EUROPEAN INTERNATIONAL UNIVERSITY

Paris, France

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COVER PAGE AND DECLARATION

	Master of Business Administration (M.B.A.)
Specialisation:	Marketing and sales Management
Affiliated Center:	CEO Buisness school
Module Code & Module Title:	MGT550
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Student ID:	EIU2020052
Word Count:	3600
Date of Submission:	5/2/2023

I confirm that this assignment is my own work, is not copied from any other person's work (published/unpublished), and has not been previously submitted for assessment elsewhere.

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Requirement no. 1:

A. The recommendation should include more cost-effective production methods:

The following recommendations are based on my relevant experience, background, and understanding.

1. **Costs associated with Product Design:**

Since development accounts for 80% of product expenses, it is prudent to start here when attempting to reduce manufacturing costs. The concept/architecture phase decides sixty percent of the total value. The product architecture determines the product's definition, technology, team makeup, technology, part combinations, and off-the-shelf components.

During this phase, manufacturing, supply chain, vendors, quality, dependability, service, variety, configuration, customization, and derivative products are also determined. These decisions have the greatest impact on all efforts for reducing production costs. Focusing on the most effective cost-reduction initiatives may be a smart place to start. These consist of:

1- Purchasing off-the-shelf components is a significant factor in reducing part costs and material expenses.
2- Eliminating quality expenses when the return on investment does not justify the standard's worth.
3- Eliminating change orders by devoting additional time to the design phase
4- Specialize in vendor partnerships that will ultimately cut manufacturing costs by adding value.

2. **Rationalize the product line to concentrate on the most profitable items:**

Concentrate on the most profitable products The rationalization of the product line and all of its components is an often-overlooked opportunity to streamline operations and liberate key resources, resulting in increased productivity, profit, and cash flow. Product rationalization focuses on the most profitable items and eliminates or outsources low-profit products with high overhead requirements that are incompatible with manufacturing cost reduction tactics.

Experience with first-time efforts to rationalize a product line indicates that over sixty percent of a product line contributes less than ten percent to the overall profit. Successful rationalization projects have reduced total supply chain management expenses by as much as 50 percent and increased inventory turnover performance by as much as 100 percent among the best industry performers.

3. **Implement Lean Production/Manufacturing Principles:**

Lean manufacturing reduces production costs. Adopting lean manufacturing concepts can reduce manufacturing costs by increasing labor productivity, decreasing production throughput times, decreasing inventory, and reducing errors and scrap by as much as 50 percent. The main premise of lean production is to attempt to accomplish more with fewer resources, and the primary focus is on eliminating waste.

Any activity that does not provide value from the customer's perspective is defined as waste. According to research undertaken by the Lean Enterprise Research Centre (LERC), sixty percent of production operations in a typical industrial operation are waste — they provide no value to the customer whatsoever. The good news is that nearly every business has the opportunity to employ lean manufacturing practices to reduce manufacturing costs.

Understanding the forms of waste and how to eliminate them is a good place to start when implementing lean production. Waiting, transportation, inventory, motion, over-production, over-production, flaws, and wasted talent are all examples of waste.

4. **<u>Reduce overhead production expenses by utilizing make-to-order and mass-customized inventory:</u>**

Build-to-order and mass-customized inventories can reduce production costs. To reduce manufacturing overhead costs, it is important to provide conventional products that are manufactured to order without forecasts or inventory and to produce customized products through on-demand mass customization. In both approaches, items are manufactured upon receipt of a confirmed order.

The outcomes are astounding. Inventory Carrying Costs are removed (the conventional "rule of thumb" for goods carrying charge is 25% of the value of the inventory on hand), and procurement costs can be decreased with automatic, on-demand restocking. In principle, more responsiveness results in increased revenue. Although not a cost-cutting approach, the outcome is unquestionably favorable.

5. **<u>Standardize components to reduce manufacturing costs:</u>**

In Build-to-Order and Mass Customization, manufacturing cost reduction is obtained at the level of parts and raw materials when standardizing parts. Standardization supports the fundamental principle of build-to-order and mass customization, in which all components must be readily available at all sites of usage, hence eliminating the need to locate load or kit components.

Standardization decreases the number of component types and facilitates the insertion of components into an assembly. Ordering fewer types of components in greater quantities will cut component and material overhead costs. Additional benefits include reductions in floor space, overhead costs, setup, logistics, and supply chain management time. Tools, features, raw materials, and procedures are examples of further types of standardization that may have a cost impact.

B. Develop a plan to reduce the number of production defects:
The plan should incorporate the measures outlined below to minimize manufacturing defects:

1. Workers training and staff development, which involves determining if employee training includes educating and qualifying personnel on specific defects and quality issues related to their role.

2. Quality auditing, examining and qualifying suppliers, is a systematic assessment of a factory's quality management systems (QMS), typically compared to ISO 9001 standards and customer needs. A thorough analysis of a provider can provide important insight into the extent to which the supplier can meet customer requirements.

3. internal control Checking work instructions, workmanship standards, production equipment, environmental controls, cleanliness, and contamination control, as well as establishing acceptance criteria for production inputs, production, and process control, are inspection methods.

4. Develop and implement a high-quality Sampling plan to establish and manage production quality expectations. Creating a sample plan for product inspection will demonstrate the factory's ability to meet the relevant quality standard. A golden sample provides the opportunity to provide input to the assembly process and rectify any quality issues before production.

5. Establish quality tolerances for quality flaws on an internal control checklist to prevent quality defects Where By utilizing an internal control checklist, we can consolidate our needs into a single document that is both comprehensive and easy to reference. Generally, QC checklists for simple items run from 3 to 10 pages in length, however, checklists for complex products with comprehensive testing may be lengthier. Effective quality manuals contain pertinent information for production and inspection personnel, such as:
- Product specifications
- Client acceptance of quality faults
- Requirements for product inspection, including on-site testing, must be met to pass Packaging requirements, including shipping and retail packaging.

Production or quality control personnel at the most reputed factories should have authored the quality handbook for the products produced there. However, these employees frequently modify their quality manuals to apply to various customers, removing our specific quality issue tolerances.

6. Nonconforming product control, which includes checking procedures for marking, identification, evaluation, separation, disposal, and rework of non-conforming or defective products, as well as how we act and investigate to confirm implementation of the correct correction, corrective, and preventive actions.

7. Labeling, packaging, handling, and storage, including processes for confirming protection against product mix-ups, degradation, or contamination.

C. The use of 21st-century tools to create a greener process:

C.1. Use Circular Manufacturing to Save Significant Energy and Decrease Waste:

By developing a regenerative approach to fuel their facilities, manufacturing equipment, and organizations have become more sustainable. Circular manufacturing is also known as lean manufacturing and consists of:

- Reclaiming materials and reusing them
- Equipment rental as part of the sharing economy
- Using predictive maintenance to extend the lifetime value and durability of machinery and equipment.
- Switching to a renewable energy source that can supply the companies with electricity.

Circular production may be a green option with three benefits.

1. It complies with "green" regulations.
2. It benefits the environment.
3. It's what the most valuable consumers want Instead of obtaining their raw materials, green plants utilize the waste (water, energy, and other resources) created by other plants to meet their needs.

C.2. Implement Safety Measures Using Automation Instruments:

Cloud-based technology and the Internet of Things (IoT) will provide humans the flexibility to determine if automation tools, artificial intelligence, and robotics are the methods for businesses to go green.

The purpose of collaborative robots is to complete activities alongside people in a shared setting. IoT will assist us in navigating the entirety of the production process, allowing humans to coordinate with robots on hazardous tasks. And this is where robots frequently inherit play.

The manufacturing sector has one of the highest rates of nonfatal workplace injuries, with an estimated average of 400,000 nonfatal injuries each year. To avoid these injuries and prevent additional injuries, AI and robots will conduct hazardous duties that will reduce the annual number of injuries. This will make industries safer places to work.

However, this is not the only advantage. Workers will experience less downtime as a result of the heightened safety measures, and machine repair downtime will be reduced as a result of predictive maintenance. Increased productivity (40 percent by 2035) and the elimination of (energy) expenditures associated with restarting equipment would result in a safer work environment for humans.

However, this will not be fully applied until internal communication is computerized.

C.3 Digitize Internal Communication:

By converting all internal communication to digital format, you save tonnes of paper annually and improve the overall efficiency of your operations.

Operations are enhanced through improved communication. And real-time, mobile communication is growing in popularity as a result of empowering frontline production employees.

Real-time communication offers numerous advantages:
- Notifying other workers of risks and equipment breakdowns is crucial for safety
- You can maintain the manufacturing pace high by transmitting vital messages (such as shift changes) quickly
- The capacity to send (and receive) messages promptly saves time and money (no bulletin boards)
- Improves collaboration between employees and supervisors
- Enables employees to control AI, robotics, and robots utilizing mobile technology tools

A digitally linked workforce is more efficient, secure, productive, and environmentally friendly.

And mobile-first communication solutions enable employees to collaborate with their coworkers, supervisors, and even machines.

This also rebrands the manufacturing plants as eco-friendly, technologically modern facilities that capture the attention of the newest members of the workforce: millennials.

Requirement no. 2:

A. Industrial regulations for chemical waste disposal:

Normal laboratory procedures will inevitably result in the production of chemical waste. This waste can come in a variety of forms and shapes including chemicals, solvents, stock solutions, and chemically contaminated paper, filters, and laboratory equipment.

As an example, incorrect disposal of chemical waste can pose several potential risks to the environment and the safety of employees and students.

• Pesticides and biocides can damage both the aquatic environment and accompanying infrastructure, such as water or sewage treatment plants that rely on bacteria that may be destroyed by biocides.
• Strong-smelling compounds, such as mercaptans, can emit foul-smelling vapors that remain in drains and piping as they move throughout the building and escape to other locations.
• Flammable or reactive compounds can cause an accumulation of flammable vapors in drainage systems, which in severe situations could pose a risk of fire or explosion.
• Corrosive substances, such as acids and alkalis, can corrode pipework and fittings, as well as react with other chemicals introduced into the system, potentially leading to the production of hazardous vapors.
• Radioactive compounds may be dumped into drains under controlled conditions, but a license for this is frequently highly regulated to reduce the risk of radioactive contamination.
• When chemicals are flushed down the drain, unanticipated reactions might occur; for instance, bleach can combine with popular drain cleaners to produce the poisonous gas chlorine.
• If toxic compounds are discharged into the environment, they may have a deleterious effect on watercourses or other discharge sites, and they will also introduce toxic residues into potable water, which will linger even after water treatment.

Therefore, chemical discharge into sewage systems should be avoided wherever possible and only considered when there is no feasible alternative or for generally harmless substances.

1. Duty of Care :
The Environmental Protection Act of 1990 includes a "duty of care" that requires all persons involved in the handling of waste (including the assembly of waste) to take reasonable and appropriate measures to ensure that:
• Waste is hardly stored, treated, deposited, or disposed of without a waste management license or other authorization;
• Waste does not escape the control of the holder,
• Waste is only transferred to authorized persons such as registered waste carriers.

The obligation of care begins with the waste generator and cannot be transferred to others. This obligation is legally binding, and violations can result in criminal punishment for both the individual and the university.

Therefore, the University (and its faculty, staff, and students) must make every effort to classify, separate, and contain the waste by applicable laws and best practices. The responsibility of pollution control requires precise management and documentation standards to be followed. Waste must be adequately described and relevant handling measures must be documented. The outline must be comprehensive enough to ensure that anyone who later handles or acquires the garbage may do so safely and avoid mishandling it. The outline of the waste should contain the source of the waste, what it is made of, how it is created, and any unique dangers or storage issues that must be taken into account.

2. Hazardous Chemical Waste:

In the course of normal research or instruction, virtually all laboratories generate waste. The majority of common laboratory waste that is uncontaminated or has been exposed to extremely small amounts of chemicals will be deemed non-hazardous.

- Tissues, paper towels, and clothing
- Packaging
- Disposable gloves
- Plastic and glass goods (including chemical bottles) that have been emptied and properly rinsed.

As a general rule, the following thresholds must be applied to all containers and contaminated goods for them to qualify as nonhazardous waste: Substances with a concentration of zero percent

1. Solids, liquids, or flammable gases (flash point of 60C or less)
2. Materials that are air-, water-, or self-reactive.
3. Prescription-only medications. Anything that emits a foul odor, including oils, heavy metals, persistent organic contaminants, and anything else Things with a 0.1% maximum absolute concentration Substances corrosive enough to cause severe burns
4. Highly hazardous substances
5. Carcinogenic compounds
6. Mutagenic compounds
7. Reproductively toxic substance
8. Additional exotoxins
9. Unknown substances or new compounds (not confirmed to fall under another classification).

1% absolute maximum concentration for certain substances.

10. Compounds that are characterized as being corrosive and causing burns.
11. Hazardous substances to the Eye, skin, and human respiratory system.

The only waste that falls below these levels could also be considered non-hazardous and disposed of through the regular general waste streams. If any of these levels are exceeded, the waste (including solid waste that is contaminated) must be treated as contaminated and disposed of or treated as necessary.

Oils, solvent waste, reaction by-products, washings, obsolete/outdated chemicals, water treatment chemicals, biocides, unknown substances, and novel compounds are examples of hazardous chemical waste.

Also included will be any chemically contaminated equipment, containers, or sharps that cannot be decontaminated properly, such as filters, contaminated spill absorption media, and needles (whether contaminated or not)

3. Separation of Dangerous Waste

To reduce the likelihood of undesirable chemical reactions occurring during storage or transit that could endanger people, property, or the environment, hazardous chemical waste must be separated according to its chemical compatibility and attributes. In general, the following incompatible substances should be isolated:

• Mineral acid waste (especially oxidizing acids such as nitric acid) must be separated from organic acids such as ethanoic acid.
• Acids (including acidic chemicals such as Virkon and calcium bisulfate) must be isolated from cyanide salts, sulfide compounds, and alkalis.
• Halogenated solvents (such as dichloromethane) should be stored separately from non-halogenated solvents like pentane, ethanol, etc.
• Pyrophoric substances (compounds that react strongly with air or moisture), such as lithium aluminum hydride, alkali metals, white phosphorus, and butyl lithium, must be kept apart from other substances.
• Any mixture containing (or suspected of having) iodine must be separated and labeled due to regulations on iodine incineration and disposal.
• Oxidizing agents must be isolated from other chemicals, especially organic materials, mineral acids, and reducing agents such as sodium borohydride.
• Debris (including liquid waste) containing heavy metals such as mercury, cadmium, etc.

It cannot be burned and must be separated to ensure proper disposal.

4. Chemical Waste Receptacles

Chemical waste should only be stored in containers that are clearly labeled and appropriate for the type of waste they contain. Consider the subsequent:

• Glass bottles (such as Winchester bottles) may be utilized for numerous chemicals, excluding acid waste (or other related substances like ammonium bifluoride).
• Plastic bottles may be used for acids and alkalis if they have been well-cleaned and rinsed. Some common plastics may be attacked by aggressive solvents such as ethyl ether and dichloromethane (or combinations including aggressive solvents). High-density polyethylene (HDPE) containers

are also used for some aggressive solvents as long as it has been determined that they will not damage the plastic.

- Steel drums are used for large quantities of non-acidic organic solvents, neutral aqueous solutions, and oils, but should never be used for corrosive substances such as acids or alkalis.
- Needles used only for chemicals should be separated from other hazardous materials and discarded in sharps containers. The labels on sharps containers holding needles that have only been exposed to chemicals should be located distant from any relevant biological waste. Should needles be rinsed or cleaned before disposal so long as it is safe and practical to do so?
- If at all possible, malodorous compounds such as mercaptans should be disposed of in a glass bottle, with the cap covered with laboratory film or tape. Additionally, secondary containment is strongly recommended. Before using or disposing of any material, it must be inspected to ensure that it is clean and does not include any residue that could react with the waste (i.e. residual acids may react with organic solvents).

Even before the container is utilized, its integrity must be verified; it must be:

- Physically sound, without cracks (especially star cracks), chips, or punctures. Remember that old plastic containers and lids may have degraded and become fragile, especially if they have been exposed to sunlight for extended periods (this frequently manifests as fading/changing colors).
- The container must be able to be firmly fastened/sealed.
- Containers must be liquid-tight; leaking containers should not be utilized to hold hazardous waste.

As a general rule, waste containers should not be loaded more than three-quarters of the way to their capacity. This air space (also known as ullage) permits changes in pressure above the liquid in response to changes in the rate of evaporation as a function of ambient temperature. The container's cap should not be overtightened to allow for some pressure relief, which could prevent a catastrophic failure.

Waste containers must be labeled with a complete description of their contents, the date, and the name of the individual (or laboratory manager for shared waste containers) responsible for collecting and transporting the waste.

Major components of the waste (such as solvents, water, or other media) must be noted, and if possible, the first container used should help offer information about the waste's hazards. If the initial container is reused, it must be labeled as waste, but the remaining information on the label must be kept.

In cases where a container is being recycled for use as a garbage container, the original label should be damaged or removed to render outmoded chemical information unreadable. This information should also be visible on any secondary containment that is employed.

B. Green alternatives to the traditional manufacturing process:

1. Green, Eco-friendly Alternative Fuels:

A firm can power its vehicles with biofuels. It can utilize electric automobiles with regenerative braking systems. On its buildings and industries, the company can install wind turbines or innovative water-powered generators. Similarly, they will bury water pipelines for geothermal heating and cooling. Air conditioners are less efficient than heat pumps.

2. Lighting and Insulation:

Switching from standard incandescent or fluorescent lamps to LEDs can save a substantial amount of money and energy. LEDs not only utilize three-quarters of the wattage of incandescent bulbs and one-third of the wattage of fluorescent or compact fluorescent light (CFL) bulbs, but they also last twice as long, if not longer. This makes them the most efficient and least costly to operate overall.

In addition, businesses can insulate with materials that are more eco-friendly than spray foam. Although the froth provides the most effective insulation of any product currently on the market, it is not only a petroleum-based product but also one of the goods with the shortest lifespan. Cellulose and denim insulation are eco-friendly alternatives with nearly equal insulating characteristics to foam but without the difficulties or additional costs of reapplication. It is equally important to note that no structure is eternal. One day, every structure is demolished, modified, or destroyed by accident or catastrophe. Green insulation is only a design strategy for minimizing environmental impact.

Utilize Green Products, Reduce, Reuse, and Recycle: Paper is frequently recycled, and businesses are permitted to utilize exclusively recycled paper. Still better, they will minimize paper usage by becoming paperless for practically all transactions requiring permanent hard copies. The only way to attempt this is to send emails as opposed to internal memos. When recycling, prioritize things created from recycled plastic. It is now possible to request paper created from plastic bottles. Therefore, if you must use paper instead of transmission, rely on plastic-coated paper. One tonne of this paper conserves at least 20 trees and 56 metric tonnes of water.

In the field of wire form fabrication, having hand-held schematics that are both rip- and water-resistant and portable while on the ground would be a big help. Therefore, machinists can examine the most recent procedure without having to return to their laptops. These few sheets of paper will be filed under the "required paper requirements" of the wire form.

References :

1. www.gla.ac.uk.
2. www.intouch-quality.com
3. www.bautomation.com