MODULE 5

22ETC15D

A Problem can be defined as an apparent gap between the existing state and the desired state of affairs, or simply a deviation from a norm, standard, or status quo. During Professional life, we face a lot of problems related to Products and services. This is where the problem-solving skill becomes essential. Through a detailed comprehensive approach, one can effectively adopt vital problem-solving skills.

Problem Solving: Challenges

An example of problem-solving in products and services may be telecommunication and banking services. In both cases Manufacture/Service Provider always find it challenging to:

- Enhance the dimensions of quality of their products/services
- Reduce the cost of the products/services
- Enhance customer satisfaction by reducing the manufacturing lead time.

To excel in the business as a Manufacturer or a Service provider an engineer must have a thorough understanding and application of Problem-solving skills.

Problem Solving Categories

The discussion on Problem solving skills is so significant that as per Albert Einstein "If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions." Two General Categories of Problem Solving include

- Analytical Problem Solving
- Creative Problem Solving

Problem Solving Steps and Methods

The comprehensive steps and methods that one should adopt while solving any problem include:

- Defining the Problem
- Generating Alternatives
- Choosing the best alternative
- Applying the best alternative
- Accepting Feedback

Engineering Design:

Engineering design is the creative process of identifying needs and then devising a solution to fill those needs. This solution may be a product, a technique, a structure, a project, a method, or many other things depending on the problem. The general procedure for completing a good engineering design can be called the Engineering Method of Creative Problem Solving. Problem solving is the process of determining the best possible action to take in a given situation. The nature of problems that engineers must solve varies between and among the various branches of engineering. Because of the diversity of problems there is no universal list of procedures that will fit every problem. Not every engineer uses the same steps in their design process, following list, which includes most of the steps of the design method that engineers use. In order to address lower grade levels, an alternate list has been developed and is included in the Teacher Notes section of this module.

1. Identifying the problem.
2. Gathering needed information.
3. Searching for creative solutions.

4. Overcoming obstacles to creative thinking.

5. Moving from ideas to preliminary designs (including modeling).

6. Evaluating and selecting a preferred solution.

7. Preparing reports, plans, and specifications. (Project Planning)

8. Implementing the design. (Project Implementation)

It is important to keep in mind as the steps are briefly described, that in many instances, one or more steps may not appear.

IDENTIFYING THE PROBLEM Evaluating the needs or identifying the problem is a very important step in finding a solution. An improper definition of the problem will cause the engineer to waste time or arrive at an incorrect solution. It is important that the stated needs be real needs. A great design may be worthless if it duplicates other known designs or doesn't benefit many people.

Life guidelines for sustainability:

Sustainable living is based on four main pillars namely minimizing waste, limiting the use of Earth's natural resources, the wise use of the environment, and ensuring quality working/living environments. The following are the guiding principles that can be used as an initiative to make sustainable and stable living a reality.

Principles of Sustainable Living

1. Effective land use and wildlife protection

This principle requires people to realize the need for effective land use and wildlife protection. The aim of the principle is to aid in creating new habitats and restoring biodiversity through effective land use and incorporating the practices in our surrounding environments.

As the custodians of the planet's natural environment, wise actions with regards to proper land use and wildlife protection are vital in embracing sustainable living.

2. Sustainable water usage

The requirement for the efficient use of water in farms, construction, and manufacturing is part of sustainable living principles. The principle emphasizes on the need to advance good water utilization practices by designing water management systems that can deal with issues such as flooding, water wastage, and protection of water sources from pollution or destruction.

3. Supporting local and organic foods

Sustainable farming is one of the vital principles of sustainable living. The principal insists on humane and sustainable farming by encouraging the availability of healthy, local, organic, low impact, and seasonal diets.

Food wastage is also highly discouraged. For this reason, people need to support local farming and organically grown products by buying local and eating organic foodstuffs.

4. The use of sustainable materials

Sustainable materials refer to healthy, efficient, and durable products. Examples include materials that are locally sourced, manufactured from waste or renewable resources, and those with low embodied energy.

5. The use of sustainable transport

Promoting the use of low and zero-carbon transport mechanisms is one of the overriding principles of sustainable living. It encompasses the need to reduce travel and accepting green transport services such as electric trains and cars and walking or cycling as an alternative to driving high emission vehicles.

6. Zero waste and zero carbon

According to this sustainable living principle, every little thing done should focus on reducing the waste to the landfills. Only buying and consuming the needed staff is essential.

Priority should be given on quality and not quantity to achieve this goal. People also need to find the easiest ways of using efficient and renewable technology.

7. Creating own healthy environment

This involves indulging in active and meaningful life activities to promote good health and well being. Fun, healthy, and less stressful living can be achieved by fun activities such as biking, hiking, walking, sailing, and skiing.

8. Realize local cultural values

Culture has easy and effective ways of preserving and enhancing the local environment. For instance, local cultures stress conservation, minimizing wastage, and the use of local materials and organic products.

Measuring Sustainability:

From an environmental standpoint, sustainability measurement is a process and framework for measuring and attributing greenhouse gas (GHG), climate, and environmental impacts and outcomes to an organization's direct actions and business operations. For example, a clothing & apparel company will measure sustainability metrics around:

1. The material impacts of its supply chain, suppliers, and labor practices - including water, waste, and emissions

2. How its raw materials and products travel from manufacturing to store (or e-commerce factility) to customers (and post-use destinations like recycling, upcycling, or consigment stores) to increase overall sustainabile circularity

3. Individual and community well-being from its operations — which could include indicators like workplace safety, health, and wellness for employees and garment workers, as well as broader trends in local rates of poverty, homelessness, and economic development based on its organizational footprint.

As we can already see in this example, there's a relationship between:

- An organization's operations or "materiality" (working with suppliers, transporting materials, making clothes, selling them to customers, handling post-use product)
- Sustainability measurement (metric tons of CO_2 generated, liters of H_2O consumed, etc.); and
- Positive or negative climate, environmental, and social externalities

Sustainability measurement tracks and understands these relationships through data.

In this sense, sustainability measurement is a process that encompasses several components:

- Mission statement and/or theory of change
- Materiality assessment
- Sustainability measurement framework or methodology (selected sustainability metrics, KPIs + indicators)
- Data strategy
- Data capacity (IT systems, collection and surveying capabilities)
- Sustainability analytics, data science, carbon accounting, and measurement
- Sustainability reporting, learning, and continuous improvement

If your business manufacturers or sells physical goods and products, your sustainability measurement efforts should also consider your suppliers and the sustainability of their operations.

Sustainable Procurement Requirements

Sustainable procurement requirements are closely tied to the company's culture and policies. But what are the requirements to attain sustainable procurement?

In this article, we will talk about what sustainable procurement requirements are. We will also examine how to measure sustainable performance and the best practices in sustainable procurement.

After reading this article, you will have an enhanced knowledge of the requirements in sustainable procurement. Thus, it will allow you to align the requirements with your business goals and objectives.

What is sustainability in Procurement?

Sustainability in procurement is the integration of corporate social responsibility (CSR) principles into your company's procurement processes and decisions while ensuring to meet the requirements of the stakeholders.

It integrates requirements, specifications, and criteria that are compatible with the protection of the environment and society.

Commitment to sustainability in procurement ensures that the company's core values are throughout the life cycle of its products or services.

Sustainable procurement helps businesses by providing opportunities for brand differentiation as it encourages businesses to develop more sustainable and innovative products.

Why Invest in a Sustainable Procurement?

1. Cost reduction

Businesses of all sizes need to save money and reduce costs as much as possible. Saving money enables them to invest more which allows them to scale and earn higher profits.

Sustainability in procurement helps reduce the total cost of ownership through the reduction of **energy** costs, minimized consumption, over-specification, and environmental and social compliance cost.

2. Risk reduction

Risk is linked with all the suppliers of an organization it chooses to partner with. But, relationships with your suppliers who engage in bad practices may have a financial impact on brand value.

Also, there is a risk associated with the economic cost of sustainable procurement disruptions due to non-compliance with industry environmental regulations.

Investing in sustainable procurement practices ensures that you are working with suppliers who have the same objectives and comply with environmental regulations.

3. Revenue growth

When we talk about sustainability in procurement, it focuses on giving back to the environment and society.

Sustainable procurement brings additional revenue through the innovation of eco-friendly products and services, price increases for premium products and services, and income from recycling programs.

According to the World Economic Forum, implementing sustainable procurement practices in the processes of a business provides a 15% to 30% increase in brand equity which creates revenue growth.

Requirements For Sustainable Procurement

Sustainable procurement requirements are strategic visions tied to a company's culture and policies that affect the decision-making level. Importantly, we know that sustainable procurement must be a strategic initiative and not just a reporting document.

Below are the following requirements of a sustainable procurement:

- Understanding local, regional, and global actions
- Support from culture, strategy, mission, and people
- Corporate social responsibility leadership
- Implementation of operational and strategic decision-making
- Measuring the performance of suppliers
- A well-thought risk management approach
- Transparent communication

- Making sustainability the opportunity for innovation

Measuring Sustainable Performance

The requirements for sustainable procurement are continuously changing. Due to this, key performance indicators must be developed as well. Companies must assess the suppliers' commitment and performance.

There are many factors to consider in knowing that you have a successful sustainable performance tracking. This includes industry knowledge, reliable data, and analytical competence.

Additionally, procurement practices must have the ability to communicate performance and enable change in the organization.

The company must identify which areas of spend have the highest ESG impact and opportunities for improvement. Additionally, it can focus its primary efforts on key suppliers and risk categories where it can make the most impact.

Furthermore, the best way to know the continued relevance of sustainability is through reporting. Using formal standards keeps your reporting transparent and organized.

Best Practices in Sustainable Procurement

Many businesses are implementing CSR policies as well as established requirements to fulfill their commitments. These policies are utilized internally to raise awareness among employees and externally with suppliers and other partners.

Here are some of the best practices for ensuring a sustainable procurement:

- Define the company's corporate social responsibility criteria
- Initiate the creation of procurement requirements
- Select suppliers with the same corporate social responsibility
- Avoid putting unnecessary pressure on suppliers that might impact your workers
- Think about the effects of the prices that you set
- Give reasonable time for suppliers to address areas of non-compliance and provide support in order to help them improve
- Help your major suppliers to share good practices by creating benchmarking groups
- Implement a life cycle and overall financial basis into procurement processes.
- Paying attention to product labels
- Raise awareness among other teams in your company

Blending sustainable procurement, corporate social responsibility, and compliance is entirely within reach and can lead to substantial gains in an organization.

Guide to Sustainable Product Design: A Sustainability Roadmap for Manufacturers:

Manufacturers are waking up to a new reality: sustainability has vaulted to the forefront of their business initiatives. In fact, a recent report (CIMData eBook) demonstrates that consumers not only prefer sustainable products but are willing to pay a significant markup to purchase them. As a result, companies are facing social and competitive pressure to meet the market demand. Organizations who may have previously resisted the perceived cost of sustainability are now scrutinizing the environmental impact of their products and processes. This includes examining their business and finding new ways to make their products and operations more sustainable.

What does sustainability mean in product design?

When looking at a product's lifecycle, we can see how a pattern of sustainability forms. Following a circular economy model, products should be designed to be reused and recycled. Every product goes through the product design, material sourcing, manufacturing, operation and service, and end of life stages. Astute manufacturers will recognize the impact that initial design decisions have on each stage that follows.

During the engineering and design phase, a sustainably informed team follows the circular economic model. As they map out ideas and create prototypes, there's ample room for sustainable adaptations, from reducing emissions to making consumables recyclable and more efficient. By addressing how efficiently a product progresses through its lifecycle, designers and engineers are dictating how a product will impact the environment.

Why is sustainable product design important?

The decisions made during the design and engineering stage are critical to determining whether a product will be sustainably resourced, built, distributed, used, serviced, and disposed of. Much of a product's CO2 footprint is determined during the design phase. Considering that, product design's role should be front and center in any manufacturer's sustainability strategy. With expanding global regulations and increased interest from both investors and consumers, sustainability has moved to the forefront of business conversations, and practicing sustainability has become imperative for many companies to stay competitive.

Four Ways to Execute Sustainable Product Design

Having trouble identifying where to start? These four principles help illustrate the steps that can be taken in the design stage to accelerate your sustainable business goals.

Source sustainably produced or recycled materials for environmental good

Sustainable materials refer to materials that don't negatively impact the environment during production, use, or disposal. When designing a product, think: where am I getting these materials from? Perhaps the materials are sourced from a company with their own sustainability initiatives or from a company that strictly uses recycled materials. Even sourcing local materials helps! By utilizing local materials, organizations end up cutting down on transportation costs and as a result, product lifecycle CO2 emissions.

Design products for reuse and recycling

By following a product through its lifecycle, we see how the product forms—with raw materials, design sketches, and prototypes –and how it ends—in a landfill, reused, or recycled. Looking through a sustainable framework, it's important to consider the ways in which we can shift a product's end of life.

Consider the type of materials included in your product and start asking questions. Are these materials able to be recycled or reused? Materials like steel, aluminum, PET plastic, and HDPE plastic, for example, make good contenders for easy recyclability. Is your product made up of multiple types of materials or one material? A product made up of one standard material is easier to recycle or reuse when compared to a product made from multiple or blended materials. It's also cost effective to reuse scrap and waste. Is your product built to be easily taken apart? If your product is made from a wide array of materials, it should be designed so that it can be easily disassembled and the materials sorted, recycled, and reused.

Track sustainability efforts with Product Lifecycle Management tools

The most important part of managing a product's lifecycle is managing all the information that comes with it. With any product, you want to be able to track usage data and feedback when creating the next generation of products. Product lifecycle management (PLM) solutions are incredibly helpful when it comes to organizing, sharing, and drawing meaningful conclusions out of complex data. Similarly, PLM can help with managing sustainability data. PLM can help with tracking metrics like CO2 emissions, average time until product retirement, and how sustainable the materials/suppliers are. By enabling the seamless sharing of information and building a digital thread across an enterprise, PLM helps designers and engineers build a better, more sustainable product for generations to come.

Build premium products that last longer

The longer a product lasts, the longer it stays out of a landfill. Therefore, designing for durability significantly extends a product's lifecycle. Product durability, in turn, lessens the need for replacements, repairs, or waste. The result is a higher-value product and brand equity.

Case studies:

1. UPS ORION: Improve transportation efficiency

Transportation activities accounted for almost 30% of US greenhouse gas GHG) emissions.. For a company like UPS, which distributes goods across regions, transportation activities make up the bulk of GHG emissions. As a result, enhancing transportation efficiency is crucial foorganizations like UPS to remain sustainable. As a solution, UPS adopted an AI system called ORION which is a routeoptimizer that aims to minimize the number of turns during the delivery. Initiation began in 2012 and up today UPS has been working on developing it. ORION saves UPS 10 million gallons of fuel per year, which means that in addition to the financial benefits, it decreases UPS's carbon footprint by 100,000 metric tonnes per year, or the equivalent to removing more than 20,000 cars from the roads. There are public cloud route optimizer systems which businesses can deploy without building hardware. These tools help firms to use their software as a service by paying a subscription cost. To learn more about ensuring supply chain sustainability with technology you can read our Top 5 Technologies Improving Supply Chain Sustainability article.

2. IKEA IWAY: Make business with ESG oriented corporations

Supplier code of conducts are established guidelines that require other businesses to demonstrate their operations' social and environmental impacts. The objective is to reward companies that meet strong ESG standards. It is also one of the positive governance indications for organizations, as we highlighted in our ESG metrics article. IWAY is the supplier code of conduct of IKEA forcing suppliers to meet certain environmental and humanitarian qualities to work with. The initiative has been

in place for over 20 years, and over that time, IKEA has refined it based on their prior experiences. IWAY six is the most recent version of IKEA's supplier code of conduct, which evaluates:

- Core worker rights.
- Safety of the working place.
- Life-work balance of employees.
- Water and waste management of potential suppliers.
- Prevention of child labour.

3. General Electric digital wind farm: Produce green energy efficiently

Wind turbine productivity varies greatly depending on the design, weather conditions, and geography of the location it is deployed. Using IoT and digital twins to collect data on each wind turbine and simulate possible modifications such as adjusting the direction of the wind turbine can assist corporations in locating their wind turbines in a wind farm more effectively

Furthermore, the performance of wind turbines declines with time and may require maintenance; employing sensors and digital twins can assist in determining the appropriate time for repair.

The General Electric's (GE) digital wind farms are based on these two elements. GE optimized over 15,000 turbines using sensors and digital twins technologies. Each wind farm can create up to 10% more green energy as a result of the digital wind farm initiative, which helps to enhance our worldwide green energy mix.

4. Swire Properties green building: Minimize GHG emissions

Swire Properties is a construction company that operates in China and especially in the Hong Kong area. In 2018, the company built One Taikoo Place which is a green building that aims to reduce GHG emissions of Swire Properties in order to align with sustainability goals of the company's

stakeholders. Swire properties use 3D modeling techniques to optimize the building'senergy efficiency. Reduce electricity consumption by using smart lighting systems with sunshine and motion sensors. A biodiesel generation system has been installed in the building, which converts waste food oil into biodiesel. Swire Properties additionally uses low carbon embedded materials and a lot

of recycled materials in their construction. Swire Properties was able to cut GHG emissions intensity throughout their portfolio by nearly 20% because of the usage of digital technologies and low

carbon integrated materials.

5. H&M Let's Close the Gap: Deposit scheme for gathering raw material

In 2021, we consumed 1.7 times more resources than Earth generates annually because our economic outlook is based on production, use and disposal. Such an economy is not sustainable and that is the reason why the concept of circular economy (CE) is trending nowadays.

The most basic principles of CE is to use trash as a raw material for production through innovation, recycling, or repairing and reusing existing products.

H&M's "Let's Close the Gap" project began in 2013 as a CE best practice that collects and categorizes discarded clothing from customers. If the garment is in decent condition, they will restore it and find a new owner for it. If a garment reaches the end of its useful life, H&M will recycle it and reuse the material in new goods.

Customers who bring in their old clothes are rewarded with tokens that can be used to get a discount at H&M shops. Incentivizing customers creates a complete CE loop. In 2019, 57% of H&M's raw materials were sustainable, according to Forbes. By 2030, the company hopes to improve it 100 percent.

6. Gusto: Hiring female engineers to close gender inequality gap

Gender inequality remains a major social issue despite all the improvements. There are two common types of gender disparity in the workplace. The first is gender pay disparity, which occurs when companies pay male employees more and provide better working conditions than female employees in the same position. The second is occupational segregation, in which women are hired for non-technical jobs while men hold the majority of leadership roles. This was the situation at software firm Gusto, where female engineers made up slightly more than 5% of the engineering team at the beginning of 2015. Julia Lee, one of Gusto's first female engineers, claimed that other engineers did not accept her ideas because she was a "female engineer." Gusto initiated an HR drive to reduce gender inequality by prioritizing the recruitment of female engineers, prohibiting female workers from scrolling, and deleting masculine job ads like "ninja rockstar coder." Gusto was able to improve its female engineer ratio to roughly 20% by the end of 2015 thanks to the campaign. The average ratio among software businesses' engineering teams was 12% in 2013, therefore this was a significant improvement in a short period of time.

7. HSBC: ESG concerned green finance

Finance companies can help speed up the transition to sustainable business practices by supporting initiatives run by responsible businesses. By the end of 2025, HSBC has committed to investing $100 billion in sustainability projects. HSBC already has funded sustainability projects that require more

than $50 billion in investment as of 2019, indicating that the corporation is on track to meet its objective.

HSBC created an ESG risk evaluation framework to assure funding for green projects in 2019. Since then, the framework has been improved. In 2021, HSBC's ESG practices were rewarded with an AA rating by MSCI. HSBC is also working toward a goal of using 100% renewable energy as their source of electricity by 2030. Company reduces its consumption of paper, and single used plastics for coffee and beverages. For more information about best ESG practices you can read our Top 6 ESG Reporting Best Practices article.

8. Signify light-as-a-Service: Enhance production stewardship

The product-service system (PSS) is a business model in which producers acquire a product over its lifetime and rent or lease it to the users. PSS ensures product stewardship since the product always becomes the asset of the company. It encourages producers to provide high-quality, repairable items in order to extend the product's useful life. As a result, it helps to close the circularity gap by ensuring better use of natural resources. Signify, a luminaire producer, adopts such a business strategy where it demands a subscription fee according to usage period of their lightning systems. PSS allows Signify claims that PSS allows them to produce 0 luminaire waste and drops maintenance costs around 60%.

9. Airbus additive manufacturing: Manufacture lighter planes with 3D printing

AIMultiple expects that additive manufacturing will disruptive for the airplane

manufacturing since:

● It speeds up the manufacturing of parts compared to traditional molding techniques.

● It is cheaper due to effective use of raw materials and time reduction of production.

● It enables the manufacturing of lighter parts by up to 45%, resulting in lighter planes that burn less fuel. According to Airbus, additive manufacturing technology can reduce an A320 plane's annual GHG emissions by around 465,000 metric tons, which is roughly the same as eliminating 100,000 automobiles from the road for a year. (An average car emits 4.6 tonnes of GHG per year).

To effectively use 3D printers Airbus partnered with Materialise, a Belgium-based technology company that specialize in additive manufacturing. For more information regarding improving corporate sustainability by digital transformation you can read our Top 4 Digital Technologies that Improve Corporate Sustainability article.

10. Tata Power: Solar plants on the roofs

Rooftops offer a lot of empty space that can be used to install solar panels. Such initiatives have been taken in various parts of the world. Tata Power does it in India and generates green electricity by using idle places of buildings. In 2021, Tata Power was able to spread their program throughout 90 Indian cities, producing 421 million watts of electricity, which is equivalent to nearly 40 thousand homes' yearly electricity use in the US. (The average annual power usage for a residential utility customer in the US was 10,715 kWh in