Strathmore
UNIVERSITY

STRATHMORE UNIVERSITY BUSINESS SCHOOL
BACHELOR OF SUPPLY CHAIN AND OPERATIONS MANAGEMENT

END OF SEMESTER EXAMINATION
SCM 4106: SUPPLY CHAIN 4.0 AND INDUSTRIAL INTERNET OF THINGS

DATE: 4th December 2023 **Time: 15:30-17:30**

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTION ONE

a) Read the case below and answer the questions that follow:

Rockwell Automation

Rockwell Automation is one of the world's largest providers of industrial automation and information solutions. It has customers in more than 80 countries worldwide and around 22,500 employees. One of its business areas of focus is assisting oil and gas companies in exploration. An example is Hilcorp Energy, a customer company that drills oil in Alaska. The equipment used in drilling, extracting, and refining oil is very expensive. A single fault in the equipment can cost the company around $100,000 to $300,000 per day in lost production. To deal with this problem, it needed technology to monitor the status of such piece of equipment remotely and to predict failures that are likely to happen in the future. Rockwell Automation considered the opportunity to expand its business in oil and gas industries by gathering data from the exploration sites and analysing them to improve preventive maintenance decision making regarding the critical equipment, thus, minimizing downtime and drive better performance. The company utilizes its vision of Connected Enterprise with Microsoft's software.

Sensor Applications and Radio Frequency Identification (RFID) Sensors

There are many types of sensors. Some measure temperature; others measure humidity. Many sensors collect information and transmit it as well.

RFID SENSORS

- Radio-frequency identification (RFID) is part of a broader ecosystem of data capture technologies. Several forms of RFID in conjunction with other sensors play a major role in IoT applications. Let us see first what RFID is, as discussed in Technology Insights 13.1. to monitor and support oil and gas equipment placed in remote areas. Rockwell is now providing solutions to predict failure of equipment along the entire petroleum supply chain, monitoring its health and performance in real time, and to prevent failures in the future. Solutions are provided in the following areas.

• Drilling: Hilcorp Energy has its pumping equipment stationed in Alaska where it drills for oil 24 hours a day. A single failure in equipment can cost Hilcorp a large amount of money. Rockwell connected electrical variable drives of pumping equipment to be processed in the "cloud," to control its machines thousands of miles away from the control room in Ohio. Sensors capture data, and through Rock well's control gateway, these data are passed to Microsoft Azure Cloud. The solutions derived reach Hilcorp engineers through digital dash boards that provide real-time information about pressure, temperature, flow rate, and dozens of other parameters that help engineers monitor the equipment's health and performance. These dashboards also display alerts about any possible issues. When one of Hilcorp's pieces of pumping equipment failed, it was identified, tracked, and repaired in less than an hour, saving six hours of tracing the failure and the large cost of lost production.

- Building smarter gas pumps: Today, some delivery trucks use liquid natural gas (LNG) as fuel. Oil companies are updating their filling stations to incorporate LNG pumps. Rockwell Automation installed sensors and variable frequency drives at these pumps to collect real time data about equipment operations, fuel inventory, and consumption rate. These data are transmitted to Rockwell's cloud platform for processing. Rockwell then generates interactive dashboards and reports using Microsoft Azure (an IoT platform). Results are forwarded to the appropriate stakeholders, giving them a good idea about the health of their capital assets.

The Connected Enterprise solution by Rockwell has accelerated growth for many oil and gas companies like Hilcorp Energy by bringing their operations data to the cloud platform and helping them reduce costly downtime and maintenance. It has resulted in a new business opportunity for industrial age stalwarts like Rockwell Automation

Source: Sharda et al (2018)

Required:

i). What type of information would likely be collected by an oil and gas drilling platform? **(4 marks)**

ii). Imagine that you have been engaged to evaluate and recommend possible technologies to improve the supply chain of a company that manufactures and sells washing machines. Based on your studies and the case above, recommend possible technologies of Supply Chain 4.0 that could make the supply chain work well. **(10 marks)**

b) Explain the historical development to supply chain 4.0 **(6 marks)**

c) Blockchain has had a big impact in the field of payment systems that facilitate business. It is also considered one of the technologies that could have a big impact in the supply chain field.

i). Explain the meaning and application of blockchain in the supply chain. **(5 marks)**

ii). Explain two factors that may be hindering the adoption of block chain in the supply chain **(5 marks)**

QUESTION TWO (TOTAL 15 MARKS)

a) Explain the meaning and scope of SC 4.0 **(2 marks)**
b) Explain three challenges of SC 4.0 **(5 marks)**
c) In order for an organization to thrive it needs to ensure the customer experience for its products or services is at a high level. It is argued that Supply Chain 4.0 can contribute to a great customer experience.

Required:

i). Explain any two measures of good customer experience. **(3 marks)**
ii). How would any two of the technologies in SC 4.0 facilitate any two of the measures of good customer experience? **(5 marks)**

QUESTION THREE TOTAL 15 MARKS)

Artificial intelligence is perhaps the most significant change in the operating environment for organizations globally.

Required:

a) Explain the meaning of AI and its various subunits. **(4 marks)**
b) Explain how AI has been influential in any three stages of the supply chain. **(6 marks)**
c) Explain the role of AI in three other components of SC 4.0. **(5 marks)**

QUESTION FOUR (TOTAL 15 MARKS)

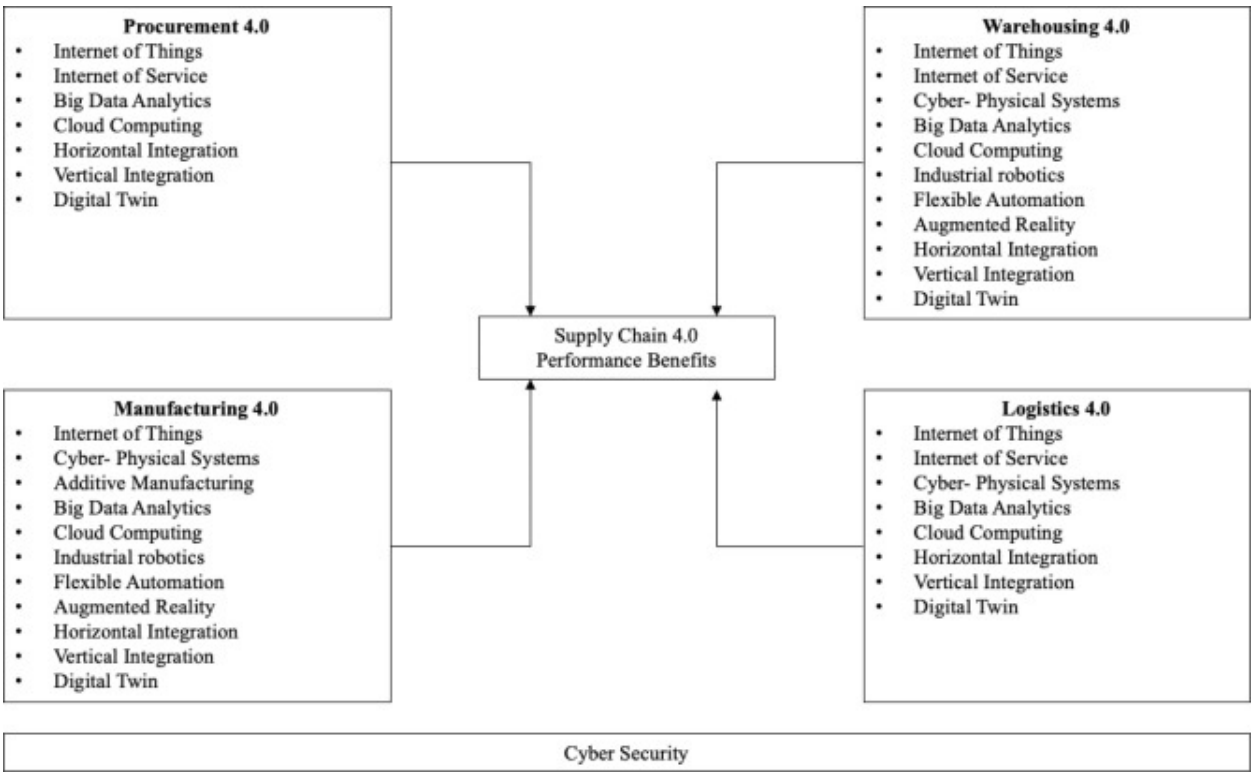
Internet of Things (IoT) and Industrial Internet of Things (IIoT) is growing exponentially and becoming increasingly pervasive in the operations of organizations.

Required:

Explain any **five** drivers of IoT

QUESTION FIVE (TOTAL 15 MARKS)

Below is a framework proposed by Govindan et al (2022) regarding performance for Supply Chain 4.0 in the respective areas.



Required:

a) Describe each dimension using relevant examples of the practical applications of the different technologies and concepts. **(6 marks)**

b) Explaining how SC performance can be increased for any two of the dimensions identified. **(9 marks)**