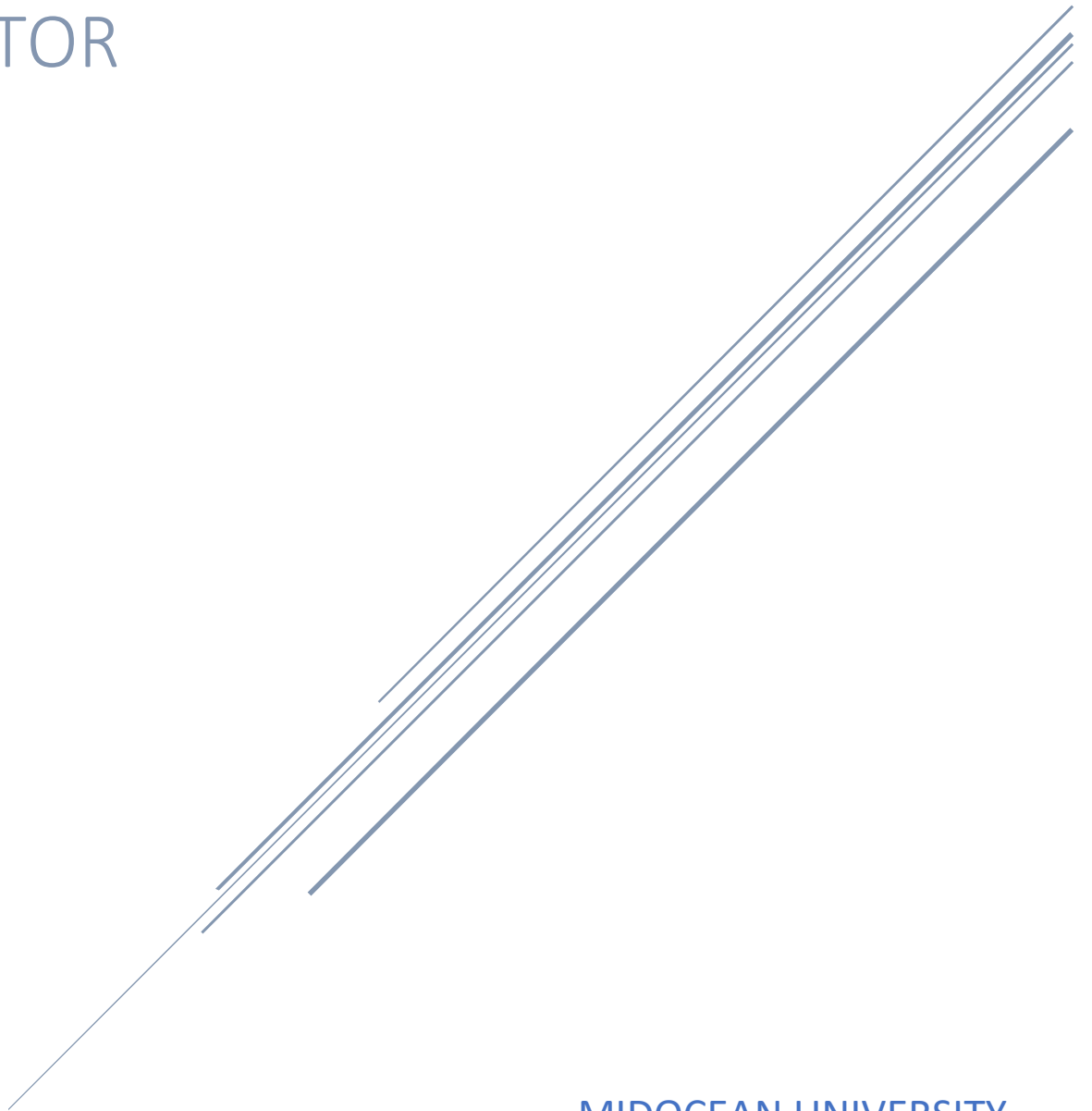


IMPLEMENT SUSTAINABILITY IN PROJECT MANAGEMENT TO MEET VISION 2030 IN SAUDI ARABIA INDUSTRIAL FOR PETROCHEMICAL SECTOR



MIDOCEAN UNIVERSITY

Table of Contents

1. Introductions:	2
2. Climate Change and the Energy Transition	3
2.1 Digitalization Power:.....	3
3. Case Study:	5
4. Objective of AI Solution for Naphtha Cracker Unit:	5
4.1 Overall Benchmarking analysis tool for yield prediction	5
4.2 Benchmarking Solution to Monitor Process Water Quality	5
4.3 Real time Furnace Decoke Optimization Solution	6
4.4 ML based Reliability solution to predict critical equipment run-lengths	6
4.5 Benchmarking Solution for Yield Prediction	6
5. Model to benchmark Process Water Quality	7
6. Study Questions:.....	9
7. Previous study and theoretical framework:	9
8. Theoretical premises of Study:.....	9
9. Methodology and research methods:	10
10. Study tools:.....	10
11. Study limitations:.....	10
12. References.....	11

List Of Figuer

FIGURE 1	3
FIGURE 2	4
FIGURE 3	4
FIGURE 4	6
FIGURE 5	7
FIGURE 6	8
FIGURE 7	8

1. Introductions:

One of the most important challenges occupying the world at the present time is the sustainability. And how we can develop prosperity without affecting the life of the future generations.

In this research, we address the issue of sustainability in the project management and impact on the project live cycle.

Introducing, the relationship between sustainability and project management can be based on the harmony dimensions (measures) environment, society and economic. Therefore, the three overlapping circles presenting environmental needs, economic needs, and social needs. Which areas are meeting the sustainability endeavors by referring to people, planet, and profit. However, the sustainability practice not limited on helping reducing pollution but also conserve natural resources of our planet. Moreover, this practice will ensure long term stability on the future project eliminating waste and control high demand on the natural resources.

We consider the emanation release from factory's during production process in the petrochemical plant by measuring the impact of chemical reactions and combustion mission of CO₂. In Saudi Arabi government has committed to reduce generated waste from industrial and investing in new technology to improve energy efficiency which will ensure a sustainable future. The approach to is to reduce, reuse, recycle and remove CO₂ emissions and investing in renewable energy and enhancing Energy efficiency program (SEEP). Saudi Arabia has set target to reduce carbon emissions by 278 mtpa by 2030. So, the industry contributes of 46% of direct CO₂ emissions in Saudi Arabia and 4% of electricity emissions, however industrial need to be reduced 65-90% by 2050.

The industrial sector had an overall target to improve energy intensity by around 1% per year, so, Saudi Arabia government provide soft loans for energy efficiency related project in industry.

In this study we will present carbon capture technology and how it will help industrial to achieve net zero goal of Saudi Arabi by fuel transformation and power generation.

2. Climate Change and the Energy Transition

A common challenge around the world is to develop and deploy technological solution at speed and scale to provide the benefit of oil and gas for future generation, while minimizing emissions. It is complex, multidimensional, and capital-intensive challenge that will span generation.

As a part of Saudi visions, the industrial sectors have a role to play to support energy security and promote sustainable practice to response to climate change. The aims of the 2015 Paris agreement to limit global temperature increase in this century to 2 degrees Celsius, while pursuing effort to limit the increase even further to 1.5 degrees, and the commitment of the Kingdom of Saudi Arabia to achieve net zero emissions in its economy 2060. This presents unprecedented design, engineering, and implementation challenges. The McKinsey Global Institute has estimated that a net zero world will cost around \$275 trillion by 2050.

As matter of fact the industrial Sector plans to reduce the net carbon emissions of its operations and support the global energy transition through the development of lower carbon products and solution across the energy, chemical, and material sectors.

To enable the energy transition petrochemicals will need to play main roles to provide the feedstock which will allow to utilize these materials to manufacture an essential material to lead the energy transition such as solar panel, infrastructure, etc.

In our research we are going to spotlight on two areas reducing the hydrocarbon emission and digital transition

2.1 Digitalization Power:

Artificial Intelligence (AI) is playing a main role in the economic sectors and can managing the environmental impact and climate change. Over the years, industrial processes have seen incredible advancements leading to Industry Digitalization and the current drive to monetize these technologies.

AI driven digital transformation provides numerous benefits for manufacturing and product supply.

DIGITAL TRANSFORMATION BENEFITS IN A NUTSHELL

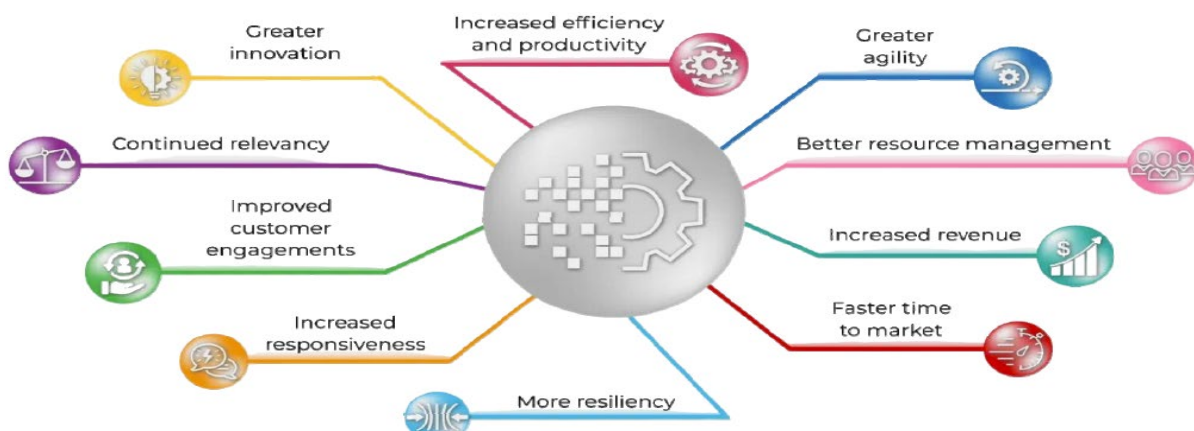


Figure 1

Typical Component of a digital solution:

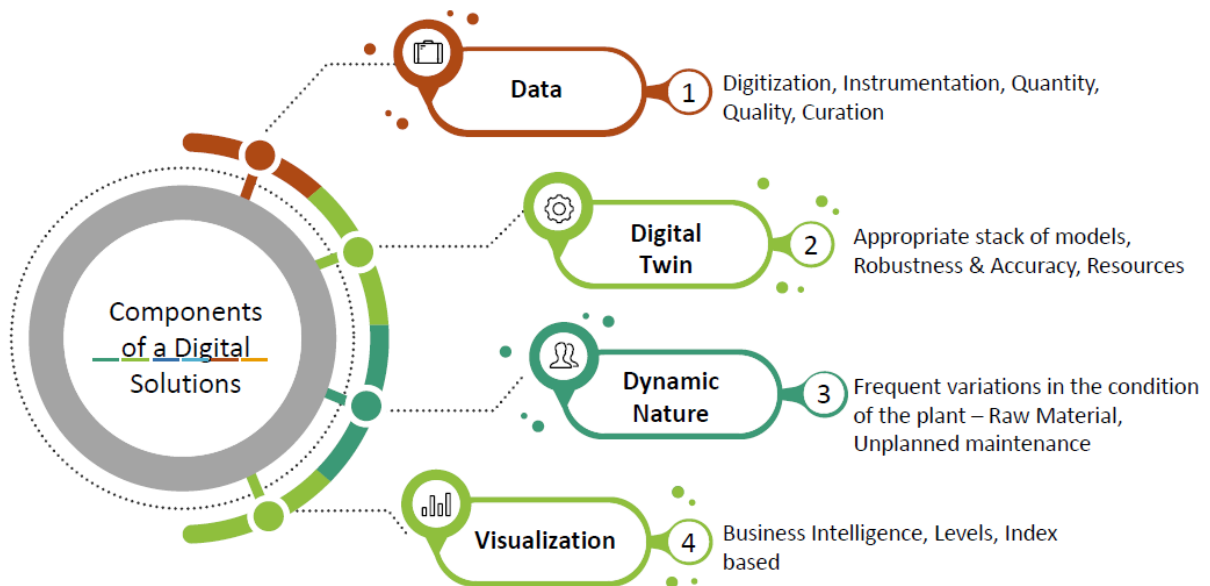


Figure 2

Applied AI Solution Workflow

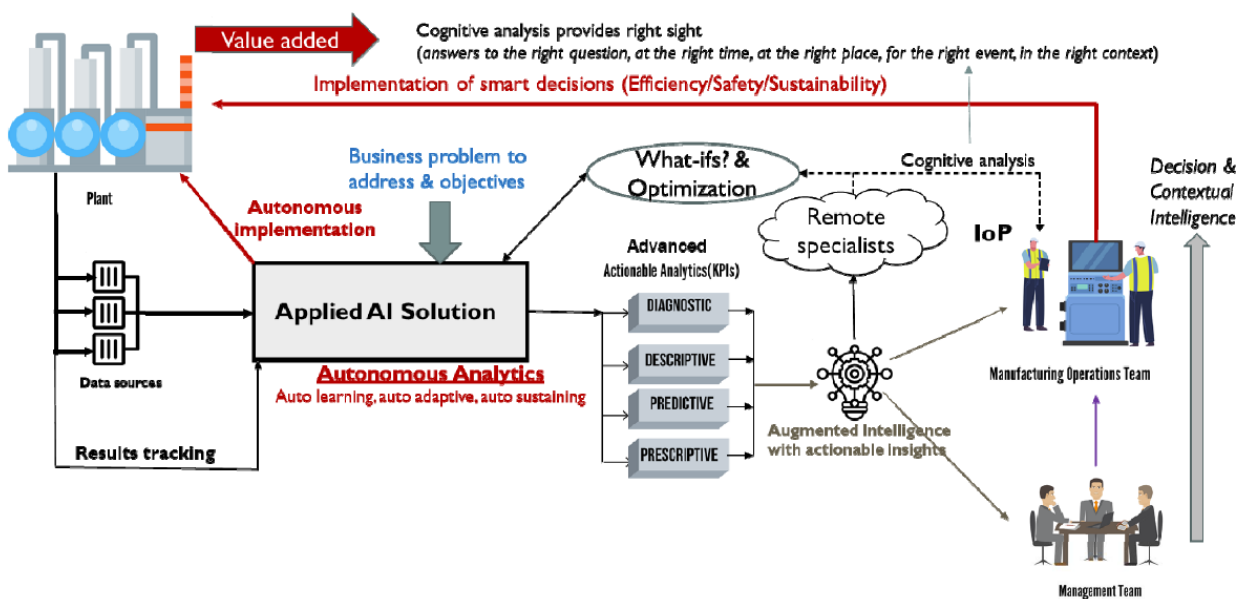


Figure 3

Applied AI Solution Applicant:

Proactive Management of Safety Compliance	Production optimization	Raw material management	Improvement efficiency and cost reduction	Best Tracking visibility and control GHG emission
Predictive & Maintenance to improve reliability	Asset management	Enhanced product recovery	Proactive handling operation failures	

3. Case Study:

Sustainability via augmented intelligence for Naphtha cracker unit.

This study is ongoing for Naphtha cracker unit in Jubail at Saudi Chevron (S-Chem) which to determine the uses of augmented intelligence in these digital solution for different sections of the Naphtha cracking unit.

The expectation is to improve the financial and environmental benefits observed from sustainable best practice. And will provide a solution for daily monitoring as well as special studies and troubleshooting with a view to improve process efficiency, overall yields, Decoke optimization and run-length prediction.

4. Objective of AI Solution for Naphtha Cracker Unit:

1. Yield predication and maximization.
2. Improve monitoring and control of process water quality.
3. Furnace De-coke optimization.
4. Prediction of critical equipment run length.

4.1 Overall Benchmarking analysis tool for yield prediction

Tool predicts the best product yield at all operating conditions, identifying key performance parameters affecting product yield. The model can be turned to achieve different benchmarks, such as maximizing olefins, propylene yield, maximizing combined olefin yield and minimizing energy consumption.

4.2 Benchmarking Solution to Monitor Process Water Quality

An integrated monitoring system assessing process water quality impact on process water exchangers. Solution digitized old data to create a data historian and develop an integrated data analytics model for exchanger performance.

4.3 Real time Furnace Decoke Optimization Solution

A real-time decoke progression monitoring solution for an olefin plant that uses artificial intelligence to recommend improvements in decoke efficiency saving the company 140,000 \$ annually. The solution simplifies historical decokes, and offers real-time recommendation for improvement.

4.4 ML based Reliability solution to predict critical equipment run-lengths

Smart prediction digital solutions to monitor critical equipment performance, detecting deterioration in advance and highlighting troubleshooting requirements leading to sustainable business practices, financial and environmental benefits. The system includes furnace run length prediction, heat exchanger (single line as well as with standby) run length prediction aiding in maintenance planning.

4.5 Benchmarking Solution for Yield Prediction

Data been collected from Ethylene Plant for analysis as shown in below tables.

Max Ethylene Yield			Current Day	
Parameter	UOM	Design	7-Dec-20	6-Apr-21
Plant Load	tph	96	96.1	96.0
Ethylene yield	wt%	25.85	27.79	27.67
Propylene yield	wt%	17.88	17.66	17.42
HP Steam Import	tph	0.00	30.9	32.7
LP Steam Import	tph	0.00	6.8	8.2

Feed Composition			Current Day	
Parameter	UOM	Design	7-Dec-20	6-Apr-21
Total C5 LIMS	vol%	78.04	69	65
C4 LIMS	vol%	15.03	1.3	1.2
C6 LIMS	vol%	2.45	20.8	22.8

Operating Parameters			Current Day	
Parameter	UOM	Design	7-Dec-20	6-Apr-21
F-3102 COT	°C	826	815.0	815.0
F-3103 COT	°C	826	814.9	815.0
F-3104 COT	°C	826	815.0	815.0
F-3102 DS/HC Ratio	-	0.37	0.370	0.370
F-3103 DS/HC Ratio	-	0.37	0.370	0.370
F-3104 DS/HC Ratio	-	0.37	0.370	0.370
CGC suction pressure	kg/cm2g	0.870	0.876	0.882

Figure 4

- Overall Benchmarking Analysis tool developed to sustain best yield at all operating conditions.
- Sensitivity to change in feed composition built into the model.
- Model used for finding out key performance parameter/parameters which is affecting yield of valuable products (Olefins in this Case).
- Data from the comparative analysis can be used to find how much change is required in these parameters and these parameters can then be tuned to achieve best run yield.

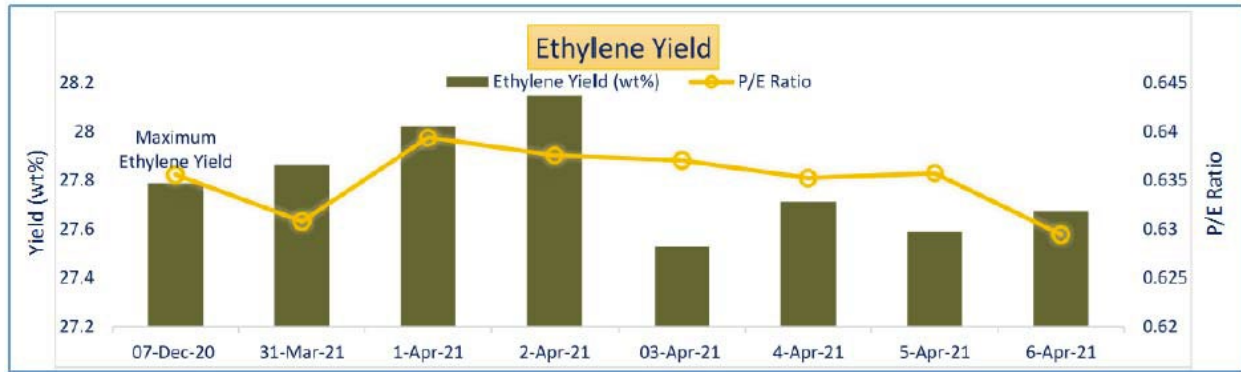


Figure 5

By comparing the data in above graph and the data on above table we can conclude that to increase ethylene yield at the given condition then, CGC suction pressure will need to be reduced. In addition to that other benefits can be achieved by digital solution such as:

- ❖ Maximizing Propylene Yield.
- ❖ Minimizing Energy Consumption of Valuable.
- ❖ Maximizing Combined Olefine Yield.

5. Model to benchmark Process Water Quality

- Weekly monitoring data for process water quality available, however data in non-processable format
- Difficult to use for assessment of process water quality impact on process water exchangers
- Ingenero developed an integrated monitoring system that can be used for benchmarking current operation against historical data and also for prediction of future performance

Solution & Approach

- Solution digitized the data and improved its usability, data correlation with other operating parameters made possible.
- Integrated data analytics model developed for process water exchanger performance correlating exchanger performance to changes in water treatment chemical dosing.
- Results consolidated and populated in detailed monitoring reports at fixed frequency.
- Solution comprised of two parts:
 1. Data Transformation/ Digitization: Converting data in non-processable format to easily analyzable format.
 2. Data Analysis – Simulation/Analytics/Machine Learning: Using Industry standards and Exchanger fouling models for intelligent outlier identification.

Unprocessed Data

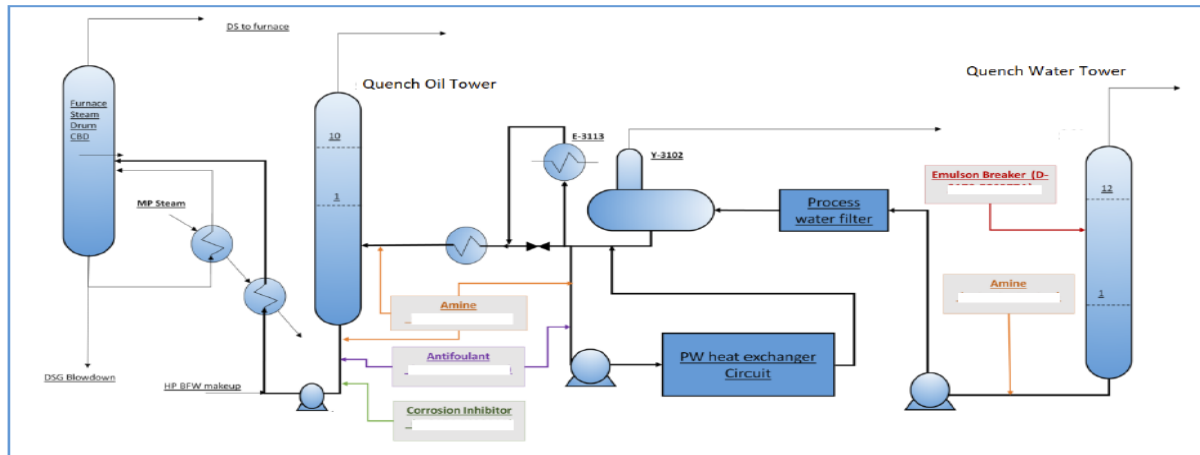


Figure 6

Process Data

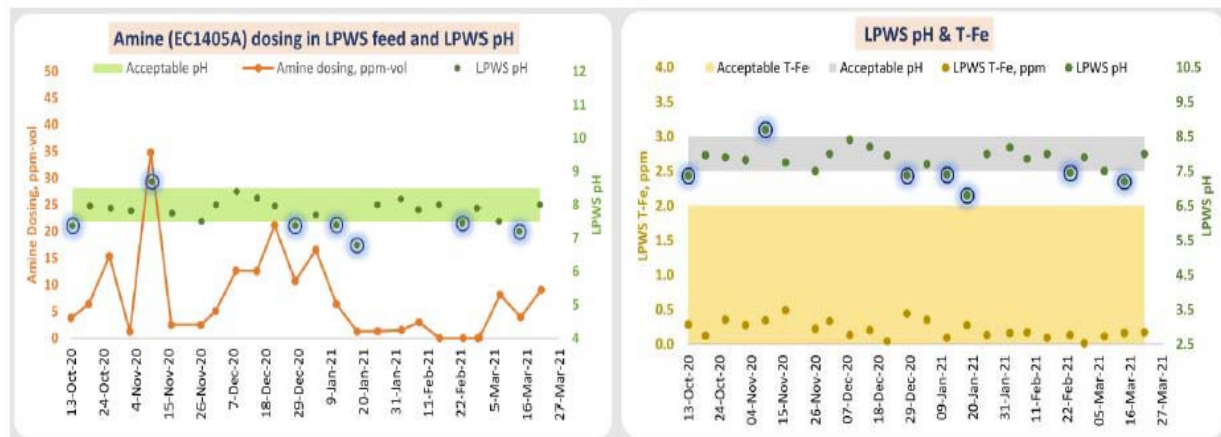


Figure 7

By analyzing the data, we can conclude the benefits from digital solution such as:

- ❖ Quick One-Click Processing.
- ❖ Intelligent Outlier Identification.
- ❖ Improve Monitoring System with Reference to Historical Data.
- ❖ Optimize Chemical Consumption.
- ❖ Exchange Fouling Prediction.
- ❖ Exchanger Run-length Improvement.
- ❖ Improving the water quality will contribute to reduce the CO2 emission from the waste water.

6. Study Questions:

1. What effect does climate change on the future recourses for petrochemical industrial?
2. What are the challenge face Climate Change and the Energy Transition on the petrochemical industrial?
3. How are the Digitalization Power can help optimization to reduce the environmental impact and climate change?
4. What type of approve technology are available to develop and deploy technological solution to reduce hydrocarbon on petrochemical industrial?
5. How does the digitalization power help reduce CO2 emissions in Saudi Arabia by meeting vision of 2050?

7. Previous study and theoretical framework:

We highlight type of studies in this section which were looked at the carbon emissions of the BRICS nations and that used consumption-based carbon emissions as the dependent variable.

Study conducted by Wang et al. (2018) used partial least square (PLS) with fixed and random factors to investigate the moderating function and relationship of economic growth, trade, urbanization, and CO2 emissions from 1996 to 2015. They discovered that corruption significantly moderates the relationship between BRICS CO2 emissions. But this analysis might also benefit from considering the trade-adjusted CO2 measure and the distinct impacts of imports and exports. Furthermore, no theoretical foundation for taking petrochemical growths into account as a factor influencing CO2 emissions in China as will the study not cover new technologies which would reduce emission of industrial sectors.

Michieka et al. (2013) investigated China's carbon emissions from 1970 to 2010 and how they were affected by exports. The findings showed that there was a unidirectional causal relationship between exports and carbon emissions. The primary driver of the discovered causation is exports to carbon emissions.

Santra (2017) used the least squares dummy variable regression (LSDV), pooled OLS, and fixed-effect methods to examine the impact of technical innovation on the productivity of production-based energy and CO2 emissions in the countries between 2005 and 2012. According to the study, technological innovation related to the environment has a positive impact on both production-based energy productivity and production-based CO2 emissions.

8. Theoretical premises of Study:

Currently, there are widespread worry about climate change brought on by human activity, specifically global warming. This has raised tensions and concerns about the possibility that global warming will only become worse and accelerate over time, potentially having an impact on future generations.

The main cause of climate change is emissions of carbon dioxide, which raise the temperature of the atmosphere.

The study will support lead by G20 country to reduce impact on natural resources which will lead to more sustainable energy for future generations.

9. Methodology and research methods:

The energy transition of digitalization power has been the focus of this research, with new digital transformation being endorsed as a crucial component to aid in the reduction of CO₂ emissions. As a result, the ability to digitize processes is enhanced by transforming process data from un-processable formats into easily analyzed ones. This will assist in finding the appropriate technology to lower emissions and in applying analysis methods to improve production.

We have considered quantitative data which collected from live plant as sample to approve study theory. The study covers the importance of digitalization approach to reduce CO₂ emission by improving operation reliability. Moreover, study cover qualitative data by circulating survey to experience engineer in different companies in Saudi Arabi to collect expert judgment.

The digitalization power technology applicable for other industrials as well in the kingdom of Saudi Arabia or world wiled by illustrated digitalization power within (Strategy, Planning. Implementation/ Operation and Controlling). This structure will support to achieve transformation process and reduce impact on the organization by improving operational process and increasing productivity.

10. Study tools:

- Monitoring data by using Instrument equipment distributed control system (DCS).
- Monitoring emission by using gas detractors' data and fix analyzer equipment.
- The study covers the interviews, online surveys and checklists to collect export judgment.

11. Study limitations:

The following are some of the difficulties that Saudi Arabia's petrochemical industry transformation study faces in being more digitally powerful:

- The collected data adopted a technology-based on engineering design which means it might not be applicable to old plants.
- The cause study presents a new plant that was designed to the most recent ASME standards; the plant's performance may differ from that of an older plant that used outdated technologies.
- The accuracy of the study may be impacted by the lack of expert judgment comments during the precenting survey due to time constraints.
- Further research is necessary before approving the technology used in industrialized nations' petrochemical sectors.
- More investigation required to approve the technology on the petrochemical sectors on industrial country.

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