

**THE INFLUENCE OF PREDICTIVE
TECHNOLOGY ON BUSINESS
SUSTAINABILITY IN OIL AND GAS SUPPORT
SERVICES INDUSTRY**

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THE INFLUENCE OF PREDICTIVE TECHNOLOGY ON BUSINESS
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ABSTRACT

This study focuses on the role of predictive technology in enhancing business sustainability within the oil and gas support service industry. The oil and gas industry is under increasing pressure to improve its environmental and social performance while maintaining profitability. Predictive technology, which involves the use of data analytics, artificial intelligence, and machine learning, has the potential to enhance business sustainability by improving operational efficiency, reducing costs, and minimizing environmental impacts. This study examines the imperatives of predictive technology adoption and implementation, as well as the challenges and opportunities associated with its use. A qualitative approach is used to investigate the use of predictive technology within a specific oil and gas support service company. Data were collected using semi-structured interviews and document analysis to meet the research objectives. Participants of this study were managers and technical experts from the oil and gas support services industry in several cities within Malaysia. The findings of the study indicate that the industry players perceived predictive technology can significantly improve business sustainability by several ways namely increase operational efficiency, cost savings, better asset management, better service to the customer, enable well-informed decision and better risk management. Despite some challenges the adopters believe that factors such as data quality and security, sound financial resources, skilled technical talent, government support, labour mobility and the growth of digital economy are enablers essential for successful adoption of predictive technology leading to business sustainability. Subsequently, the study reports the key elements of sustainable strategy with regard to implementing predictive technology that is collaborative partnerships, business scalability planning, talent management, leadership and change management as well as continuous monitoring and evaluation. This study proposes a framework of predictive technology implementation toward enhancing business sustainability from the oil and gas support services industry, which may assist industrialists in planning for effective technology adoption. The findings of this study limits generalizability to other business environment, which is common for qualitative research. While the study primarily focuses on an exploratory study of predictive technology's imperatives, further research could examine empirically to a larger sample, the factors found by this research.

Keywords: Predictive technology, business sustainability, oil and gas sector, support service industry, artificial intelligence.

APPROVAL

This is to certify that this thesis conforms to acceptable standards of scholarly presentation and is fully adequate, in quality and scope, for the fulfilment of the requirements for the degree of Doctor of Business Administration

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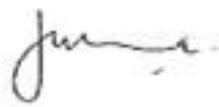
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Professor Juhary Bin Ali

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12 September 2023

DECLARATION

I hereby declare that the thesis submitted in fulfilment of the DBA degree is my own work and that all contributions from any other persons or sources are properly and duly cited. I further declare that the material has not been submitted either in whole or in part, for a degree at this or any other university. In making this declaration, I understand and acknowledge any breaches in this declaration constitute academic misconduct, which may result in my expulsion from the programme and/or exclusion from the award of the degree.

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LIST OF ABBREVIATION

4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
IOT	Internet of Things
O&G	Oil and Gas
TBL	Triple Bottom Line
RBV	Resource-Based View
TOE	Technology-Organization-Environment

CHAPTER 1

INTRODUCTION

1.0 Overview

The Fourth Industrial Revolution has brought about significant technological advancements that have had a profound impact on industries worldwide (Kagermann et al., 2013). Artificial Intelligence and Internet-of-Things technologies have transformed the way businesses operate by providing a better understanding of customer needs and wants, increased efficiency, and effectiveness in business processes (Lee et al., 2015). Predictive technology, a subset of artificial intelligence, has been identified as a technology that can create significant business value for companies (Lapão et al., 2018).

In the oil and gas support services industry, predictive technology can help enhance business sustainability by improving operational efficiency, reducing costs, and minimizing environmental impacts. With the increasing pressure on industry to reduce its negative environmental and social impacts, it is becoming increasingly crucial for companies to adopt sustainable business practices. Predictive technology can play a vital role in this effort by providing valuable insights that can guide decision-making and lead to more sustainable practices.

The importance of sustainability in the oil and gas industry cannot be overstated. The industry is under increasing scrutiny from regulators, investors, and society as a whole to reduce its carbon footprint and mitigate its environmental impact. Failure to do so can result in significant reputational damage and financial consequences. Therefore, there is a growing interest among industry players to rethink business strategies while taking advantage of predictive technology to enhance sustainability. This study aims to investigate the potential benefits and challenges of predictive

technology adoption and implementation in the oil and gas support services industry, with the aim of providing valuable insights that can guide decision-making and lead to more sustainable business practice.

1.1 Background of Study

The advancement of technology has been a major driver of change in various industries over the past few years. In particular, the rise of artificial intelligence (AI) and the Internet-of-Things (IoT) has transformed the way companies operate. Predictive technology, a subset of AI, has gained considerable attention as a tool for enhancing business sustainability and improving decision-making.

According to a report by Grand View Research, the global predictive analytics market is expected to grow from \$7.2 billion in 2020 to \$23.5 billion by 2028, with a compound annual growth rate (CAGR) of 16.5% during the forecast period (Grand View Research, 2021). The report cites the increasing demand for predictive technology in various industries, including healthcare, finance, and retail, as a key factor driving this growth.

In the oil and gas industry, predictive technology has been identified as a valuable tool for enhancing sustainability. A study by the Global CCS Institute found that predictive maintenance using IoT sensors can help to reduce unplanned downtime and improve efficiency in the oil and gas sector (Global CCS Institute, 2018). This, in turn, can lead to reduced emissions and improved environmental performance.

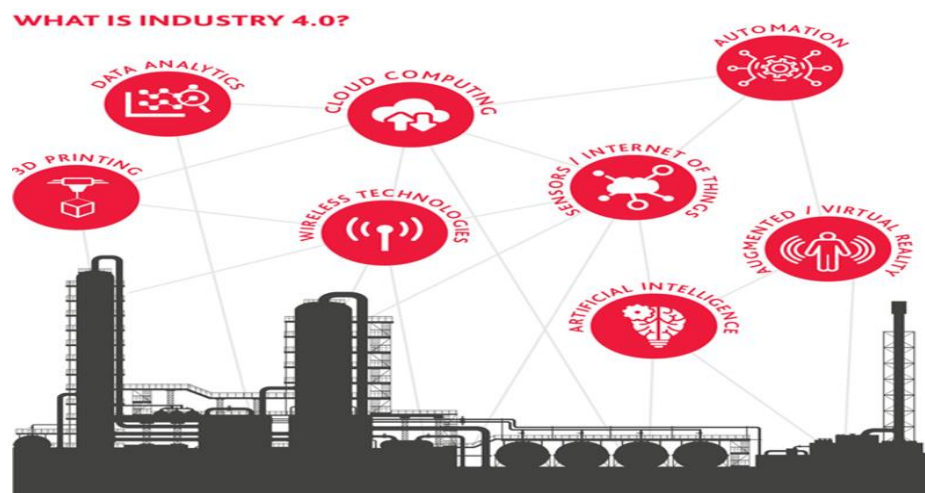
Furthermore, a report by the World Economic Forum highlights the potential of AI to help reduce greenhouse gas emissions and enhance sustainability across various industries, including energy and transportation (World Economic Forum, 2018). The report notes that AI can help to optimize operations, reduce waste, and improve efficiency, thereby reducing the environmental impact of these industries.

In mainstream news, there have been several reports on the increasing use of predictive technology in various industries. For example, Forbes reported on the use of predictive analytics in healthcare to improve patient outcomes (Forbes, 2020), while The Guardian highlighted the use of predictive technology in agriculture to increase crop yields and reduce waste (The Guardian, 2019). Several studies on predictive technology have been reported in recent years. For example, a study in the International Journal of Production Research examined the use of predictive analytics in supply chain management (Lee et al., 2019), while a study in the Journal of Business Research investigated the use of predictive modeling in customer churn analysis (Nguyen et al., 2018).

Overall, there is significant literature supporting the use of predictive technology in enhancing business sustainability and improving decision-making across various industries, including the oil and gas sector. The growing demand for this technology is expected to drive continued growth in the predictive analytics market in the coming years.

1.1.1 The 4th Industrial Revolution (4IR)

Figure 1.1: What is industry 4.0?



Source: BDO USA, LLP, 2018

Industry 4.0, as depicted in a diagram by BDO USA, LLP in 2018, represents a transformative paradigm shift in the manufacturing and industrial sectors. It encompasses the convergence of digital technologies, data analytics, automation, and connectivity to create a highly interconnected and intelligent ecosystem. This concept envisions a future where smart factories and production systems leverage technologies such as the Internet of Things (IoT), artificial intelligence (AI), cloud computing, and cyber-physical systems to enable seamless communication, real-time monitoring, and adaptive decision-making. Industry 4.0 aims to enhance operational efficiency, optimize resource utilization, and enable predictive maintenance, all of which contribute to higher productivity and innovation across the value chain. The diagram by BDO USA, LLP, captures the essence of Industry 4.0 as a dynamic integration of cutting-edge technologies, transforming traditional industries into agile, data-driven, and interconnected systems that shape the future of manufacturing and beyond.

The 4th Industrial Revolution, characterized by the fusion of digital technologies, automation, and data-driven decision-making, has paved the way for transformative changes in various industries (Schwab, 2017).

1.1.1.1 Artificial Intelligence and Its Predictive Capabilities as Part of the Fourth Industrial Revolution Key Technologies

AI, as a cornerstone of the 4IR, encompasses a broad range of techniques and approaches that enable machines to mimic human intelligence and perform tasks that traditionally require human cognition. From machine learning algorithms to natural language processing and computer vision systems, AI technologies have demonstrated their potential to revolutionize industries and spur innovation. Moreover, AI-powered quality control systems can identify defects or anomalies in real-time, enabling immediate corrective actions and minimizing product defects. This results in improved

product quality, customer satisfaction, and reduced re-work or scrap (Lee et al., 2019). Additionally, AI algorithms can optimize energy consumption, resource allocation, and supply chain management, contributing to sustainable and environmentally conscious practices in the manufacturing sector (Chen et al., 2020). As Brynjolfsson and McAfee (2017) emphasize, AI technologies have the capacity to automate routine and cognitive tasks, enhance productivity, and contribute to economic growth.

The application of predictive technologies has become increasingly prevalent in various industries, offering valuable insights and contributing to business sustainability (Marwala & Hurwitz, 2017; Sharma & Sharma, 2019).

Predictive technology, powered by AI algorithms, leverages vast amounts of data to identify patterns, predict outcomes, and optimize processes in real-time. This capability has significant implications for industry, allowing businesses to anticipate maintenance needs, optimize production schedules, and enhance product quality (Lee et al., 2019).

One area where predictive technologies have made a significant impact is in supply chain management. By utilizing predictive analytics, businesses can enhance operational efficiency and reduce costs. For example, predictive demand forecasting models enable companies to anticipate consumer demand patterns accurately, optimize inventory levels, and streamline production processes. According to a study by Li et al. (2020), predictive analytics in supply chain management can lead to reduced stockouts, minimized excess inventory, improved customer satisfaction, and enhanced sustainability performance.

Another critical application of predictive technologies is in customer relationship management (CRM). By analyzing customer data and behaviors, businesses can predict customer preferences, anticipate their needs, and offer

personalized experiences. This enables targeted marketing campaigns, improved customer retention, and enhanced loyalty. A research study by Verhoef et al. (2017) highlights how predictive analytics in CRM helps businesses achieve higher customer lifetime value, increased profitability, and sustainable growth.

Moreover, predictive technologies contribute to business sustainability by enabling proactive risk assessment and mitigation. By analyzing historical data and identifying risk patterns, businesses can anticipate potential risks and take preventive actions. For instance, predictive analytics can help identify potential equipment failures, enabling timely maintenance and reducing costly downtime. A study by Hu et al. (2018) emphasizes how predictive maintenance using advanced analytics can significantly improve operational efficiency, extend asset lifecycles, and enhance business sustainability.

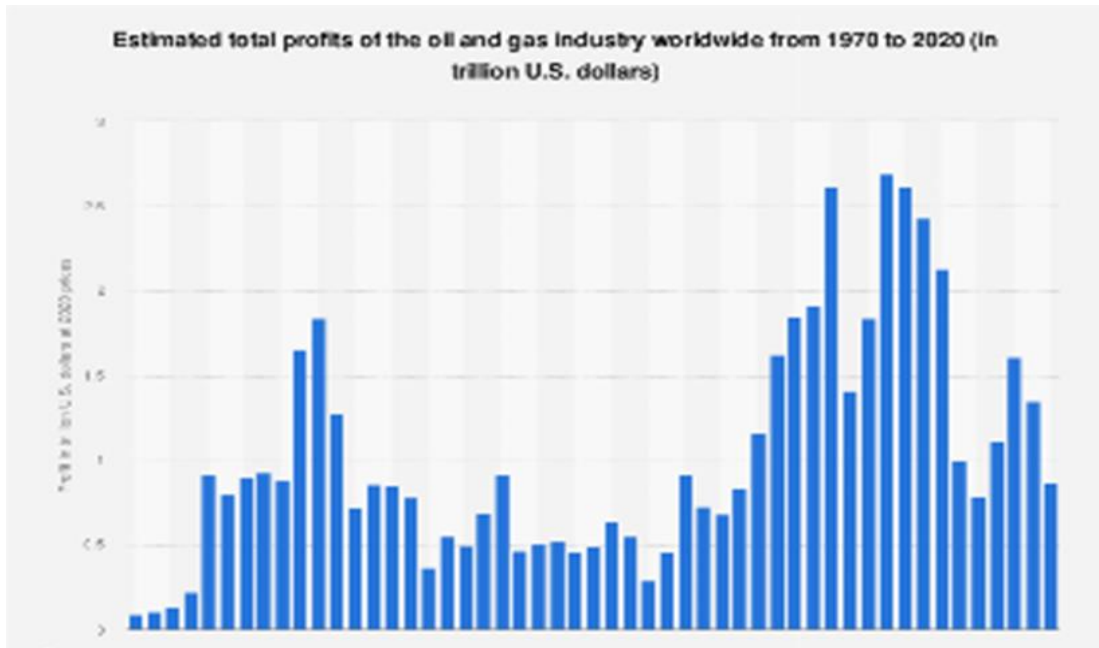
Furthermore, predictive technologies play a vital role in optimizing energy consumption and promoting sustainable practices. By analyzing data from energy monitoring systems, businesses can identify energy usage patterns, detect inefficiencies, and implement energy-saving measures. A study by Gupta et al. (2018) emphasizes how predictive analytics helps optimize energy usage in buildings, leading to reduced energy waste, lower costs, and improved environmental sustainability.

1.1.2 Oil and Gas Industry Economic Importance

1.1.2.1 The Oil and Gas Industry

The oil and gas (O&G) industry holds immense importance both globally and in Malaysia, contributing significantly to economic growth, energy security, and employment.

Figure 1.2: Estimated total profits of the oil and gas industry worldwide from 1970 to 2020



Source: Statista, 2023

Figure 1.2, sourced from Statista's 2023 data, provides a compelling visual representation of the estimated total profits of the global oil and gas industry spanning from 1970 to 2020. This figure offers a historical perspective on the industry's financial performance over several decades, capturing the fluctuations and trends in profitability within the sector. By presenting a chronological depiction of profits, the figure showcases pivotal events and milestones that influenced the industry's economic trajectory, such as geopolitical shifts, market dynamics, technological advancements, and environmental considerations. The comprehensive scope of the data, combined with the credibility of Statista as a reputable data source, enhances the figure's value as a reference tool for researchers, policymakers, and stakeholders aiming to grasp the economic resilience and responsiveness of the oil and gas industry to global developments across the decades.

Globally, the O&G industry remains a critical sector that powers economies and fulfills a substantial portion of the world's energy demand. According to the International Energy Agency (IEA), in 2020, oil accounted for approximately 33% and gas for about 24% of global energy consumption. The industry's significance stems from its role in powering various sectors, including transportation, manufacturing, and residential heating. It acts as a key driver of economic development, attracting investments, and creating job opportunities throughout the value chain.

Table 1.1, extracted from the "ISEAS Perspective 2022/21," offers a structured overview of the oil and gas revenue's contribution to Malaysia's total public revenue spanning from 1975 to 2020. This tabular representation provides a comprehensive breakdown of the financial significance of the oil and gas sector within Malaysia's economic landscape over several decades. It showcases an immense increase in the sector's share of the country's public revenue from 7.8 per cent in 1975 to 22.4 per cent in 2022 – close to 15 per cent within 45 years, allowing for a clear understanding of its evolving impact on the national fiscal framework. By aligning with the authoritative source of ISEAS Perspective, the table gains credibility as a reliable reference for policymakers, researchers, and analysts interested in exploring the historical trends and financial implications of the oil and gas industry on Malaysia's economic development.