COVER PAGE AND DECLARATION

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Student's Full Name:	**Ahmed Zaky Dwidar Eltaher**
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E-SIGNATURE: Ahmed Zaky Dwidar

DATE: 11/11/2021

EIU Paris City Campus
Address: 59 Rue Lamarck, 75018 Paris, France | **Tel:** +33 144 857 317 | **Mobile/WhatsApp:** +33607591197 | **Email:** paris@eiu.ac

EIU Corporate Strategy & Operations Headquarter
Address: 12th Fl. Amarin Tower, 496-502 Ploenchit Rd., Bangkok 10330, Thailand | **Tel:** +66(2)256923 & +66(2)2569908 |
Mobile/WhatsApp: +33607591197 | **Email:** info@eiu.ac

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MGT550: Managing Operations

Module Assignment: Big Green Tractor "Operational Procedures & Guide"

Introduction and executive summary:

Operations Management "OM" is the art of managing production to support the organizational goals and objectives through conversion process transforming inputs - such as raw material and labor - into outputs of finished goods and/or services.

Transformation process is a series of activities extending from supplier to customer that involves design, control and improvement of production systems. The objectives of production and operations management are efficiently providing the consumer with the right amount of products and services at the right time with accepted quality.

Standardized OM is key for business growth and competition however, companies may face significant troubles and challenges if failed to develop and implement strategies, which ensure their long-term growth and sustainability (Y. Kim, 1993).This is happening with Big-Green organization that operates in tractor manufacturing industry and has noticeable decline in growth since last few years.

This report addresses business challenges and focus on the plan to improve Big-Green value chain, market proposition and suggests a streamlining of its operations with more cost-efficient manufacturing processes including; waste management and controls , compliance with safe environment code and maintaining industrial standards in addition to disposal of chemical waste through green alternatives.

Task 1: Big Green operational industrial streamline procedural guide:

Manufacturing team is accountable to tracking products and streamline operations by ensuring that business keeps up with customer demands in an efficient and profitable manner. The main concept is to constantly identify and eliminate waste, processes or activities that don't add value to the end consumer.

1.1: Understanding the value of Processes Management:

Since Frederick Taylor released his work "The principles of Scientific Management" in 1911, task optimization acted as foundation when Henry Ford started using assembly line methodology in his automotive industry in the early 20th century.

During past three decades the amount of production optimization and improvement management methodologies have increased to a vast amount of different approaches to improve processes within companies and development of competitive business. For example: Lean Production, Six Sigma, 5S, Total Quality Management (including the Seven management tools), ISO9000 and ISO14000, Time Based Management, Continuous Quality Improvement, Kaizen, Total Productive Maintenance etc., Oluyisola, (2020); Magnusson, Kroslid and Bergman (2003).

1.2: Big-Green Problem identification:

Process activity mapping and Decision point analysis –:

- As a consultant, we focused on the production department and surrounding functions associated, from the view of customer's order to product delivery.
- We interviewed the directors of each department gathering data, build the holistic intercompany information flow to map all concerned processes and evaluating performance level and bottlenecks.
- We identified the problems' root-cause adopting simple method called "The 5 Whys'" and concluded activities that are unnecessary and very cost inefficient in addition to areas of improvement.

1.2.1: Complexities in Big-Green processes:

Opting K. Singh (1993) definition, we categorized it into four types:

- **Logistical complexity:** Because of high transactions or tasks' volume and resulted in increase of tied-up capital.
- **Technological complexity:** related to inherited system and technologies for both products and processes.
- **Organizational complexity** of organizational structures, forms and procedures of decision- making.
- **Environmental complexity** results from events outside the organization, for example, the technological turbulence in computer and software industries.

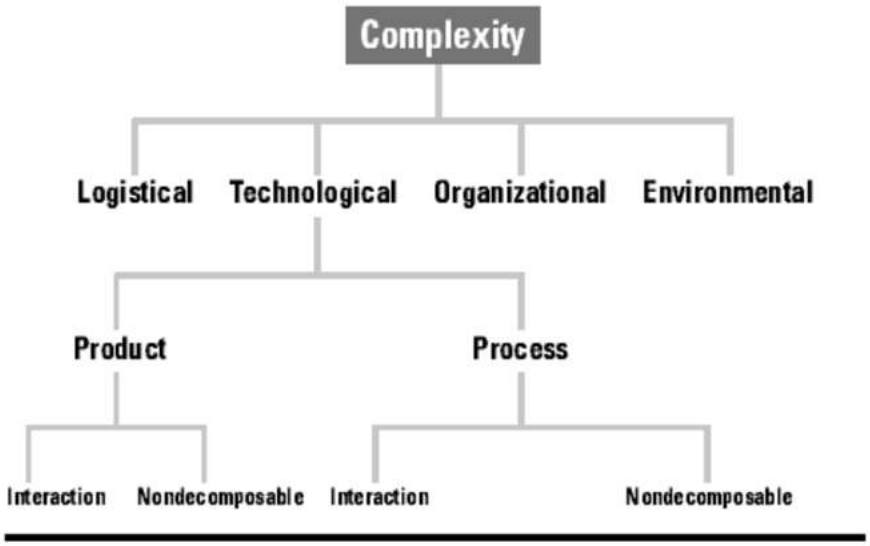


Figure 1: Classifying Big Greem process complexity

1.2.2: Big Green identified operations' waste:

Adapting Sullivan et al (2002) definition, Big Green wastes discovered are as follow:

- **Excess inventory:** Unnecessary storage resulting in increase of tied-up capital.
- **Improper processing**: Inappropriate use of tools, systems and procedures leading to reworks.
- **Overproduction:** Producing too much goods counteracts the wanted production flow.
- **Waiting:** Inactivity in and between production processes results in poor flow.
- **Unnecessary transportation:** Wasting time on movement of people, information and material.
- **Excessive motion:** Design of workplace, resulting in underutilization of human asset.
- **Defects:** Quality of raw material leads to rework and poor end performance.

1.2.3: Big-Green Physical and Organization mapping structures:

- We discovered Centralization - Mechanistic - structure resembling a bureaucracy where the decision-making authorized only to higher level of the hierarchy.

- All pricing, purchasing orders and B2B decisions wait for senior leader who don't always have accurate or timely information to make an effective decision. As a result, Big-Green is at a disadvantage against competitors.

2: Proposed improvement plan and operational procedural guide:

Cost efficiency as per Ron (1998) means; reducing waste in production, avoiding quality failure and avoiding waste of time etc. To tackle waste drivers for efficient production, Ron emphasizes on processes' revamping and simplification in the entire organization that will possibly reduce redundancy and drive efficiency.

Bergman and Klefsjö (2010) stated that "There is always a way to get improved quality using fewer resources", meaning that processes, methodologies and products can always improve achieving higher quality to a lower cost. Moreover, the goal to satisfy the customers requires a change and continuous processes improvement.

- ***2.1: Improvement tools and framework:***

We examined the preexisting conditions that may facilitate implementation of improvements plan like; how Big-Green measures performance, learning situation and level of standardization within the processes then, concluded the below framework:

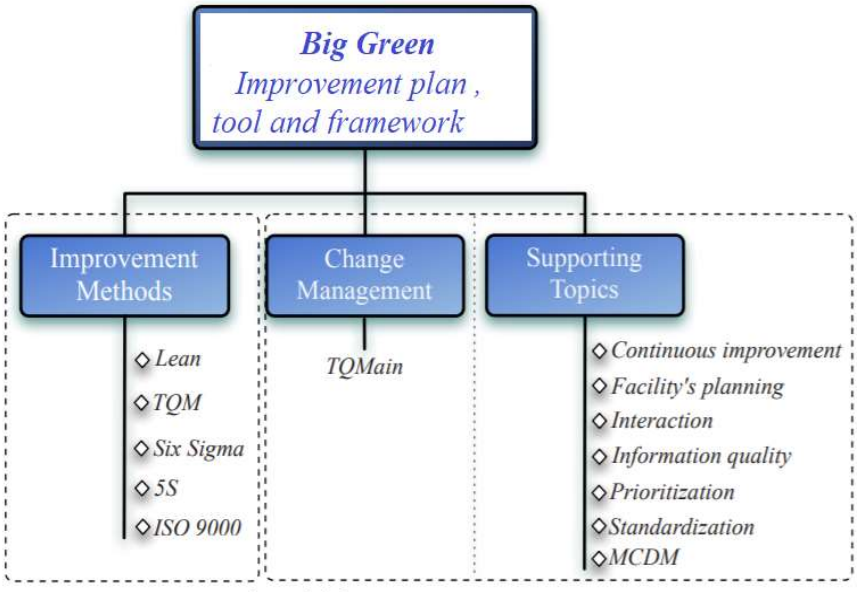


Figure 2: Proposed model for improving Big Green processes .
Opting Kornyshova 2007

TQM: Total Quality Management
MCDM: Multiple criteria decision-making
5S: Sort, Straighten, Scrub, Systematize, Sustain, Henderson and Larco (1999)

- ***2.2: Implementing Big-Green Lean Production philosophy:***

Womack et al (1990) stated that Lean production uses half the human effort in the factory, half the manufacturing space, half the investment in tools, half the engineering hours to develop a new product in half the time. It needs to keep half the required inventory, which will result in lesser defects, and results in producing a sustained growing mix of products.

Just-In-Time (JIT)/ stockless Production:

JIT is a philosophy of manufacturing based on planned elimination of all waste and on continuous improvement of productivity and aims to producing the right part in the right place at the right time, which should improve profits and return on investment by:

- Reducing inventory levels/increasing the inventory turnover rate.
- Reducing variability.
- Improving product quality.
- Reducing production and delivery lead times.
- Reducing other costs (associated with machine setup and equipment breakdown).

JIT applies on repeated manufacturing processes of same products using same components over again.

Our general recommendation is to establish flow processes by linking work centers so that there'll be a balanced flow of materials throughout the entire production process similar to that found in an assembly line. To achieve this, a trial for buffering all inventory toward zero and accomplish an ideal lot size of one product.

Big-Green recommended actions to lean / streamline manufacturing:

- ***Apply Decision point analysis(DPA)***

To identify where in the supply chain the production demand (pull) gives way for forecasted customer orders (push).

Having DPA, production can be aligned to the manufacturing approach utilized (push or pull).

- ***Stabilize the Master Production Schedule (MPS) with uniform plant loading:***

Consistent daily production ensures a uniform workload on all work stations (establish constant windows to prevent fluctuations in assigned production plan over a period of time) and mixed

model assembly (gives the same daily products, repeating process sequence in case many goods are produced using same production line). Meet fluctuating demand by end item inventory rather than through oscillations in level of production.

The use of stable production schedule permits using of back flushing to manage inventory waste; end item billing of materials to calculate quantities of various components used to make the item.

- ***Reduce or eliminate setup times:***

We recommend a single digit setup times (< 10 minutes) or "one touch" setup through better planning and implementing our redesigned/simplified and coordinated process through using specialized software equipment.

- ***Reduce lot sizes (manufacturing and purchase):***

Doing "Supply chain response matrix", we recommend Big-Green to reduce setup times that will allow economical production of smaller lots and we confirm on the necessity of better and closer cooperation with suppliers to achieve reductions in order's lot sizes for purchased items.

- ***Reduce lead times (production and delivery):***

Done Process activity mapping defined a bottleneck in Production lead times where we recommend Big Green to reduce it by:

- Moving workstations closer together.

- Applying group technology and cellular manufacturing concepts.

- Reducing queue length (reducing the number of jobs waiting for processing at a given machine)

- Reducing Delivery lead times by coordinating between successive processes and the suppliers.

- ***Big Green Preventive maintenance:***

Machine and worker idle time used to maintain equipment and prevent breakdowns.

- ***Flexible work force:***

HR to train/upskill production workers to operate several machines, perform maintenance tasks in addition to quality inspections.

- ***Apply supplier quality assurance:***

The organization is required to conduct internal and external audits to examine the quality of material sourced from different vendors (Dimian, Bildea & Kiss, 2019).

Since there are no buffers of excess parts, we formulated "Big Green quality at the source" program giving the staff personal accountability for the quality of work they do, and the authority to hold production if things go wrong.

- ***Small lot (single unit) conveyance:***

Big Green will use a control system like Kanban system to deliver parts between workstations in small quantities (best practice is one product at a time).

- ***Define set of Operation metrics and KPIs***:

Big-Green Key performance indicators "KPIs" and metrics can scale across all operations to monitor performance. Following are the recommended steps to develop solid KPIs:

1. **Defining effective metrics** and most essential KPIs to streamline manufacturing operations once there are updated processes and systems in place, to aggregate data from all data points and use it creating a dashboard showing interdependencies of these metrics in meeting business goals.
2. **Implementing manufacturing Execution System "MES"** to track, monitor and control all the activities on the factory floor on real-time basis and to define areas to improve or change to better meet the demand.

   MES will capture machine level data and process parameters, metrics and KPIs to streamline manufacturing activities to maximize output and identify overall equipment effectiveness **"**OEE" to measure the production effectiveness of running equipment on a specified schedule.

3. **Attaching older machines with sensors:** to enable operation managers visualize the entire production process. Sensors provide data to define parameters and performance indicators for every component or configuration.

4. **Developing an integrated system** connecting all data points into one dashboard that analyzes data in real-time and make it accessible cross-functionally and allows live performance monitoring.
5. **Creating a database:** that stores historical data and parameters such as machine configuration, part number, batch number, etc. for continuous improvement and future KPI planning in-line with evolving business goals.

3.2 Implementing Total Quality Management (TQM), Big Green Zero defects program:

(Al-Najjar B, 1996) defined TQM as "continuously striving to fulfill, preferably overcome, customers' needs and expectations to lowest cost through continuous improvement where everyone is committed and has focus on the organizations' processes".

Poor quality output of the different functions will lead to rework and poor information quality etc., Keyte and Locher (2008); Larsson (2008).

We recommend the following:

- ***Establishing TQM department*** to ensure the production of tractors is having high-quality standards. In this way, practices of manual as well as robotic inspection of tractors carried out in consistent way. (Lee, Speight & Loyalka, 2014).
- ***Adopting Kanji and Asher (1996) eight concepts*** to drive the processes and develop a framework for continuous quality improvement:
  - **Customer satisfaction:** surveying customers' voice, Big Green can measure performance against customers' expectations.
  - **Internal customers are real:** fulfill the inter-departmental relations with simplified processes to satisfy the needs of external customers.
  - **All work is process:** a process is a combination between methods, machines, staff, and material, which will affect the end-product.
- **Teamwork:** gathering people into teams to address and analyze the root cause behind reported defects in addition to the standardized solutions. The teams will then work as a platform for changes.
  - **People make quality:** healthy fair environment makes workers willing to take

responsibility for their work quality.

- **Continuous improvement cycle:** by meeting customer demands, measure success and keep on improving both internal and external processes, a never-ending process.
- **Prevention:** Continuously challenging the process to ensure that failures do not occur/recur.
- **Measurement:** the core concept of TQM proposes that in order to improve, we must first measure the present situation

- ***Applying Kaizen tool:***

Kaizen is a Japanese word simplified as "change for the better". It's a philosophy of continuous improvement of daily activities involving all employees.

It includes learning from own experience, systematic problem solving, knowledge utilization and exploring new ideas doing internal/external comparison of different ways of solving a task or problem to find inspiration for own improvements, Berger (1997).

- ***Following International Standardization:***

A key to minimize the occurrence of defects in manufacturing process is following accredited international standards like ISO 9001 applicable for production, manufacturing and Assembly of goods in organizations (Dimian, Bildea & Kiss, 2019).

We recommend it to ensure TQM is efficient with less nonconformity.

3.3 Enhancing IT and technology infrastructure:

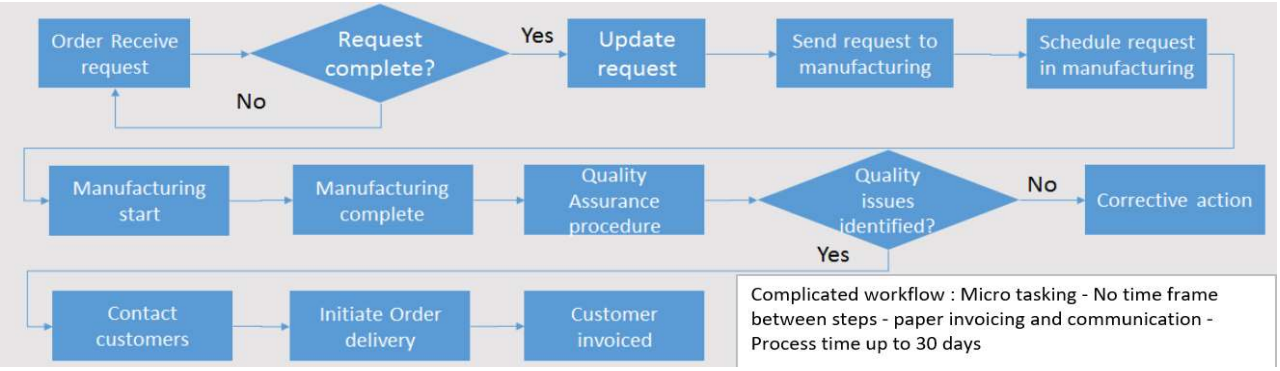
Automation:

Robotic process automation (RPAs) for repeated non-skilled work is a gold standard that we recommend for Big-Green to streamline its manufacturing operations and acquire cost efficiency with less sources and defects. For example; painting, handling and assembly.

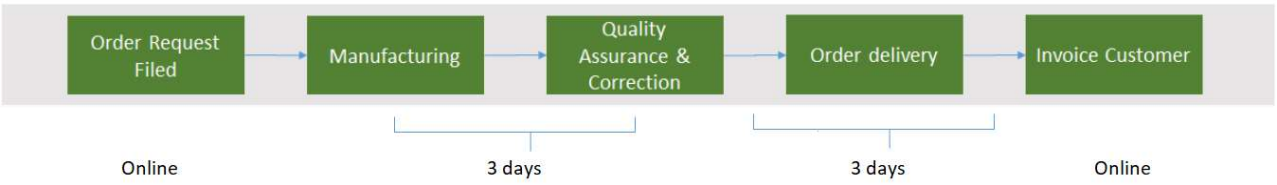
Management Information System (MIS) "Data and Analytics":

We recommend Big-Green to have a solid operation system and create clean/constructive information for fact-based business decisions, build performance management/KPIs monitoring and supervise overall business behavior and quality assurance.

Example of a Big Green people-driven into a system-driven process:



Simplified/systematic process:



3.4: Personalized training:

Effective in minimizing defects in manufacturing process of Big Green specially that not all processes associated with manufacturing can be automated. Therefore, human resource managers will conduct a skill gap analysis for production staff and organize personalized training sessions accordingly.

3.5: Material cost control:

For Big-Green, purchasing can reduce immense cost through effective negotiations with suppliers (Drucker, 1990).

We recommend the following:

- Shifting from direct purchasing to bidding system.
- Suppliers' proper selection; applying a **Vendor rating system** based on details of the suppliers, materials, purchase order, date of receipt, ordered quantity versus accepted quantity & quality in rating scale points to eliminate vendors failing to meet the standards, warn a supplier for improvement and reject the quotations/bids from low rating vendors

3.6: Scrap waste management:

Big Green Tractor recommended selling scraps wasted during the manufacturing to relevant vendors. A dedicated team for this purpose getting reasonable price may attribute to less Production cost and better profitability.

3.7: Control energy consumption:

Energy consumption leads to significant rise of production cost in addition to negative environmental effects. Safe alternatives are available like; Electricity, Solar and wind energy.

Use of 21st-century tools to create greener process

Green manufacturing-as a modern firm- aims at continuous integration of environmental improvements of industrial processes and products to reduce or prevent pollution to air, water and land; to reduce waste at source and mitigate risks to humans and other species (Berkel et al., 1997).

Recommended Big-Green strategy includes creating products/systems that consumes less material and energy, substituting input like non-toxic replacing toxic materials, reducing unwanted outputs and converting outputs to inputs "Recycling".

Variety of techniques emerged in the 21st century and can be of significant benefit for business sustainability as follows:

- **Using production planning and scheduling system:**

To define required quantity of material, manpower, machinery and budget to produce planned output in a given period of time "work force management"

- **Changes in production processes:**

- Changing dependence on human intervention using automation and RPAs.
- Using of continuous instead of batch process.
- Simplifying/Eliminating steps in production process.

- Changing cleaning process to closed loop Hi-tech systems.

- **Changes of inputs in the production process:-**

Using less-polluting raw materials for ingredients that contribute to production without being incorporated in the end-product will be worth changing. For example:

* The use of lubricants and coolants changed with longer service lifetime.

* The introduction of powder based and high solids paints instead of regular paints substantially reduces the emission of volatile organic compounds (Deif,2011)

- **Internal re-use:-**

it's often substantial with many possibilities for the re-use of water, energy, chemicals and metals. Washing, heating and cooling in the counter current process will facilitate the internal re-use of energy and water.

Closed loop process recycling will replace the current process is economically attractive, with both water and chemicals potentially being recycled. (Rahma et al 2009)

- **Better housekeeping:-**

We recommend a simple, routinized, non- resource intensive measures to keep safe facility and environmental order as follows:

- Segregating, minimizing chemical and waste inventories.
- Installing overflows' alarms and automatic shutoff valves.
- Eliminating leaks/drips using collective devices where spills may occur.
- Comprehensive staff training.
- Frequent inspections to identify environmental concerns or malfunctioning of the production process, better control on operating conditions (flow rate, temp., pressure, etc.), regular machinery fine-tuning and optimizing maintenance schedules, (Bergmiller, 2010)

- **Using process mass intensity (PMI):**

PMI is a key metric to measure sustainability of a manufacturing process and chosen for

its ease in generating, measuring and communicating data and ability to use quickly to determine an estimation of greenness (Jimenez et al 2011)

Big-Green will target lowest PMI score to optimize raw material usage and achieve better volumetric productivity, time cycles, etc. which ultimately will control emission of toxic material and energy consumption. .

- **Robotics and software*:***

In the 21st century, the combination of robotics and software can be greatly effective in evaluating carbon emissions from the manufacturing plans of Big Green Tractor (Couto, Plansky & Caglar, 2017). For example, Big-Green will use –as mentioned before- smart software to automate:

- Processes of iron sheets' cutting and modulation.
- Monitoring Chemical and harmful waste.

- **Big-Green Reagent guides and solvent selection tools:**

The tool allow the R&D department to evaluate toxicity level of different chemicals used in manufacturing such as paints, acid, bases, etc. (Neu, 2013). Outputs of these tools allows selection of Eco-friendly chemicals that have lowest toxicity.

Task 2:

Big-Green socially responsible operational guide:

Significance of CSR in an Organization

CSR is a procedure companies undertake to act morally and increase financial profitability by improving the personal fulfilment of employees, their families and the immediate environment and society (Oluyisola et al., 2020).

A well-designed CSR implementation framework integrates economic, social and environmental decision making throughout Big-Green from board level to front-liners and intimately connected with corporate governance is planned to reap optimal business benefits, integrity and community welfare.

Big-Green CSR implementation framework and corporate governance

When?	What?	How?
Conceptual phase	Task delineation	Checkpoints on the journey
Plan	1. Conduct a CSR assessment	*Form a leadership team. *Develop Defenition of CSR. *Identify legal requirements. *Review corporate documents, process activities and internal capacity. *Identify and engage key stakeholders.
	2. Develop a CSR Strategy	*Build support with CEO , Senior management and Employees *Research what others do and assess the value of recognised CSR instruments. *Prepare a matrix of proposed CSR actions *Decide on directions,approach and focus areas
Do	3. Develop CSR Commitments	*Do a scan of CSR commitments *Hold discussions with major stakeholders *Create a working group to develop the commitment *Prepare a preliminary draft and consult with affectedstakeholders
	4. Implement CSR commitments	*Develop an integrated CSR decision-making structure. *Prepare and implement a CSR business plan. *Set measurable targets and identify performance. *Engage employees and others to whom CSR commitments apply. *Design and conduct CSR training. *Establish mechanisms for addressing problematic behavior. *Create internal and external communications plans. *Make commitments public.
Check	5. Assure and report on progress	*Measure and assure performance. *Engage stakeholders. *Report on performance internally and externally.
Improve	6. Evaluate and improve	*Evaluate performance. *Identify opportunities for improvement. *Engage stakeholders.
Cross-check: One cycle completed		*Return to plan and start the next cycle.

Recommendations for CSR:

- ***Change to energy-efficient machine:***

A strategy Big-Green has to consider replacing older machines with new technology that consume less energy. However, such purchases can be costly yet; a one-time investment allows improving its CSR KPI and solid image in the targeted business market (Couto, Plansky & Caglar, 2017).

The High-tech machines consumes less fuel with subsequent control of fuel cost, emissions and Eco-friendly approach.

- ***Electrification:***

It's evident that electricity is better in reducing carbon emission compared to fossil fuel. Big Green to replace older and inefficient technology with updated versions that run on electricity.

- ***Reduce carbon emission:***

Carbon emission reduction is a time-consuming process but accomplishment of yearly targets will enhance the environmental sustainability of Big-Green. For this purpose, a variety of practices like replacement of old machines with updated technology in addition to using fossil fuel with high octane score if necessary.

- ***Affiliation with professional agencies:***

Big-Green will develop alliance with international agencies that work for environmental protection to:

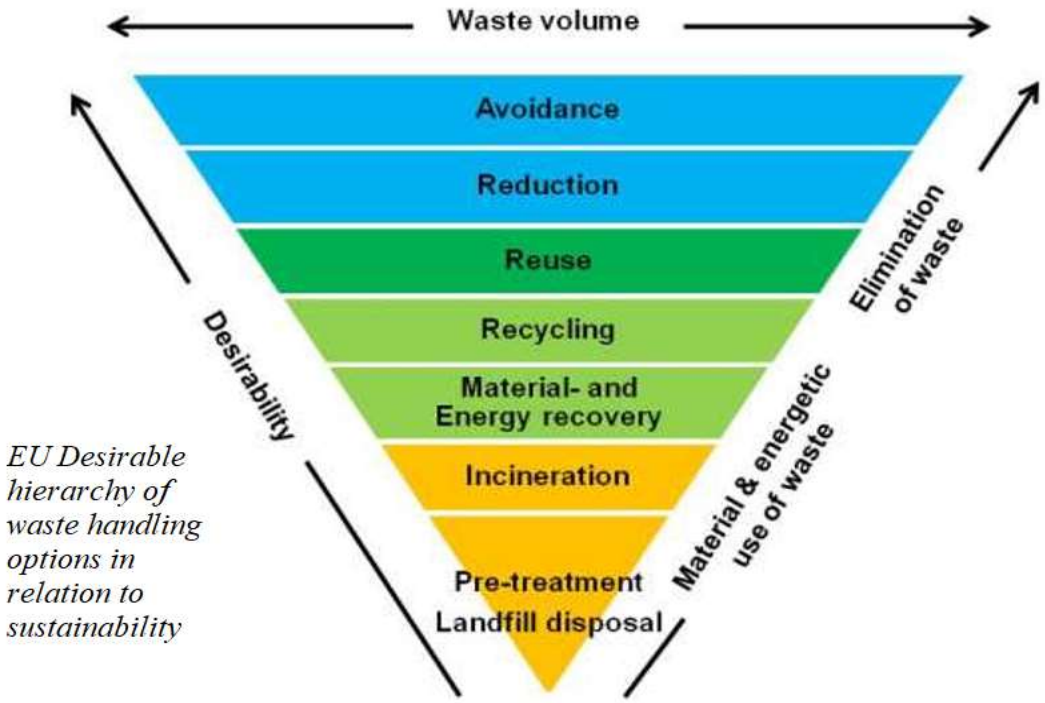
- Evaluate current carbon emission levels and follow the instruction, norms and regulations set by such agencies (Dimian, Bildea & Kiss, 2019).
- Frame new protocols, training and follow up plans to achieve target Green KPI.
- Comply with legal and regulatory procedures nationally obligated.

- ***Setting Big-Green CSR KPI:***

A corporate KPI; Fixed emissions reduction target of 50% by 2026.

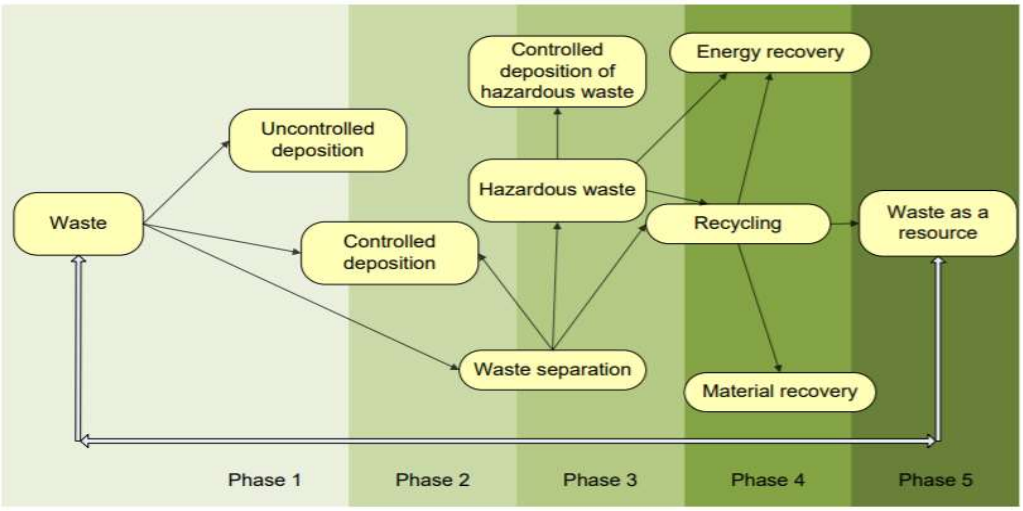
Industrial standards on disposal of chemical waste:

Big Green strategic managers will follow European standards and procedures illustrated as follows:



EU Desirable hierarchy of waste handling options in relation to sustainability

Big-Green Guide/phases for treating Chemical waste:



Phases of waste management development (Source BMZ Resource waste, 2012)

- **Classifying hazardous level:**

Considering the international list of Known Hazardous and Extremely Hazardous Waste for input/output material to follow proper procedures and requirements, which differs handling both.

- **Designating Big-Green waste storage areas:**

- Where the waste generated most.
- Under the control of assigned safety personnel.
- Away from normal production activities.
- Labeling the area with a "Danger / Hazardous Waste" sign.
- Easily accessible and recognizable to safety technicians.

- **Compatible collecting containers:**

- Container must not react with the waste.
- Basic compatibilities: - Acid and Bases react with Metal containers.
  - Gasoline "Solvents" react with Polyethylene.
- Screw-on caps control leak and spill.
- Always keeping waste containers closed.
- Always place container in a secondary container to capture spills (Double control).

- **Tagging waste containers:**

Attach a completed hazardous waste tag to the container **before** storing the waste.

- **Handling Liquid waste:**

- No overfilling: to allow expansion and safe transportation.
- Never mixing solids with liquid waste**.**
- Oils: are stored for recycling as long as it has no regulated metals.

- **Unidentified or "unknown" chemical waste:** treated as hazardous waste:

- Labeled with "hazardous waste" tag.
- Write "Unknown" on the tag.
- Tag any known information like; where the material discovered, age of the material, etc.

- **Storage time and quantity limits:**

Keep compliance with Indonesian standards that oblige requesting a hazardous waste collection **before** time or quantity limits are reached.

- **Final phase of treatment:**

- ***Secure landfills***:

Wasted Chemicals and material supposed to be stored in secured landfills (Henriques, Pecas & Silva, 2013).

Big-Green will use governmental landfills established with impermeable cap to protect the environment above the ground from the hazardous chemical fumes (Lee, Speight & Loyalka, 2014). Moreover, it's insulated away from groundwater level to protect nearby environment and people.

- ***Processing and treatment***:

Big-Green will consider the strategy of chemical processing through reaction with other chemicals or reagents to neutralize the hazardous impact. Although, processing and treatment activities may have more expenses but will remarkably enhance corporate social responsibility KPI with fewer legal and regulatory obligations.

- ***Recycle***:

Lee, Speight & Loyalka (2014) stated that; not all chemical waste products are unusable. Subsequently, reusing the chemicals is an efficient technique Big-Green will use to control waste along with cost reduction.

Green alternatives to the traditional manufacturing process:

We recommend green alternatives for Big-Green as follows:

- Reduce consumption of energy, water, other natural resources and emissions of hazardous substances.
- Use or produce recycled and recyclable materials, increase the durability of products, and minimize packaging through effective design (reduce, reuse and recycle").

- Train and encourage staff to look for additional ways reducing the firm's environmental footprint.
- Use green power (renewable energy) like, electricity with energy-efficient lighting like old bulb switched to CFL or LED.
- Join or start a local "green business" club helping local firms to access conservation grants and expertise for reducing waste, water use and energy.

- ***Big-Green renewable energy***:

- Facility upgrade for effective input/output flow of material, information and people.
- Floor insulation and thermal-efficient cladding.
- Change to everlasting and cost-effective energy like solar thermal/PV, heat pumps, and biomass systems that make difference immediately and generate clean electricity and heating while bringing down the cost.
- Solar illumination.
- Closed pipe system for wasted liquids.

- ***Biodegradable material***:

Using biodegradable material is eco-friendly considering that plastic material cannot be decomposed (Lee, Speight & Loyalka, 2014).

Big-Green will change its supply chain strategy to replace all Plastic wrapping, storage containers & parts utilized during along manufacturing process to reduce waste and hazardous impacts on the health and safety.

- ***Using effective Heating, Ventilation and Air Conditioning "HVAC" system:***

Big-Green new HVAC system carry the following benefits:

- Energy Efficiency: programmable thermostat allows precise control utilizing less energy with lesser cost.
- Optimized Indoor Comfort: With consistent throughout indoor temperatures and balanced humidity levels.
- Less waste production.

- ***Managing Operations' Waste:***

Implementing Lean concept as discussed before.

Conclusion

Production with cost-efficiency and sustainability, a never-ending process, potentially achieved by lean operations' management that focus on TQM and controls.

Minimizing defects and standardization throughout the manufacturing process are key enablers to Big Green value addition.

Reduction of material cost/process mass intensity, automation, scrap management, recycling and green power are main objectives to achieve efficiency.

Environmental safety through secured landfills, processing, treatment guidelines, recycling and green alternatives are key responsibilities of Big Green to comply with social requirements, build customer loyalty, business viability and sustainability.

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