ZIMBABWE EZEKIEL GUTI UNIVERSITY

FACULTY OF LAW, BUSINESS INTELLIGENCE AND ECONOMICS

DEPARTMENT OF ECONOMICS, MARKETING AND ENTREPRENEURSHIP

EXAMINATION PAPER

COURSE CODE	:	CBM 405/414
COURSE TITLE	:	PRODUCTION AND OPERATIONS MANAGEMENT
DURATION	:	3 Hours
LEVEL	:	4.1
SPECIAL REQUIREMENTS	:	NONE

13 FEB 2024

INSTRUCTIONS TO CANDIDATES:

1. No cell phones are allowed in the examination venue.
2. Use of silent, non-programmable calculators is allowed
3. Answer question number **one (1)** in Section A (Compulsory) and any other **three (3)** questions in Section B.
4. Begin each question on a new page.
5. The number of marks for each question or part question is shown in brackets [ ]
6. Show all workings, where applicable.

SECTION A (Compulsory)

CASE STUDY: Siemens, The Pioneers Of Smart Manufacturing

Siemens' Amberg plant in Germany and Chengdu plant in China are both smart factories and have been devoted to providing automation and smart manufacturing services for manufacturers. When the concept of smart manufacturing emerged, Siemens rapidly launched comprehensive smart manufacturing solutions. Siemens' solutions include two categories, TIA (Totally Integrated Automation) and PLM (Product Lifecycle Management).

TIA and PLM indicate the functions required by smart factories and use all kinds of hardware/software technology to improve production quality. Siemens' solutions show that the company has made deployment in every aspect of smart manufacturing. Since the launch of Siemens product life-cycle management (PLM) Software in 2007, Siemens has gradually become a critical competitor to PTC, Dassault, and Auto Desk. As Siemens' PLM deployment expands, the company has enjoyed steady business growth every year. Siemens has aggressively acquired vendors specializing in robotic arms and industrial components since 2001. The goal is to provide integrated solutions by combining its existing information control systems with plant-floor machines and standardizing hardware and information systems.

Siemens already played a key role in the Industry 3.0 era, helping factories transfer towards automation. As Industry 4.0 approached, Siemens adopted more aggressive M&A strategies over the past decade as part of its attempt to help factories move further towards smart manufacturing through a comprehensive portfolio of integrated hardware and software solutions.

The aim is to allow physical equipment and information to communicate and converge with each other, turning factories into an organic entity and ultimately becoming autonomous. To achieve autonomous production, the smart manufacturing process is divided into three aspects, which are manufacturing equipment, information control, and software applications. The transformation begins with hardware integration (manufacturing equipment), followed by the convergence of software, hardware, and networks (information control and software applications). The result is a smart factory where physical and virtual components are integrated together.

As data from the manufacturing environment becomes increasingly diversified, massive, and complex, analyzing the data more efficiently to improve factories' control over production volume, quality, and equipment maintenance pose tremendous challenges for Siemens.

Siemens has continued to enhance its deployment in information control and manufacturing equipment. With organizational restructuring and the acquired technologies, Siemens' solutions can be further applied to different areas. While Siemens has proactively acquired information control and manufacturing equipment companies, the key to smart factory lies in the capabilities of using software effectively to integrate factory data, support product design, and analyze data. Siemens has aggressively purchased software companies to integrate its smart manufacturing solutions.

From 2011 to 2014, Siemens acquired or formed strategic alliances with ten IT software providers in MES, Computer Aided Design/Computer Aided Engineering, CAM, and big data areas. Siemens even combined different vendors' systems into one large solution to expand the convergence of smart manufacturing technologies. While major vendors

resort to M&A to turn their weaknesses into strengths, some vendors have sought to enhance their capabilities via strategic partnerships in order to support factory transformation with system integration solutions. Although these business models can help the vendors expand their service coverage, executives still need to negotiate with their partners over cooperation models and profit-sharing arrangements to make sure the cooperation ends with a bang, not a whimper. With these efforts, vendors can earn customers' confidence in their system integration abilities. By operating as a system integration partner and accumulating integration experience in different manufacturing sectors, vendors will be able to create a win-win outcome while providing cost effective services with consulting expertise for customers.

QUESTION ONE

a i) Using information from the case and any other, give a brief explanation of the concept of Industrie 4.0 Smart Manufacturing. **[5 Marks]**

ii) Distinguish the difference between Computer Aided Design (C.A.D) and Computer Aided Manufacturing (C.A.M) in Industrie 4.0 Smart Manufacturing. **[4 Marks]**

b) Analyse any two benefits of Industrie 4.0 to Siemens if it is to be adopted. **[8 Marks]**

c) Discuss two ways that companies and economies can adopt and adapt to promote Industrie 4.0. **[8 Marks]**

SECTION B

Essay Questions (Choose any three questions)

QUESTION 2

"The importance of one department of an organization over another is more of an egg-chick relationship, but yet they complement each other." In light of this notion, discuss how an organization can gain a competitive advantage through the use of both Production and Marketing functions. **[25 Marks]**

QUESTION 3

a) A hardware sells 2000 bags of cement each year. It has estimated that cost of holding one bag of cement for a year is $4. The cost of replacing an order for new stock is $250. From this information, calculate:

i) Economic Order Quantity for the bag of cement. **[3 Marks]**

ii) Number of orders to be placed each year. **[3 Marks]**

iii) Annual cost of placing orders **[3 Marks]**

iv) Annual cost of holding stock of cement **[3 Marks]**

v) Annual Total Inventory Cost **[3 Marks]**

b) "Either way stock can be costly." Discuss this assertion in light of costs associated with dealing with stock. **[10 Marks]**

QUESTION 4

a) With the aid of practical examples, analyze two factors that influence product and service design or redesign. **[10 Marks]**

b) With reference to an organization of your choice, evaluate how the company incorporates the voice of the customer as it designs its products or its services. **[15 Marks]**

QUESTION 5

a) Explain three characteristics of a good plant layout. **[10 Marks]**

b) Giving Practical Examples, discuss three basic plant layouts that manufacturing enterprises can adopt. **[15 Marks]**