, and in so many directions. Technology advancement continues to drive economic growth and, in some cases, unleash disruptive change. Economically disruptive technologies—like the semiconductor microchip, the internet, or steam power in the Industrial

Revolution—transform the way we live and work, enable new business models, and provide an opening for new players to upset the established order.

31.11 Disruptive Technologies

McKinsey Global Institute in its study and analysis identified twelve potentially economically disruptive technologies that will have a profound bearing on operations technology.

i. **Mobile Internet -** Low cost and highly capable mobile computing devices and Internet connectivity can enhance productivity and provide competitive advantage.

ii. **Automation of knowledge work** Advances in artificial intelligence, machine learning, and natural user interfaces (e.g., voice recognition) are making it possible to automate many worker tasks regarded as impossible for machines to perform.

   - Employees or customers without specialized training can get information on their own. Sophisticated analytics tools can be used to augment the talents of highly skilled employees, and as more knowledge worker tasks can be done by machine, it is also possible that some types of jobs could become fully automated.

iii. **The Internet of Things** Networks of low-cost sensors and actuators for data collection, monitoring, decision making, and process optimization.

   - Allows organizations to manage assets, optimize performance, and create new business models - from monitoring the process flow in a factory to measuring the moisture in a field of crops to tracking the flow of water through utility pipes, the Internet of Things

iv. **Cloud technology** The cloud is enabling the explosive growth of Internet-based services, from search to streaming media to offline storage of personal data (photos, books, music), as well as the background processing capabilities that enable mobile Internet devices to do things like respond to spoken commands to ask for directions.

   - The cloud can also improve the economics of IT for companies and governments, as well as provide greater flexibility and responsiveness. Cloud can enable entirely new business models, including all kinds of pay-as-you-go service models.

v. **Advanced Industrial** robots have taken on physically difficult and dangerous jobs, such as welding and spray painting. Now, more advanced robots are gaining enhanced senses, dexterity, and intelligence, due to accelerating advancements in machine vision, artificial intelligence, machine-to-machine communication, sensors, and actuators.

   - These robots can be easier for workers to program and interact, can be more compact and adaptable and easy to deploy safely alongside

workers. These advances could make it practical to substitute robots for human labor in more manufacturing tasks, as well as in a growing number of service jobs, such as cleaning and maintenance.

vi. **Autonomous and near-autonomous vehicles** It is now possible to create cars, trucks, aircraft, and boats that are completely or partly autonomous (vehicles that can navigate and operate with reduced or no human intervention). From drone aircraft on the battlefield to Google's self-driving car, the technologies of machine vision, artificial intelligence, sensors, and actuators that make these machines possible is rapidly improving.

Autonomous cars and trucks could enable a revolution in ground transportation. The potential benefits of autonomous cars and trucks include increased safety, reduced CO2 emissions, more leisure or work time for motorists (with hands-off driving), and increased productivity in the trucking industry.

vii. **Next-generation genomics marries advances in the science of sequencing** and modifying genetic material with the latest big data analytics capabilities. Relatively low-cost desktop sequencing machines used in routine diagnostics, significantly improve treatments.

- The advances in the power and availability of genetic science could have profound impact on medicine, agriculture, and even the production of high-value substances such as biofuels—as well as speed up the process of drug discovery.

viii. **Energy storage** Energy storage technology includes batteries and other systems that store energy for later use.

- Lithium-ion batteries and fuel cells are already powering electric and hybrid vehicles, along with billions of portable consumer electronics devices.
- Li-ion batteries in particular have seen consistent increases in performance and reductions in price, with cost per unit of storage capacity declining dramatically over the past decade.
- Over the next decade, advances in energy storage technology could make electric vehicles (hybrids, plug-in hybrids, and all-electrics) cost competitive with vehicles based on internal-combustion engines.
- On the power grid, advanced battery storage systems can help with the integration of solar and wind power, improve quality by controlling frequency variations, handle peak loads, and reduce costs by enabling utilities to postpone infrastructure expansion. In developing economies, battery/solar systems have the potential to bring reliable power to places it has never reached.

ix. **3D printing** Until now, 3D printing has largely been used by product designers and hobbyists and for a few select manufacturing applications. However, the performance of additive manufacturing machinery is improving, the range of materials is expanding, and prices are declining rapidly—bringing 3D printing to a point where it could see rapid adoption by consumers and even for more manufacturing uses.

- With 3D printing, an idea can go directly from a 3D design file to a finished part or product, potentially skipping many traditional manufacturing steps.
- 3D printing enables on-demand production, which has interesting implications for supply chains and for stocking spare parts—a major cost for manufacturers.
- 3D printing can also reduce the amount of material wasted in manufacturing and create objects that are difficult or impossible to produce with traditional techniques.

x. **Advanced materials** Over the past few decades, scientists have discovered ways to produce materials with incredible attributes—smart materials that are self-healing or self-cleaning; memory metals that can revert to their original shapes; piezoelectric ceramics and crystals that turn pressure into energy; and nanomaterials.

- Advanced nanomaterials such as graphene and carbon nanotubes could drive particularly significant impact. For example, graphene and carbon nanotubes could help create new types of displays and super-efficient batteries and solar cells.

xi. **Advanced oil and gas exploration and recovery** Exploration and recovery techniques make extraction of unconventional oil and gas economical. The ability to extract unconventional oil and gas reserves from shale rock formations is a technology revolution.

- With continued improvements, this technology could significantly increase the availability of fossil fuels for decades and produce an immediate boon for energy-intensive industries such as petrochemicals manufacturing.
- Improving technology for oil and gas exploration and recovery could even unlock new types of reserves, including coal-bed methane, tight sandstones, and methane clathrates (also known as methane hydrates), potentially ushering in another energy revolution.

xii. **Renewable energy** Renewable energy sources such as solar, wind, hydro-electric, and ocean wave hold the promise of an endless source of power without stripping resources, forcing layoffs, contributing to pollution or worrying about competition for fossil fuels.

31.12 Technology Trends for Indian Companies in Infrastructure and Operations

Gartner, Inc. highlighted the top 10 strategic technology trends for most Indian organizations in infrastructure and operations. Internal trends, market trends and societal trends are rapidly converging, and many will have dramatic effects on infrastructure and operations planning. Gartner is the world's leading information technology and advisory company. The top 10 technology trends identified by Garner include:

i. Software-defined Networks

Software-defined networks (SDN) provide a means to abstract the network just as server virtualization abstracts the server. Unlike traditional networks, the SDN controller (pair) is optimized for control of a data center (single, or hybrid cloud) and is the authoritative source for topology and policy enforcement. This is important in that it allows simplification of how the network is designed and operated such that one is not boxed by configuring it to individual vendor platforms and even different distributed network protocols.

ii. Software-Defined Storage

Data growth continues unabated. From an IT perspective, one of the main issues is not awareness of the issue, but prioritization of the issues. Software-Defined Storage (SDS) is the logical next step of the software defined data center. By employing SDS, organizations are able to separate and abstract storage elements, as well as combine storage elements and capabilities providing storage solutions/services. They also have the potential to enable heterogeneous storage resources to create virtual pools of resources based on application requirements rather than the physical storage characteristics.

iii. Hybrid Cloud Services

Unlike private, public or community cloud services, hybrid cloud services horizontally "span" two complete implementations. A single service request could be deployed in either implementation, or moved from one to the other, or can horizontally grow between the two implementations (also called cloud bursting or over drafting). The primary benefit is flexibility of deployment, managed security and elasticity. This is contrasted from a cloud service that relies completely on another cloud service in a supply chain - in which the service is incomplete without the connection between the multiple implementations.

iv. Integrated Systems

The very use of the appliance or integrated terminology creates great angst for some vendors and users - particularly for physical appliances. And yet, deploying traditional server, network and storage systems has been a labor of frustration. The new world of virtualization has forced greater attention to speeding the

processes of deployment and using resources more efficiently. In effect, IT is demanding the end of hard and fixed intersections and boundaries. This "unified fabric" concept will take time to evolve through increased levels of automation, OS intelligence and management tools, but the evolution toward integrated systems is well underway.

v. Applications Acceleration

- The consumerization of technology is creating more devices that organizations will need to support in order to reach out to customers and employees.
- A more relevant tipping point, when there will be more Internet-connected mobile devices (Smartphones, tablets and other mobile devices using lightweight OSs, such as Apple iOS and Android) than PCs. As a result, users expect applications to be available on all their devices and organizations increasingly have to build multichannel applications - ones that run on all the key endpoint devices and preserve state between them, so users can switch devices as they need to.

vi. The Internet of Things

The Internet of Things is not a technology, but a concept that describes how the Internet will expand as physical items such as consumer devices and physical assets are connected to the Internet. The vision and concept have existed for years; however, there has been acceleration in the number and types of things that are being connected and in the technologies for identifying, sensing and communicating.

Key advances include:

- Embedded sensors: Sensors that detect and communicate changes (e.g., accelerometers, GPS, compasses, cameras) are being embedded in an increasing number of places and objects.
- Image recognition: Image recognition technologies strive to identify objects, people, buildings, places, logos etc. Smart phones and tablets with cameras have pushed this technology from industrial applications to consumer and enterprise applications.
- NFC payment: NFC (Near Field Communication) allows users to make payments by waving their mobile phone in front of a compatible reader. Once NFC is embedded in a critical mass of phones for payment, many industries will be able to explore how NFC technology can improve efficiency and customer service.

What does this really mean? It means that the phone, neatly tucked in the pocket, will talk to and turn on owner's car. Depending on readings, car radio will play appropriate music.

Industry watchers have singled out India as a hotspot for IoT deployments, with the market expected to reach $17bn by 2021, according to Ray Wang, founder and principal analyst at Constellation Research. Exhibit 31.1 shows a few examples for the diversified application of IoT in India

Exhibit 31.1: IOT applications in India

- In the northern Indian city of Kohima, data collected from sensors and other internet of things (IoT) devices is being used to manage street lighting, ensure public safety and deliver a slew of citizen services.
- Between the capital city of New Delhi and Varanasi in Uttar Pradesh, the Vande Bharat Express – India's first semi high-speed train – uses a collision-avoidance system comprising sensors and other IoT devices to prevent accidents due to human error or equipment failure.

In agriculture, Tea Tantrum, a supplier of wellness and premium teas in India, is using IoT technology to monitor moisture content and maintain the ingredient proportions of some of its products.

Source: https://www.computerweekly.com/feature/India-is-becoming-a-hotspot-for-IoT, 15 March, 2021

vii. Open Compute Project

Originally founded by Facebook and Rackspace as a vehicle to highlight their energy efficiency and hardware design projects, the Open Compute Project is now designed to drive open design concepts where own design manufacturer (ODM) equipment will be much easier to interchange within a rack or data center environment.

viii. Intelligent Data Centers

- As more of the IT infrastructure becomes virtualized, it is becoming reshaped. Increasingly, there will be more possibilities for the "fabric" to have the intelligence to analyze its own properties against policy rules that create optimum paths, change them to match changing conditions and do so without requiring laborious parameter adjustments.
- X86 virtualization is effectively the most important technology innovation behind the modernization of the data center. It heralds a sea-change in how IT leaders view the roles of compute, network and storage elements - from physical hardwired to logical and decoupled applications.

ix. IT Demand

- With the increased awareness of the environmental impact data centers can have, there has been a flurry of activity around the need for a data center efficiency metric. An effective way to look at energy consumption is to analyze the effective use of power by existing IT equipment, relative to the performance of that equipment.

- Pushing IT resources toward higher effective performance per kilowatt can have a twofold effect of improving energy consumption and extending the life of existing assets through increased throughput. The Power to Performance Effectiveness (PPE) metric is designed to capture this effect.

x. Organizational Entrenchment and Disruptions

- The personal device era of IT provides business users with increased levels of personal flexibility and functionality, together with a complexity that the traditional IT service desk is unable to support
- The IT service desks of the future must look to new and innovative means of user engagement. The survival of the IT support organization rests on new IT service desk analyst skill sets and techniques that leverage the same consumer-based forces that accelerate business demand to their advantage
- Business-user satisfaction can be a moving target, but enabling higher levels of productivity at the IT service desk level demonstrates that the IT organization cares about the business, and that it's committed to ensuring that users meet their goals and objectives.
- While a focus on traditional training, procedures, security access, knowledge management and scripts is warranted, a focus on next-generation support skills will be paramount to meet the needs and expectations of the business more efficiently.

31.13 Role of Information Technology

IT is all pervasive. Most of the above technologies are directly enabled, or enhanced, by information technology.

- Information technologies tend to advance very rapidly, often following exponential trajectories of improvement in cost/performance.

The nature of work will change, and millions of people will require new skills.

- New technologies make certain forms of human labor unnecessary or economically uncompetitive and create demand for new skills.
- Automated knowledge work tools will almost certainly extend the powers of many types of workers and help drive top-line improvements with innovations and better decision making, but they could also automate some jobs entirely.
- Advanced robotics could make more manual tasks subject to automation, including in services where automation has had less impact until now.

A new wave of unprecedented innovation and entrepreneurship is forced by falling costs and rapid dissemination of technologies:

- Cloud-based services and mobile Internet devices could help level the playing field, putting IT capabilities and other resources within reach of small enterprises.
- The opportunities and innovation unleashed by a new wave of entrepreneurship could provide new sources of employment.

31.14 ERP and Operations

Enterprise Resource Planning (**ERP**) is a business management software—usually a suite of integrated applications a company uses to store and manage data from every stage of operations:

- ERP encompasses product planning, development, manufacturing, marketing and sales, inventory management and shipping and payment.
- ERP provides an integrated real-time view of core business processes, using common databases maintained by a database management system.
- ERP systems track business resources—cash, raw materials, production capacity—and the status of business commitments: orders, purchase orders, and payroll.

The applications that make up the system share data across the various departments (manufacturing, purchasing, sales, accounting, etc.). ERP facilitates information flow between all business functions, and manages connections to outside stakeholders.

- Organizations consider the ERP system a vital organizational tool because it integrates varied organizational systems and facilitates error-free transactions and production.
- However, ERP system development is different from traditional systems development.
- ERP systems run on a variety of computer hardware and network configurations, typically using a database as an information repository.
- An ERP system covers the following common functional areas. In many ERP systems these are called and grouped together as *ERP modules*:
    - Financial accounting: General ledger, fixed asset, payables, receivables, cash management, financial consolidation.
    - Management accounting: Budgeting, costing, cost management, activity based costing.
    - Human resources: Recruiting, training, payroll, benefits, 401K, diversity management, retirement, separation.

- Manufacturing: Engineering, bill of materials, work orders, scheduling, capacity, workflow management, quality control, manufacturing process, manufacturing projects, manufacturing flow, product life cycle management.
- Supply chain management: Supply chain planning, supplier scheduling, order to cash, purchasing, inventory, product configuration, claim processing.
- Project management: Project planning, resource planning, project costing, work break down structure, billing, time and expense, performance units, activity management.
- Customer relationship management: Sales and marketing, commissions, service, customer contact, call center support - CRM systems are not always considered part of ERP systems but rather Business Support systems (BSS). Specifically in telecom scenario.
- Data services: Various "self–service" interfaces for customers, suppliers and/or employees.

31.14.1 MRP and ERP

Materials Resource Planning (MRP) is a computer program that translates finished product requirements into time-phased requirements for each dependent demand item- items in which demand is derived from plans to make certain products (things like raw materials, parts, and assemblies). Example: The parts and materials that go into the making a car. Dependent demand tends to be fluctuating whereas independent demand is fairly stable.

MRP Input uses three primary sources for information: Master schedule, bill-of-materials file, and an inventory records file.

Master schedule relates to product demand and timeline. It states what end items need to be produced, when they are needed and how much are needed.

Bill of materials relates to product composition. It lists all of the raw materials, parts, sub-assemblies and assemblies required to manufacture one item.

Inventory records relate to inventory, consisting of status information on an item sorted by time period - gross requirements, scheduled receipts and expected amount on hand.

MRP Output: MRP systems have capabilities of providing management with a wide range of outputs. These typically include primary reports and secondary reports.

- Primary Reports - production and inventory planning and control are part of primary reports. Planned orders - a schedule indicating the amount and timing of future orders. Order releases - authorizing the execution of planned orders. Changes to planned orders - revisions of due dates or order quantities/ cancellation of orders.

- Secondary Reports - performance control, planning, and exceptions belong to secondary reports.

  Performance-control reports - measure deviations from plans such as deliveries and stock-outs, as well as providing information that can be used to assess cost performance. Planning reports - predict future inventories, procurement contracts and data for future assessment of material requirements.

Exception reports - recognizes inconsistencies within the report such as errors in overdue or late orders, etc.

MRP II

Manufacturing Resources Planning II developed after manufacturers realized MRP had additional needs. MRP II expanded the use of MRP by adding features essential to the use of other functional areas, marketing and finance to enable the use of short-range capacity requirements. Material requirements are essential for the use of MRP II. With the new function areas added, the manufacturing company is able to develop a master production schedule. MRP generates the materials needed and schedules the requirements, where managers can obtain more detailed capacity requirements. Capacity requirements is the process of determining short-range capacity requirements.

ERP has an MRP core. ERP provides information sharing among numerous dimensions of a business in order to direct the system more effectively. An ERP system typically has modular hardware and software units and "services" that communicate on a Local Area Network.

Industry 4.0 and Operations Technology

History shows that industrial revolution enhances industrial productivity, foster growth, and improves quality of work-life. Steam-powered engines replaced the manual efforts and brought mechanical production in the late 18th century. Then, the electrical-powered machines improved productivity and brought mass production in the late 19th century. In the late 20th century, computing-powered machines further improved productivity through electronic machines and automated production. Recently, in the early 21st century, cyber-powered devices changed the way of producing and delivering products and services to the customers. The technological advancement transforming the way of running the companies as well. In this transformation, sensors, machines, internet, operations, and information technology are well connected and capable of communicating to each other across the supply chain. This new digital industrial technology is known as Industry 4.0. These connected systems, also known as cyber-physical systems, can communicate to each other, analyse data, and deliver good results. Hence, the technologies behind Industry 4.0 has huge potential to increase productivity, foster growth, and enhance quality of work-life.

According to a recent BCG Report on Industry 4.0, there are nine technologies transforming the way industrial production is happening now in the factories. They are big data and analytics, autonomous robots, simulation, horizontal and vertical system integration, industrial internet of things, cyber security, cloud, additive manufacturing, and augmented reality. Another study by McKinsey identifies four clusters of technology that disrupting the manufacturing and supply chain operations. The technologies grouped under each cluster as: data, computational power, and productivity as cluster (1), analytics and intelligence as cluster (2), human-machine interaction as cluster (3), and digital-to-physical conversion as cluster (4). These clusters consists of technologies such as big data, internet of things, machine-to-machine connectivity, cloud technology, digitization and automation of work, advanced analytics, touch interfaces and next level graphical user interfaces, virtual and augmented reality, additive manufacturing (also known as 3D printing) technology, advanced robotics, and energy and storage harvesting. These technologies are building blocks for Industry 4.0 and have huge impact on production and distribution of products and services that creates value for customers. For example, today's isolated, optimized manufacturing cells would be tomorrow's fully integrated and material & information flows across the cells that enable highly integrated and automated production process across the manufacturing cells. This smart factory would improve efficiency, redefine production relationships among suppliers, manufacturers, logistics, and customers, as well as human-machine relationship. The technical and economic benefits of key Industry 4.0 technologies are examined below.

- ***Big Data, Analytics and Intelligence:*** A large set of data is collected from production and equipments systems, and analysed to optimize production quality, energy saving, and predictive maintenance. For example, a semi-conductor manufacturer, Infineon Technologies, had reduced product failures by correlating a single-chip data collected at the testing phase with process data collected at the initial stage.
- ***Autonomous Robots:*** Robots are becoming more flexible, cooperative, and autonomous. They interact with each other to share the work load, and work together with humans and learn from them. For example, a robotic manufacturer, Kuka Automation Company, offers autonomous robots for factory automation. These robots can interact with each other and adapt to different situations with the help of high-end sensors and control limits.
- ***Plant Operations and Simulation:*** Simulation tools allow operators to simulate plant operations, which includes machines, humans, and products, test, and optimize machining process. For example, a machine-too vendor and Siemens developed a virtual machine that would simulate the manufacturing

process by obtaining data from other physical machines. This helped to reduced setup time by 80% for that manufacturing process.

- ***Platform and Cloud Technology:*** Both internal and external integration allows supplier, manufacturers, logistics, and customers to share design and development of products and services in real-time. For example, Dassault Systemes and Boost AeroSpace launched a platform, namely AirDesign, to collaborate design and manufacturing processes, which is available in a private cloud for European aerospace and defense industry as a service. This approach improves visibility, reduces design and development time, ensures standards, and manages complex tasks of exchanging design data to the business partners.
- ***Industrial Internet of Things:*** Industrial equipments and machines are embedded with sensors and field devices to communicate and interact with each other, as well as with centralized controllers that enables real-time tracking and controlling of the manufacturing processes inside the factory. For example, an electric drives and control system supplier, Bosch Rexroth, had setup a semi-automated factory with decentralized production processes for valve production. Inside the factory, each workstation exactly knows what is the next production step to be done for the product by identifying the product's production process status by radio frequency identification codes.
- ***Virtual and Augmented Reality:*** Virtual and augmented reality-based systems provide variety of supports to workers in order to improve work procedures and make real-time decisions. For example, virtual glasses offer information about order picking inside the warehouse, provide part replacement instructions in machines, and enhance product design and development process in automobile manufacturing. Siemens developed a plant engineering software solution, namely Comos, for training plant operators to handle machines and emergencies. It uses real-data and realistic 3D environment with augmented-reality glasses in order to train operators in a virtual environment to interact with machines, change parameters setting, receive production and maintenance order instructions, and retrieve operational data from the machines.
- ***Blockchain Technology:*** Blockchain allows companies to easily exchange data more accurately and even more securely among multiple partners with independent information systems within a complex supply chain operation. It provides immutable, permanent digital record of transactions about materials and financials that enhances end-to-end visibility and a single-source of truth to all participants in the supply chain. For example, aircraft manufacturers are in the process of testing the use of blockchain technology to track and trace the source of aircraft's components and parts from their multiple tiers of suppliers.

Check Your Progress - 2

Indicate your choice of the answer from the options given by putting a ✓ mark.

5. Innovation in operations leads to
   a. operational excellence
   b. competitive advantage
   c. both a and b
   d. none
6. Internet of Things
   a. is not relevant to manufacturing and services
   b. is highly useful in process optimization
   c. helps management of assets
   d. both b and c
7. Industrial Robots are useful in
   a. safety management in risky operations
   b. helping workers interact with machines
   c. replacing human labor
   d. all a, b and c
8. 3D printing is an operations technology for
   a. hobbyists
   b. production of critical components
   c. mass productions
   d. a and b

31.15 Summary

There is an emerging trend in operations management with a host of technologies changing the value chains and supply chains in pursuit of competitive advantage. It is a foregone conclusion that even to survive locally, companies need to globalize in view of the local presence of MNCs. The competitive dimensions call for state of the art operations technologies to harness and effectively utilize. These call for building the necessary infrastructure, skills, systems and structures significantly different from the traditional shop floors. Information Technology and ERP systems will make manufacturing intelligence a common feature to tone up supply chains. Flexible manufacturing systems are necessitated by increasing customization of products and services. The trends in operations technologies as forecast by research firms point towards unimaginable disruption and may bring in new players to the business arena. Those companies which anticipate adopt and implement latest technologies in operations management will be the winners in future.

31.16 Glossary

Manufacturing Intelligence is a tool for automatic data capture from the operations to facilitate decision making.

Flexible Manufacturing is a manufacturing system providing flexibility to accommodate changing customer and unavoidable internal requirements.

Internet of Things is a network of gadgets for data collection, monitoring, decision making and process optimization.

Cloud Computing uses a variety of computing concepts that involve a large number of computers connected through a real-time communication network such as the Internet.

ERP is Enterprise Resource Planning: It is a business management software a company can use to store and manage data from every stage of operations.

Radio-Frequency Identification (**RFID**) is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects.

31.17 Self-Assessment Exercises

1. Do you visualize any future changes in operations technology? Explain with examples.
2. What is manufacturing intelligence? Explain for any industrial shop floor familiar to you.
3. How do you describe a Flexible Manufacturing System?
4. What are Intelligent Value-chains and Supply-chains?. Explain with examples
5. Is sustainability an issue in operations technology? Justify your answer,
6. Is innovation possible in operations? Explain with examples,
7. Can customization of products be addressed by operations technology?
8. Do you consider ERP and IT as essential in operations? Why?

31.18 Suggested Readings/Reference Material

1. Dr Srikanth Gaddam, The Future of Disruptive Technologies, Goodreads, Kindle Edition, November, 2020
2. Anand Tamboli, Build Your Own IoT Platform: Develop a Fully Flexible and Scalable Internet of Things Platform in 24 Hours, e-Book, Apress, April, 2019
3. Pranjal Sharma, India Automated: How the Fourth Industrial Revolution is Transforming India Hardcover, Kindle Edition, 7 November 2019

4. Ashley McDonough, Operations and Supply Chain Management Essentials You, Vibrant Publishers, 24 May, 2019
5. Jose Arturo Garza-Reyes, Vikas Kumar, Juan Luis Martinez-Covarrubias, Ming K Lim, Managing Innovation and Operations in the 21st Century, Productivity Press, 2018

31.19 Answers to Check Your Progress Questions

1. **(d) Severe.** Yes the impact of globalization on operations is so severe that even well entrenched players are finding it difficult to compete.
2. **(d) All the options given in a, b and c** are benefited through manufacturing intelligence.
3. **(d) All a, b and c.** The flexibility is across all manufacturing processes.
4. **(d)** FMS calls for huge investments, high skills and meticulous planning.
5. **(c) Both a and b.** Innovation leads to operational excellence and competitive advantage.
6. **(d) Both b and c.** Useful in process optimization and management of assets
7. **(d) All a, b and c.** helps in safety, interaction with machines and replacing workers.
8. **(d) a and b.** It helps hobbyists and production of critical components. It is not useful in mass production in view of high costs and cycle times involved.

Unit 32

Globalization and Operations Management

Structure

32.1 Introduction

With the advent of globalization, the nature of business operations has undergone many significant changes- entire world has become a *global village*- people anywhere can buy anything of their choice from anywhere; customer has become the king- is more knowledgeable than the seller and is demanding value for money; importing is no longer a preferred buying decision; Organizations after meeting domestic demand for products and services wants to venture into global due to several reasons; growth of the organization through building huge capacities thereby economies of scale, taking advantage of core competencies available at various places across the globe, low cost due to relative cost advantage, gaining knowledge about various consumer preferences, cultural perspectives at the same time sustenance in global arena is challenging. For example, once Chinese products have gained importance because they are more competitive but China is no longer a competitive location for manufacturing due

to raising wages and emergence of still low cost locations elsewhere in the world; sought after Swiss watches in 60 s gave way to several other brands across the world due to advent of electronics Multi National Corporations (MNCs) in the developed world are establishing their operations in developing countries and even in countries literally banned sometime back. Globalization has put the customer at the center of operations, brought new competitive forces and profitability pressures, made 'innovation' an unavoidable strategy in operations, mergers and acquisitions, partnerships and global locations have become essential features of global operations; outsourcing, body-shopping and off-shoring inevitable competitive strategies. This unit discusses all such aspects of globalization as relevant to Operations Management.

32.2 Objectives

In this unit, we will discuss the following topics:

- Meaning and Significance of globalization
- Emerging trends in Operations Management
- Location choices in Operations Strategy
- Globalization of operational competencies, resources and processes
- Key imperatives for business leaders
- Globalization and sustainability
- Difficulties in managing globalization
- Approaches to globalization

32.3 Meaning and Significance of Globalization

In business terms, globalization can be defined as the removal of trade barriers (restriction of the flow of goods or services, capital, information, knowledge and ideas between economics) among economics. For local, regional and national organizations, globalization refers to the strategic expansion of operations into other countries. Globalization integrates the economy of a country with that of the rest of the world. Globalization has transformed the business environment into a more competitive one and has provided many new opportunities for the expansion of organizations. Organizations can exploit these opportunities through comparative advantages, economies of scale and proprietary product technology. Emerging countries like India benefited immensely through global employment opportunities in areas like IT. Pressure of competition changed the global manufacturing scenario

- It is a strategic option rather than taking advantage of low cost labor. Many industries employed automation as the basic strategy to ensure operational excellence
- Distributed manufacturing though gives several advantages like utilizing core competencies, cost advantage, etc., poses challenges in planning, coordinating, logistics, fluctuating exchange rates, cultural differences,

managing disruptions in supply chain etc., in this context, Enterprise Resources Planning (ERP) has become an essential requirement in operations

- Thus manufacturing has become distributed and capital-intensive where as and servicing labour-intensive
- Globalization has a major impact on supply chain management, significantly influencing operations strategy.

It is no longer a one-way process of flow of goods from developed to developing and other countries. The reverse process has started with emerging economies assuming leadership role. Any disruption in supply chain due to any reason will have drastic effect on the production systems. For example, disruption caused by pandemic Covid-19 virus, almost all the countries in the world took decision to stop movement of people and goods suddenly as the disease is contagious in nature. Entire transport system was paralyzed by grounding all their aircrafts, trains, buses, and ship routs within their country and also from other countries. As a result their production systems were halted for few months which impacted their GDP adversely.

When we study globalization we must know about drivers of globalization. There are mainly four drivers of globalization; markets, Government, cost, and competition. These drivers affect possible conditions for globalization across industries which are generally not in the control of individual firms. Market drivers; Market drivers are such as common customer needs and transferable marketing, whereby the emergence of global markets for standardized products has enabled corporations to cater demands in new markets with existing products. Cost drivers; by streamlining their production processes and synchronizing supply chains globally rather than nationally, companies can drastically lower their costs and reduce their prices to stimulate demand for their products, attract new customers, and even enter into new markets. One more major driver is Government influence with its policies which may lead to reductions in trade barriers enhancing and contributing shift towards an open market economy. With access to new markets and human capital, cost advantage drivers, companies will able to get new economies of scale by selling at higher quantities. Also companies can explore the advantage of low cost production through outsourcing and import. In the case of competitive drivers, the growing trade between nations along with foreign direct investment (FDI) has helped to increase interdependence among countries and organizations, as well as exposing firms to new competitors.

Growing interdependence of national economies, and cross- border movement of materials, products, labor, information, technology and capital are forcing companies to globalize their operations. It is no longer a one-way process of flow of goods from developed to developing and other countries. The reverse process has started with emerging economies assuming leadership role.

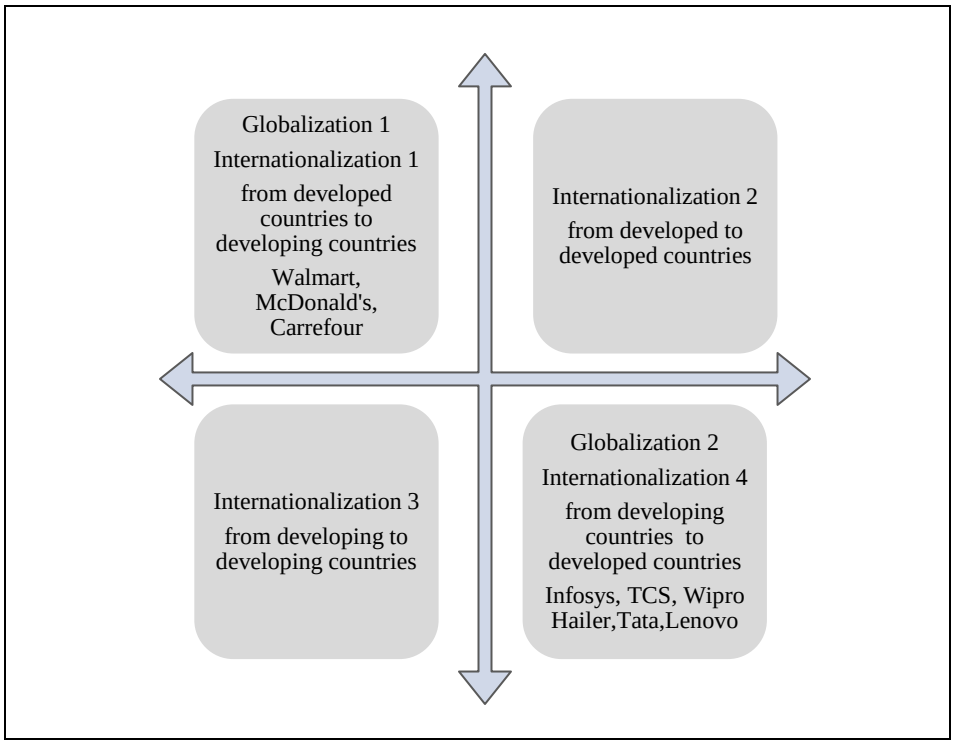
32.3.1 Globalization Components

Total global strategy (Yip, 2003) consists of three separate components or stages:

- Developing the core strategy- may be developed in the home country, identifying the factors for global competitive advantage.
- Internationalizing the core strategy- expanding the activities internationally and understanding the dynamics of international business.
- Globalizing the international strategy- integrating the strategy across countries.

32.3.2 Globalization Directions:

As shown below, there are four possible directions:



As seen above, directions from developed to developed and developing to developing are not real globalization directions as they are supposed to include other directions also. A firms' globalization may develop along multiple directions and in many stages. For example,

- Coca-Cola first grew from developed countries to other developed countries and then to developing countries.
- Huawei first grew from developing countries to developing ones and then to developed countries.
- Infosys, Wipro, TCS grew from developing countries to developed countries and then to rest of the world.

From developed countries to developing countries:

- The advantages of companies such as IBM, Microsoft, Walmart are in technology, advanced management experience, product quality and financial strength.
  - They enter developing countries for market, raw materials etc.
  - They encounter legal (Pharma companies), political (Walmart), social and environmental challenges (Kudankulam Nuclear Power Plant)

From developing to developed countries:

- Companies like Infosys, Wipro, Haier, Lenovo and Huawei have the advantages of low-cost resources and demographic dividend.
  - They globalize mainly for market and technology but often meet challenges from product quality, world-class service, technology, international business knowlede and regulatory requirements.

32.4 Emerging trends in Operations Management

For the past few decades manufacturing across the globe witnessed significant changes; outsourcing, offshoring, vertical specialization, and new sourcing strategies. Growing interdependence of national economies, and cross- border movement of materials, products, labor, information, technology and capital are forcing companies to globalize their operations. Fragmentation of production process and international dispersion of tasks and activities leading to borderless production across the globe is order of the day.

According to a study conducted by McKinsey Global Institute, by 2025,

- About 50% of large companies in the world will be located in the emerging countries.
- Hundreds of new locations will host large companies as against 20 big cities today.
- 45% of Fortune 500 companies will be from emerging world as against 26% in 2013, contributing 46% of global revenue.
- Emerging nations are likely to generate new global players and assert their presence.
- Emerging markets will no longer be low cost production centers but major consumers and hubs for many companies' operations.
- The imminent geographic rebalancing will have important implications for market opportunities, competition and economic growth.

Large companies in emerging economies will become corporate giants and will engineer seismic shifts challenging the dominance of the western countries. They

will fuel local growth, reconfigure global networks and compete at different levels. They will also have a growing pool of skilled, hardworking and well-educated workforce.

- Create jobs, generate incomes and provide stimuli for higher productivity, innovation, standard setting and the dissemination of skills and technology, disrupting industries and the way operations are strategized
- Intensify corporate competition for markets, resources and talent.
- Provide major opportunities for service firms and suppliers.
- Adapt to changes in physical and social infrastructure and to differing regulatory environments and enforcement practices
- Develop a corporate culture of ingenuity, making them potentially formidable competitors for today's global incumbents.

32.5 Globalization of Manufacturing Operations

Globalization is facilitated by liberalization of trade regulations and free trade agreements. The supply chain networks and thereby manufacturing and servicing operations are made effective and efficient by the communication and transportation technologies. Decreasing tariffs, taxes and encouragement given by governments enabled creation of more global manufacturing destinations. Professional skills and talents can be drawn from the global pool. To compete in this global competitive environment, companies have no option but to globalize.

According to the dictionary of economics, globalization is defined as geographical shift in domestic activity around the world and away from the nation state and also referred as inter dependent economies through the increase in cross boarder movement of goods, service, technology, and Capital.

Globalization can be characterized by manly four factors; growing worldwide inter connections, rapid discontinuous changes, increased number and diversity of participants, and growing complexity.

Though international production is not new, but its size and extent of fragmentation of global value chains are new. Firms can look at the chain and break up their value chains and select each area of business process according to comparative advantage. Considering from both the sides of globalization the country which sends some of the production activities out of the country feels that they are losing jobs, technology, profits to other country. On the other hand, from the perspective of host countries, they may feel that they had benefited from capture high value activities or trapped with MNCs with low value added activities depending on what they get. Also, other the effect of foreign firms on local social, political environmental standards are to be considered. Global value chain can determine who gets what, when, and how in the global economy.

Though there are several ways of funding, firms attempt to internalize and seek greater control of the process and gain markets through FDI. Growth of global trade depends on the extent of liberalization which implies reduction of trade barriers, growth of market based policies, and latest technology i.e., new forms of transportation, telecom, standardized shipping containers, shift to modularity which helped global reach of products. Success depends on how best a firm coordinates and manages it's fragmented value chain across the geographical locations of the globe.

Globalization can happen in any of the following ways:

- Establishing a manufacturing plant and production infrastructure
- Project management
- Overseas Operations Management
- Offshore design
- Global purchasing and supply chain management
- Global inspection/ QA/certification of products, processes

To ensure success of global manufacturing, following elements need attention:

- Total landed cost- The total end to end costs from inputs to product outputs and delivery to customers and wherever applicable, life-cycle costs.
- Global quality control- Adoption of international standards like ISO 9000 quality systems. As manufacturing contributes to Green House Gases, compliance to relevant standards and emission norms is mandatory. Similarly occupational health and safety standards are relevant in all industries.
- Production Planning- It is complicated if the firm operates in more locations with different sources and resources like labor and management. Efficient information and communication system and systems like ERP can help in better production planning and monitoring.
- Technology innovation- Sustaining competitive advantage necessitates continuous innovation in processes encompassing manufacturing. Global manufacturing by developing countries need technological innovation to compete with entrenched global players.
- Workforce- Mobility of workforce across the globe poses many HR challenges due to diversity of languages, cultures and values. Identification and recruitment of right talent in labor, technical and managerial levels is an onerous task. Forging team spirit within such a heterogeneous workforce is essential.

Exhibit 32.1 shows global manufacturing/Services modes

Exhibit 32.1: Global Manufacturing/Servicing Modes

Requirement	Outsourcing/Joint venture/ wholly owned	Advantages
Resources	Huawei R&D center and GE's software development center in India	Technology, efficiency and global talent at local costs
Market	Manufacturing of tractors by Mahindra & Mahindra in the US and China	Market share, competitive prices and branding
Efficiency	Automobile manufacturing in India by global players	Chasing and setting global benchmarks, competitive edge and effective risk management and optimization of resources
Assets	Aditya Birla, Tatas, Indian Pharma and software companies acquiring foreign companies	Acquisition of physical assets and strategic human resources to enhance Tata's acquisitions from Ford to position it as a global brand

Source: Important Types Of Globalization, https://schoolofpoliticalscience.com/what-are-the-5-types-of-globalization/ September 13, 2020

32.6 Globalization of Servicing Operations

Mind-boggling developments in communication technology totally changed the nature and quality of service operations. Some globalization services are:

- Hospitality and tourism including hotel chains and restaurants
- Transportation and Travel services in air, rail, road and sea modes
- Management consulting and strategic planning
- Project management
- Quality inspections, evaluations, accreditations, audits and certifications
- Insurance and banking services
- Investment and other financial services
- IT services, ERP and Cloud services
- Agencies and facilitation of outsourcing

Some of the key operational elements for service globalization are:

- Customization- to suit local requirements. Global automakers operating in India are focused on fuel efficiency and environmental concerns and focus on diesel variants.

- Cultural adaptation- Disney Hong Kong and KFC China incorporated Chinese cultural elements and McDonalds' addressed local cultural elements in Indian operations.
- Information intensity- to ensure efficient customer services and loyalty.
- Service unbundling- segregation of front office and back office activities.
- Labor intensity- direct customer contact in the service supply chain makes it highly workforce intensive with quality of service as a top priority for customer retention and attracting new customers. Cost, skill and productivity considerations are important in service delivery.
- Innovation in services- both products and services- the global food chains like KFC and McDonalds' continuously innovate to retain their competitive advantage. Banking sector introduces innovative products and services regularly to ensure paperless transactions.

32.7 Location choices in operations strategy

- Cities with large and diversified local urban economies and favorable business environments will be top choices.
- Locations with research universities and access to fresh graduates will have preference.
- Cities operating as hubs in global industry networks and supply chains will be preferred.
- Rising population generates demand, enabling companies to scale up and expand the availability of labor and talent.
- Cities will strengthen schools and create vocational training programs.
- Cities and nations have to focus on creating a competitive business environment with streamlined and efficient regulatory and approval processes.
- Companies look for infrastructure like airports, lower corporate taxes, competitive wages and the presence of upstream and downstream companies

Rise of new corporate giants will heighten competition for companies and cities alike and will open up possibilities for economic growth in new corners of the globe.

Different industry sectors employed different strategies for locating their operations

- In high-tech electronics and computers, designing and engineering are done at global centers of excellence and manufacturing is done at very efficient low cost locations anywhere in the world. Servicing is managed locally. BPO (Business Process Outsourcing) centers at some locations provide customer services through a centralized server. For example, GE Healthcare makes parts for its diagnostic machines in China, Hungary and Mexico and develops the software for those machines in India.

- In the automobile industry, design and engineering are at global R&D centers, material sourcing is global, manufacturing and servicing are local by 24/7 mobile service centers.

Check Your Progress - 1

Indicate your choice of the answer from the options given by putting a ✓ mark.

1. Globalization means
   a. Selling a company to a foreign company
   b. Removing barriers to trade
   c. Sending employees abroad
   d. Permitting all foreigners
2. Which of the following is not true globalization?
   a. Exporting from one developed country to another developed country
   b. Exporting from one developing country to another developing country
   c. Both a and b
   d. Exporting from developing to a developed country
3. Which of the following is an example for globalization?
   a. Tatas acquiring Jaguar and Land Rover from Ford
   b. Aditya Birla group establishing a Fibre Plant in Thailand
   c. GMR constructing an airport abroad
   d. All a, b and c
4. Which of the following is not an advantage of globalization?
   a. More Profits
   b. Acquisition of technology
   c. Creation of jobs abroad
   d. Access to resources

32.8 Globalization of Operational Competencies, Resources and Processes

32.8.1 Globalization of Operational Competencies

Globalization is a two-edge weapon. It can enhance the operational competency of a firm by providing new opportunities or reduce the competency of a firm by imposing new constraints. The competency requirements may change from a domestic 'well' and bring in many new and unheard challenges.

***Cost*:** Globalization's first attack is on costs- taxes and duties, transportation and other country-specific conditionality. Thus cost competency calls for global cost

competency vis a vis the competitors, who are unknown in terms of technologies, strategies and other competitive advantages. As a relief to big players, globalization provides the leverage of new processes like outsourcing, new resources like low cost labor and raw materials, new technologies to enhance productivity, new locations/facilities to reduce manufacturing and logistics costs and new reservoirs of managerial and technical talent. All these factors have a potential to reduce costs; and operations strategy lies in identifying the right combination of techniques to be cost competitive.

***Flexibility*:** Ability to respond to varied customer requirements by dynamically changing/redesigning product offerings and service portfolio. The firm should develop the necessary resilience and the flexibility to combat unexpected eventualities and business opportunities.

***Quality*:** Non-negotiable requirement is world-class quality. Globalization is also changing quality standards in different regions.

> European markets insist on certain compliances like emission levels and banning ROHS (Restriction On the use of Hazardous Substances) materials and components. In items like food and medicines, the requirements are mandatory and quality control norms are stringent like the USFDA (Food and Drug administration of the US).

Quality, if understood in a holistic perspective, can lead to organizational excellence by addressing all the competitive dimensions to the level of excellence.

***Time*:** Globalization makes achievement of time competency more difficult due to the enlarged supply chain.

- There will be a natural tendency to locate cost-effective sources for resources like materials and labor, which may cause disruptions in supply chains.
- Proven techniques like Just-In Time may not work so effectively in such a changed scenario, that too in a resource constrained environment.
- Added dimension of globalization is customization of products and services, which obviously enlarge the cycle times depending upon the amount of development, engineering, sourcing and process times involved.

Consequently cycle times for various operational processes and delivery to customers may be affected. Reputed MNCs are well positioned to combat these challenges with a continuous global scan and engineering their strategies suitably.

> Zara (world famous Spanish clothing and accessories retailer) uses global operations systems to speed its design, manufacturing and distribution process to remain distinctive in fashion. Zara takes just two weeks to develop a new product and get it to stores compared to an industry average of six months

32.8.2 Globalization of Operational Resources

The resources based view of global operations strategy is to tailor global real assets in a global environment through such techniques as VRIO- Valuable, Rare, Inimitable and exploited by Organization to achieve competitive advantage. The resources are globalized in sizes, times, types and locations.

- The capacity size decision needs to examine global demand, which is very difficult to forecast than local demand in view of local cost, political environment and tax system
- The timing problem considers five generic capacity-timing strategies, viz., leading, lagging, smooth, demand-chasing, hybrid-timing and follow-the-competitor strategies on a global scale.

  It will be difficult to improve resource flexibility in production input, production capacity and production output due to complexities involved in a heterogeneous market environment.
- Choosing an appropriate location for global manufacturing, global service or global R&D is an important decision to reduce cost, get access to markets, acquire knowledge and recruit talents.

Starbucks in its sustainability endeavour, started sourcing raw materials from Indian suppliers and achieve operational efficiency. Similar approach is being followed by Ikea in its Indian operations.

32.8.3 Globalization of Operational Processes

In Global Operations, all associated processes-supply chains, technology, revenue and risk management are globalized.

- The global supply chain is globalized to meet dynamic needs of growing markets and new consumer segments to balance risks caused by economic and political uncertainties and severe resource constraints and associated price fluctuations. Options to consider include global outsourcing, distribution, alliances and partnerships with suppliers of products and services.
- Product development and R&D processes are globalized, driven by market or technology factors. Global product strategy considers global manufacturability, different staff learning curves, customer heterogeneity and product standardization versus localization to apply an open innovation paradigm and manage global R&D activities.
- Globalization faces risks due to natural, economic, political and social risks. Firms can formulate strategies to control risks associated with various operational flows.

32.9 Key imperatives for business leaders

To reengineer their operations strategies

- Understand how the ecosystem for customers and competitors is evolving and watch for new sources of innovation and potentially disruptive change.
- Set sights on international expansion and therefore need to compete for global customers, talent, capital and resources.
- After understanding the new ecosystem, think??? the structure and location of senior management and reconsider headquarters configuration and location choices.

This calls for reviewing traditional organizational structures and drafting new operations strategies. CEOs need to prepare for the emerging competitors by understanding who they are and how they will compete differently. Businesses need to understand the new company landscape to track competition and tailor their organizations.

32.10 Globalization and Sustainability

The importance of sustainability catapulted to the top of agenda for all institutions emerging out of growing concern for environment due to accelerating climate changes and global warming. UN sponsored international conferences, summits, protocols and declarations, governments' commitments and industry's responses necessitated a strategic approach to sustainability management. Among all actors, industry has been identified as the primary contributor to this global concern. Therefore industry has to play an important role and anchor the process of effectively managing various actors and factors associated with this growing concern.

Businesses are affected by six resource constraints:

Raw material, Energy, Water, Food, Climate Change (Pollution) and Waste

These constraints lead to bottlenecks in operations, impacting competitiveness, performance and profitability. As traditional ways of production and distribution are no longer competitive, companies started competing on the basis of more efficient use of resources and eco-friendly operations. Total return on resources has become the focus of supply chain and resource management. By keeping eco-friendly resource management at the core of operations strategy and supply chain management, smart companies convert constraints into opportunities.

William Clay Ford Jr., executive chairman of Ford, highlighting his business strategy of 'winning through sustainability', advocated sustainability as a performance enabler, as energy efficient operations and eco-friendly automobiles are bound to reduce overall costs and increase profitability.

Exhibit 32.2 briefs the globalization plans of M&M.

Exhibit 32.3: Indian Auto Industry- M&M's Global Plans

Performance of Indian auto industry is very disappointing and the challenges are many. M&M is very optimistic about the future and towards realization of its dream of aggressive globalization, recast its operations strategy

- Grow the brand globally in the utility vehicle space
- Maintain competitive advantage across all product segments
- Focus on sustainable mobility space with focus on electric vehicles
- Leverage synergies across -sourcing, logistics, IT infrastructure and talent management
- Adapt frugal engineering to extract maximum value out of investments
- Enhance capabilities
- Encourage takeovers and partnerships to benefit in the areas of technology, product development, sourcing and channel
- Provide opportunities for global brands (Ford, Renault and Navistar) to enter Indian market and gain entry for its products into global markets through Joint ventures.

M&M is a US$16.2 billion Indian conglomerate based in Mumbai, employing 155,000 in over 100 countries selling products in 40 countries with tractor manufacturing facilities in the US and China.

Source: https://economictimes.indiatimes.com/industry/auto/auto-news/mm-puts-design-at-heart-of-future-plans-sets-up-new-global-vertical,6 October, 2021

Exhibit 32.2 explains the green initiatives taken by Ford

Exhibit 32.2: Green Initiatives Taken by Ford Include

- Promoting sustainability as a business strategy to ensure economic sustainability
- Remaking the very old River Rouge plant as a role model
- Building bridges between environmental community and business community
- Developing products for all fuels - electric, bio-fuels, hydrogen or diesel
- Removing internal resistance to change for sustainability initiatives
- Driving sustainability philosophy through the whole product-development system
- Conserving water through recycle, recharge and reduce approach
- Collaborating with universities and suppliers for innovative ideas on sustainability

Source: https://www.reliableplant.com/Read/5906/green-initiatives-ford, March, 2021

32.11 Challenges in Managing Globalization

Globalization brings many challenges and firms have to address them before venturing into global expansion. Success depends on managerial competence and leadership. Apart from the problems of raising initial investments, organizations encounter some challenges during globalization process:

32.11.1 Economic challenges

- Need to customize products and services to suit the preferences of customers of different markets.
- Variations in product/service are influenced by legal restrictions and the technical and quality standards of different markets.

32.11.2 Managerial challenges

- Managers working for a global organization have to operate in a highly competitive global environment.
- Though the products in different countries are similar, the marketing strategies and means to reach potential customers differ for different countries. Global customers have varied preference, choices, and tastes.
- To compete in the local markets, organizations need time and effort to constantly realign their production processes with customer requirements to remain competitive in the local market.

32.11.3 Institutional challenges

The rules, regulations and trade barriers of governments to protect local organizations from global competition could hinder the expansion process of global corporations. Some institutional impediments are:

- Tariffs and duties may limit the benefits achieved by economies of scale in production
- Quantitative quotas and other similar restrictions
- Preferential procurement from local organizations by government and quasi-government entities
- Governmental pressure to use locally produced components or to engage in local R & D
- Preferential tax treatment, corporate laws, or other policies of the local government.

32.12 Production Linked Incentive Scheme (PLI) for Large Scale Electronics Manufacturing

The domestic electronics hardware manufacturing sector faces lack of a level playing field vis-à-vis competing nations. The sector suffers disability of

around 8.5% to 11% on account of lack of adequate infrastructure, domestic supply chain and logistics; high cost of finance; inadequate availability of quality power; limited design capabilities and focus on R&D by the industry; and inadequacies in skill development.

The vision of National Policy on Electronics 2019 (NPE 2019) is to position India as a global hub for Electronics System Design and Manufacturing (ESDM) by encouraging and driving capabilities in the country for developing core components and creating an enabling environment for the industry to compete globally.

Production Linked Incentive Scheme (PLI) for Large Scale Electronics Manufacturing notified vide Gazette Notification No.CG-DL-E-01042020-218990 dated April 01, 2020 offers a production linked incentive to boost domestic manufacturing and attract large investments in mobile phone manufacturing and specified electronic components, including Assembly, Testing, Marking and Packaging (ATMP) units. The Scheme would tremendously boost the electronics manufacturing landscape and establish India at the global level in electronics sector. The scheme shall extend an incentive of 4% to 6% on incremental sales (over base year) of goods manufactured in India and covered under target segments, to eligible companies, for a period of five (5) years subsequent to the base year as defined. The Scheme is open for applications for a period of 4 months initially which may be extended. Support under the Scheme shall be provided for a period of five (5) years subsequent to the base year

The Scheme will be implemented through a Nodal Agency which shall act as a Project Management Agency (PMA) and be responsible for providing secretarial, managerial and implementation support and carrying out other responsibilities as assigned by MeitY from time to time.

Source: https://www.meity.gov.in/esdm/pli,2020

32.12.1 Major Initiatives Planned

- Foreign investments and technologies will be welcomed while leveraging the country's expanding market for manufactured goods to induce the building of more manufacturing capabilities and technologies within the country.
- Competitiveness of enterprises will be the guiding principle in the design and implementation of policies and programmes.
- Rationalization of compliance and regulatory requirements.
- Innovation will be encouraged for augmenting productivity, quality and growth of enterprises.

PWC observations

In its viewpoint on this policy, observed that the policy has been formulated keeping in mind existing initiatives such as Foreign Direct Investment (FDI), Goods and Services Tax (GST), Land Acquisition Bill etc. It has been felt that coordinated implementation of the NMP with other policy and procedural initiatives is the key to its success and will be vital in establishing India as a viable alternative to China. It has presented a SWOT analysis of Indian Manufacturing industry.

32.12.2 SWOT Analysis

An analysis of Indian manufacturing reveals that there are certain inherent advantages which if leveraged properly can boost manufacturing output. However, volatile business environment where politics influence the policies, procedures and regulatory framework will definitely impede decision making and delay critical investments. Foreign investors expect a more stable political climate and a pro-industry regime. Undoubtedly open access to export markets and government procurement will help Indian manufacturers achieve economies of scale and combat demand volatility. SMEs, the focus of accelerated growth in manufacturing need to respond with agility to develop or absorb state of art technologies. There is a need for adopting flexible manufacturing techniques and world class practices with total compliance to global standards and regulations.

Strengths	Weaknesses
• Demographic dividend for next 2-3 decades • Increasing domestic demand • High quality manufacturing destination • Sustained availability of skilled workforce • Strong technical and engineering capabilities • Corporate sector highly credible and professional committed to world-class standards • Well regulated and stable financial markets	• Low productivity, high illiteracy and inadequate skill development efforts • Volatile governance and regulatory environment • Poor power and transport infrastructure • Rising input costs of labor, fuel, power etc. • Inadequate credit flow and high cost of credit • Limited ability to adopt technology • Low backward and forward integration • Slow pace of reforms and policy implementation

Opportunities	Threats
• India seen as an emerging destination, as a source of manpower and also as a place of consumption • Easing excise restrictions can help export-import markets • Global slowdown considers India as a low-cost destination • Role of SMEs in driving innovation and employment • Commitment to green manufacturing • Adoption and compliance to global standards	• Policy paralysis, slow and faulty implementation • Intense competition from emerging countries • Slow pace of growth in manufacturing output • High volatility in demand discouraging aggressive decisions • Credit crunches due to increasing NPAs and raising cost of capital • Cheap imports

32.13 Corporate Social Responsibility (CSR)

Also called corporate conscience, corporate citizenship, social performance, or sustainable responsible business is a form of corporate self-regulation integrated into a business model. CSR policy functions as a built-in, self-regulating mechanism whereby a business monitors and ensures its active compliance with the spirit of the law, ethical standards, and international norms. In some models, a firm's implementation of CSR goes beyond compliance and engages in "actions that appear to further some social good, beyond the interests of the firm and that which is required by law." CSR is a process with the aim to embrace responsibility for the company's actions and encourage a positive impact through its activities on the environment, consumers, employees, communities, stakeholders and all other members of the public sphere who may also be considered stakeholders.

Definition and Concept of CSR

European Community defines CSR as “the responsibility of enterprises for their impacts on society”. To completely meet their social responsibility, enterprises “should have in place a process to integrate social, environmental, ethical human rights and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders”.

The World Business Council for Sustainable Development (WBCSD) defines CSR as “the continuing commitment by business to contribute to economic development while improving the quality of life of the workforce and their families as well as of the community and society at large.

According to the UNIDO, "Corporate social responsibility is a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders. It is important to draw a distinction between CSR, a strategic business management concept and charity, sponsorships or philanthropy."

From the above definitions, it is clear that:

- CSR is holistic and integrated with the core business strategy for addressing social and environmental impacts of businesses.
- CSR has to address the wellbeing of all stakeholders and not just the company's shareholders.
- Philanthropic activities are only a part of CSR.

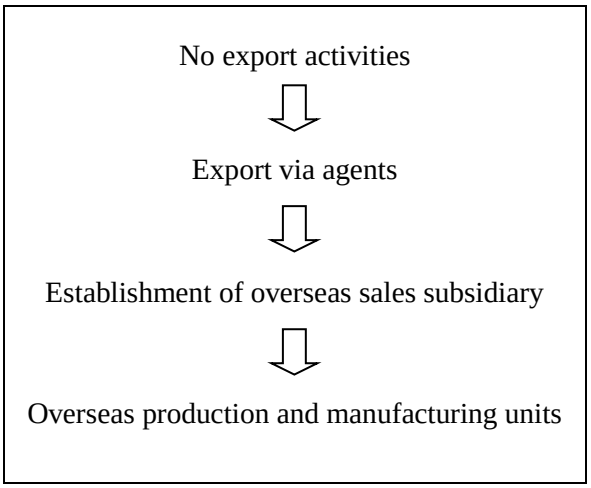
CSR in Indian Industry CSR in India is mostly seen as a philanthropic activity. There are certain family run businesses like the Tatas and Birlas, who have been doing CSR activities since generations as an integral part of their business activities. Subsequently, after globalization major software companies like Wipro, Infosys, TCS and HCL took major CSR initiatives. Government of India made it mandatory for all Public Sector Undertakings to allocate certain percentage of its profits towards CSR. It is now a compulsory parameter in the annual MOUs of PSUs with the Government of India for assessing organizational performance. CSR initiatives by ACC standout as a role model at least for Cement industry, whose carbon footprint is largest. The company partnered with local communities around its operations in providing education, healthcare and supporting efforts to create sustainable livelihoods, build village infrastructure and other developmental schemes.

- These initiatives reached out to 132 villages, touching the lives of about half a million people.
- Skill development programmes for differently-abled youth enabled placement of 136 young deaf adults
- HIV/AIDS treatment reached out to 319 affected people.
- Initiated behavioural change campaigns to encourage segregation of wastes by households to promote solid waste management.
- Adopted seven government-run technical schools and started operating two technical institutes for students from remote places.

Its partnership with local communities helped in taking social volunteering initiatives leading to the betterment of society. These include efforts in rural health, livelihood creation, education, vocational guidance and technical knowledge advancement programmes.

32.14 Approaches to Globalization

A company can go global through two approaches: Market entry and Value-chain models. Market entry is usually influenced by the differences in language, culture, political systems and the regulatory framework of the targeted market. By making a modest entry, the company acquires familiarity and starts strengthening its presence. Some aspirants go through the following sequential stages for globalization:



Some companies also follow the route of exporting, competitive alliances, acquisition and foreign direct investment. For example,

- Global defence equipment manufacturers prefer to export only due to fear of Intellectual Property Rights (IPRs) and also to ensure perennial dependence for spare parts, support etc.
- The offset policy of the Government of India forced some MNCs to tie up with Indian private and public sector firms to localize certain percentage of production.
- Tatas acquired Jaguar and Land Rover from Ford and Lenovo acquired IBM PC unit and both of them proved successful.
- Foreign Direct Investment is a major channel followed by many MNCs. Suzuki now fully owns erstwhile Maruti. Government has permitted FDI in retail amidst reservations of some state governments.

Make or Buy is the basic decision in globalization, similar to outsourcing. There are five popular approaches to globalization:

i. Acquisition- Lenovo entered the US market by acquiring IBM's PC unit
ii. Internal development- Microsoft established a research centre in Beijing
iii. Joint venturing- Wal-Mart tied-up with Bharti Air Tel in retail business
iv. Licensing- very common in hotel chains like Ramada
v. Partnership- Huawei with Vodafone for communication products

Globalization is no longer the traditional one-way traffic- goods flowing from developed countries to developing countries. Reverse process has started with global operations engineered by emerging countries. Some are born global, some embrace globalization as a business opportunity and some others adopt it as an imperative to survive even locally.

Check Your Progress - 2

Indicate your choice of the answer from the options given by putting a ✓ mark.

5. Future decisions on locations for operations will be based on
   a. Infrastructure
   b. Availability of resources
   c. Market share
   d. All a, b and c
6. Which of the following is not an operational competency?
   a. Investment
   b. Quality
   c. Delivery
   d. Flexibility
7. Lenovo's globalization started with
   a. Changing its name
   b. Acquisition of IBM
   c. Establishing a distribution network
   d. All a, b and c
8. Which of the following is not a sustainability issue in operations?
   a. Raw material
   b. Water
   c. Energy
   d. people

32.15 Summary

Globalization and liberalization heralded a new paradigm in operations management, throwing new challenges and opening immense opportunities. Operations have attained a digital destiny- competent will survive and others will perish. However organizations are created for survival and success. Globalization of operations, especially by emerging economies like India needs to be looked from an 'inclusive' angle to ensure sustainability and job creation. There are approaches and elements to address both in manufacturing and service operations. What companies in Japan did in 70s and 80s and companies in Singapore, Korea and Taiwan achieved subsequently is being demonstrated on a much larger scale

by the Chinese companies. Opportunities for Indian companies are many and companies like Tatas, L&T, Reliance, Aditya Birla in manufacturing and Infosys, Wipro, TCS, Mahindra Satyam in Software services have already established their global presence and many more are on track. Globalization calls for adopting and habitually demonstrating world class excellence in all performance dimensions like quality, delivery, speed, flexibility and overall operational excellence. The New Manufacturing Policy announced by the Government of India is expected to give fillip to the manufacturing sector and ensure inclusive and sustainable growth of the economy.

32.16 Glossary

Globalization- removal of trade barriers (restriction of the flow of goods or services, capital, information, knowledge and ideas between economics) among economics.

MNCs - Multi National Corporations

ERP - Enterprise Resources Planning

ROHS - Restriction On the use of Hazardous Substances

USFDA - Food and Drug Administration of the United States

32.17 Self-Assessment Exercise

1. What is globalization and its implications for operations management? Explain.
2. What are the popular directions in globalization? Explain with examples.
3. Why is location an important consideration in globalization of operations?
4. Is sustainability an important issue in globalization? Is Corporate Social Responsibility related to sustainability? Explain.
5. What are the emerging trends in globalization as per global studies?
6. What are the considerations in globalization of manufacturing and service operations?
7. What are the main objectives of New National Manufacturing Policy?
8. Give a detailed account of successful globalization by one Indian company.

32.18 Suggested Readings/Reference Material

1. Richard Baldwin, The Great Convergence: Information Technology and the New Globalization Hardcover – Illustrated, Oxford University press 15 March 2017
2. Globalisation and the Challenges of Development in Contemporary India, Editors, Sita Venkateswar and Sekhar Bandyopadhyay, Springer, 2017
3. Maria Waida, 3 Ways the Globalization of Services Will Affect Agencies in 2020, Wrike, November 19, 2019

4. Erdogan Bada (Editor), An Approach to Globalization from Different Perspectives Paperback, Nova Science Publishers Incorporated, 19 October 2018
5. Nirbhav Lumbe, Corporate Social Responsibility in India: A Practitioner's Perspective, India CSR, 2018

32.19 Answers to Check Your Progress Questions

1. **(b) Removing trade barriers.** All other answers are consequences of globalization.
2. **(c)** Exporting from developed to developed and developing to developing countries is not considered as globalization. Only cross- exporting from developing to developed and developed to developing countries is globalization.
3. **(d)** All the three cases are Indian examples of globalization.
4. **(a)** Profitability is not a part of globalization process. It is an outcome.
5. **(d)** All the three requirements indicated above at a, b and c are important.
6. **(a)** Quality, delivery and flexibility are operational competencies and investment is not.
7. **(a)** The process of globalization of Lenovo was started by changing its name first.
8. **(d)** All a, b and c are sustainability issues but not people.

Unit 33

Sustainability and Operations Management

Structure

33.1 Introduction

Organizations have recognized the importance of sustainability for their business due to the competitive environment, service and quality uprising. Which is turn out the most important focuses for the operations managers to manage their organization. In business, sustainability is defined as management of the triple bottom line – a process by which companies manage their financial, social and environmental risks, obligations and opportunities. This motivates managers to take care of prevention or mitigation of the negative effects to improve the operation of their business considering the sustainable criteria's. The purpose of this chapter is to understand various sustainable operations and its effects on their management.

Sustainability has catapulted to the top of agenda for everybody- governments, NGOs, business leaders, stakeholders and the individuals. It has emerged out of a growing concern for environment due to accelerating climate changes, global warming and resource constraints. UN sponsored international conferences, summits, protocols and declarations, government's commitments and industry's responses necessitated a strategic approach to sustainability management. Among all actors, industry has been identified as the primary contributor to this global concern. Therefore industry has to play an important role and anchor the process

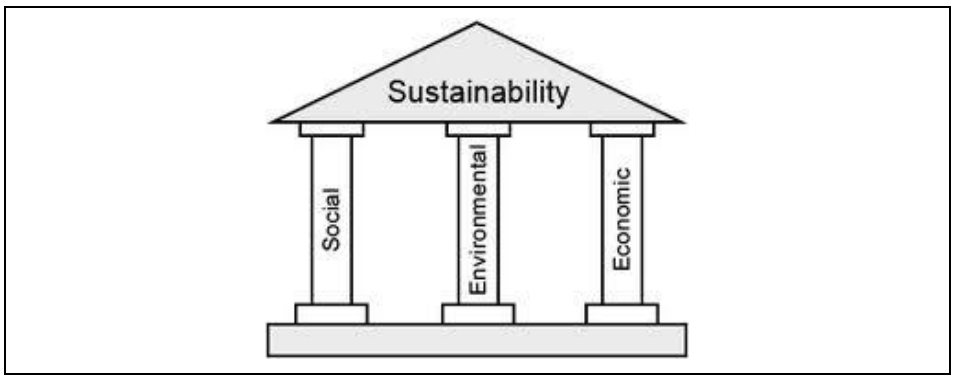
of effectively managing various actors and factors associated with this growing concern. This unit familiarizes the student with the meaning and concept of sustainability, its importance to operations management and the activities thereof. It will also try to showcase initiatives taken by some reputed organizations world-wide, their current status and likely trends. By the end of the unit, the student will be able to appreciate the growing importance of sustainability in operations management.

33.2 Objectives

The unit aims at making the student understand:

- The meaning and concept of sustainability
- The importance of sustainability to operations management
- How to establish sustainability objectives and incorporate them in operations planning
- The implications of sustainability in supply chain management
- The need for innovation in sustainability
- How to develop a framework for sustainability in operations management

33.3 Meaning and Concept of Sustainability



Source: ICFAI Research Center

The term 'sustainability' now has a much broader reach and meaning, extending its influence and implication to wider social and economic factors, including education, jobs, land use and community cohesion. Business needs to

- Balance its primary goal of generating ongoing financial returns for shareholders with an understanding of how their involvement in a region or in part of a value chain both creates and destroys social, economic and environmental value.
- Respond to new, enhanced requirements for transparency that are being placed on them by other key stakeholders.
- Sustainability is not about making sure that we don't deplete resources- it is all about being able to create wealth in the future as well as today.

- Sustainability doesn't mean commitments by business to go green – though environmental reporting and the use of that data to guide decision making is important.
- It is an understanding that the world has an impact on business and business has an impact on the world.

If a company wants to open up a mine in a developing country, it's now essential to show that dealings with local government aren't encouraging corruption, that impact on the environment has been considered from all angles, that employment of the local community is on open terms and that it has considered the full range of risks posed and planned for worst case scenarios. License to operate relies on proving honesty, safety and ability to bring good growth to the region, in the long term.

33.3.1 Business sustainability

All types and size of business depends on their effective operation management. An efficient and reliable management of the operation of their business is necessary to sustain in the global dynamic market with economic as well as social growth of the country considering the environmental concern. From the last two decades, the business organizations have passed through several transformation related to managing their operational performance. The results of sustainable operation management in the business provides a significant insight into the theory and especially in action response planning practice. The sustainable operation management approach helps in making decision-making approach more effective, because it may also support in planning and direction of management process in advance.

It is often defined as managing the *triple bottom line* - a process by which companies manage their financial, social and environmental risks, obligations and opportunities. Business sustainability requires firms to adhere to the principles of sustainable development. According to the World Council for Economic Development (WCED), sustainable development "meets the needs of the present without compromising the ability of future generations to meet their own needs." So, for industrial development to be sustainable, it must address important issues at the macro level, such as: economic efficiency (innovation, productivity), social equity (poverty, community health and wellness, human rights) and environmental accountability (climate change, land use, biodiversity).

There are a number of best practices that foster business sustainability which include:

- ***Stakeholder engagement***: Organisations can learn from customers, employees and their surrounding community. Engagement is not only about pushing out messages, but understanding opposition, finding common ground and involving stakeholders in joint decision-making;

- ***Environmental management systems***: These systems provide the structures and processes that help embed environmental efficiency into a firm's culture and mitigate risks. The most widely recognized standard worldwide is ISO 14001, but numerous other industry-specific and country-specific standards exist;
- ***Reporting and disclosure***: Measurement and control are at the heart of instituting sustainable practices. Not only can organisations collect and collate the information, they can also be entirely transparent with outsiders. The Global Reporting Initiative is one of many examples of well-recognized reporting standards;
- ***Life cycle analysis***: Those organizations wanting to take a large leap forward should systematically analyse the environmental and social impact of the products they use and produce through life cycle analysis, which measures impact more accurately.

Firms that are sustainable have been shown to attract and retain employees more easily and experience less financial and reputation risk. These firms are also more innovative and adaptive to their environments.

- Issues related to sustainability are fundamental to the ongoing success of any business.
- Corporate competitiveness and the health of local communities are mutually dependent.
- Sustainable development isn't a one-off or a 'nice-to-have'; it's critical to the broader economy and can only have an increasing impact on business's ability to secure a 'licence to operate' in an ever more complex and fast-moving environment.

33.4 Globalization and Sustainability

Continued outsourcing and growing globalization of the organizations have caused organizations to function and compete in the market considering all the perspectives of their business. The concept of sustainability in the operation management has become a vital part of not only the economic growth of any country but also to handle the evolving environmental, social and political pressures in to the practice. In the globalization of the market the organizations facing challenge is balancing the need to maintain efficient standards to best serve customers by integrating sustainable practices and technology into operations. It helps in taking strategic action by understanding their immediate most important and necessary actions they may take to make their operational process sustainable.

After globalization**,** the importance of sustainability catapulted to the top of agenda for all companies. This emerged out of growing concern for environment due to accelerating climate changes and global warming and intense competition for depleting resources. UN sponsored international conferences, summits,

protocols and declarations, governments' commitments and industry's responses necessitated a strategic approach to sustainability management. Among all actors, industry has been identified as the primary contributor to this global concern. Therefore industry has to play an important role and anchor the process of effectively managing various actors and factors associated with this growing concern. William Clay Ford Jr., executive chairman of Ford, highlighting his business strategy of 'winning through sustainability', advocated sustainability as a performance enabler as energy efficient operations and eco-friendly automobiles are bound to reduce overall costs and increase profitability. Ford's globalization strategy is based on its Green initiatives.

Sustainability and the Development Goals. As shown below in Exhibit 33.1, sustainability is one of the MDG goals superseded by the Sustainability Development Goals.

Exhibit 33.1: Millennium Development /Sustainability Development Goals

The Millennium Development Goals (MDGs) are eight international development goals that were established following the Millennium Summit of the United Nations in 2000, and the United Nations Millennium Declaration. All 189 United Nations member states committed to help achieve the Millennium Development Goals by 2015. Urgent action to halt climate change and deal with its impacts is integral to successfully achieving all Sustainable Development Goals (SDGs).

- Collectively, the three post-2015 agendas for action – the Paris Agreement, the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction - provide the foundation for sustainable, low-carbon and resilient development under a changing climate.
- As the MDGs era comes to a conclusion with the end of the year, 2016 ushers in the official launch of the bold and transformative 2030 Agenda for Sustainable Development adopted by world leaders last September at the United Nations.
- The new Agenda calls on countries to begin efforts to achieve 17 Sustainable Development Goals (SDGs) over the next 15 years.
- "The seventeen Sustainable Development Goals are our shared vision of humanity and a social contract between the world's leaders and the people," said UN Secretary-General Ban Ki-moon. "They are a to-do list for people and planet, and a blueprint for success."

Source: United Nations Framework Conference on Climate Change (UNFCCC), 2021

33.4.1 Collaborative approach in sustainability

The Sustainability Apparel Coalition and the Higg Index: Globalization resulted in intense competition in apparel industry due to the entry of low cost manufacturers from other countries**.** Those from the developed countries like the

US are the worst hit. It is also the industry raising sustainability concerns. It was found that efforts by individual manufacturers cannot generate breakthrough improvements, the requirement to combat global competition. Nike invested huge amounts but was unable to elicit the cooperation of others. The apparel manufacturers in the US, with a view to ensure sustainable growth and development adopted a collaboration approach to address the problem of sustainability. The Sustainability Apparel Coalition, the collaboration of manufacturers developed a measurement tool called the Higg Index. It allows companies to compare environmental performance outcomes in areas such as energy efficiency, material waste, water use and sustainable raw materials. It provides benchmarks at the company, product and factory levels. The benchmarks mobilized a 'race to the top' and the companies scoring less are motivated to improve.

The Higg Index drives better outcomes, influences capital investment decisions and changes operational behavior, helps vendor selection, waste reduction through improved product design and helps the manufacturers to justify investments in new capabilities like wastewater recycling and improved energy efficiency. The Index is enabling systemic collaboration on innovative practices such as used apparel recycling. By end 2020, the SAC has 250 member orgganizations from 25 countries with a global revenue of $245 Billion representing a lion's share of global market. The collaboration has fostered a strong culture of trust, openness and collaborative spirit among fierce competitors.

33.5 Sustainability Objectives

Sustainability implementation in an organizational helps the managers in decision making process with competitive advantages. Which aims to identify and implement the sustainable practices in their operation management approach. The sustainability focuses on the analysing and assessing the sustainability category and recognize the most suitable practice for the organization. Sustainable development helps in fulfillment of rising demand of energy, which is basic requirement of social and well as environmental perspective ethically and transparently. In doing so, organizations must take care not only the rules regulations but also comply the international standards. Eventually, these points are should be taken care by the management considering the circumstance and requirement of the operational process.

Objectives can be at country level like the emission targets set by Kyoto Protocol; industry level like the Euro norms for automobiles or organization level for the resources influencing sustainable operations. Thus sustainability objectives of organizations are generally centered around the basic resource constraints likely to affect their sustainability. An insight into the sustainability strategies followed by renowned companies provides adequate inputs for identifying and defining sustainability objectives.

Exhibit 33.2 narrates the sustainability journey of the Tata Group

Exhibit 33.2: Sustainability Journey of the Tata Group

A Climate Change Policy, authored by Ratan Tata, mandated Tata companies to "measure their carbon footprint … strive to be the benchmark in their segment of industry on carbon footprint … engage actively in climate advocacy and … incorporate 'green' perspective in all key organisational processes". In sync with the group's focus on sustainability, a new organization—the Tata Sustainability Group (TSG)—was formed in 2014. TSG has evangelized volunteering across the Tata group through Tata Engage, which now delivers over a million volunteering hours a year. To ensure that key sustainability messages cascade across the group, a Global Sustainability Council with the chief executives of various Tata companies has been constituted. For the past seven years, the month of June has been celebrated as Tata Sustainability Month, to embed 'sustainable thinking' at the core of the Tata group's strategy and encourage employees to embrace SMART (Sustainable Meaningful Actions for a Responsible Tata) actions in lifestyle and business decisions. In June 2015, the group adopted the Tata Sustainability Policy, which commits Tata companies to integrate environmental, social and ethical principles into their businesses. While almost 40 Tata companies have undertaken sustainability reporting consistent with global reporting frameworks such as the United Nations Global Compact and the Global Reporting Initiative (GRI), Tata Steel has gone a step further and reported under the new International Integrated Reporting Council (IIRC) framework. By 2021, Tata Group makes compliance to ESG standards top priority. Being ESG compliant is expected to raise the ratings of Tata group investment opportunities globally while potentially lowering its borrowing costs.

Source: https://economictimes.indiatimes.com/news/company/corporate-trends/tata-group-makes-compliance-to-esg-standards-top-priority/, March, 2021

Check Your Progress - 1

Indicate your choice of the answer from the choices given by putting a ✓ mark.

1. Which of the following is **not** a major sustainability constraint?
   a. Materials
   b. Energy
   c. Money
   d. Water
2. Jain Irrigation Systems championed which resource?
   a. Energy
   b. Water
   c. Materials
   d. Food

3. Which country is the biggest polluter in the world?
   a. USA
   b. China
   c. Japan
   d. India
4. Florida Ice & Farm, Costa Rica focused on
   a. Total Return on Resources
   b. Water only
   c. Energy only
   d. Food only

33.6 Sustainability and Operations Planning

Over the last two decades the organizations, whether in service industry, manufacturing sector or non-profit organization have experienced globalization and increasing competitions in the market. Due to such evolution's management has received attention towards the sustainability component their planning process. In the operations planning managers plays and vital role in identification and effective progress implementation towards sustainability in the operation. Therefore, integration of sustainability has become critically important that operations management planning. In addition to these, the integration of sustainable concept in the business plan may help in identification and development of sustainable strategies (tactical and strategical) to achieve the goal of the organizations.

Sustainability objectives identified as exemplified above need to be embedded into the operational plans. As every process in every activity of operations will have sustainability implications, operational plans should be realistic with a focus on realization. They should be SMART (Specific, Measurable, Achievable, Repeatable and Tangible). The plans should have provision for continuous monitoring, periodic reviews and necessary mid-course correction. The integrated operational plans should be aligned with the business and corporate plans so as to ensure top management commitment and support. . One of the greatest benefits of such integrations in the operations planning process is that it provides a structural thinking process to improve the intuition for all the complications in the operational process that can be envisioned.

ABB, Zurich based MNC is a global leader in power and automation technologies. The company employs 150,000 people and operates in approximately 100 countries. ABB's sustainability strategy has been designed around the following objectives as shown in Exhibit 33.3.

Exhibit 33.3: ABB's Sustainability Strategy

- **Improve ABB's Environmental Performance through resource efficiency**
  a. Energy All sites to reduce use of energy by 2.5% annually
  b. Water Action plans for improved risk management and performance at facilities in water stressed regions
  c. Travel Develop action plans to reduce the environmental impact of business air travel
- **Provide a healthy, safe, secure and responsible workplace**
  a. Maintain and improve crisis management, security and human rights capability through training and exercises.
  b. Implement improvement programs through Group and Country consolidated Health Safety and Environment (HSE) plans, training and BU-specific activities.
- **Drive sustainability performance in the supply chain**
  a. Improve sustainability performance in the supply chain through the Supplier Sustainability Development Program.

Source: ABB's website

Bellway, a major UK residential property developer defined its sustainability objectives as

- Concentrating on the key areas that give rise to significant sustainability effects where Bellway has the ability to control or influence these for the better.
- Directly aligning sustainability targets to core business objectives.

The central tenets of this policy and objectives are:

Responsibility: To both limit damage and to enhance the environment, managers are given the responsibility of integrating environmental best practices into everyday business processes.

Environment: Aim to minimize harmful effects upon the environment and where possible use sustainable resources to seek environmental improvements.

Stewardship: Conduct business to ensure that developments realise commercial returns in an environmentally responsible and sustainable manner.

Performance: Meet, as a minimum, with legislation and associated codes and, where possible, aim to exceed these performance targets.

Operational plans essentially incorporate the goals, objectives and targets in measurable terms**.** They will also be outlining the infrastructure and other

resources required to achieve the set targets**.** They also need to spell out the necessary competence and skills required among the workforce to ensure their cooperation in achieving the desired goals.

33.7 Sustainability and Supply Chain Management

Integration of sustainability in to supply chain management has recognized as a key element of business responsibility. Ssustainable supply chain management is defined as the managing the information and materials flow with the cooperation among the all stockholders and companies in the supply chain by considering the dimension of sustainable development dimensions (economic, environmental and social) (Seuring et al., 2008). With the help of such integration, it is expected that competitiveness would be sustained by satisfying the customer needs and related sustainable criteria.

The primary reasons that companies adopting supply chain sustainability in their practice is to ensure compliance the rules and regulations to obey the international principles for sustainable business.

Fifty to sixty per cent of the world's current CO2 emissions appear in the supply chains of just 500 global corporations. Covid pandemic reduced the intensity due to reduced energy consumption and transportation during 2020. In India alone, the CO_2 emissions reduced by 7% during 2020. However, Internal Energy Agency (IEA) expects the emissions to raise again once the economic activity picks up with industrial activity. So de-carbonizing these supply chains could make a huge impact. Exhibit 33.4 shows the framework for Green Supply Chains

Exhibit 33.4: Framework for Green Supply chain

<table>
<tr><td rowspan="2">Successful Green Supply Chain Implementation</td><td colspan="4">Environmental Compliance</td></tr>
<tr><td colspan="4">Sustainable Supply Chain Efficiencies</td></tr>
<tr><td>Dimensions of Green Supply Chain</td><td>Operational Alignment</td><td>Collaboration with Business Partner</td><td>Capabilities</td><td>Measurement</td></tr>
<tr><td rowspan="3">Organizational Foundation for Green Supply Chain</td><td colspan="4">Leadership</td></tr>
<tr><td colspan="4">Business context</td></tr>
<tr><td colspan="4">Program Management</td></tr>
</table>

33.7.1 Carbon Efficiency in Supply Chains

According to the Anny Huang et al., (2009) More than three quarters of the greenhouse gas (GHG) emissions related with several industry sectors come from their supply chains. For this reason, supply chain managers emphasis towards the reduction in carbon emission in the business community to improve the effective energy utilization and consumptions associated with the service and goods delivery process. In the modern and complex supply chain the delivery of a product to the customers engages multiple collaborator and partners. It is

therefore very important to address the carbon efficiency problem from a supply chain perspective. Over the past few years, the managers have incorporated green practice in their operations to reduce carbon emissions.

By focusing on carbon efficiency in supply chain management, companies are harvesting competitive advantage.

Marks & Spencer, in pursuit of achieving carbon neutrality in their supply chains, started promoting eco-factories.

- They combine energy saving devices, renewable energy, waste reduction processes and a healthy working environment for the factory workers.
- Their carbon neutral products enhanced the brand image of the company.
- The initiative demonstrated 'how to influence carbon neutral elements through supply chain and design decisions, incorporate them into product and investment portfolio decisions and drive significant value to the companies and their customers'
- Created a competitive differentiator and first mover advantage.

British Telecom introduced a climate change procurement standard for all its suppliers, encouraging them to use energy efficiently and reduce carbon all along the supply chain- production, delivery use and disposal of products and services. It has organized a number of workshops for the suppliers to help in drafting carbon neutral policies and share best practices.

Supply chain carbon is a key area to enhance efficiency and reputation and meet compliance. Companies which are able to fully understand emissions from a total supply chain view to measure, manage and reduce them substantially gain competitive advantage.

- 93% of multinationals are addressing their own carbon emissions in supply chain management in order to exploit reputational and efficiency gains.
- Many companies started addressing indirect emissions called 'scope 3 emissions' contributed by the suppliers and customers also, in their supply chain planning as they contribute a lion's share (60 to 70% of total emissions).
- Half of the global companies are set to select their suppliers based upon carbon performance and 66% are willing to pay a premium to pay for low emission products.

In automobiles, fuel consumption is an important consideration, but the mining of materials for construction is also a massive part of the vehicle's material and carbon footprint. Toyota has reduced overall emissions by about 20–25 per cent by driving up the fuel efficiency of its vehicles, largely due to lighter vehicles – so the sourcing of these materials has been crucial. Ford is driving down carbon through the supply chain by redesigning the body parts with lighter materials.

33.7.2 Kyoto Protocol:

Kyoto Protocol (KP) became the most widely accepted climate change framework across the globe encouraging businesses to redefine operation strategies. KP addresses two issues:

i. Binding emissions reduction commitments

ii. Flexible market mechanisms

KP countries have to meet assigned targets mostly through domestic action and reduce their emissions onshore. But they can meet part of their targets through the following three flexibility or "market-based mechanisms" that ideally encourage GHG reductions.

I. International Emissions Trading (IET)

II. Clean Development Mechanism (CDM) and

III. Joint Implementation (JI).

At the time of the original Kyoto targets, studies suggested that the flexibility mechanisms could reduce the overall (aggregate) cost of meeting the targets.

Exhibit 33.5 provides a brief on Kyoto Protocol

Exhibit 33.5: Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities." The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. The detailed rules for the implementation of the Protocol were adopted at COP 7 (Conference of Parties of the participating countries) in Marrakesh, Morocco, in 2001, and are referred to as the "Marrakesh Accords." Its first commitment period started in 2008 and ended in 2012. In Doha, Qatar, on 8 December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes new commitments and a revised list of greenhouse gases. After a series of conferences mired in disagreements, delegates at the COP21, held in Paris, France, in 2015, signed a global but nonbinding agreement to limit the increase of the world’s average temperature to no more than 2 °C (3.6 °F) above preindustrial levels while at the same time striving to keep this increase to 1.5 °C (2.7 °F) above preindustrial levels.

Contd….

The landmark accord, signed by all 196 signatories of the UNFCCC, effectively replaced the Kyoto Protocol. It also mandated a progress review every five years and the development of a fund containing $100 billion by 2020—which would be replenished annually—to help developing countries adopt non-greenhouse-gas-producing technologies.

Source: UNFCCC

33.8 Sustainability and Resource Management

Boston Consulting Group, in collaboration with the World Economic Forum after identifying five sustainability champions across the world, identified seven principles of resource management essential for creating sustainable competitive advantage. They are:

Principle 1: Monetize Resource Management

Principle 2: Embed Resource Management

Principle 3: Measure, Measure, Measure

Principle 4: Look Widely at Resource Management

Principle 5: Be Innovative with the Business Model

Principle 6: Shape the Business Ecosystem

Principle 7: Constantly Explore and Improve

According to the BCG study, businesses are affected by six resource constraints, namely:

Raw Material, Energy, Water, Food, Air (Climate Change and Pollution) and Waste. These constraints lead to bottlenecks in operations, affecting competitiveness, performance and profitability. Population growth and economic development have severely strained the natural resources and ecosystems globally. Consequently,

- Available supplies will decrease for four key factors of production: Raw material, energy, water and food.
- Prices increase effecting competitiveness and profitability
- There may be protests in the society over the use of these resources due to fears of pollution and threat to environment.

As traditional ways of production and distribution are no longer competitive, companies started competing on the basis of more efficient use of resources and eco-friendly operations. Total return on resources has become the focus of supply chain and resource management. By keeping eco-friendly resource management at the core of business strategy, operations and supply chain management, the companies can convert constraints into opportunities as exemplified by the sustainability champions. The proven sustainability practices of companies

exemplified above lead us to identifying some common sustainability objectives. They depend upon the nature of operations, supply chain dynamics and organizational priorities. They are essentially focused on the resource constraints and community related issues, alignment with sustainability strategy and its effective implementation.

33.9 Sustainability and Operations Stakeholders

Sustainability management, by virtue of its all pervading nature, can follow neither a top-down nor a bottom-up approach. It is a holistic philosophy and needs to be a way of life for every stakeholder.

- Customers are the reason for the organizations to exist. They evaluate the sustainability performance of the organization in terms of social responsibility, pollution and community health. As users of the products and services, customers also add indirectly to emissions (as high as 40%). They need to be educated and trained in handling emissions and ensuring that the products at the end of their active life are disposed off in a scientific and eco-friendly way.
- Suppliers constitute a crucial link the in the organization as its sustainability performance depends upon the suppliers' cooperation and shared responsibility. Suppliers and subcontractors add significantly to emissions due to the materials, processes and the equipment they use. European companies are qualifying suppliers based on their sustainability performance. Suppliers are supported and promoted as partners so as to participate actively in emission reduction projects like exploring new materials, simplifying processes etc.
- Employees need to accept and demonstrate their commitment to sustainability as a work ethic. Organization's ability to attract talent depends upon its sustainability performance index. Employees are the prime movers of work in an organization throughout the life cycle of a product and can contribute significantly towards innovation across the entire supply chain.
- Another important group of stakeholders concerning sustainability are the regulatory and certification agencies like the Ministry of Environment and Forests, Pollution Control Boards etc. The requirements are revised periodically and every organization should continuously monitor the changes in these areas and alert all concerned accordingly.
- Top management and the board of directors play an important role as their commitment and active participation are inevitable for the success of sustainability management programmes. Provision of resources and ensuring compliance to mandatory requirements is the responsibility of top management.

- Non Governmental Organizations (NGOs) play a very important role in sustainability programs as the activities of an organization affect communities. For example, establishing a power plant results in acquisition of land, compensation to the displaced families, provision of livelihood to them, developing infrastructure and the drain on the natural resources generally constitute a bone of contention between the organization and the communities affected. They need to be resolved as a part of project approval to minimise time and cost overruns.

All other stakeholders have their respective roles but a positive approach lies in all stakeholders working in a partnership mode to define and achieve goals and objectives for sustainability. It is now adequately established that sustainability is tending to be a major competitive advantage.

33.10 Sustainability and Innovation

Global competition is limiting the effectiveness of conventional wisdom and traditional approaches to manage sustainability. The focus on organizational resources and processes call for actionable innovation to carve out more effective sustainability strategies. Surprisingly such innovations are coming more from emerging nations and are being emulated by MNCs of the developed world.

Boston Consulting Group, in collaboration with the World Economic Forum identified a group of emergent-market-based companies as sustainability champions. *All these champions focused on Total Return on Resources* and their success stems from three primary practices:

i. They turn constraints into opportunities through innovation- they have a pragmatic approach adapting and tailoring existing technologies to their local business environment.

ii. Embed sustainability in their company culture- they believe that only with the commitment of the entire organization, they can achieve sustainability and profitable growth.

iii. Actively shape their business environment on the foundations of sustainability- they partner with all stakeholders and educate them to evolve share goals. They set industry/national/global standards and influence policies at macro level and practices at micro level.

33.11 Framework for Sustainability Strategy

The strategy framework follows a familiar ‘process approach’

- ***Design*** focuses on the design of sustainability strategy by considering the basic building blocks of strategy in such a way that it is easy to implement and can enlist the cooperation of all stakeholders.

- ***Deploy***ment is concerned with effective implementation. It should be deployed through a top-down approach from the top management with a 'sustainability champion' as a facilitator. But it is the effectiveness of role clarity, responsibility; authority and accountability at the level of individual employees which decides the effectiveness of implementation.
- ***Decentraliz***ation ensures embedding sustainability practices throughout the value chain.
- ***Demonstration*** of sustainability performance through measurement, analysis and identification of opportunities for improvement is essential as that which cannot be measured cannot be managed. The measures should be Specific, Measurable, Actionable, Relevant and Time-bound.
- ***Develop***ment deals with implementing the improvement strategies through a Plan, Do, Check and Act (PDCA) approach.

Check Your Progress - 2

Indicate your choice of the answer from the options given by putting a ✓ mark.

5. Ford focused on which sustainability initiatives?
   a. Developing products for all fuels
   b. Conservation of water
   c. a and b
   d. None
6. Sustainability strategy focuses on
   a. Environment
   b. Society
   c. The Triple Bottom Line
   d. Profits
7. Kyoto Protocol is concerned with
   a. CO_2 emissions
   b. Methane
   c. Water vapour
   d. All Green House Gases
8. Successful sustainability strategy focuses on
   a. Operations Strategy
   b. Supply chain
   c. Risk
   d. Value chain

33.12 Summary

Sustainability management has become the most serious concern and focus of all enlightened organizations across the business world. There is an unambiguous understanding that industrialization and its accelerated growth is primarily responsible for the emission of Green House Gases (GHGs) and the depletion of precious resources, forcing the entire world to the brink of disaster. At the same time, there is an appreciation and commitment for taking necessary and immediate initiatives to address climate change concerns and ensure sustainable growth and development across the world we live in. Various studies unanimously established that formulating a sustainability strategy is the starting point for such endeavours. The unit provided salient aspects of sustainability and the impacts and implications thereof. It has exemplified how organizations are aggressively pursuing sustainability objectives and crafting appropriate strategies.

33.13 Glossary

Sustainability is the capacity to endure. For humans, sustainability is the potential for long-term maintenance of well being, which has ecological, economic, political and cultural dimensions. Sustainability requires the reconciliation of environmental, social equity and economic demands.

Climate change is a change in the climate over long periods of time, regardless of cause

Triple bottom line organizational performance in economic, social and environment areas

Kyoto Protocol signed by all member countries of the world for reduction of emission levels

GHGs Green House Gases

IET International Emission Trading

CDM Clean Development Mechanism

JI Joint Implementation

MDGs Millennium Development Goals established by the United Nations

33.14 Self-Assessment Exercises

1. Explain what is sustainability in your own words.
2. Do you feel that every organization must have a sustainability strategy? Justify.
3. Give a list of major resource constraints with examples.
4. What is Kyoto Protocol and its major resolutions and mechanisms?

5. What are Millennium Development Goals and locate the importance of environmental sustainability and its targets
6. Why there was a public outcry over PersiCo India's operations and what sustainability initiatives were taken by the company?

33.15 Suggested Readings/Reference Material

1. UNFCCC United Nations Framework Convention on Climate change, 2021
2. Global Compact, https://www.unglobalcompact.org/, 2021
3. Getting Globalization Right, Sustainability and Inclusive Growth in the Post Brexit Age, Editors: Paganetto, Luigi (Ed.), 2018
4. Innovation for Sustainability, Business Transformations Towards a Better World, Editors: Bocken, N., Ritala, P., Albareda, L., Verburg, R. (Eds.), Palgrave Macmillan, 2019
5. Grant DB, Sustainable Logistics and Supply Chain Management Koganpage, http://dspace.vnbrims.org › xmlui › bitstream › handlePDF, 2020

33.16 Answers to Check Your Progress Questions

1. **(c) Money**. It is not a resource in the context of sustainability whereas all others are.
2. **(b) Water**
3. **(b) China** as per surveys, China overtook the US as the biggest polluter in the world.
4. **(a) Total Return on Resources**. It has championed water, wastage and CO_2
5. **(c) and (b**) Ford focused on fuels and water
6. **(c)** Sustainability focuses on TBL- economic, social and environmental performance
7. **(d) all Green House Gases**. a, b and c are some of the GHGs
8. **(d) Entire value chain** covering all activities of an organization

Project & Operations Management

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