

COVER PAGE AND DECLARATION

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1. Introduction

The Big Green Tractor, which is positioned in Palembang, Indonesia, has suffered a notable decrease in its business growth over the last few years. In the present situation, the company is confronted with the problems of more numerous competitors, higher production expenses, and customers who have developed all-consuming expectations for sustainable products after years, having had to cut down with a situation where they are now looking for an opportunity to re-organize their activities and become a socially responsible company. This study is a complete step-by-step manual for the improvement of The Big Green Tractor's operational procedures by means of new technologies, as well as the concept of sustainable production, the latter not less important to the environment than the former, so the overall results will be more efficient and bring savings to nature. The outline is structured in a manner that involves two major subheads. The first section, first of all, is a green operational streamline procedure guide, which is more about those production activities that require less expenditure, the processes that are implemented to minimize defects, and the use of modern technological tools to help conserve the environment. The second part, in turn, is about the formulation and realization of a guide oriented towards the company's socially responsible side, whose purpose is to reduce the number of pollutants released from the production line, to adapt to global legal

requirements, and to check the existence of eco-friendly alternatives. Through the point that this guide takes, The Big Green Tractor is going to recover its operations in line with the most current standards of the EV, and, therefore, enhance its competitiveness. Moreover, it will be a positive force of nature that leads in contributing to environmental sustainability.

2. Company History

Started in the early 1990s, The Big Green Tractor has become a major force in Indonesia's industrial machinery market. The firm mostly caters to the local market and portions of Southeast Asia, specializing in the manufacture of high-performance agricultural tractors. Demand for the business has declined, however, in recent years because of various internal and external influences including poor operations, little creativity, and growing environmental concern.

The Big Green Tractor is at a crossroads given Industry 4.0 and worldwide focus on green manufacturing techniques. It has to either change to fit the new criteria or run the risk of losing market share to more nimble and ecologically sensitive rivals. The chance to put into place simplified operational procedures backed by creative technologies and environmentally friendly policies marks a turning point in the strategic direction of the business.

This paper aims to offer a road map for The Big Green Tractor to improve its production efficiency, cut operational waste, lower its carbon impact, and accept social responsibility without sacrificing profitability.

Operational Streamline Procedural Guide

3.1 Affordable Manufacturing Techniques

Improving profit margins and guaranteeing sustainability depend on manufacturing cost efficiency. For The Big Green Tractor, this entails modernizing old production methods, supporting lean manufacturing ideas, and maximizing resource use.

First, lean manufacturing can eliminate pointless procedures and waste. The Big Green Tractor

can keep cleaner, more orderly workstations by using the 5S approach (Sort, Set in Order, Shine, Standardize, Sustain), which helps to lower mistakes and downtime. Methods such as Just-In-Time (JIT) inventory control and Kaizen (continuous improvement) can enable the business to match manufacturing with real market demand, so reducing overproduction and surplus inventory.

Reducing costs also much depends on automation. Repetitive and time-consuming activities can be simplified by investing in smart robotics and programmable logic controllers (PLCs). This not only lowers labor expenses but also lowers the possibility of human error, therefore improving

general product quality.

Furthermore, delegating non-core tasks—such component manufacturing or logistics—to specialized third-party companies can help to lower expenses and enhance operational concentration. Strategic outsourcing lets the business also use economies of scale and access outside invention.

Another key component is energy efficiency. Retrofitting old equipment with energy-saving substitutes like variable frequency drives (VFDs), LED lighting, and enhanced insulation in manufacturing areas can greatly reduce utility costs and electricity use.

Adopting lean manufacturing, automation, outsourcing, and energy-saving technologies helps the Big Green Tractor to greatly lower manufacturing costs in conclusion even as it enhances output and product quality.

Defect Minimization Strategy

Reducing waste and production costs depends on minimizing flaws in the manufacturing process, but so does preserving consumer happiness and brand image. To find, stop, and fix flaws at every stage of the production cycle, the Big Green Tractor has to use a multi-faceted quality assurance approach.

A robust Total Quality Management (TQM) approach should be adopted. This means including every staff member in quality control, defining unambiguous quality goals, and keeping ongoing training courses to raise knowledge and skills of the workers. Empowering line workers to stop production in case of defect detection fosters a culture of responsibility and quick response. Six Sigma approaches can help even more to cut defects. DMAIC (Define, Measure, Analyze, Improve, Control) helps The Big Green Tractor to methodically evaluate its manufacturing procedures, find underlying reasons of quality problems, and make changes. This approach guarantees that changes are evidence-based and quantifiable by means of data and statistical analysis.

Statistical Process Control (SPC) is a useful tool as well. Deviations can be found and fixed before they cause flaws by means of real-time data and control charts monitoring and controlling

production. Automated sensors and IoT devices help to quicker detection and smarter interventions in the manufacturing line.

Priority should also be given to preventive maintenance. Regular machine inspections and maintenance guarantee that mechanical failures do not cause flaws. AI-powered diagnostics help predictive maintenance to reduce downtime even more and guarantee machines run under best settings.

Supplier quality control also has to be stressed. Setting rigorous standards for material inputs and working closely with suppliers will help to lower incoming defects. To keep high standards, vendor performance should be routinely examined and audited.

Adopting digital twins and simulation tools, finally, can help test virtually new manufacturing configurations before they are put into use. This proactive strategy helps the business to anticipate possible problems and plan around them.

Including these techniques will help The Big Green Tractor to greatly lower defect rates, cut warranty claims, and build consumer confidence in its products.

Green Tools of the 21st Century Modern manufacturing has to fit environmental sustainability objectives; for businesses like The Big Green Tractor, including green technologies is absolutely vital. Using 21st-century technologies that support eco-efficiency not only reduces the environmental effect of manufacturing but also helps to notable cost savings and legal compliance.

Renewable energy integration is among the most powerful tools. Putting wind turbines or solar panels on manufacturing sites can help to lower the company's carbon emissions and cut fossil fuel dependence. Smart grids and energy management systems also enable real-time monitoring of energy consumption, therefore enabling the identification of more optimizing possibilities.

Green manufacturing technologies like additive manufacturing (3D printing) provide means to lower material waste. 3D printing can be used to prototype and test parts with less environmental effect and allows exact production with low raw material use. Sustainable materials—like biodegradable plastics or recycled metals—can also take the place conventional resources.

Technologies for water conservation are also quite important. Closed-loop water systems, low-flow equipment, and water purification units help reduce industrial water use and waste. In areas like Palembang, where water resources may be limited, this provides operational and environmental benefits.

Environmental monitoring software is another important green tool. These systems track waste creation, water discharge, and air emissions using cloud-based analytics and IoT sensors. Real-time data guarantees environmental rule compliance and helps managers to make quicker decisions.

When enlarging or modernizing facilities, green building design concepts—such as insulation upgrades, natural lighting systems, and ventilation improvements—should also be taken into account. These improvements not only reduce energy consumption but also foster more effective and healthy workplaces.

Investing in electric or hybrid logistics vehicles for shipping and transportation can help to

greatly lower greenhouse gas emissions in the end. The firm can cut fuel use and delivery times. Using these 21st-century technologies, The Big Green Tractor can lower running expenses, meet its sustainability targets, and improve its standing as a responsible and future-ready producer.

Sales & Performance New Technologies Companies trying to improve their market performance and increase sales must adopt innovative technology as a need rather than a luxury. Integrating smart technologies into its operations and customer engagement strategies could help The Big Green Tractor to open new avenues for growth, improve efficiency, and give a competitive edge. Among the most powerful tools in this field are Customer Relationship Management (CRM)

systems. A modern CRM system lets the business monitor consumer interactions, preferences, and buying trends. Sales teams can customize marketing campaigns, forecast consumer demands, and create long-term loyalty by means of data analysis. CRM systems also guarantee departmental internal cooperation by means of which sales, marketing, and customer service are in sync.

Another important aspect is e-commerce integration. The Big Green Tractor can reach a larger audience, including rural areas where access to physical showrooms may be limited, by increasing its online presence via a user-friendly and mobile-responsive e-commerce system. Virtual product configurators and 3D product visualizations are among online tools that can enable consumers tailor their tractors to fit particular agricultural needs, therefore improving interaction and boosting conversion rates.

Improving sales forecasting, inventory planning, and customer service depends much on artificial intelligence (AI) and machine learning (ML). AI chatbots, for instance, can answer simple questions, offer product suggestions, and 24-hour customer sales process direction assist. Tools for predictive analytics can maximize promotional campaigns and pricing plans by means of analysis of historical sales data and market trends.

Used in training and sales presentations, Augmented Reality (AR) is another potent tool. AR gives consumers a more engaging and informed buying experience by letting them see equipment in their own agricultural setting before they buy. This strategy not only sets the brand apart but also helps to allay the uncertainty connected with high-investment purchases. Mobile apps designed for clients and field agents can simplify order management, provide after-sales support, and give real-time updates on service appointments or deliveries. These tools promote openness and close the communication gap, both of which are essential for building trust and customer retention.

Adopting these technologies will help The Big Green Tractor to create a modern, tech-driven

identity that appeals to digitally knowledgeable consumers and business clients alike, significantly enhance its customer experience, and raise its sales conversion rate.

Manufacturing Transparency through Blockchain Originally created for safe digital transactions, blockchain technology has turned into a revolutionary tool in the manufacturing sector. Its distributed and tamper-proof character lets improved openness, traceability, and trust—qualities especially vital in complicated industrial supply chains.

Using blockchain technology could change the way The Big Green Tractor runs its distribution,

production, and purchasing networks. The firm can build a clear and unchangeable audit trail by recording every transaction and movement of parts on a blockchain ledger. This facilitates the detection of bottlenecks, fraud prevention, and verification of component and raw material authenticity.

Among the key advantages of blockchain is its capacity to improve supplier responsibility. Agreements with suppliers and partners can be automated and enforced by smart contracts—self-executing contracts with terms directly inscribed into code. A smart contract, for instance, can automatically release payments when a supplier delivers items that satisfy pre-defined quality criteria, so lowering administrative work and delays.

Blockchain can help to manage product lifecycles as well. The business can monitor the whole lifecycle of a tractor—from raw material sourcing to manufacturing, delivery, maintenance, and final recycling—by including blockchain tags in equipment components. This degree of openness helps to build consumer confidence and helps to follow environmental rules. Moreover, combining blockchain with IoT sensors lets one track in real time temperature, pressure, or other component integrity critical parameters. Should any anomaly be found, notifications can be set off and blockchain logs can identify precisely where and when the problem happened, therefore facilitating quicker corrective action.

Regarding customer-facing apps, blockchain can generate digital certificates of authenticity and maintenance records. Providing verifiable evidence of quality and service history helps to prevent counterfeiting as well as to raise the resale value of the company's products.

All things considered, blockchain gives The Big Green Tractor a creative and safe framework to create operational transparency, improve quality control, and promote confidence along the supply chain—from suppliers to end-users.

Tools for Reducing Carbon Footprint For manufacturers trying to fit with world environmental criteria and consumer expectations, lowering the carbon footprint of industrial activities is a vital

goal. By including carbon-reducing technologies and sustainable practices into its operations, the Big Green Tractor has the chance to greatly lower its greenhouse gas (GHG) emissions.

Using carbon management software is among the most powerful tools. From energy use and logistics to procurement and waste, these systems let businesses quantify, track, and report carbon emissions across all departments. The Big Green Tractor can give reduction initiatives top priority and establish clear goals for progress by finding the key emission sources.

Another crucial tactic is to switch to renewable energy sources. Installing solar panels, buying green power from nearby sources, and supporting biomass energy where practical will help to significantly lower emissions connected to fossil fuels. Including energy-efficient equipment and

smart meters would also help to maximize energy use and reduce waste.

A fast expanding trend is electrification of transport fleets—especially for delivery and logistics operations. The business should think about switching from diesel-powered trucks to electric or hybrid substitutes. When coupled with route optimization software, this can shorten delivery times as well as lower fuel use.

Sustainable packaging is another important topic. Using biodegradable or recyclable packaging materials and maximizing package sizes to cut material use and shipping volume helps to minimize the whole environmental effect. Working with suppliers who follow green criteria is also essential to reaching complete supply chain sustainability.

Carbon offset schemes offer a sensible way to offset unavoidable emissions. The business can reduce its carbon impact by investing in methane capture projects, renewable energy credits, or reforestation efforts, thereby earning good recognition for environmental responsibility.

Moreover, employee engagement initiatives like "green challenges," carpooling rewards, and environmental awareness training can help to create a sustainable culture all across the company.

The total effect might be considerable when workers are driven to act sustainably.

Using these tools and techniques, The Big Green Tractor can move toward a low-carbon operating model that satisfies legal standards, attracts eco-conscious consumers, and benefits the earth.

Big Data and Data Analytics The capacity to gather, process, and examine massive amounts of data is a vital success factor for manufacturers in the data-driven society of today. Using data analytics and big data technologies for The Big Green Tractor has great promise to simplify operations, improve decisions, and propel strategic corporate expansion.

Big data is data too large or complicated for conventional data-processing programs to manage. These consist of data from machine sensors, environmental monitoring, customer interactions, supply networks, and production lines. The Big Green Tractor can get useful insights from these data sources by using sophisticated analytics tools, therefore enabling observable changes.

Predictive maintenance is one of its main uses. Algorithms can forecast possible failures before they happen by means of real-time data analysis from machinery and equipment. This increases operational efficiency by extending the life of equipment, lowering repair costs, and reducing downtime.

Another main subject is demand forecasting. The firm can more accurately forecast product demand across various seasons and areas by means of historical sales data, weather patterns, economic indicators, and consumer behavior analysis. This guides production planning, cuts inventory waste, and increases consumer happiness.

Big data analytics can maximize manufacturing processes by dynamically adjusting workflows, tracking material use, and spotting bottlenecks. Real-time dashboards let plant managers track

important performance indicators—KPIs—such equipment efficiency, defect rates, and cycle times.

Data analytics provides, in supply chain management, end-to-end visibility. The business can react fast to interruptions, track shipments, and watch supplier performance. To preserve continuity, machine learning models can recommend alternative suppliers or rerouting plans.

Product development and marketing plans are much shaped by customer analytics. The Big Green Tractor can create features that consumers really value, enhance satisfaction, and customize outreach campaigns by examining comments, service requests, and purchase patterns. Furthermore, artificial intelligence combined with big data lets the business deploy autonomous decision-making systems. Based on real-time data, these systems can automatically trigger alerts, reorder supplies, or change production schedules, therefore lowering human error and improving agility.

In the end, big data and data analytics enable The Big Green Tractor to continuously improve its operations depending on empirical evidence instead of intuition and to make more informed decisions and react swiftly to market changes.

Socially Responsible Operational Guide

Companies have to embrace socially responsible behavior exceeding compliance as public knowledge and regulatory pressure on environmental sustainability grow. For The Big Green Tractor, this means putting into practice operational plans that support the worldwide movement toward greener industrial standards, cut waste, and lower pollution.

Industrial Standards for Chemical Waste Disposal

Responsible manufacturing starts with good chemical waste management. The Big Green Tractor has to match its disposal techniques with local environmental laws and international best practices, including ISO 14001 Environmental Management Systems and Indonesia's Ministry of Environment and Forestry standards.

Hazardous waste should be stored in designated facilities with limited access, categorized and

labeled. The business should create a thorough waste management strategy comprising standard operating procedures (SOPs) for collection, transportation, treatment, and final disposal.

Working with certified waste disposal companies guarantees legal and safe handling of industrial by-products. Monitoring waste creation and disposal in real-time may be aided by the use of centralized tracking systems—possibly combined with blockchain for auditability.

Reinforcing a safety culture and preserving compliance depend on periodic training courses for staff members managing chemicals as well as consistent audits. The Big Green Tractor can

increase its environmental credibility and avoid legal responsibilities by showing compliance to internationally accepted practices.

Green Alternatives to Manufacturing Procedures

Using green substitutes helps to greatly lower the environmental effect of manufacturing activities. Switching to water-based or bio-based paints and lubricants, which are less toxic and simpler to dispose of than their petroleum-based counterparts, is one such strategy.

Re-engineering equipment and manufacturing techniques to reduce emissions and energy consumption is another approach. Using closed-loop systems in machining and metal processing, for example, can help to recover coolants and lower water use.

Process redesign can also involve changing from conventional casting and forging to additive manufacturing, which uses less raw materials and creates less waste. Using sustainable materials and recycled metals wherever possible helps to improve environmental performance even more. Furthermore, applying circular economy ideas—where end-of-life equipment and materials are refurbished, repurposed, or recycled—helps to prolong product lifetime and lower landfill waste.

Environmental Sustainability Roadmap

The Big Green Tractor should create a thorough sustainability roadmap to properly include social responsibility into its activities. This plan should have timelines for execution, defined goals, and key performance measures (KPIs).

The first step is to do a baseline evaluation of the environmental impact of the business including carbon emissions, energy use, water use, and waste generation. From this information, targeted action plans for every environmental aspect may be developed.

Short-term objectives could be installing solar panels on factory roofs, replacing fluorescent lights with LEDs, and using a digital document management system to cut down on paper waste. Medium-term objectives might center on fleet electrification and creating supplier codes of conduct stressing sustainable sourcing.

Long-term plans should seek ISO 14001 certification, carbon neutrality, and more community involvement via local environmental projects including tree planting or educational alliances. The Big Green Tractor can set itself as an industry leader in responsible manufacturing by following a methodical road map and promoting a culture of sustainability at all levels of the company.

5. Conclusion

The Big Green Tractor is at a turning point in its operational path. Confronted with market stagnation, higher expenses, and growing environmental obligations, the business has a special chance to change its future by means of a thorough operational and sustainability revamp. Ranging from lean production and defect reduction to cutting-edge technologies like blockchain, artificial intelligence, and big data analytics, this paper has highlighted strategic actions to simplify manufacturing processes. These developments not only offer financial savings and increases in production but also improved quality control and consumer happiness. Furthermore, The Big Green Tractor can greatly lower its environmental impact by adopting eco-friendly practices. The business can satisfy world environmental criteria and establish itself as a leader in corporate responsibility by enhancing chemical waste management to include green materials and sustainable manufacturing practices.

The path set out in this paper shows that operational excellence and social responsibility are not at odds. Rather, when pursued together, they provide a robust business model appropriate for the difficulties of the 21st century, stakeholder trust, and long-term development.

The Big Green Tractor can transform its operations and become a smarter, greener, and more competitive force in the agricultural machinery sector by means of dedication, leadership, and strategic execution

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