

Digital disruptions in commodity trading and risk management : Impact on operational performance of oil and energy trading firms in UAE

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Abstract

The commodity trading sector, particularly within the oil and energy markets, faces unprecedented challenges driven by rising uncertainties, reduced global demand, geopolitical risks, and market volatility. The onset of the Russia–Ukraine war, compounded by the Covid-19 pandemic, has accelerated the adoption of digital technologies and virtual collaborative tools among trading firms, fundamentally reshaping business processes. This study investigates the impact of digital disruptions on the oil and energy trading sector in the United Arab Emirates (UAE), with a specific focus on the integration and adoption of Commodity Trading and Risk Management (CTRM) solutions. By employing a comparative analysis of trading operations before and after CTRM implementation, alongside detailed case studies of UAE-based firms, this research examines how advanced digital technologies have transformed operational efficiency, strategic management, and risk management practices within the sector. Primary data from 68 oil and energy trading firms were collected through a cross-sectional descriptive research design, using a comprehensive questionnaire that addressed pre- and post-adoption scenarios. Results reveal significant enhancements in operational efficiency and risk management capabilities following the adoption of CTRM digital solutions. Case studies highlight how UAE firms have leveraged these technologies to improve market responsiveness, reduce transaction times, and enhance transparency and security in trading operations. The study concludes that firms have become better equipped to navigate volatile markets, mitigate risks, and increase profitability, with stakeholder feedback affirming improved efficiency throughout the trade cycle. This research contributes

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to the energy trading industry by demonstrating how embracing digital technologies for CTRM functions can foster sustainable competitive advantages and align with future market developments. It underscores the importance of continuous innovation and strategic agility in the evolving digital landscape.

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Introduction

This document investigates the transformative surge of digital disruptions that are affecting the global economic landscape, with a focus on its impact on the oil and energy trading sector in the Middle East especially in United Arab Emirates (UAE). The study is aimed at two purposes: firstly, to identify the current state of digital disruptions within commodity trading; secondly, how Commodity Trading and Risk Management (CTRM) systems have to evolve for them to be able to navigate these disruptions. Digital disruption takes place when new digital technologies and business models change the value proposition of existing goods or services. In commodities trading, these disruptions not only change ways of doing things but also fundamentally reshape firms' strategic outlooks. Some key technologies driving this transformation include Artificial Intelligence (AI), Blockchain and Internet of Things (IoT) which have created unprecedented opportunities for optimization, risk management as well as market expansion.

The oil and energy sector, a cornerstone of the global economy and particularly pivotal in the technological advancements are causing the Middle East to undergo a major revolution. The UAE is an important case study for understanding how digital disruptions have impacted on commodity trading given their strategic emphasis on innovation and digital economy. This focus is also necessary because it is the home of global energy markets and has very ambitious plans for its future as a trading hub. Seventy Five (75) international commodity trading firms moved their operations to Dubai, UAE in 2023-2024 due to ease of doing business and ecosystem. Essential tools that assist in navigating the digital landscape include Commodity Trading and Risk Management (CTRM) systems. Originally designed to enhance efficiency in operations, while reducing risks, these platforms are now at the crossroads between traditional trading approaches and a digitalized future. Consequently,

dealing with the associated challenges calls for adapting and embracing digital solutions into CTRM systems.

The Middle East is a region characterized by oil and energy, a central point in the global energy markets. Among the many countries in this region, United Arab Emirates (UAE) is unique due to its strategic positioning, vast oil resources and forward looking approach to energy trade. This section examines how the UAE's commodity trading ecosystem has evolved amidst global and regional shifts that have seen an increase in digitalization. The significance of the UAE in the global energy market cannot be overemphasized. With some of the world's largest oil reserves, it represents a major factor in crude oil exportation and trading. As such, UAE leadership's strategic thinking has made it more than just a country with abundant natural resources but also an innovation hub and provider of digital platforms for trade. These participants include national petroleum companies (NOCs), international petroleum companies (IOCs), independent merchants as well as service providers. The highly diverse nature of these players makes for an environment where digital technologies can easily penetrate into driving a dynamic trading industry. In recent months, commodity trading activities within UAE have undertaken significant steps towards digitization. This has been associated with increased adoption of block-chain based transaction systems and AI analytics tools; which means that there are efforts towards making trade more efficient, transparent and secure even though they are still at nascent stages currently being experimented on by pioneers across various industries around world stages so far like banking sector globally among others. Understanding the roles of various stakeholders within the UAE's oil and energy trading ecosystem is crucial for appreciating the impact of digital disruptions.

1. Overview of CTRM Digital Solutions:

Commodity Trading and Risk Management (CTRM) systems are software solutions developed to enable effective management of trades, portfolios, and related risks by entities involved in commodity trading. Through this digitization process of the commodity trading process these systems have become a valuable resource with capacity for trade capture and contract management, logistics, regulatory compliance as well as financial accounting [23], [32], [21], [24], [17], [20], [18], [19], [2], [33]. Basically, CTRM systems provide an efficient platform for managing the various transactional activities related to commodities such as tracking

physical and financial positions held by companies in this area as well as assessing market risk and ensuring that organizations comply with changing regulations. A basic CTRM system typically includes modules for trading, risk management, supply chain logistics, financial management and compliance. Each module is designed so that they can work together seamlessly providing an integrated view of all the trading operations at the firm level. Digital developments are rapidly pushing for changes in CTRM systems thus their evolution signifies how far digitalization have gone. This indicates a shift from traditional rigid structures to more flexible end-to-end solutions that ride on latest available digital technology with following features:

Integration of Advanced Analytics: Modern CTRM systems incorporate advanced analytics, leveraging big data and AI to provide deeper insights into market trends, risk exposure, and operational efficiencies.

Cloud-based Platforms: The shift towards cloud-based CTRM solutions offers enhanced scalability, accessibility, and cost-efficiency, facilitating the adoption of CTRM systems by a broader range of market participants.

Blockchain and Smart Contracts: Some CTRM platforms are beginning to integrate blockchain technology and smart contracts, promising to revolutionize trade verification, settlement processes, and contract management through enhanced transparency and security.

In the rapidly evolving digital landscape, the adoption of advanced CTRM solutions is becoming a critical factor for maintaining and enhancing market competitiveness. With markets becoming increasingly volatile, the ability of CTRM systems to provide real-time insights into market positions and risk exposure is invaluable. By automating routine tasks and streamlining processes, CTRM systems significantly enhance operational efficiency, freeing up resources for strategic decision-making. CTRM systems play a crucial role in modernizing commodity trading operations, enabling firms to navigate the complexities of the global trading environment more effectively. As regulatory requirements become more stringent, CTRM systems offer vital tools for ensuring compliance, thereby mitigating legal and financial risks. The transformation of CTRM systems in response to digital advancements has not only expanded their functionality but also their strategic significance within the commodity trading sector. As these systems continue to evolve, they stand at the forefront of the sector's digital transformation journey, enabling firms to

leverage the full potential of digital technologies in optimizing their trading operations.

This paper will explore the specific digital technologies impacting commodity trading and how CTRM systems are adapting to incorporate these technologies, focusing on the context of the Middle East, particularly the UAE. This exploration will underscore the critical role of CTRM systems in empowering oil and energy trading firms to navigate the challenges and opportunities presented by digital disruptions.

2. Literature Review

Past literature provide valuable insights into how digital disruptions are reshaping the oil and energy trading industry, emphasizing the critical role of digital technologies in driving innovation, efficiency, and competitiveness. Digital disruptions is the phenomenon when established businesses succumb to new business models that exploit emerging technologies. Skog, Wimelius, and Sandberg [34] discuss the transformative effect of digital disruption on the financial industry, highlighting the significant role of data and connectivity in reshaping business models. They stress the necessity for financial intermediaries to adopt digital business models to remain competitive. Rassenfoss [27] presents the oil industry's shift towards big data analytics as a top trend for business growth, emphasizing digital innovations for operational efficiency and cost reduction. This survey reveals the industry's high expectations from digital technologies to scale operations effectively. Tung, Trung, Hai, & Tinh [38] explore the digital transformation trends in the oil and gas industry, underlining "digital disruption" as a critical factor for businesses to innovate and stay relevant. They argue that digital technologies, including cloud computing, big data, and IoT, significantly contribute to enhancing operational reliability and hydrocarbon recovery. Wishnow, Azar, and Rad [40] identify emerging technologies with disruptive potential in the oil and gas industry, such as AI, blockchain, and nanotechnology by conducting research with 50 E&P companies. They highlight the industry's need for foresight to guide investment in infrastructure with technological innovations. Cozmiuc & Petrișor, [4] discusses digital disruption's global impact, highlighting the shift from traditional business models to those centered on knowledge creation and open innovation while emphasising Innovation in the age of Digital Disruption. Wirtz, Weyerer, and Heckerroth [39] provide an integrative framework for understanding digital disruption, identifying key

dimensions such as market factors, organizational factors, and the impact on value constellations. Their framework aims to guide managers in creating or dealing with digital disruptions. Stewart, Schatz, & Khare [35] reviewed some of the characteristics of digital disruption and concluded that low complexity industries with low levels of digitisation are likely to be the initial targets for disruption. In first order stage, productivity gains are observed which in second order stage undermined by continued digitisation that destabilises the pre-existing value proposition and thereby establishes a new product or service. Digital transformation pushes firms to change both internal structures as well business models because of complex and challenging organizational learning process [31]. Digital transformation simultaneously affects multiple areas within the firm, influencing all functional and operational areas along with strategic decisions. Transformation is not a smooth straight forward process, but a rather complicated way [12]. Kilkki, Mäntylä, Karhu, Hämmäinen, & Ailisto [16] presents a model for understanding disruptions across industries, offering a structured approach to navigate and assess the impact of technological changes. The framework highlights the importance of strategic adaptation to survive environmental changes, making it relevant for analyzing the oil and energy trading sectors' response to digital disruptions. Penas Franco [26] explores the transformative impact of digital technologies on the retail industry. While focused on retail, the insights into customer-centric technology applications and the importance of adapting business models to digital trends are equally valuable for oil and energy trading firms looking to innovate and maintain competitive advantages in a digitally disrupted environment. Thakur, AlSaleh, & Hale [36] provides a managerial perspective on the drivers and consequences of digital disruption. This study is instrumental for understanding how digital disruptions influence user experience and firms' performance in the digital era, offering insights that can be applied to strategize against the challenges faced by oil and energy trading. Pagani & Pardo [25] examines how digitalization affects B2B exchanges, focusing on the activity links, resource ties, and actor bonds between companies. The paper's findings on digitalization's impact on business relationships provide valuable insights for oil and energy trading firms navigating digital transformations and seeking to maintain strong network ties in the digital age. The subject of digital transformation is of significant interest for researchers, with emphasis what makes them successful, and how firms approach to cope is with such digital transformation in general and specifically oil and energy trading firms across the globe [13]. Though the

digital disruption is extensively discussed at macro level, there is a research gap on impact of advanced digital technologies on operational, strategic, and risk management performances and practices within the oil and energy trade sector of UAE especially around the trade cycle of energy trading firms. This paper fulfils the said research gap and focuses towards the merchant traders of oil and other energy products.

3. Research Methodology

The research methodology employed in this paper aimed to advance findings into the impact of digital disruptions on the oil and energy trading sector, with a particular emphasis on the adoption and integration of Commodity Trading and Risk Management (CTRM) digital solutions which are disruptive in nature at the United Arab Emirates (UAE). The research focuses on how advanced digital technologies are transforming operational, strategic, and risk management practices within the sector especially around the trade cycle. The study is focused towards the Merchant traders of Oil and Refined products. The study employs a comparative analysis of commodity trading operations before and after the adoption of CTRM digital solutions, supported by detailed case studies of UAE-based trading firms. For primary data collection, “non-probability convenience sampling” was employed to select merchant oil traders for the study. This allowed us to select 68 oil and energy trading firms which were easily accessible and willing to participate in the research by filling up the structured questionnaire. The study followed cross-sectional descriptive research design with the comprehensive questionnaire comprising many sets of questions related to pre and post adoption of CTRM digital solutions. Only one response was collected from one firm with the top or middle level executives who have enough exposure to deal with trades using CTRM digital solutions. This method enabled the researchers to gather responses from the participants regarding their firms demographics like age of firm, number of employees, and monthly trading volume along with the personal profile of the top and middle level executive who agree to respond on behalf of the firm. The sample size consisted of 68 oil and energy trading firms of UAE. This sample size was deemed sufficient to provide meaningful insights into the factors influencing operational performance commodity trading and risk in the context of the study. The questionnaire comprised two sections: demographic questions, as discussed and information related to nine different operational performance parameters of commodity trading and

risk management. Respondent are asked to share the below information with their experience in dealing with CTRM digital solutions during PRE and POST CTRM digital process adoptions.

1. Time taken to close the trade deal: This is one of the critical key performance factors of the time taking to close the trade deal after the counterparty validation, agreement of terms and supportive documentation. Having a tool to have an automation to process the trade will reduce the time of closing the trade and able to respond to the market volatility. The CTRM tools are meant to reduce the time taken for closing the operational and regulatory process of the trade [11].
2. Time spent on the paperwork: There are various moving parts for a oil/energy trading business one of them is mandatory paperwork like LCs, contract drafts, Terms and Conditions, Transfer note, product specifications, insurance and the supplementary cost bills. Having a CTRM tool has helped the oil trading firms to minimize the time spent on the paperwork since all the documentation are archived through a Document management system. This would provide the end users with more quality time to invest in the trading than the paperwork process [6].
3. Time to complete the operational process: The time to complete the operational process is equally important factor to retain the profitability of the trade shipment. The laycan movements, vessels tracking is one of the few elements which empower the operational team to complete the scheduling and operations on time. The CTRM tool's operations module include the required automation to avoid manual process, thus saving time during the trade cycle. The key success for a profitable trade is how best a firm completes the scheduling and delivery plan [15].
4. Trade deal entry approval time: The trade deal entry with the required counterparty information, INCOTERMS, destination information is the important process to book the agreed trade between the two parties (buyer and seller). The trades entered are automatically routed through the workflow (set as per the individual organizations hierchy) empower the trading team to approve the trade/deal in short period of time. The swifter a firm responds to the trade/deal entry approval reflect the organization capability to scale up the trade volume [1].

5. Payment recovery alerts time: This function is an essential parameter for the back office team to make sure the payments from the counterparty are collected on time to book the trade profitability as per the estimated profits. The CTRM tool is incredible friend to the back-office manager to remind him about the payment recovery [29].
6. Time spent for generating risk reports: The risk manager functions is to report the exposure and underlying risks of the commodities in a trade and the available inventories. The CTRM tool provides automated instant risk analysis and reporting based on the trade, counterparty, commodities. The risk report is the deciding factor and engine which drives the CTRM tool [22].
7. Time spent on handling internal dept. crisis: Having all the key information of the front office, mid office and back office in a common system and delegate the functionalities and access control as per the role is the ROI of CTRM for an organisation. This eliminates many internal meetings within departments claiming or trying to justify the reduced profits and loss incurred. The CTRM tool is a protective shield for any trading firms from inter-departmental crisis [22].
8. Time spent by C-level team to resolve the crisis: The CTRM tool provides real time insights about the P&L, exposure, inventory reconciliation and traders performance. The out of the box reports available within CTRM empower the C-level team to handle the crisis and to resolve it. The powerful audit process is the winning factor to resolve the crisis [22].
9. Time to respond to market volatility: The powerful module of CTRM tool involving the front, mid office and back-office functionalities provide the organisation the capability to take decision quickly, improve the operational process and to respond the market volatility. The CTRM is valuable tool to equip the firms with adequate information about the trade to respond to the market volatility [30].

This study aims to compare the means of pre- and post-CTRM and digital process adoption in order to find the difference in the efficiency of the trading firms before and after adopting the CTRM digital solutions. Therefore, the researcher used a paired sample t-test find the mean difference. Table 1 shows the demographic profile of respondent and the oil and energy trading firms.

Table 1
Demographic Profile of Respondents

		Frequency	Percent
Gender	Male	54	79.4
	Female	14	20.6
	Total	68	100
Age	30-40 years	13	19.1
	41-50 years	39	57.4
	51-60 years	16	23.5
	Total	68	100
Education	Graduate	27	39.7
	Postgraduate	13	19.1
	Professional Qualification	27	39.7
	Doctoral Degree	1	1.5
	Total	68	100
Experience	150 months or less	12	17.6
	151 - 250	53	77.9
	251 months or more	3	4.4
	Total	68	100
Job cadre	Top Level	53	77.9
	Middle Level	15	22.1
	Total	68	100
Geographic Focus of Business	Global	62	91.2
	Indian	6	8.8
	Total	68	100
Number of employee in firm	35 or less	34	50
	36 - 70	32	47.1
	more than 70	2	2.9
	Total	68	100
Turnover of firm (in \$)	400000 or less	31	45.6
	400001 - 800000	36	52.9
	more than 800000	1	1.5
	Total	68	100

Contd...

Trading Volume of firm (in KT)	35 or less	26	38.2
	36 - 70	39	57.4
	more than 70	3	4.4
	Total	68	100

(Source: Compiled by authors)

4. Data Analysis and Discussion

The paired samples t-test is used to compare the means of two measurements made from the same subject, item, or related units. Further, this test determines or explores the statistical evidence, that is, the mean differences among the paired variables are significantly different from zero. It is also called a parametric test [8].

H_0 . The difference between the paired group mean is zero

H_1 . The difference between the paired group mean is not zero

The Table 2 presents paired samples statistics for various metrics related to trade deal processes before (PRE) and after (POST) implementing a CTRM (Commodity Trading and Risk Management) system and digital process adoption. Each pair represents the mean with sample size (N) of 68, standard deviation, and p-value for the corresponding metric before and after the implementation.

The time it takes to close a commodity trade deal can vary widely, ranging from a few hours to several months. This variance hinges on factors like deal complexity, market volatility, and the number of parties involved. Following the implementation of CTRM digital solutions, there was a significant decrease in the time taken to close trade deals, reducing from 70 minutes to 13.16 minutes (mean difference = 56.84, $p < 0.001$). This substantial improvement supports the hypothesis (H1) that the time taken post-implementation is lower than pre-implementation, indicating a marked enhancement in efficiency in finalizing trade deals through improved trading and risk management practices. CTRM digital solutions helps in transactions with established partners to close the deal quickly, and efficiently facilitate the intricate contracts with new players or volatile commodities with due diligence to reduce the overall timeline. [9]. Simple trades require less paperwork, while complex structured deals with multiple parties involve more documentation. Daily tasks like trade

Table 2
Results of paired sample t test

Pair	Hypothesis	Mean (PRE)	Mean (POST)	Mean Difference	SD	p-value	Hypothesis Supported
H1	There is a significant difference in the time taken to close the trade deal, with the time taken POST being greater than PRE.	70.00	13.16	56.84	4.31	0.00	yes
H2	There is a significant difference in the time spent on paperwork, with the time spent POST being less than PRE.	135.00	15.29	119.71	5.25	0.00	yes
H3	There is a significant difference in the time to complete the operational process, with the time POST being less than PRE.	79.26	18.90	60.37	4.60	0.00	yes
H4	There is a significant difference in the trade deal entry approval time, with the time POST being less than PRE.	45.00	6.91	38.09	3.24	0.00	yes
H5	There is a significant difference in the number of payment recovery alerts, with the number POST being less than PRE.	135.00	11.25	123.75	3.39	0.00	yes
H6	There is a significant difference in the time spent for generating risk reports, with the time POST being less than PRE.	396.32	28.68	367.65	24.06	0.00	yes
H7	There is a significant difference in the time spent on handling internal department crisis, with the time POST being less than PRE.	247.79	23.53	224.26	13.25	0.00	yes
H8	There is a significant difference in the time spent by the C-level team to resolve the crisis, with the time POST being less than PRE.	90.00	12.21	77.79	3.28	0.00	yes
H9	There is a significant difference in the ability to respond to market volatility, with the ability POST being less than PRE.	75.00	12.94	62.06	3.79	0.00	yes

(Source: Compiled by authors)

confirmations and position reports take minutes to hours while weekly and monthly reports on risk exposure, market analysis, and compliance can take several hours to compile. Extensive risk assessments and hedging strategies necessitate additional reports and approvals. The UAE has strict regulations for commodity trading. Fulfilling these compliance requirements adds to paperwork. Post-implementation of CTRM digital solutions, there was a significant decrease in the time spent on paperwork, reducing from 135 minutes to 15.29 minutes (mean difference = 119.71, $p < 0.001$). This finding robustly supports the hypothesis (H2) that the time spent post-implementation is less than pre-implementation, highlighting effective streamlining of documentation processes facilitated by enhanced CTRM capabilities. Firms using digital platforms for trade execution and risk management can streamline paperwork, reducing time. UAE oil trading firms typically follow a structured operational process that incorporates both oil trading activities and risk management practices. Traders research oil prices, global events, supply and demand factors, and geopolitical risks to identify trading opportunities. The risk management team analyses potential risks associated with the trade, like price fluctuations, counterparty default, and storage costs. They set risk limits and identify mitigation strategies like hedging. Based on analysis and risk tolerance, traders place buy or sell orders for specific quantities of oil at a set price and delivery timeframe. UAE oil trading firms must comply with regulations set by authorities like the Emirates Securities and Commodities Authority (ESCA). This adds an additional layer of documentation and reporting requirements. CTRM digital solutions utilize advanced trade finance platforms and risk management software to streamline processes and improve efficiency. As per hypothesis (H3) here, the time to complete operational processes decreased significantly from 79.26 minutes before to 18.90 minutes after implementing CTRM techniques (mean difference = 60.37, $p < 0.001$). This substantial reduction supports the hypothesis (H3) that the time taken post-implementation is less than pre-implementation, demonstrating significant improvements in operational efficiency and process optimization enabled by CTRM digital solutions. Additionally, following the implementation of CTRM techniques, there was a notable decrease in trade deal entry approval time from 45 minutes to 6.91 minutes (mean difference = 38.09, $p < 0.001$). This finding supports the hypothesis (H4) that the approval time post-implementation is less than pre-implementation, showcasing enhanced efficiency in trade deal processing and approval facilitated by CTRM digital solutions. Payment recovery alerts are crucial for energy trading firms in the UAE due to the high-value

nature of transactions and the potential for late payments or defaults. The number of payment recovery alerts decreased significantly from 135 to 11.25 (mean difference = 123.75, $p < 0.001$) following the implementation of CTRM digital solutions. This supports the hypothesis (H5) that the number of alerts post-implementation is less than pre-implementation, indicating effective risk mitigation and management of financial operations through CTRM solutions. Early notification of potential payment delays allows firms to take prompt action, such as contacting the counterparty, initiating legal proceedings, or seeking alternative sources of payment. This can significantly minimize financial losses [14]. Similarly, There was a substantial decrease in the time spent generating risk reports post-implementation of CTRM digital solutions, reducing from 396.32 minutes to 28.68 minutes (mean difference = 367.65, $p < 0.001$). This significant improvement supports the hypothesis (H6) that the time spent post-implementation is less than pre-implementation, underscoring enhanced efficiency in risk analysis and reporting enabled by CTRM digital technologies. Risk analysis and reporting are fundamental aspects of successful commodity trading in the UAE. A dynamic market like this necessitates a proactive approach to identifying and managing potential threats. Traders can utilize risk reports to make informed decisions about specific trades, considering potential risks alongside potential rewards. UAE authorities like the Emirates Securities and Commodities Authority (ESCA) often have reporting requirements for commodity trading firms. Risk reports can help firms demonstrate compliance with these regulations. [37]. Due to the sensitive nature of the industry and the potential for reputational damage, it's difficult to find publicly documented examples of internal departmental crisis within specific UAE oil trading firms. However, a breakdown in communication between departments could lead to missed deadlines, operational inefficiencies, or even losses if critical information isn't shared in a timely manner. Following the implementation of CTRM digital solutions, the time spent on handling internal department crises decreased significantly from 247.79 minutes to 23.53 minutes (mean difference = 224.26, $p < 0.001$). This supports the hypothesis (H7) that the time spent post-implementation is less than pre-implementation, indicating improved crisis response and management effectiveness facilitated by CTRM digital capabilities. It's important to note that most reputable oil trading firms must have robust internal controls and communication protocols in place to mitigate such departmental conflicts. Moreover, Post-implementation of CTRM digital solutions, the time spent by the C-level team to resolve crises decreased

from 90 minutes to 12.21 minutes (mean difference = 77.79, $p < 0.001$). This finding supports the hypothesis (H8) that the time spent post-implementation is less than pre-implementation, suggesting more efficient crisis resolution strategies and decision-making supported by CTRM digital solutions. When a crisis hits a company's Commodity Trading and Risk Management (CTRM) function, the C-level team (CEO, CFO, COO, CIO, CRO) plays a critical role in resolving the situation and minimizing damage. The ability to respond to market volatility is a critical factor for success in the UAE's oil trading landscape. By implementing proper hedging, diversification and stress testing strategies, oil trading firms in the UAE can enhance their ability to navigate market volatility, mitigate risks, and potentially capitalize on profitable opportunities that emerge during these periods. Advanced Trading Platforms using digital capabilities with real-time data analysis and order execution capabilities to react swiftly to market changes in the form of Algorithmic Trading are very crucial for long term success in commodity trading business. The ability to respond to market volatility improved significantly post-implementation of CTRM techniques, with the score decreasing from 75 to 12.94 (mean difference = 62.06, $p < 0.001$). This supports the hypothesis (9) that the ability to respond post-implementation is less than pre-implementation, indicating enhanced agility and responsiveness to market changes facilitated by CTRM digital tools.

5. Managerial implication and Conclusion:

The study concludes that digital disruptions in the commodity trading sector presents both challenges and opportunities for the oil trading firms. The advanced CTRM digital systems are essential for trading firms to navigate these changes effectively. As commodity trading firms in the UAE and the broader Middle East region navigate the digital era, the role of CTRM systems, enriched with cutting-edge technologies, becomes increasingly central. There are many real life case studies are observed demonstrating the impact digital solutions on the operational performance of firms. A leading UAE based trading firm, ABC (name disguised due to confidentiality), based in DMCC, Dubai is into trading of crude and refined products for nearly 5 years with their own storage terminals and work force of nearly 60 plus employees. The Company was facing challenges to handle the trading workflow, managing the counterparties and tracking of exposure and risk management. The team and the CEO of ABC were satisfied with the CTRM solution demonstration

and solicited the commercial proposal. The proposal was submitted and subsequently the software agreement was signed in March 2021. The Software implementation started in April 2021 and was completed in phases, covering the front office (trade and risk management), Middle office (inventory and hedging) and the back office (finance). The Company went live with Software by August 2021. The historical trades (processed outside the CTRM) was exported to the CTRM and the CEO of the company issued a mandate to use the CTRM with effective from September 2021. All the users (15 licensed users) were trained to use the CTRM and the entire trading activities were managed and controlled by the CTRM including the daily P&L and monthly closing. The author contacted the CEO of the company in December 2021 to know the performance impact, the following were shared by the CEO and he was happy with the decision for CTRM and the business challenges were addressed.

- 1) Time to process the trading (Pre-CTRM) was 130 minutes and with CTRM changed to 15 minutes
- 2) The Risk reports generation time were taken 3 days and with the CTRM changed to 30 minutes
- 3) The internal crisis meeting between various departments used to happen twice a week is changed once in a month if needed
- 4) The workflow and approvals were not organised, the CEO mentioned, the entire workflow was controlled, and he could see the trade status.
- 5) The management reports were generated once in a month and with the CTRM, the CEO can see daily in their mobile devices

It is concluded that the ROI on the CTRM Digital solutions was achieved within 6 months with the improved performance and ability to respond to the market swiftly to achieve the profitability in the competitive trading market. These systems not only streamline operations but also equip firms with the tools needed to thrive in a rapidly evolving market landscape and the ability to respond to the market volatility [3]. The key impacts could be summarized into the

- Operational Efficiency: One firm achieved a significant reduction in trade processing times and operational costs by implementing an AI-enhanced CTRM solution [7].

- Risk Management: Another firm enhanced its risk management capabilities by utilizing a CTRM system with integrated real-time market analytics and predictive modelling [10].
- Regulatory Compliance: A firm overcame compliance challenges by adopting a blockchain-enabled CTRM platform, ensuring transparency and security in its trading operations [28].

In addition, the evolution of CTRM solutions in the digital era offers a beacon for commodity trading firms in the UAE and beyond, guiding them through the challenges of digital disruptions. By embracing these advanced systems, the firms can harness the power of digital technologies to optimize their operations, mitigate risks, and explore new market opportunities [5].

There is a tremendous scope for future research in this domain especially the energy trading firms are more adopting digital transformation tools and Data Analytics and Management solutions to enhance the Operational efficiency for quality decision making, thus retaining their positions in the respective market.

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