



BUS.AL22 Lean Production: Just-in-Time, Kaizen and Time-Based Management

AQA 7132 · Calculators not allowed · about 75 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions in the spaces provided. Show working for calculations. Full sentences are required for extended answers (questions 11 and 12). GreenTech Bikes, used throughout this pack, is a fictional UK business.

- 1** Match the lean production terms to their definitions for GreenTech Bikes, a UK maker of electric bicycles. Choose the correct letter for all four terms.

Terms: 1 Just-in-time (JIT); 2 Kaizen; 3 Kanban; 4 Time-based management.

Definitions: A A visual signalling system used on the shop floor to trigger the movement or production of parts. B Continuous small improvements by employees across the business. C Reducing the time from product design to customer delivery. D Ordering or producing inventory so it arrives only when it is needed for production.

(Total for Question 1 is 1 mark)

- 2** State two operational benefits to GreenTech Bikes of using JIT stock control on its assembly line.

(Total for Question 2 is 2 marks)

- 3** Identify one risk to GreenTech Bikes of operating with very low inventory under a JIT system.

(Total for Question 3 is 1 mark)

- 4** State two features of kaizen as it might be practised at a small manufacturer such as GreenTech Bikes.

(Total for Question 4 is 2 marks)

- 5** GreenTech Bikes wants to reduce the time from prototype to customer delivery. Identify one example of a time-based management technique the business might use.

(Total for Question 5 is 1 mark)

- 6** Explain one operational benefit to GreenTech Bikes of using kanban cards on its production line.

(Total for Question 6 is 3 marks)

- 7** Identify one way GreenTech Bikes could reduce the risk of supply chain disruption while still operating JIT.

(Total for Question 7 is 1 mark)

- 8** Explain one benefit of kaizen for GreenTech Bikes. Give a developed answer that refers to the business context.

(Total for Question 8 is 6 marks)

- 9** Explain one drawback of adopting JIT for GreenTech Bikes. Give a developed answer that refers to the business context.

(Total for Question 9 is 6 marks)

- 10** GreenTech Bikes currently holds an average of 150,000 pounds of inventory on the balance sheet. Management estimates that adopting JIT would reduce average inventory by 40 percent. Calculate the new average inventory value and the reduction in pounds sterling. Show your working.

(Total for Question 10 is 4 marks)

- 11** Analyse the likely operational impact of introducing JIT at GreenTech Bikes, a manufacturer of electric bicycles that currently sources some parts from overseas and has seasonal demand peaks. Use the information in this pack in your answer.

(Total for Question 11 is 8 marks)

- 12** Evaluate whether GreenTech Bikes should adopt lean production across its operations, considering JIT, kaizen and time-based management, and using evidence from this pack. Reach a justified conclusion.

(Total for Question 12 is 12 marks)

- 13** State two operational benefits GreenTech Bikes could gain from time-based management, such as reducing time to market or using mass customisation.

(Total for Question 13 is 2 marks)

- 14** Identify one example of a kanban signal GreenTech Bikes could use on its assembly line.

(Total for Question 14 is 1 mark)

- 15** Explain one way time-based management supports mass customisation at GreenTech Bikes. Give a developed answer.

(Total for Question 15 is 3 marks)

Mark scheme · BUS.AL22 Lean Production: Just-in-Time, Kaizen and Time-Based Management

Question 1

- **B1** All four matches correct: 1 D, 2 B, 3 A, 4 C
- **Answer: 1 D; 2 B; 3 A; 4 C**

Question 2

- **B1** lower stockholding costs, because less capital is tied up in inventory
- **B1** reduced waste or lower risk of obsolete parts, since parts are held for shorter periods
- **Answer: Lower stockholding costs; reduced waste or lower risk of obsolete parts.**

Question 3

- **B1** supply chain disruption could stop production because there is no buffer stock
- **Answer: Supply chain disruption could halt production because there is no buffer stock.**

Question 4

- **B1** employee suggestions for small, ongoing improvements to processes
- **B1** frequent implementation of small changes rather than occasional large projects
- **Answer: Employee suggestions for small improvements; frequent small changes rather than occasional large projects.**

Question 5

- **B1** mass customisation, parallel processing of tasks, or reducing setup times (any one)
- **Answer: Mass customisation or parallel processing of tasks or reducing setup times.**

Question 6

- **B1** identifies a benefit, for example clearer signalling of when parts are needed
- **B1** develops the point, for example reducing overproduction and avoiding excess batches
- **B1** links to an operational outcome, for example smoother flow on the line and lower inventory levels
- **Answer: Kanban provides clearer signalling of when parts are needed, reducing overproduction and avoiding excess batches, which leads to a smoother production flow and lower inventory levels.**

Question 7

- **B1** use multiple suppliers or hold a small safety stock with critical parts
- **Answer: Use multiple suppliers for key parts or hold a small safety stock for critical components.**

Question 8

- **B1** identifies a benefit, for example continuous small improvements can improve process efficiency
- **B1** applies this to GreenTech Bikes, for example employees on the assembly line suggest ways to reduce bolt-fitting time
- **B1** develops the application, for example faster bolt fitting reduces cycle time per bike
- **B1** links to operational outcome, for example increased throughput or ability to meet demand faster
- **B1** explains a secondary benefit, for example lower unit labour cost or higher staff engagement
- **B1** gives a short evaluative comment, for example these improvements cumulatively can make the business more competitive
- **Answer: Continuous small improvements by staff can make assembly tasks quicker, for example a suggestion to change the order of components could reduce bolt-fitting time, lowering cycle time per bike. This raises throughput, helps meet demand faster and lowers unit labour cost, while engaging staff. Over time these cumulative gains make GreenTech Bikes more competitive.**

Question 9

- **B1** identifies a drawback, for example lack of buffer stock increases vulnerability to supplier delays
- **B1** applies this to GreenTech Bikes, for example a late delivery of battery packs could stop assembly of electric bikes
- **B1** develops the consequence, for example production stoppage leads to lost sales and unmet delivery promises
- **B1** links to a financial or reputational outcome, for example lost revenue or damage to customer relationships
- **B1** explains a mitigation cost, for example holding a small safety stock or paying more for faster deliveries
- **B1** gives a short evaluative comment, for example the risk may be acceptable if suppliers are reliable but not if supply chains are unstable
- **Answer: Operating with minimal stock makes GreenTech Bikes vulnerable to supplier delays; for example, a late delivery of battery packs would halt assembly, causing lost sales and missed delivery dates and potentially harming customer relationships. Mitigation, such as holding small safety stocks or paying for quicker deliveries, increases costs. The risk may be acceptable with very reliable suppliers but is dangerous if supply chains are unstable.**

Question 10

- **M1** method: $150,000 \times 0.40$ seen to find reduction
- **M1** $150,000 - (150,000 \times 0.40)$ or $150,000 \times 0.60$ seen to find new inventory
- **A1** new average inventory 90,000 pounds cao
- **A1** reduction 60,000 pounds cao
- **Answer: New average inventory = 90,000 pounds. Reduction = 60,000 pounds.**

Question 11

- **B1** identifies a relevant impact: lower inventory costs and reduced waste
- **B1** applies to the case: inventory could fall from 150,000 to 90,000 pounds (question 10)
- **B1** identifies a second impact: improved flow and faster response to demand due to smaller stock levels and kanban signalling
- **B1** develops the second impact with business context, for example quicker assembly turnaround helps meet peaks in seasonal demand
- **B1** identifies a risk: vulnerability to supply chain delays, especially for overseas suppliers
- **B1** develops the risk with context, for example delays at ports or customs could cause production stoppages during peak season
- **B1** discusses mitigation and trade-off, for example using local backup suppliers or small safety stocks increases resilience but reduces some cost savings
- **B1** provides an overall balanced analysis linking operational impacts to business outcomes such as cost savings, capacity to meet seasonal peaks and risk of lost sales
- **Answer: Introducing JIT would reduce inventory holding costs and waste, illustrated by a possible fall from 150,000 to 90,000 pounds in average stock, freeing up cash. It should improve production flow and responsiveness, particularly if kanban is used, which could help meet seasonal demand peaks by shortening assembly turnaround. The main risk is greater vulnerability to supply chain delays, especially from overseas suppliers where port or customs delays could cause stoppages during peak season. Mitigation, such as local backup suppliers or small safety stocks, reduces the risk but also reduces some cost savings. Overall, JIT can deliver meaningful operational benefits for GreenTech Bikes but requires careful supplier management to avoid harming sales during busy periods.**

Question 12

- **Level 1** (1-4): Limited evaluation with general points about lean production. Little use of the pack's figures and no clear judgement about GreenTech Bikes.
- **Level 2** (5-8): A developed evaluation that uses some evidence from the pack, considering both benefits and risks. May offer a recommendation but with limited justification.
- **Level 3** (9-12): A well developed evaluation that balances detailed advantages and disadvantages, applies figures and examples from the pack, considers mitigations, and reaches a justified conclusion appropriate to GreenTech Bikes.
- **Indicative content:**
 - Benefits: lower inventory holding costs (example reduction from 150,000 to 90,000 pounds), reduced waste, improved flow and quicker response to customer orders, and continuous incremental improvements from kaizen that raise efficiency and staff engagement.
 - Risks: increased vulnerability to supply chain disruption, especially with overseas suppliers and seasonal peaks; potential hidden costs of implementing systems such as kanban or staff training; possible need to pay higher prices for faster deliveries or hold small safety stocks.
 - Time-based management: mass customisation and reduced time-to-market can increase competitiveness and allow premium pricing, but require flexible processes and possibly investment in modular design or parallel processing.
 - Mitigations: using multiple suppliers, holding minimal safety stock for critical components, investing in closer supplier relationships, and rolling out lean methods gradually starting with pilot lines.
 - Judgement: a balanced conclusion might recommend adopting lean production selectively and with safeguards: implement kaizen and kanban widely to gain efficiency gains, trial JIT on components with reliable local suppliers, and adopt time-based approaches where mass customisation adds clear value. Full adoption across all suppliers and components carries risk unless supplier reliability and contingency plans are in place.

Question 13

- **B1** faster time to market, enabling earlier sales or first-mover advantage
- **B1** ability to offer mass customisation, allowing higher prices or better customer fit
- **Answer: Faster time to market; ability to offer mass customisation enabling higher prices or better customer fit.**

Question 14

- **B1** a coloured card, a barcode scan, or an empty bin used as a signal (any one)
- **Answer: A coloured card, a barcode scan or an empty bin used as a signal.**

Question 15

- **B1** identifies a way, for example using modular design or parallel processing to shorten lead times
- **B1** develops the point, for example modular components let the firm assemble customised bikes quickly
- **B1** links to an outcome, for example faster delivery of customised orders and potential to charge a premium
- **Answer: Using modular design and parallel processing allows GreenTech Bikes to assemble customised configurations quickly, so customised orders are delivered faster and the firm can potentially charge a premium.**