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## 1. Introduction

### 1.1. Summary

Production and Operations Management is the system which sets the standards and guidelines for any productive system to achieve its goals efficiently, the main goal of any productive system is to convert the input resources into outputs in the shape of useful goods (Neha Tikko, n.d.). To set those guidelines and standards, the environment, visions and philosophies of the company, factory or firm have to be set and understood by the management to be able to produce standards upon them, those guidelines and procedures shall include all daily, weekly, monthly and periodic instructions and procedures which help the employees and the management to streamline their day-to-day jobs and to standardize the different processes in order to have better, (The Clinical Information Support System Occupational Health Record-Keeping System Production Operations Manual, 2011)

safer and more efficient operational activities which will eventually lead to better production efficiency and hence revenues. The instructions and processes shall cover the proper use of tangible and intangible assets to create a better and efficient business.

Recently, and due to several factors (internal and external), The Big Green tractor company has faced a significant growth declining and have lost some markets, and to get it back to the track of successful business, we had to make some of the necessary changes in the system to be able to compete with competitors

### 1.2. Purpose

This guide is intending to:

- Put the guidelines for a more productive, safer and more efficient productional operations
- Ensure the operations are performed with the leanest processes and least resources
- Ensure the least production time frame with the maximum efficiency
- Ensure all processes are cost efficient

- Ensure cleaner environment by eliminating the pollutants or decreasing them to the minimum
- Enhance the procurement management to ensure greener resources and shortest lead time possible
- Enhance maintenance system to guarantee the cost efficiency of production
- Ensure sustainability by taking the proper measures to achieve it
- Give alternatives to traditional manufacturing processes
- Enhance the social image of the company by introducing it as an environmentally friendly manufacturer

### 1.3. Scope

This guide is addressed to all personnel of The Big Green Tractor (employees and management) to streamline the daily operations and to follow the related standard to achieve the most cost efficient, the most sustainable and the safest production processes

### 1.4. Definitions

QA	Quality Assurance
QC	Quality Control
ISO	International Organization for Standardization
ASME	American Society of Mechanical Engineers
BOM	Bill of Material
KPI	Key Performance Indicator
SOP	Standard Operations Procedure
IoT	Internet of Things
AI	Artificial Intelligence
LCA	Life Cycle Assessment
OEM	Original Equipment Manufacturer

## 2. Roles and responsibilities

### 2.1. Operations manager

It is of operation manager's responsibilities to estimate costs and to prepare the budgets. To link with other departments' managers to understand and cooperate in setting the standard and strategies on which the factory objectives can be achieved. Manage and organize the work to meet the organization targets. To track and ensure the quality of the output products and set the effective plans to enhance the quality whenever gaps are detected. Monitor production phases and workers to detect and intervene if issues raised, able to resolve those issues with the least harm way or the most winning way. To control the resources and determine the amounts to ensure the workflow and the quality are not affected. Monitor the quality of all workers and ensure proper promotion plans are set, he is responsible to set rewards and punishment policy. Ensure the implementation of the production is done upon the company strategy and the standards in this guide. It is of his responsibility to participate in recruitment of new workers to ensure the quality of the employees is meeting the company vision. (The workable.com, n.d.)

## 2.2. Production Supervisor

it is the responsibility of production supervisor to monitor and track the daily production operations and report any delays in production to the production manager. To understand and implement the production plans in the most effective and safely manner. To solve the operational issues in a proper timely manner to avoid delays in deliveries. To supervise the performance of the workers, raise evaluation reports on each one. To prepare the activities of each shift and resources required for each job, prepare lists of requirements and discuss plans with Production manager. Make sure the activity plans are discussed with shift supervisors and targets are set and understood by them.

## 2.3. Line Supervisor

Line Supervisor is responsible of implementation of the daily tasks and the distribution of them to the workers of his line. It is of his responsibilities to monitor the performance of the equipment and report any defects or shut downs to the maintenance department as well as his direct manager. Handover properly the tasks implemented and any findings related to Production Lead.

## 2.4. Quality Manager

It is of his responsibility to manage the department team to collect the necessary input data to design prototypes which the final product of each line and the final product which will be in markets, the prototype which has to meet all requirements needed based on the market needs and company marketing plan. Create and maintain quality management system which reflects international related standards and the procedures to implement them. Put the proper references to audit the output products upon and lead the controls to mitigate those quality deviations compared to the standard. Analysis failures and defects of the products to propose better designs. Coordinate with operations manager and supply chain manager to ensure quality operations manager and procurement lead to ensure quality of spares and raw materials to be used. Ensure the equipment and machines to be used in manufacturing phases are of the proper quality and meets the industrial international standards. Issue certificates which certify the products to be used

## 2.5. Maintenance Manager

It is of his responsibility to ensure the maintenance program is in place and is created based on OEM recommendations, related international standards and best practices, and to fit for the purpose. He has to put the necessary measures to ensure the implementation of this program to manage the factory's assets and control them to meet the requirements with the maximum life cycle available. Ensure the understanding of maintenance programs from the workers and the engineers. Coordinate with the production manager to set all the needed upcoming plans for maintaining the equipment and manage extra resources needed in the case of long maintenance period is required. To assess and control the maintenance requirements of The Big Green Tractor assets. To ensure all related industrial inspection standards are systemized, standardized and implemented. Monitor all maintenance activities and personnel, evaluate and enhance when required. Contribute in new projects and selection of new equipment to ensure the applicability of current maintenance plans on them, enhance the maintenance plans to meet the new equipment requirements or suggest better options.

It is of his responsibility to ensure the selection of the proper ERP and the proper platform used in this ERP which meets the maintenance program and assures smooth implementation of this program inside the ERP, also it is of his responsibility to lead the maintenance team to assure proper records and history of each equipment

## 2.6. Supply Chain and Procurement manager

It is of the responsibility of Supply Chain and Procurement manager to facilitate and enhance the supply chain process by reviewing and negotiating possible vendors and make contracts to ensure sustainability of procurements. Cooperate with production manager, maintenance manager and quality manager to understand their needs and hence process the requirements in the most effective way. Review quotations of single requests and compare according to best price, lead time and quality. Float service and purchase tenders and evaluate the tenders with Production manager and Maintenance Manager to choose the most effective option. Also, he is responsible of putting effective plan to reduce delivery periods and lead time in both input materials and output products, ensure ease of transportation in and out the factory.

To assure sustainability, it is of his responsibility to audit and evaluate all vendors based on the effect of their products/service on environment, to ensure all products and services are eco-friendly and environmentally friendly.

It is of his responsibility to ensure a proper stock management system is in place and implemented.

## 2.7. Stock Controller

It is of the responsibility of stock controller to ensure minimum and maximum amounts of materials (raw or spare parts) are available as per the stock management system. To issue spares when required, report the status of the issued spares on a weekly basis to Operations Manager, Maintenance Manager and Supply Chain Manager. Make sure all request of the frequently used items and spares (consumables and raw materials) are in order. Highlight when the necessary spares/materials are not available with the minimum requirements

It is of his responsibility to highlight as well any abnormal consumption based on the history and request a proper justification of the increased consumption.

Also, it is of his responsibility to issue and follow up any request (purchase or service) and list the important ones on a weekly basis

### 3. Procedure

#### 3.1. Preface

The Big Green Tractor has faced declining of its growth due to some significant factors which affected the outcome of its business and put it in an improper place in the market, those factors included but not limited to:

- Design of Tractors that didn't meet the requirement of the market quality wise and price wise
- Uncontrolled employment which didn't focus on quality and focused on salary reduction (taking into consideration the culture of Palembang and the nature of the citizens)
- Uncontrolled material stocking which led to delays in deliveries and failing to deliver with a proper quality
- Poor quality control due to the absence of QCQA engineer position and reference standards to evaluate and audit
- Poor maintenance system which led to shut downs of equipment and delays in production
- Improper quality of supervisors led to poor supervision on workers and the absence of proper evaluation of employees which led to poor performance
- The absence of procurement manual which contains the proper procedures of supply chain and ensures all the necessary items are procured in the least time frame with the least price and with the proper applicable quality
- The absence of using the new technologies neither in equipment nor in the production processes
- The image of the company in the market as one of the pollutant companies (in production phase and the final product specifications)



- Therefore, this procedure is containing the guide lines to better performance, better results, the most cost-efficient way and the least pollutant way. It will contain instructions of quality management, production management, maintenance management, and supply chain management to reach the goals of the company to be More productive with the most cost-efficient as well as using the proper technologies to turn into greener manufacturer with greener products

## 3.2. Quality management

### 3.2.1. Quality Assurance

- Map the process of manufacturing
- Define and prepare quality policy
- Prepare quality management manual defining the standards and processes to be followed according to key objectives
- Determine the time frame of manufacturing in each line and the time frame of manufacturing one complete tractor
- Survey the market and check the needs in the industry
- Survey the peers' products and designs
- Determine the design of the product, the quality of the product (in each phase of manufacturing and the final product)
- Determine the reference standards which raw materials, finished materials, final product and different processes should meet
- Define and set how the quality will be monitored and measured
- Design the prototype and evaluate it against the planned design
- Coordinate with operations manager to create BOM (Bill of Material) and identify each item serial number

### 3.2.2. Quality Control

- Work on and ensure the factory is licensed against related manufacturing standards like ISO, ASME, etc.

- Inspect the new raw materials and compare it to the internal and international standards
- On a daily basis, check each line's production and inspect the output products and compare it to the initial design and relative standards
- Inspect the final product and compare it to the design and related standards
- Inspect all materials are identified with the related name plate with all information including serial numbers
- If name plates are not applicable, serial or identification numbers should be punched on the item
- Audit the performance of the workers technically and safe manners
- Record the deviations
- List all recorded deviations in each production phase
- Compare the deviations with the standards and design and evaluate the gaps
- Analyze the root cause/s of the deviation/s and possible mitigations to correct
- Determine whether the root cause/s is/are temporary or permanent
- Determine in which phase the nonconformance or the error occurred
- Set the corrective action plan to rectify or change the errors
- Set the time frame and needed resources to correct each error
- If gaps are of permanent root causes, manage the change in the design and system
- Re-evaluate the output after the corrective actions
- Redesign according to the surveys (The ISO Standards, 2015)

### 3.3. Supply Chain management Process

#### 3.3.1. Procurement

(Jaipur National University Courses, 2013)

- Plan with Operations and Maintenance departments for the needed materials (raw materials, manufactured items, and new technologies items).
- Prepare the lists of materials/items and quantities (minimum and maximum) which should be always available to secure continuous production

- Score the available local and external suppliers and build the data base accordingly (based on cost, delivery time frame, lead time, payment terms and quality)
- Always consider Eco friendly vendors to supply material from
- Maintain records of waste materials that can be recycled and share it with operations management, this will reduce the waste, reduce procurement and decrease expenses. (The Industry Today.com, 2020)
- Rank the suppliers referring to the previous scoring process results
- Select possible suppliers through either bids, reverse auctions or direct negotiations, focus on local suppliers to avoid custom charges and currency change differences
- Design proper collaboration by signing contracts (where applicable) with the most trust worthy suppliers according to the previous experiences

### 3.3.2. Logistics

- Forecast the world trade system to ensure no show stoppers in deliveries when items are ordered or purchased
- Avoid as possible global suppliers and ensure proper stock of materials/items, required globally especially from hot zones
- Prepare clearance plan for all items ordered internationally
- Ensure proper contract in place with 3<sup>rd</sup> parties to use their fleet for transportation
- Concentrate as much as possible on domestic supplies whenever possible
- Ensure proper routes are identified to transfer material or products in and out to the factory, avoiding routes which may be affected by different natural or non-natural obstacles. (Alan Harrison & Remko van Hoek, 2008)

## 3.4. Operations (Production) Management Procedure

### 3.4.1. Planning

- Evaluate the market and gather the needs of the target customers
- Decide the needed design and coordinate with the design team for the final product design

- Map the manufacturing process according to the agreed design
- Coordinate with Supply Chain Manager and prepare bills of material
- Schedule the manufacturing processes in different manufacturing lines. (The Unleashedsoftware.com, n.d.)
- Coordinate with sales department to understand and plan the sales strategy, inaccurate lead time can cause excess waste or delay in deliveries
- Control the waste by accurately determine the needed materials in each production line
- List the needed equipment in each line and ensure they are designed and operated with the latest technologies, ensure the level of environmental abuse is zero
- Ensure all equipment are AI programmed and featured which can accelerate the production time, control the quality of the output, identify the deviation from design and ease the waste control
- Ensure all programs needed to operate the new technology equipment are available and well known by the workers and maintenance personnel
- Ensure all workers are trained on how to operate and maintain the equipment effectively and safely, suggest training programs to adopt the new technologies
- Float a tender for a new ERP software (Enterprise Resource Planning)
- Select and roll out the new software to control the daily operations, ERP software should be built to meet the requirements and the goals of the factory and to help facilitating and improving the day-to-day operation
- Ensure proper waste register is in place, create a plan how to recycle the waste, ensure needed equipment and technologies are available to achieve the waste control
- Plan trainings for the workers on the equipment to be operated, other awareness trainings teaching the importance of quality, safety and environment
- Create and implement KPI (Key performance Indicator) of each production line
- KPI created should include the amount of waste of each production line
- Ensure SOPs (Standard Operating Procedures) are in place of each production line process, the procedure shall include all the recommended steps in each production

line with the necessary safety measures to be taken with risk assessments and mitigations to avoid incidents, asset damages and delays in operation

- Widen the use of automated and semi-automated production and assembly lines to reduce errors, human interference, hazards and reduce costs and time (The Unleashedsoftware.com, n.d.)

### 3.4.2. Production Lines Management

- Assign competent leaders for each production line
- Ensure proper hand over system is in place and implemented
- Line supervisors have to update management of the jobs done the previous day and the jobs to be done the coming day every morning, information should include the production amount done and the targeted production amount
- On a weekly basis, product line analysis meeting to be held by operations manager, maintenance manager and procurement manager to discuss the production numbers versus the planned ones and identify the gaps. (The ipmcinc.com Articles, 2013)
- Lines' supervisors should inform maintenance department of any abnormalities with the equipment to plan ahead before complete failure
- Lines' supervisors shall propose and select employee of the month to management
- Lines' supervisors have to evaluate all worker every 6-months
- Rotation system should be implemented for workers as well as lines' supervisors to gain experience and cover the vacant position in case of a sudden shortage

## 3.5. Sustainability Management

### 3.5.1. Preface

Manufacturing and manufacturing companies are facing different challenges nowadays which require new measures to be able to have sustainable business and profits, challenges like increasing in energy costs, higher customers demand, shortage of natural materials and strict governmental regulations. (Chiara Franciosia,

Alexandre Voisinb, Salvatore Mirandaa, Stefano Riemmaa, Benoit Jungb, 2020) This led to the needs of new processes to control the inputs to get sustainable outputs

### 3.5.2. Procedure

The below instructions were set to guarantee the sustainability to the factory by reducing the environmental negative effect and increasing the value and quality by increasing the life cycle and using the closed loop manufacturing processes

- Float a tender and implement the replacement of fossil fuels input energy to renewable energy inputs (geothermal, hydropower or solar energies) (The bkpm.go.id Article, n.d.)
- Instead of procuring pollutant materials, like solvents, look for environmentally friendly materials, establish contracts with environmentally friendly suppliers where possible. (The Trihaz solutions.com Site, 2020)
- Establish contract with reputable waste removal vendors, list all waste materials, categorize them and keep them sealed in containers till being picked up by the waste removal vendor. (The Trihaz solutions.com Site, 2020)
- Use the LCA (Life Cycle Assessment) frame work to achieve maximum sustainability (NAGESWARA POSINASETTI, 2018)
- Design and manufacture the tractors engines as per the latest standards with zero emissions
- Recycle all wastes which can be recycled, this may include (but not limited to) rubber, glass, steel, etc. (The armmass.com extensions, n.d.)
- Reduce energy usage by controlling the usage of lights, ACs and kitchen appliances to the minimum
- Improve efficiency of the production by purchasing the latest technologies in equipment and equipment maintenance, remove old equipment from service or renew it to meet the current technologies and efficiency requirements

## 3.6. Maintenance Management Procedure

### 3.6.1. Planning

- List all equipment and their functional location, each equipment has to have its identification number
- Ensure all equipment have proper operational and maintenance manual
- Ensure all equipment have proper certificates and all certificates are meeting the current relative standards
- Make entries of all equipment in the selected ERP
- Ensure all critical spare parts and consumable spare parts are listed and identified as minimum and maximum recommended quantities
- Ensure lining with procurement and finance to budget the spares required to be stocked and the expected shelf life of each one
- Ensure proper manpower available, structured to meet the maintenance requirements
- Ensure all maintenance personnel are competent and well trained
- Ensure all planned corrective or predictive maintenances are budgeted

### 3.6.2. Preventive Maintenance

- Prepare maintenance program of each equipment as per OEM recommendations, related standards recommendations and best practice recommendations
- Schedule all equipment maintenances as per the program created and distribute the maintenance as per the recommendations, the operational requirements and the manpower available
- Ensure evaluation of maintenance program is done by the corresponded engineers
- Ensure all maintenance history is linked with the equipment based on its identification number
- Ensure maintenance work orders and history are recorded in ERP and in print put formats for auditing purposes

- Each work order should be assured by the related line supervisor and maintenance engineer

### 3.6.3. Predictive Maintenance

- Prepare list of equipment issues and plan to close the issues with target dates
- Ensure needed parts are available when target dates are chosen
- Ensure all maintenance instructions are including how to measure all potential to wear items and the allowable tolerances references to identify when to replace the item
- Use new technologies of inspections like sensors, flow rate analysis and vibration analysis to identify the improper (Nathan Jeans, march, 2022)
- Ensure all predictive maintenance plans are discussed with operations to ensure no downtimes based on the time frame of repair, recertification or overhauling
- Ensure any failure occurs whether it was accompanied by shut down or no shut down has a failure report
- Each failure report should include the failure nature, the possible root causes and recommendations

### 3.6.4. Corrective Maintenance

- Manage to plan for repairs based on the repair time, quality and expenses
- List down all repairing service providers based on the three main elements (repair time, quality and expenses)
- Make sure all needed parts for repair are available or can be mostly purchased locally
- Ensure repairs to be done under the recommendations of OEM with genuine spare parts where possible (especially for the critical parts)
- Ensure proper reports are created after repairs completion



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