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## 1. Introduction

The tractor sector has been a vital component of the agriculture industry for decades, providing farmers with the necessary tools to cultivate and harvest crops efficiently. However, in recent years, companies in this sector, such as The Big Green Tractor, have been experiencing declining growth. The Big Green Tractor, an industrial tractor company based in Palembang, Indonesia, has been facing similar challenges and is seeking ways to streamline its operations to become more efficient. This decline in growth could be attributed to various factors, including increased competition, changing customer preferences, economic conditions, and technological advancements (Monahan and Bambury, 2017). As such, it is critical for companies like The Big Green Tractor to identify the root causes of their declining growth and implement effective strategies to overcome these challenges. By doing so, they can remain competitive, meet the needs of their customers, and sustain their business in the long run.

## 2. Recommendations to Streamline the Business Management Process

The Big Green Tractor can streamline its production processes and reduce costs of overall process. The cost of raw materials accounts for a significant portion of tractor manufacturing costs. To reduce these costs, The Big Green Tractor can consider the following strategies: -

- ***Implement a "Just-In-Time" (JIT) inventory system:*** The Big Green Tractor could implement a JIT inventory system to reduce the inventory in hand. This would help to minimize waste and reduce the costs of storing and managing inventory. With a JIT system, the company would only order raw materials as needed, rather than keeping large amounts of inventory in hand (Mukwakungu et al., 2019). This would reduce the amount of capital tied up in inventory and reduce the risk of waste due to obsolescence or spoilage. Implementing a JIT system would have a direct impact on the company's bottom line by reducing inventory costs and improving cash flow.

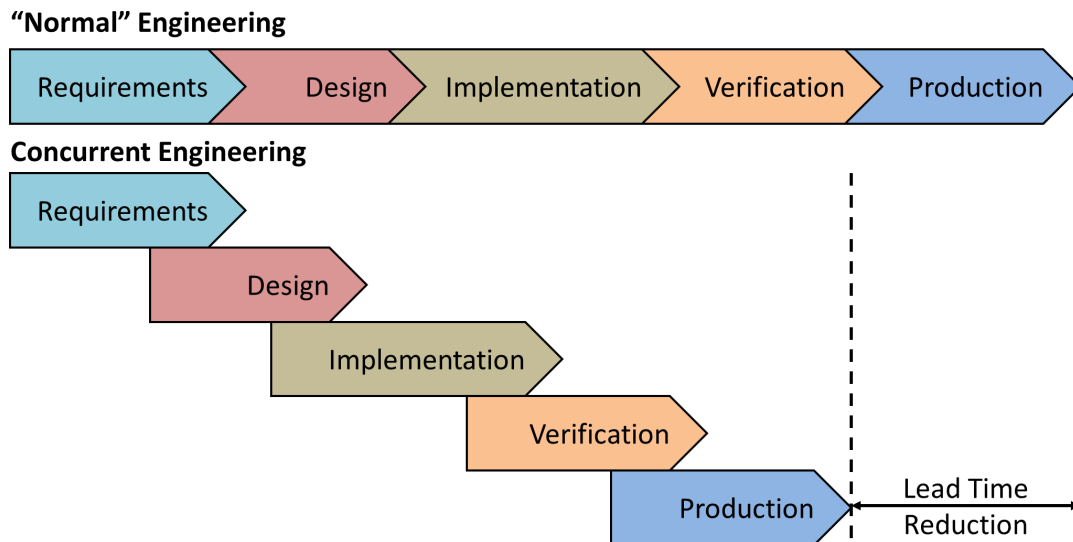


**Figure 1: JIT Approach for Big Green Tractor (Author)**

- ***Negotiate better prices with existing suppliers:*** One way to reduce material purchasing costs is by negotiating better prices with existing suppliers. This could involve bulk purchasing or longer-term contracts with suppliers (Balkhi et al., 2022). By negotiating better prices, The Big Green Tractor could save money on the raw materials needed to manufacture its tractors. This would have a direct impact on the company's bottom line, as it would reduce the cost of goods sold and increase profits.
- ***Diversification of Procurement:*** The Big Green Tractor can benefit from diversifying its procurement sources in several ways. By sourcing materials from multiple suppliers, the company can reduce its reliance on a single supplier and minimize the risks associated with supply chain disruptions (Dong et al., 2022). This can help to ensure a reliable supply of raw materials, which is critical for maintaining production schedules and meeting customer demand. Additionally, diversification of procurement can enable the company to negotiate better prices and improve its bargaining power with suppliers, which can help to reduce costs.
- ***Use alternative raw materials:*** Another way to reduce material purchasing costs is by exploring the use of alternative raw materials that are more cost-effective (Donkor et al., 2023). This could involve conducting research on alternative materials that are just as effective but cost less. For example, instead of using high-grade steel, The Big Green

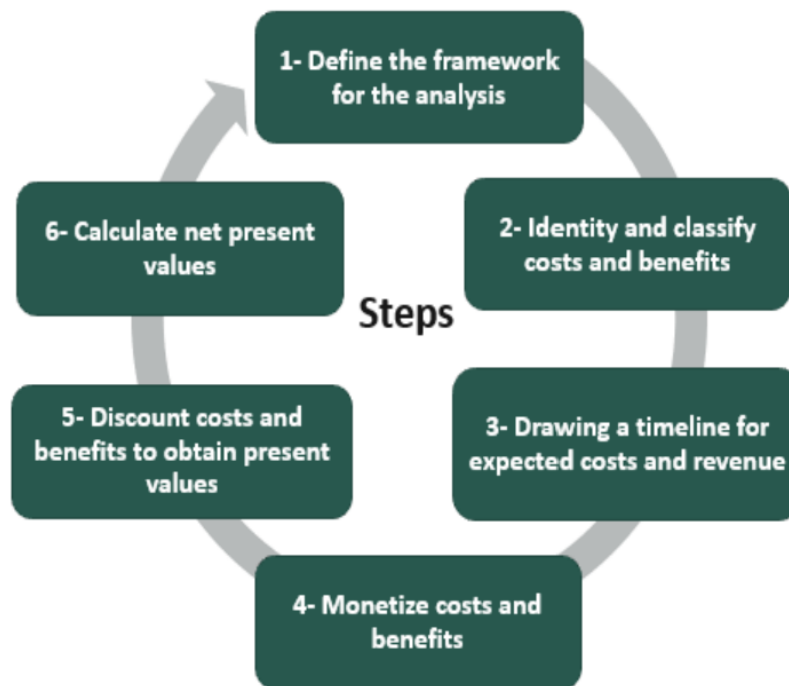
Tractor could explore the use of lower-grade steel or other materials that meet the same quality standards but are less expensive. This could have a direct impact on the company's bottom line by reducing the cost of goods sold and increasing profits.

- ***Establish Relationships with Multiple Suppliers:*** By establishing relationships with multiple suppliers, The Big Green Tractor can improve its procurement process. This can help the company to negotiate better prices and terms with its suppliers, which can reduce costs. Additionally, having multiple suppliers can ensure a more reliable supply of raw materials, which can help to maintain production schedules and meet customer demand (Qiao and Capaldo, 2022).
- ***Conduct Regular Supplier Evaluations:*** Regular evaluations of suppliers can help The Big Green Tractor to ensure that its suppliers are meeting the company's quality standards and are reliable. This can help to identify any potential issues early on and address them before they become major problems. Additionally, supplier evaluations can provide feedback to suppliers, which can help to improve the quality of the raw materials they provide (Blome et al., 2023).
- ***Concurrent Engineering Practices:*** Concurrent engineering practices can help The Big Green Tractor to reduce manufacturing costs and improve efficiency. By involving design engineers early in the manufacturing process, the company can optimize the design of the product for efficient production. This can help to reduce the number of iterations required to achieve the desired product, thereby saving time and money. Additionally, using CAD software to simulate the production process can help to identify potential bottlenecks and areas of inefficiency, allowing the company to optimize its production process (Araci et al., 2022).



**Figure 2: Concurrent Engineering for Big Green Tractor (Author)**

- **Implement a Cross-Functional Team Approach:** A cross-functional team approach can help The Big Green Tractor to improve its product design and manufacturing processes. By involving representatives from different departments in the design and production process, the company can ensure that all aspects of the process are considered (Guerineau et al., 2022). This can help to identify potential issues early on and address them before they become major problems. Additionally, a cross-functional team approach can foster collaboration and communication among team members, which can improve efficiency and reduce costs.
- **Relocation of Factories near Raw Material:** Relocating its factories closer to its raw material suppliers can benefit The Big Green Tractor in several ways. This can help to minimize transportation costs and reduce lead times, which can improve the company's competitiveness (Alaoui and Penta, 2022). Additionally, having factories located near raw material suppliers can enable the company to take advantage of local expertise and knowledge, which can help to improve product quality.
- **Conduct a Cost-Benefit Analysis:** Conducting a cost-benefit analysis can help The Big Green Tractor to determine whether relocating its factories closer to its suppliers would be cost-effective. This can help the company to make informed decisions about its manufacturing processes and identify areas where cost savings can be achieved (Zhang et al., 2022).



**Figure 3: Cost Benefit Analysis for Big Green Tractor (Author)**

- **Consider the Impact on the Workforce:** Relocating its factories can have a significant impact on the workforce, and The Big Green Tractor will need to take steps to minimize any negative impact. This can involve providing training and support to employees who may be affected by the relocation and ensuring that the company complies with local labor laws and regulations (Vivona et al., 2022).

By implementing these strategies, The Big Green Tractor can streamline its production processes and reduce costs. This will enable the company to remain competitive in the market while improving its bottom line.

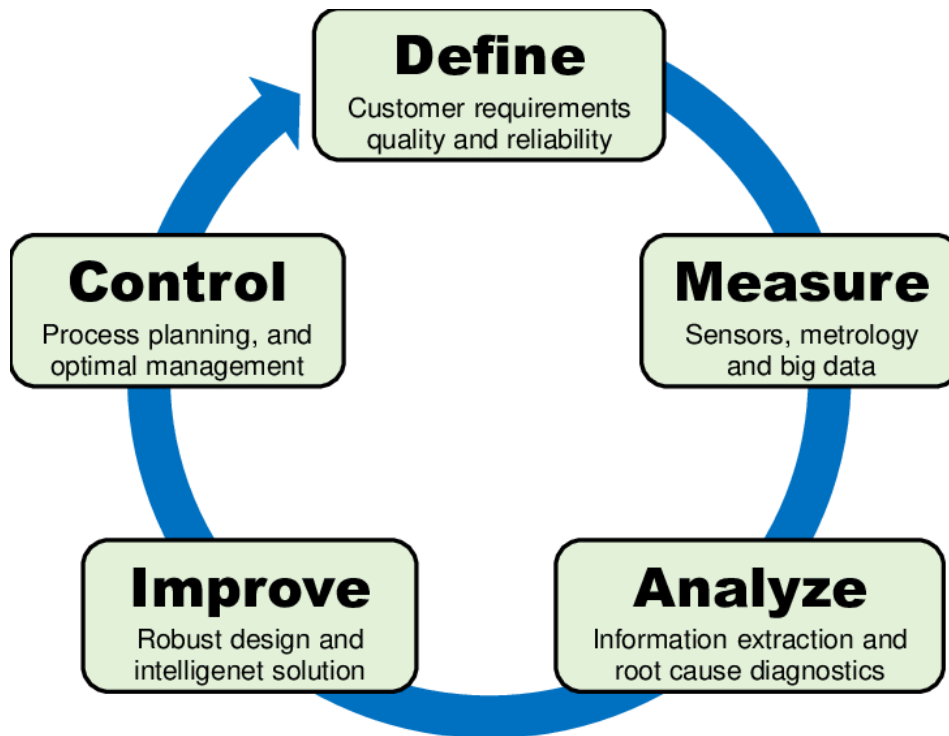
### **3. Minimizing Defects during the Tractor Manufacturing Process**

One of the key challenges that The Big Green Tractor is facing is the need to minimize defects throughout its manufacturing process. This is critical to improving the quality of its products, reducing costs associated with rework, and increasing customer satisfaction. One approach that the company can use to address this challenge is the Six Sigma method, which is a data-driven approach to quality management. Another approach is the Kaizen approach, which involves continuous improvement.

**Six Sigma Method:** The Six Sigma method is a structured approach to quality management that is focused on reducing defects and minimizing variability in processes (Tissir et al., 2022). The approach involves five key steps, including Define, Measure, Analyze, Improve, and Control (DMAIC).

- **Define:** In this step, the company needs to define the problem it is trying to solve and establish clear goals for the project. For example, the company may define the problem as reducing defects in the manufacturing process by 50%.
- **Measure:** In this step, the company needs to collect data on the current state of the manufacturing process and identify key metrics to track (Daniyan et al., 2022). For example, the company may collect data on the number of defects per unit produced.
- **Analyze:** In this step, the company needs to analyze the data collected in the previous step to identify the root cause of the problem. This may involve using tools such as Pareto charts or Fishbone diagrams.
- **Improve:** In this step, the company needs to develop and implement solutions to address the root cause of the problem. This may involve making changes to the manufacturing process or implementing new quality control measures (Yanamandra and Alzoubi, 2022).
- **Control:** In this step, the company needs to establish processes to monitor the effectiveness of the solutions implemented in the previous step and ensure that the improvements are sustained over time.





**Figure 4: Six Sigma Method (Author)**

**Kaizen Approach:** The Kaizen approach is focused on continuous improvement and involves making small, incremental changes to processes to improve efficiency and reduce defects. The approach can involve the following steps:

- **Identify opportunities for improvement:** The company needs to identify areas where it can make improvements in the manufacturing process (Yigit, 2022). This may involve analyzing data on defects or conducting a process audit.
- **Develop and implement solutions:** Once opportunities for improvement have been identified, the company needs to develop and implement solutions to address them. This may involve making small changes to the manufacturing process or implementing new quality control measures.
- **Monitor progress:** The company needs to monitor the effectiveness of the solutions implemented and track progress over time (Abuzied, 2022). This may involve tracking key metrics such as defect rates or customer satisfaction.
- **Continuously improve:** The company needs to continue to identify opportunities for improvement and make incremental changes to processes to improve efficiency and reduce defects (Berhe, 2022).

**Impact on The Big Green Tractor:** Implementing the Six Sigma method and the Kaizen approach can have a significant impact on The Big Green Tractor. By reducing defects in the manufacturing process, the company can improve the quality of its products, increase customer satisfaction, and reduce costs associated with rework. Additionally, these approaches can help the company identify opportunities for process improvements and continuously improve its operations over time.

For example, by using the Six Sigma method, the company may identify that a particular component in the manufacturing process is consistently leading to defects. By analyzing the data, the company can determine the root cause of the problem and develop solutions to address it. This may involve implementing new quality control measures or redesigning the component. (Kholil, 2023) Similarly, by using the Kaizen approach, the company may identify opportunities to improve the efficiency of the manufacturing process by making small, incremental changes. This may involve implementing new technologies or streamlining processes.

Therefore, implementing the Six Sigma method and the Kaizen approach can help The Big Green Tractor minimize defects throughout its manufacturing process and improve its overall efficiency and quality. By taking a data-driven approach to quality management and focusing on continuous improvement, Big Green Tractor can achieve zero defect management.

#### **4. Creating Greener Manufacturing Processes using 21st-Century Tools**

The Big Green Tractor company is facing declining growth and would like to streamline its operations to be more efficient. In addition, the company wants to reduce its environmental footprint by implementing green practices using 21st-century tools to create a greener process.

**5S:** Implementing 5S practices can help the company to become more organized and reduce waste. This methodology focuses on sorting, setting in order, shining, standardizing, and sustaining (Saxena and Srivastava, 2022). By organizing the workplace, Big Green Tractor can minimize pollution and increase productivity.

**Bottleneck Analysis:** Conducting a bottleneck analysis can help identify bottlenecks in the production process. This methodology will help Big Green Tractor to identify inefficiencies in the process and improve them. By addressing bottlenecks, the company can reduce waste, save time, and reduce environmental pollution.

***Muda (Waste):*** Implementing Muda practices can help Big Green Tractor to identify and eliminate waste in the production process. This methodology involves identifying eight types of waste (overproduction, waiting, transportation, processing, motion, inventory, defects, and unused talent) and eliminating them. By reducing waste, the company can minimize environmental pollution and save money (Mahadevan and Chejaria, 2022).

***Total Quality Management (TQM):*** Implementing TQM practices can help Big Green Tractor to improve the quality of its products and reduce waste. This methodology involves ensuring that all aspects of the production process are focused on quality. By improving quality, the company can minimize environmental pollution and reduce waste.

***Poka-Yoke:*** Implementing Poka-Yoke practices can help Big Green Tractor to prevent errors during the production process. This methodology involves designing equipment and processes in a way that reduces the likelihood of errors occurring. By minimizing errors, the company can reduce waste, save time, and minimize environmental pollution (Ojo et al., 2022).

***Andon:*** Implementing Andon systems can help Big Green Tractor to identify problems in the production process and address them quickly. This methodology involves using visual signals to alert workers of any issues that may arise during production. By addressing problems quickly, the company can reduce waste and minimize the environmental footprint (Marinelli, 2022).

***Heijunka (Level Scheduling):*** Implementing Heijunka practices can help Big Green Tractor to balance the production process and minimize waste. This methodology involves leveling the production schedule to ensure that production is consistent. By balancing production, the company can minimize environmental pollution and reduce waste.

***Continuous Flow:*** Implementing continuous flow practices can help Big Green Tractor to streamline the production process and reduce waste. This methodology involves ensuring that the production process is continuous and efficient. By reducing waste, the company can minimize environmental pollution and save money.

***Jidoka (Automation):*** Implementing Jidoka practices can help Big Green Tractor to automate certain processes and minimize waste. This methodology involves automating processes to ensure that they are consistent and efficient. By automating processes, the company can minimize environmental pollution and reduce waste (Helmold, 2022).

**Gemba (The Real Place):** Implementing Gemba practices can help Big Green Tractor to identify problems and inefficiencies in the production process. This methodology involves going to the "real place" where the work is done to observe and identify problems. By addressing problems quickly, the company can minimize waste and reduce environmental pollution (Wan and Leirimo, 2023).

**Hoshin Kanri (Policy Deployment):** Implementing Hoshin Kanri practices can help Big Green Tractor to align its goals and objectives with its overall strategy. This methodology involves setting goals, creating action plans, and monitoring progress. By aligning its goals and objectives, the company can minimize environmental pollution and reduce waste.

## 5. Social Responsibility Operational Guide for the Big Green Tractor Company

The Big Green Tractor is committed to being a socially responsible business, which includes taking steps to minimize the pollutants generated by its operations. Chemical waste should be disposed of in accordance with local regulations and industrial standards (Jha et al., 2022). Examples of common gases and chemicals that may require special disposal considerations include:

- Sulfur dioxide (SO<sub>2</sub>)
- Sulfur trioxide (SO<sub>3</sub>)
- Nitrogen dioxide (NO<sub>2</sub>)
- Carbon monoxide (CO)
- Carbon dioxide (CO<sub>2</sub>)

<b>Gases</b>	<b>Formula</b>	<b>TLV-TWA (ppm)</b>	<b>TLV-STEL (ppm)</b>
Carbon dioxide	CO <sub>2</sub>	5000	30000
Carbon monoxide	CO	25	200
Hydrogen sulfide	H <sub>2</sub> S	1	5
Sulfur dioxide	SO <sub>2</sub>	-	0.25
Nitric oxide	NO	25	-
Nitrogen dioxide	NO <sub>2</sub>	0.2	-

**Figure 5: Standard Guidelines for Threshold Limits for Fumes and Gases (Jaramillo-Urrego et al., 2017)**

The threshold limits for fumes and other gases in a tractor factory will depend on the specific type and concentration of the gases being emitted, as well as the exposure time and frequency of exposure. It is important to comply with relevant health and safety regulations and standards to ensure that workers are not exposed to harmful levels of these substances.

Some commonly monitored gases in industrial settings include carbon monoxide, nitrogen oxides, sulfur dioxide, particulate matter, and volatile organic compounds. Threshold limits for these gases may be established by regulatory agencies such as the Occupational Safety and Health Administration (OSHA) in the United States or the Health and Safety Executive (HSE) in the United Kingdom (Jha et al., 2022). For example, OSHA has established a permissible exposure limit (PEL) of 35 parts per million (ppm) for carbon monoxide, and a short-term exposure limit (STEL) of 200 ppm over a 15-minute period. Sulfur dioxide has a PEL of 2 ppm and a STEL of 5 ppm over a 15-minute period. Nitrogen dioxide has a PEL of 5 ppm and a STEL of 10 ppm over a 15-minute period (Jaramillo-Urrego et al., 2017). It is important for employers to conduct regular air quality monitoring and provide appropriate personal protective equipment (PPE) to workers as needed to minimize exposure to harmful gases and fumes in the workplace.

The Big Green Tractor should comply with all applicable regulations related to the usage and disposal of chemicals. The REACH Regulation (Registration, Evaluation, Authorization and Restriction of Chemicals) is a European Union regulation aims to protect the environment and human health from the risks posed by chemicals. The Big Green Tractor should comply with all REACH requirements, including the registration and evaluation of chemicals, as well as the authorization and restriction of certain hazardous substances (Sheoran et al., 2022). The Big Green Tractor should comply with all RCRA (Resource Conservation and Recovery Act) requirements, including the proper identification, storage, transportation, and disposal of hazardous waste generated by its operations. The Clean Air Act is a US federal law that regulates air emissions from various sources, including industrial facilities. The Big Green Tractor should comply with all Clean Air Act requirements, including the monitoring and reporting of air emissions and the implementation of best practices to minimize air pollution (Alawa et al., 2022). The Clean Water Act is a US federal law that regulates the discharge of pollutants into surface waters. The Big Green Tractor should comply with all Clean Water Act requirements, including the proper treatment and disposal of waste water generated by its operations.

To comply with these regulations, the Big Green Tractor should:

- Identify all chemicals used in its operations and ensure that they are properly registered, labelled, and stored
- Develop standard operating procedures for the handling and disposal of chemicals, and train workers on these procedures
- Regularly monitor air and water emissions to ensure compliance with regulations
- Keep accurate records of all chemical usage and waste disposal activities
- Implement a waste management system that includes proper storage, transportation, and disposal of hazardous waste
- Continuously improve its operations to minimize the generation of hazardous waste and reduce its environmental impact.

By complying with these regulations, the Big Green Tractor can ensure that its chemical usage and disposal practices are safe and environmentally responsible.

## 6. Green Alternatives to Traditional Manufacturing Processes

The suitable green alternatives to traditional manufacturing processes for Big Green Tractor can be-

**3D printing:** The process of creating a physical object by layering material one layer at a time. It has the potential to reduce waste and minimize the use of raw materials. This process can also be used to produce customized parts with high precision and quality, which can lead to increased efficiency and reduced energy consumption during the manufacturing process.

**Sustainable materials:** Using sustainable materials such as recycled steel, bio-based plastics, and natural fibers can significantly reduce the carbon footprint of the manufacturing process. These materials have a lower environmental impact compared to traditional materials and can be recycled at the end of their useful life, reducing waste Devika et al., 2022).

**Lean manufacturing:** Lean manufacturing is a process that aims to minimize waste and maximize efficiency. It involves eliminating unnecessary steps in the manufacturing process, reducing the amount of energy required, and minimizing the use of raw materials. This approach can lead to significant cost savings and environmental benefits.

**Renewable energy sources:** Using renewable energy sources such as solar, wind, and hydropower can reduce the carbon emissions associated with the manufacturing process. By powering manufacturing facilities with renewable energy, companies can reduce their reliance on fossil fuels and decrease their carbon footprint (Andaregie and Astatkie, 2022).

Adopting green manufacturing processes such as 3D printing, sustainable materials, lean manufacturing, and renewable energy sources can provide several benefits to Big Green Tractor as compared to traditional manufacturing processes. Green manufacturing processes can help to reduce the cost of raw materials, energy, and waste disposal. By using sustainable materials and lean manufacturing processes, Big Green Tractor can reduce the amount of waste generated during the manufacturing process, which can lead to significant cost savings. Green manufacturing processes can significantly reduce the environmental impact of the manufacturing process (Umar et al., 2022). By using renewable energy sources, Big Green Tractor can reduce its carbon footprint and contribute to a cleaner environment. Additionally, using sustainable materials can help to reduce the use of non-renewable resources and decrease waste generation. 3D printing and lean manufacturing processes can increase the efficiency of the manufacturing process. 3D printing can be used to produce customized parts with high precision and quality, which can lead to increased efficiency and reduced energy consumption during the manufacturing process. Lean manufacturing processes can help to eliminate unnecessary steps in the manufacturing process, leading to increased efficiency and reduced waste. Adopting green manufacturing processes can help to improve the brand reputation of Big Green Tractor. Consumers are increasingly concerned about the environmental impact of products they buy and prefer companies that use sustainable manufacturing processes.

## **Conclusion**

The Big Green Tractor, an industrial tractor company based in Palembang, Indonesia, has been facing similar challenges and is seeking ways to streamline its operations to become more efficient. This decline in growth could be attributed to various factors, including increased competition, changing customer preferences, economic conditions, and technological advancements. The Big Green Tractor could implement a JIT inventory system to reduce the amount of inventory in hand. One way to reduce material purchasing costs is by negotiating better prices with existing suppliers. By sourcing materials from multiple suppliers, the company can reduce its reliance on a single supplier and minimize the risks associated with supply chain disruptions. Concurrent engineering practices can help The Big Green Tractor to

reduce manufacturing costs and improve efficiency. Conducting a cost-benefit analysis can help The Big Green Tractor to determine whether relocating its factories closer to its suppliers would be cost-effective. One of the key challenges that The Big Green Tractor is facing is the need to minimize defects throughout its manufacturing process. This is critical to improving the quality of its products, reducing costs associated with rework, and increasing customer satisfaction. One approach that the company can use to address this challenge is the Six Sigma method, which is a data-driven approach to quality management. Another approach is the Kaizen approach, which involves continuous improvement. 5S, bottleneck analysis, Muda, TQM, Poka-Yoke, and Hoshin Kanri are 21st-century tools to create a greener process. Adopting green manufacturing processes such as 3D printing, sustainable materials, lean manufacturing, and renewable energy sources can provide several benefits to Big Green Tractor as compared to traditional manufacturing processes.

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