Operational Excellence Management System (OEMS) Manual

VERSIONING

Date	Version	Note
25th June 2012	v.0.9.1	• Integrate comments from PTTES, • Restructured VCM, RAI and OPS elements
1st July 2012	v.0.9.2	• Added Leadership message, • Updated SSHE, PM, CPI sections. • Consistent use of "Operational Excellence". • Updated Vision, Objectives and Values. • Include note on Legal & Regulatory requirements. • Updated Architecture chapter. Updated format on the bottom of the pages. • Updated RD section.
6th July 2012	v.0.9.3	• Added assets nomenclature, • Added document hierarchy. • ORM, SSHE, OPS, RD section updated. • Cornerstone of PTT Way refers to TAGNOC. • New Code of Conduct. • Include comments from corporate working team (except for CPI).
13th July 2012	v.0.9.4	• New Leadership message, • Updated principles for SSHE, RAI, VCM, and ORM. • Updated Governance.
23rd July 2012	v.1.0	• Release 1.0 as of 23rd of July.
24th August 2012	v.1.1	• Updated Code of Conduct and CPI. • Include comments from Corporate working team
12th September 2012	v.1.2	• Included comments from OEMS Champions
18th September 2012	v.1.3	• Included comments from OEMS Champions & OpEx team
15th January 2014	v.2.0	• Update member of OEMS element champions, • Change period of external assessment from every 2 years to every 3 years
15th August 2014	v.2.1	• Update content of CPM by revise the principle and expectation no. 11.4
2nd December 2014	v.2.2	• Update content of SM
10th January 2017	v.2.3	• Update content of O&C by revise the expectation no.3.3
5th February 2018	v.2.4	• Update content of SSHE by add the expectation no.1.12 • Update content of SM by revise the expectation no.4.4
6th February 2019	v.2.5	• Update member of OEMS element champions

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

1

Table of Contents

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

3

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

4

INTRODUCTION

Leadership Message

"Our resources are limited, but creativity is unlimited" is the maxim at the core of the PTT Way. To create a sustainable future that transcends our limited resources, PTT Group is laying the foundations for a Technologically Advanced and Green National Oil Company (TAGNOC) – shifting away from the conventional resource-based-only National Oil Company (NOC). Hence, we are encouraging our member companies to create a knowledge-based environment, sharing best-practices in all aspects of our fully integrated operations and value chains.

Top-Quartile Performance is PTT Group's strategic priority in production processes and operations. Optimizing energy and resource consumption contributes to our "Green" attribute, and also enhances PTT Group's sustained economic justification.

Operational Excellence *(OpEx)* is a key pillar of the PTT Way that supports our STRONG aspirations. The *Operational Excellence Management System (OEMS)* is designed to elevate PTT Group's operations to a world-class standard.

OEMS standardizes operations and drives high performance. It is an integrated system for our assets and resources – with principles to **P**rotect, **E**ngage, **O**perate, **P**artner, **L**ead, and **E**volve (PEOPLE principles).

The PEOPLE principles build a common platform that captures more synergies, unlocks significant value, and inspires sharing among PTT Group companies in terms of resources, skills, and innovation. Thus, the OEMS reinforces the Continuous Performance Improvement culture that is integral to the PTT Way. As a result, our assets and resources continue to be safe and produce satisfactory returns to PTT Group.

Lastly, let me remind us all that the best Management System still needs the best people in order to produce the best, most resilient organization.

As we embark on a journey toward attaining Operational Excellence, we pledge to never lose sight of the commitment in the hearts and minds of our people that makes it possible to attain our coveted goals. The PEOPLE principles will constantly remind us of our most important enabler – it is indeed our people who will make the PEOPLE principles work to their fullest potential.

Together, we will make PTT Group a stronger and safer company.

OpEx is PEOPLE.

Pailin Chuchottaworn, Ph.D.
President & Chief Executive Officer, PTT Public Co.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

5

OpEx Transformation Leaders

The OEMS Level 1 manual was developed with the support and leadership of:

PTT

SEVP Petrochemicals & Refining Business Unit
Sukrit Surabotsopon

EVP Natural Gas Processing
Charcrie Buranakanonda

PTTEP

President and CEO
Tevin Vongvanich

EVP Operations & Supply Chain Group
Somchai Monopinives

ptt GLOBAL CHEMICAL

CEO
Anon Sirisaengtaksin

President
Bowon Vongsinudom

EVP Engineering & Maintenance
Kun Patumraj

Thaioil Group

CEO
Veerasak Kositpaisal

Deputy Managing Director Refinery
Chaiwat Damrongmongkolgul

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

6

IRPC

President
Atikom Terbsiri

Senior EVP, Petrocheimcals & Refining Business
Sahaschai Panichapong

ptt PHENOL

President
Suwanunt Chatiudompunth

EVP Operations
Kumpol Chaikitkosi

ptt UTILITY

President
Jakchai Barlee

ptt ES

President
Bhawana Suphavilai

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

7

OEMS Element Champions (as of 6th February 2019)

SSHE	Operations Risk Management	Organization & Capabilities	Sustainability Management
EVP of Sustainability Management Sirasak Chandrema	**EVP of Natural Gas Processing** Somnuek Phangwapee	**EVP of Corp. Human Resources** Adisorn Smathimanant	**EVP of Sustainability Management** Sirasak Chandrema
Reliability & Asset Integrity	**Operations**	**Value Chain Management**	**Mgmt. of Contractors & Suppliers**
SVP of Technical, Eng. & Maint. of GC Jeeranee Pimthanothai	**EVP of MANUFACTURING of TOP** Jeerawat Pattanasomsit	**EVP of Downstream Business Group Alignment** Kamphon Chaengsuthivorawat	**EVP of Organization Effectiveness** Nampetch Boonyaviwat
Strategy & Leadership	**Performance Management**	**Capital Project Management**	**Management of Change**
EVP of Strategy & Portfolio Management Prasong Intaranongpai	**EVP of Natural Gas Processing** Somnuek Phangwapee	**EVP of Eng., Develop. & Operations Group of PTTEP** Suksant Ongvises	**EVP of Petrochem. and Refinery Operation of IRPC** Pranarch Kosayanont

PTT Group Operations Value Chain

PTT Group operates across the Hydrocarbon and Energy Value Chain as Resource Owner and as Value Creators inside different segments (*cf. Figure OE.1*).

Figure OE.1: PTT Group value chain

Resource Owners and value Creators

In the upstream business, PTT Group is the **Resource Owner**.

The key objective of upstream business is to produce hydrocarbons, oil, gas, coal, and crops safely and in the most cost-effective and sustainable manner.

In the downstream business, PTT Group is a **Value Creator**, focusing on creating additional value by transforming natural resources into higher value products and marketing them to end consumers or for industrial use.

The most cost-effective additional barrel that the company can produce in the upstream or process in the downstream businesses requires minimizing downtime, optimizing operating cost, and maximizing efficiency, effectiveness, and product value.

PTT Group companies achieve these goals by having a best-in-class **Operational Excellence Management System** (OEMS) that will help us deliver safe, reliable, sustainable, and cost-effective operations.

Note: Resource Owner includes both direct ownership and partnership in Thailand and international assets.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

9

PTT Group hierarchy and assets nomenclature

PTT Group hierarchy for OpEx has **four main levels**. These are:

1. **PTT Group**: We refer to "PTT Group" as the highest level on the hierarchy – it is the sum of all existing PTT Group companies and PTT Corporate units along the value chain depicted in *Figure OE.1*.

2. **Value chain segment**: There are four value chain segments (*cf. Figure OE.1*) – **Resource Owners** (i.e. upstream), **Value Creators** (i.e. downstream), **Optimizer** (i.e. Trading), and **Green Energy**.

3. **PTT Group companies**: We refer to PTT Group companies as the single and stand-alone PTT business entity (e.g. PTTEP, IRPC, PTTGC, TOP, PPCL, PTTUT, PTT GSP).

4. **Asset**: We refer to "asset" to define any physical property, plant, and equipment employed in the production of end products or services. Assets can be further classified in three different levels:

   - **Complex**: A series of closely integrated producing plants typically connected by a common flow of products (e.g. refining complex, petrochemical complex).

   - **Plant**: A self-contained facility that constitutes of several units which are interlinked by a common production process (e.g. HDPE plant, PP plant, and Floating Production, Storage and Off-loading (FPSO)). The boundaries of a plant are defined as the smallest entity that will not impact another asset during a shutdown.

   - **Unit**: Equipment within a plant that is performing a specific function within the production process of end products (e.g. flash tank, blending silos).
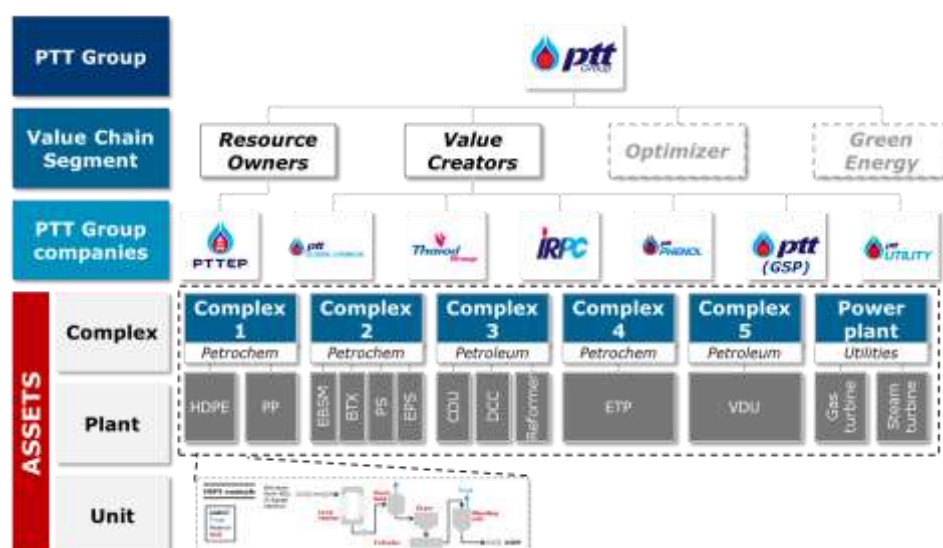

Figure OE.2: Illustration of PTT Group hierarchy

PTT Group aspires to become the "***Thai Premier Multinational Energy Company***". To achieve this objective, the leadership team has identified TAGNOG and **nine functional excellence areas to achieve the BIG, LONG, and STRONG aspiration**.

TAGNOG (Technologically Advanced and Green National Oil Company) is a key enabler to move PTT from a resource based organization to a knowledge based organization through innovation and technology.

The functional excellence areas, which include OpEx, directly support upstream and downstream businesses to achieve their objectives (*cf. Figure OC.1*). **Operational Excellence is interlinked with other areas of functional excellence**, in particular with Capital Project Management, Sustainability Management, HR and Organizational Excellence. Operational Excellence incorporates these functional areas as elements of the OEMS system with the focus on production assets.
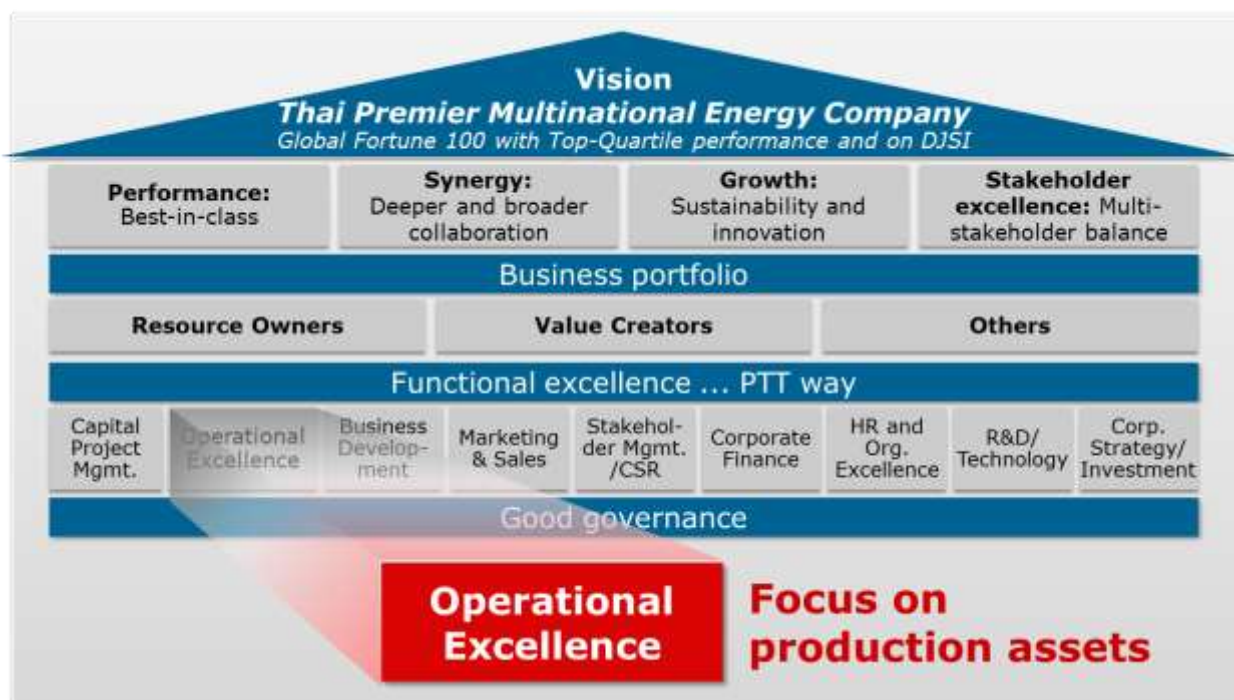
Figure OC.1: Operational Excellence as one of the nine areas of functional excellence

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

11

OPEX ARCHITECTURE

The PTT OpEx architecture groups the key Operational Excellence tools and enablers to achieve Top-Quartile performance.

Figure OA.1: OpEx Architecture

Management Commitment

The explicit support and commitment of the entire PTT Group management team is a fundamental driver for achieving Top-Quartile performance and realizing the vision to become "The most admired national oil company for Operational Excellence". The management will lead by example and ensure all PTT employees comply with the OpEx Code of Conduct and adhere to the Operational Excellence Management System (OEMS).

Governance

OpEx governance ensures that the OpEx program is implemented and embedded in all PTT Group assets. OpEx governance consists of two key elements:

1. **OpEx organization:** A structure at PTT Corporate and PTT Group company level that ensures OEMS is implemented, maintained, and updated.

2. **OEMS review process:** A process to monitor the implementation of OEMS for each company across PTT Group.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

12

OEMS

OEMS is a comprehensive operating management system that integrates, standardizes, and improves existing management systems across PTT Group companies. It is structured around 12 elements and provides the framework to achieve safe, reliable, sustainable, and cost-effective operations.

Intellectual Capital

Intellectual capital at PTT Group consists of best-practices and innovations (including new technology and intellectual property) to improve operations and create competitive advantage. The creation of intellectual capital is supported by knowledge management. Knowledge management comprises of the process and enablers to create, capture, organize, and transfer knowledge.

Continuous Performance Improvement

Continuous Performance Improvement (CPI) is a collection of tools and processes supported by a continuous performance improvement culture. CPI ensures every individual in the company is motivated and able to achieve and sustain Top-Quartile performance.

Results Delivery

Results Delivery is a cohesive and integrated approach applied during OpEx implementation to systematically identify and mitigate key implementation risks. It ensures changes in behavior and resistance to change are carefully managed.

By winning the hearts and minds of our employees, the OpEx values are embedded in our attitudes – ensuring the OpEx program is not just a one-off success, but a truly sustainable transformation that moves PTT Group forward into the future.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

13

MANAGEMENT COMMITMENT

OpEx Vision, Objectives, and Values

PTT Group aims to be the *"Thai Premier Multinational Energy Company"*. This vision is supported by PTT Group's OpEx Vision to become "*The most admired national oil company for Operational Excellence*".

The OpEx Vision forms the foundation for the "Case for Change", "Success Indicators" and "Future States", as defined by the CEOs and COOs of PTT Group.

OpEx objectives are:

- **World-class SSHE:** Best-in-class results on SSHE metrics and leading SSHE culture.

- **Top-Quartile assets:** Highly reliable asset performance.

- **Best-in-class processes & systems:** Standardized, consistent OEMS adopted across all PTT Group companies.

- **High-performance culture:** OpEx culture across all assets and functions.

- **Distinctive capabilities:** Highly talented and skilled employees.

- **Immaculate reputation:** Envied reputation in the industry for best-in-class operations.

To ensure successful implementation of OpEx, change must be driven by operations leaders. The OpEx Leadership Behaviors, guided by the 'SPIRIT' framework, outlines the leadership values specific to operations that are expected of operations leaders.

The OpEx Code of Conduct is the set of rules and expected behaviors for all employees in operations.
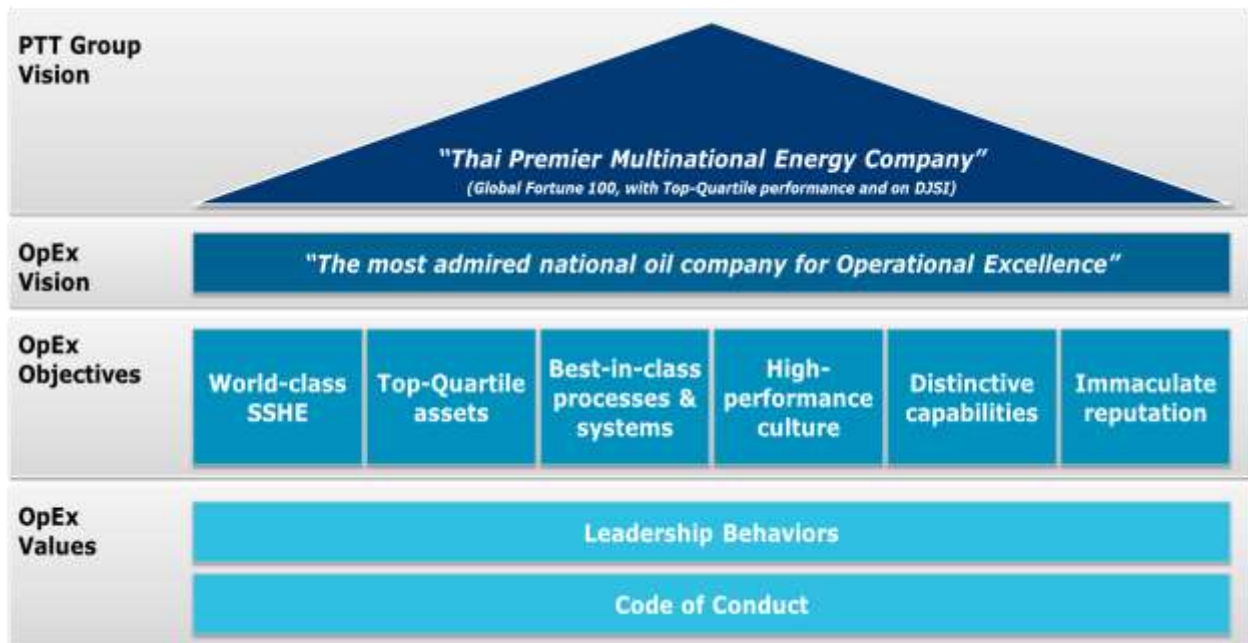
Figure OV.1: OpEx vision, objectives, and implications to behaviors

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

15

The Case for Change for OpEx is captured by the following statements *(cf. Figure CFC.1)*:

*"At PTT Group, we protect our people, our assets, and our community for **zero incident and injury free.**"*

*"OEMS is the PTT way to achieve safe, reliable, and sustainable performance: **One team, One system, One goal.**"*

Figure CFC.1: OpEx Case for Change

PTT Group's portfolio has grown to over 51 companies in 26 countries. Expanding operations across a diverse and international business portfolio requires a world-class OEMS.

OEMS ensures consistency in the way assets are operated and drives best-practices to deliver continuous performance improvement. The benefits of the move towards standardization and use of OpEx are seen in *(Figure CFC.2)*.
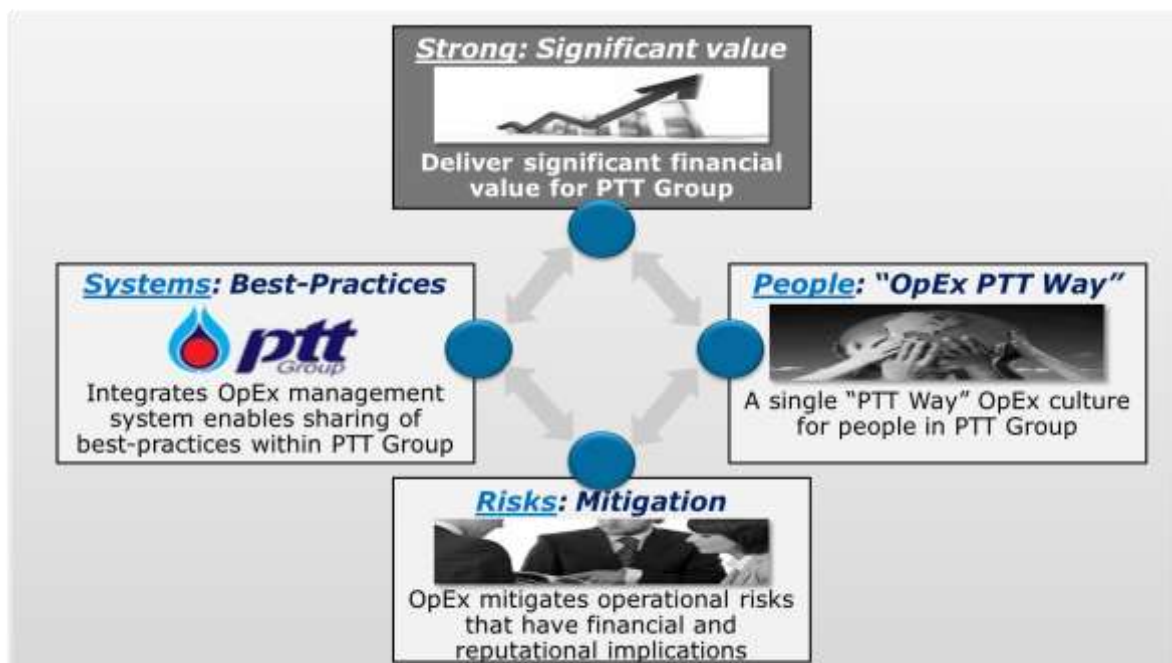
Figure CFC.2: Benefits of OpEx in PTT Group

OpEx:

1. **Creates and delivers significant value:** Financial benefits can be maximized (EBIT and ROIC) by focusing on safe, reliable, sustainable, and cost-effective operations.

2. **Shares best-practices:** Sharing best-practices across PTT Group is an essential part of achieving and maintaining Top-Quartile performance.

3. **Promotes the "PTT Way":** The "PTT Way" cultivates a culture of excellence and learning, designed to attract, develop, and retain talented employees. A common culture also facilitates future consolidation and synergies across PTT Group.

4. **Identifies and mitigates risks:** OpEx ensures all operations continuously identify and mitigate risks that could have safety, environmental, financial, or reputational consequences.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

17

Future State

The top management of PTT Group has developed the future state when OpEx is implemented successfully from the perspectives of four key stakeholders (*cf. Figure FS.1*). This compelling future state ensures the organization remains focused at all times on the ultimate goal of becoming "The most admired national oil company for OpEx" throughout the journey towards Operational Excellence.

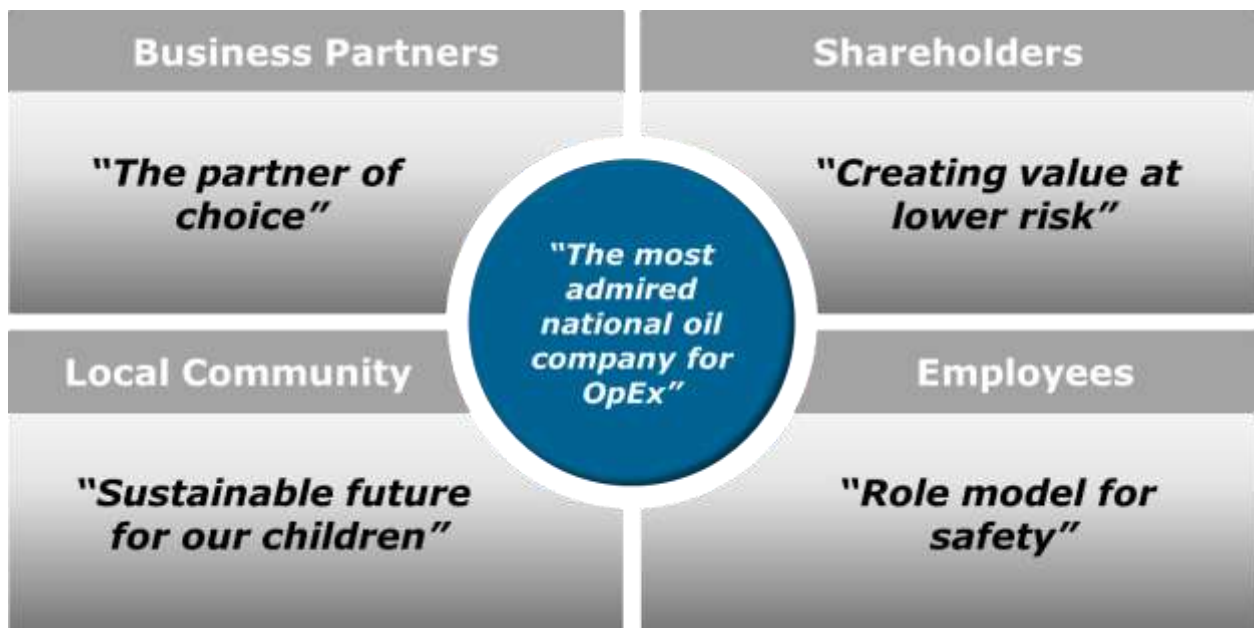*Figure FS.1: Future state of PTT Group from the perspectives of key stakeholders*

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

18

Leadership Behaviors

Leaders are expected to abide by the OpEx Leadership Behaviors *(cf. Figure LB.1)* to drive successful implementation of OpEx.

Operations leaders engage the organization by clearly communicating the case for change and the OpEx Vision.

Further detail on leadership behaviors can be found in the Strategy & Leadership chapter of the OEMS Level 2 manual (*cf. Strategy & Leadership 9.4: Leadership Behaviors*).

As a leader, I...

S — Synergy
- Commit to **one team, one system, one goal**
- Encourage **best-practice sharing** and **mutual learning**

R — Responsibility
- **Look after each other.** Care, share, and respect **communities** and the **environment**
- **Be the change agent** and **"walk the talk"**

P — Performance Excellence
- Set **challenging operating targets** and **monitor execution**
- **Motivate, coach** and **develop** teams

I — Integrity
- Have the **courage** to tell the **truth** and to do what is **right**
- Commit to be **honest** and **reliable** in all business dealings

I — Innovation
- Build and leverage **intellectual capital** to **continuously improve** operations
- Encourage teams to systematically **apply new technology**

T — Trust
- **Energize** teams, set them up for **success** and **trust** them to deliver
- Give and receive **constructive feedback**

Figure LB.1: OpEx Leadership Behaviors

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

19

OpEx Code of Conduct

The OpEx Code of Conduct is a set of rules and expected behaviors for all PTT Group employees, contractors, and agents acting on behalf of PTT Group.

Always,

P **rotect** our people, our assets, our community

E **ngage** employees, enhance capabilities, share best-practices

O **perate** by the rules, adhere to procedures in all situations

P **artner** with integrity, care, share, respect each other

L **ead**, aim high, believe you can do better, have confidence

E **volve** through innovation, be open to ideas and solutions

Figure CC.1: OpEx Code of Conduct

Success Indicators

Measurable success indicators ensure leaders are aligned towards a common goal. Success indicators are measured by lagging and leading indicators as illustrated in *(Figure SI.1)* below.
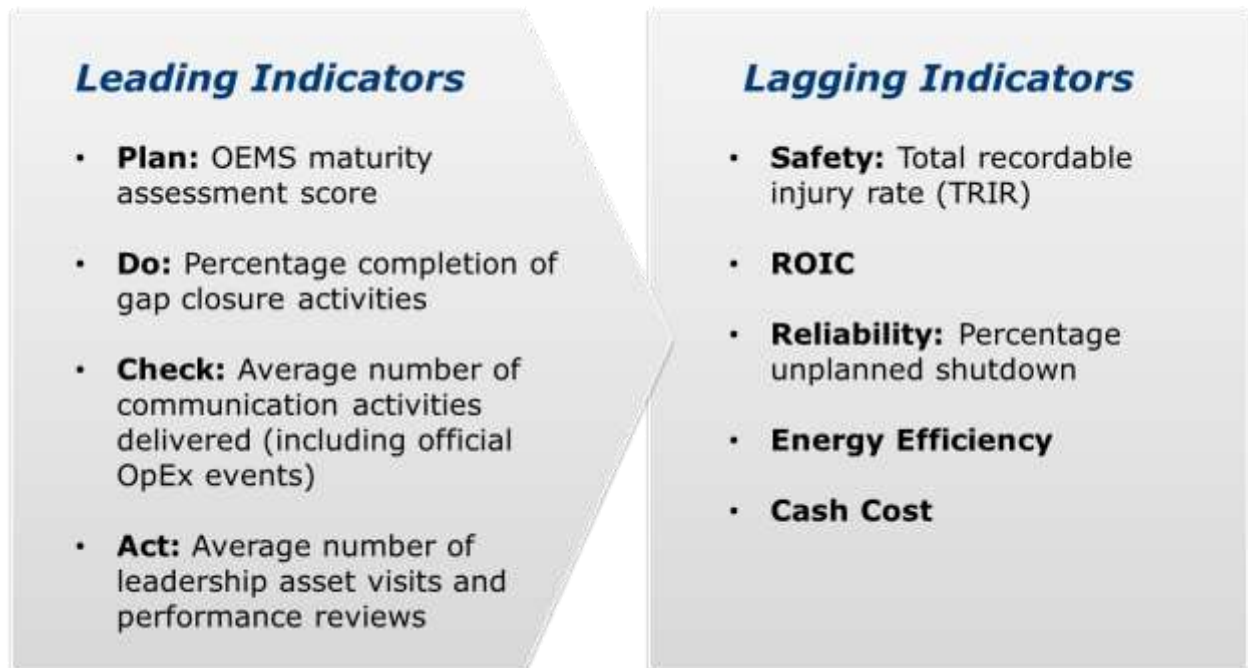
Leading Indicators

- **Plan:** OEMS maturity assessment score

- **Do:** Percentage completion of gap closure activities

- **Check:** Average number of communication activities delivered (including official OpEx events)

- **Act:** Average number of leadership asset visits and performance reviews

Lagging Indicators

- **Safety:** Total recordable injury rate (TRIR)

- **ROIC**

- **Reliability:** Percentage unplanned shutdown

- **Energy Efficiency**

- **Cash Cost**

Figure SI.1: Leading and lagging success indicators for OpEx

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

21

OPERATIONAL EXCELLENCE MANAGEMENT SYSTEM (OEMS)

Introduction to OEMS framework

Purpose of OEMS

PTT Group's Operational Excellence Management System (OEMS) is a commitment to the new way of operating in the "PTT Way". Wherever and whenever we operate, we comply with the elements of our management system, as documented in this manual.

The primary objective of OEMS is to help PTT Group employees manage every element of operations, from basic compliance to excellence in performance.

This OEMS manual describes the key principles and minimum mandatory expectations set by PTT Group. It provides guidance for PTT Group companies to ensure their management systems are aligned to the group's principles and value chain segment specific expectations.

In the short term, OEMS helps us meet the minimum requirements set by the law and PTT Group. In the longer term, effective OEMS implementation will position PTT Group to achieve and sustain leadership position in Operational Excellence while building a supportive and innovative culture that learns and drives continuous improvement.

OEMS document hierarchy

OEMS is a comprehensive operating management system that integrates and improves existing management systems across PTT Group companies. It provides the framework to achieve safe, reliable, sustainable, and cost-effective operations.

The OEMS hierarchy (*cf. Table OEMS.1)* sets the guidelines on how we operate as one across PTT Group, takes into consideration value chain segments and PTT Group company specific requirements.

Levels 0, 1, and 2 are corporate standards while *Levels 3, 4, and 5* are specific translation of corporate standards for each PTT Group company.

Level 0 is the *PTT Way*, which sets the strategic agenda for Operational Excellence (OpEx).

Level 1 is the *OEMS Corporate Principles and Expectations* manual. **Principles and expectations are "non-negotiable" and essential to achieve Operational Excellence**. Level 1 also includes enablers that are critical to successfully implement OEMS (e.g. Governance and Continuous Performance Improvement).

Levels	Document	Document type	Definition
Level 0	PTT Way	Corporate standards	Includes principles (i.e. overall goals/objectives), expectations (minimum requirement to satisfy the principle), high level processes (suggested actions to implement expectations), KPIs (measurement and tracking of success of implementation) to achieve the corporate objectives and enablers (e.g. international standards and tools).
Level 1	OEMS Corporate Principles & Expectations		
Level 2	OEMS Value Chain Segment-specific Recommendations		
Level 3	PTT Group company standards	Manual	Emphasizes principles, policies, organizational responsibilities and guidelines to achieve the company's objectives in accordance with international and corporate standards.
Level 4	Asset Procedures	Procedure	Details the operational processes in accordance with the corporate standards and company manual. The document demonstrates the work flow, who, how, what, where, and why.
Level 5	Work Instructions	Work instructions	Describes specific activities and tasks for asset specific procedures.

Table OEMS.1: Description of OEMS hierarchy levels

Level 2 is the *OEMS Value Chain Segment-specific Recommendations* manual, which mandates segment-specific requirements. It describes "what good looks like" and outlines how to achieve it in a specific value chain segment (i.e. Resource Owner and Value Creator).

Within each PTT Group company, each segment-specific requirement is then translated into local level OEMS, i.e. *PTT Group companies Standards Manual* (Level 3). These are then further detailed in specific *Asset Procedures* (Level 4) and *Work Instructions* (Level 5). Level 4 and 5 describe step-by-step business operations in compliance with group and segment principles and expectations.

PTT Group's OEMS framework is built around **'P.E.O.P.L.E'** *(cf. Figure OEMS.1),* which consists of the six Operational Excellence themes of **'Protect, Engage, Operate, Partner, Lead and Evolve**'. Each theme comprises two elements. Each element is underpinned by a principle and statements of expectations.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

23

Figure OEMS.1: PEOPLE framework

The principles of each of the 12 elements are as follows:

1. **SSHE:** PTT Group companies are committed to achieving the highest standards of Safety, Security, Health, and Environmental performance in all aspects of business in line with our SSHE standards.

2. **Operations Risk Management:** PTT Group operations risk management identifies and manages all operations risks to minimize the impact on the organization to as low as reasonably practicable (ALARP).

3. **Organization & Capabilities:** PTT Group companies' organizational structures in operations are designed for effective and efficient decision-making. Operations capabilities are enhanced through systematic development of competencies and skills, sharing of best-practices, and effective knowledge management.

4. **Sustainability Management:** PTT Group companies are committed to working in a socially, environmentally, and economically sustainable manner to maintain

a license to operate while balancing a diverse range of stakeholders, in order to assure sustainable business growth.

5. **Reliability & Asset Integrity:** PTT Group companies always ensure that asset, facility, and equipment inspection and maintenance activities are systematically planned and executed to ensure the highest standards of reliability and asset integrity that guarantee safe, reliable, sustainable, and cost-effective operations throughout its lifecycle.

6. **Operations:** PTT Group companies operate with a focus on preventing injury to people and harm to the environment. Operations are committed to ensure safe and optimized operations over the lifecycle of asset, facilities, and equipment.

7a. **Value Chain Management (Upstream):** PTT Group companies manage the upstream lifecycle and value chain to deliver quality products that always meet customer expectations whilst satisfying business requirements, optimizing operations and inventories.

7b. **Value Chain Management (Downstream):** PTT Group companies manage the end to end value chain to deliver quality products that always meet customer expectations whilst satisfying business requirements, optimizing operations and inventories.

8. **Management of Contractors & Suppliers:** PTT Group companies ensure that materials and services provided by contractors and suppliers comply with all contractual requirements, policies, standards, and business objectives defined at PTT Group level.

9. **Strategy & Leadership:** PTT Group companies' leaders are committed to safe, reliable, sustainable and cost-effective operations. They maximize synergies across PTT Group companies, to achieve and sustain Top-Quartile performance.

10. **Performance Management:** PTT Group companies aspire to achieve and sustain Top-Quartile performance. Performance management drives progress towards Top-Quartile performance through assessment, benchmarking and prioritized implementation of preventative, corrective, and improvement initiatives.

11. **Capital Project Management:** PTT Group companies' capital project management process selects and progresses the right projects through disciplined decision-making and ensures projects are delivered safely, to specification, on time, and within budget.

12. **Management of Change:** PTT Group companies are committed to ensure that all temporary or permanent changes in operations, administration, or organization are systematically managed to a level of risk that remains as low as reasonably practicable (ALARP).

Each of the 12 elements has a Champion who is the owner and custodian of the element. The list of Champions is in the Introduction section of this document.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited
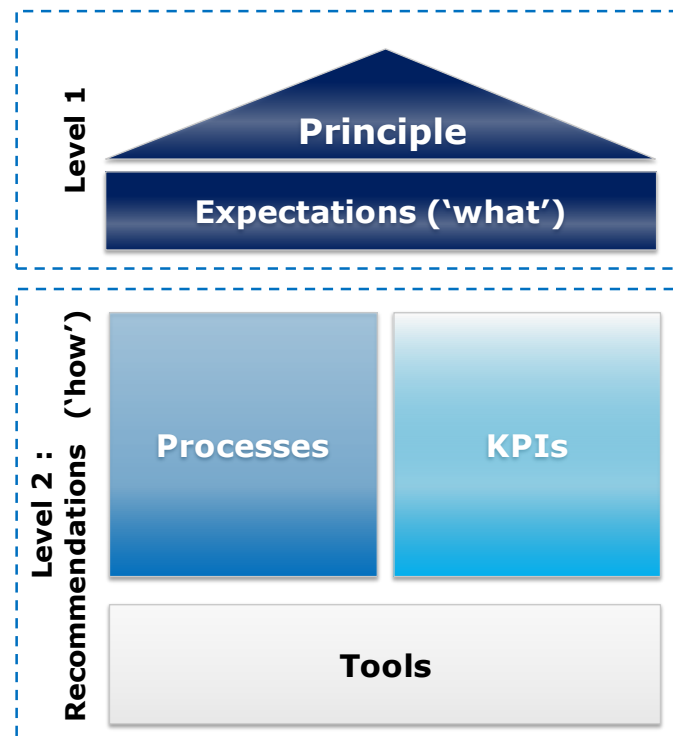
25

OEMS Level 1 and Level 2 architecture

Figure OEMS.2: OEMS Level 1 and Level 2 architecture

OEMS Level 1 and Level 2 manuals outline a standardized and systematic approach to manage operations in PTT Group. The manuals are organized as shown in *Figure OEMS.2*.

The Level 1 OEMS manual contains the principles and expectations for all 12 Elements of OEMS. Together, the principles and expectations provide the top-level direction on areas of operations. All PTT Group companies must comply with the principles and expectations as a minimum.

The Level 2 OEMS manual provides recommendations (the 'how') for operations to fulfill the expectations (the 'what') set out in Level 1. Expectations in Level 1 are supported in Level 2 by:

- **Processes:** Actions to implement expectations
- **KPIs:** Measure of implementation success
- **Tools:** Best-practice systems, international standards, and internal documents

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

26

Notes on legal & regulatory requirements

All OEMS principles and expectations are designed to meet or exceed all legal and regulatory requirements in the countries where PTT Group companies operate.

- **Identify** and document all laws, regulations, compliance requirements, and other commitments made to stakeholders.
- **Monitor** compliance regularly and take immediate actions in case of non-compliance.
- **Track** changes in requirements that may impact business and operations and document new requirements as appropriate.
- **Maintain** readily available records that demonstrate regulatory compliance and conformance to requirements.

Notes on documentation & recordkeeping

All PTT Group companies shall:

- **Maintain** documents that describe all the OEMS principles and expectations, including indexes or maps that provide direction to related documents.
- **Implement** document and record management procedures to ensure current versions are readily available.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

27

OEMS PRINCIPLES AND EXPECTATIONS

| 1 | PROTECT: SSHE |

PTT GROUP COMPANIES ARE COMMITTED TO ACHIEVING THE HIGHEST STANDARDS OF SAFETY, SECURITY, HEALTH, AND ENVIRONMENTAL PERFORMANCE IN ALL ASPECTS OF BUSINESS IN LINE WITH OUR SSHE STANDARDS.

1.1 **SSHE Policy:** Issue SSHE Policy to set out SSHE performance expectations, and to guide day-to-day behaviors and decision-making.

1.2 **Visible Leadership:** Management exhibit visible commitment to SSHE policy and performance, to build/reinforce the SSHE culture and drive program implementation.

1.3 **Resources**: Provide sufficient resources to support effective SSHE management, implementation, and maintenance of SSHE requirements.

1.4 **Management Review:** Senior management review overall SSHE program and performance to ensure it is achieving the desired outcomes.

1.5 **Security of Personnel and Assets:** A secure environment is provided to ensure business continuity.

1.6 **Occupational Health:** A safe and healthy working environment is established and maintained, to deliver and preserve optimal physical and mental health of employees and contractors.

1.7 **Environmental Management:** Environmental impact from all operations activities are systematically identified, measured, controlled, and reported to improve PTT Group's environmental performance.

1.8 **Incident Management:** Report, investigate, and analyze SSHE incidents. Identify trends and implement measures to reduce incident frequency and severity. Take corrective and preventive actions and share learnings.

1.9 **Emergency and Crisis Management:** Plans and procedures are put in place to effectively respond to emergency and crisis situations.

1.10 **Employee Engagement, Behavior, and Culture:** SSHE behavior and culture is embedded and continuously improved through workforce engagement.

1.11 **Inspections and Audits:** SSHE performance and systems are audited to assess conformance and drive continual improvement.

1.12 **Legal & regulatory requirements:** Relevant laws, regulations and other SSHE requirements are identified, accessible, understood and complied with.

> PTT GROUP OPERATIONS RISK MANAGEMENT IDENTIFIES AND MANAGES ALL OPERATIONS RISKS TO MINIMIZE THE IMPACT ON THE ORGANIZATION TO AS LOW AS REASONABLY PRACTICABLE (ALARP).

2.1 **Risk Management System:** The risk management system provides consistent company-wide guidance on risk management decisions and practices.

2.2 **Risk Assessment:** Risks are assessed to enable PTT Group companies to comprehensively understand and appropriately act on operations risks for ongoing operations, projects, and changes.

2.3 **Risk Treatment:** PTT Group companies actively manage and reduce the impact and likelihood of risks by identifying and implementing risk treatment actions.

2.4 **Documentation, Monitoring, and Review:** All risks are documented, monitored, and reviewed systematically to ensure they are managed effectively and in line with risk management policy.

2.5 **Communication and Consultation:** PTT Group companies communicate and consult with stakeholders (internal and external) throughout the risk management process ensuring all relevant inputs are captured and all stakeholders have an appropriate understanding of the operations risks.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

29

PTT GROUP COMPANIES' ORGANIZATIONAL STRUCTURES IN OPERATIONS ARE DESIGNED FOR EFFECTIVE AND EFFICIENT DECISION-MAKING. OPERATIONS CAPABILITIES ARE ENHANCED THROUGH SYSTEMATIC DEVELOPMENT OF COMPETENCIES AND SKILLS, SHARING OF BEST-PRACTICES, AND EFFECTIVE KNOWLEDGE MANAGEMENT.

3.1 **Organization Design in Operations:** Successful business organizations develop organizational systems for operations that enable effective and efficient decision-making. This system is supported by hiring the right people for the right job, providing them with the right tools, and setting them up for success.

3.2 **Enabling Decision-Making:** Organization structures in operations have clear definitions of roles and responsibilities, enabling a structured approach to decision-making. These organizational structures are designed to support PTT Group's overall business objectives.

3.3 **Manpower Resourcing:** Strategic Workforce Planning (SWP) is a holistic approach to identify number (size), type (permanent vs. outsource), shape and quality which was evolved from conservative approaches such as Time-Motion Simulation or Full-Time Equivalent (FTE). SWP will encourage organizations to improve their productivities to prove their actual performances. This approach helps push PTT group toward sustainability and HPO (High performance organization) aspiration.

3.4 **Career Management:** Careers in operations are managed to ensure the systematic deployment of the right person to the right job and at the right time to deliver safe, reliable, sustainable, and cost-effective operations.

3.5 **Competencies and Skills:** The required competencies and skills for operations are systematically defined, with the objectives of achieving consistency across companies and ensuring activities are conducted by competent people.

3.6 **Learning and Development:** Formal training and informal on-the-job training are designed to equip employees with the required skills to build and enhance organizational capabilities for existing and future operations requirements.

3.7 **Knowledge Management (KM):** PTT Group companies implement a Knowledge Management system for operations, in alignment with PTT Group Knowledge Management framework. The system is built around people, processes, and technology, and is supported by best-practice KM tools.

PTT GROUP COMPANIES ARE COMMITTED TO WORKING IN A SOCIALLY, ENVIRONMENTALLY, AND ECONOMICALLY SUSTAINABLE MANNER TO MAINTAIN A LICENSE TO OPERATE WHILE BALANCING A DIVERSE RANGE OF STAKEHOLDERS, IN ORDER TO ASSURE SUSTAINABLE BUSINESS GROWTH.

4.1 **Organizational Governance:** A sustainability management system is established alongside risk and crisis management to embed sustainability in the organization in line with the PTT Way.

4.2 **Human Rights:** Human rights are protected, including access to natural resources and information for those individuals affected by operations. PTT Group provides appropriate fair and equitable treatment for all stakeholders.

4.3 **People:** PTT Group is committed to labor rights and human capital to execute sustainability strategy and program, in its transformation to a knowledge-based organization.

4.4 **Security, Safety, Health, and Environment:** PTT Group is committed to continuously improve Safety, Health, and Environment (SHE) performance as well as maintaining transparency through appropriate monitoring, reporting, and assurance of PTT Group's SHE performance.

4.5 **Fair Operating Practices:** Operations adhere to fair operating practices, incorporating fairness and transparency in all business interactions.

4.6 **Corporate Citizenship:** PTT Group is committed to create long term value to its stakeholders through clearly defined and managed corporate philanthropy programs.

4.7 **Supply Chain Management:** PTT Group commits to adopt sustainable supply chain management approach to work with suppliers that have lower supply chain risk profiles, or have appropriate management of existing risks to improve long term financial performance and protect PTT Group's reputation.

4.8 **Product Stewardship:** PTT Group commits to the health and safety of its customers while investing in technologies or strategies that improve product sustainability or lifecycle performance.

4.9 **Reporting and Reputation:** PTT Group is committed to communicate PTT Group's Sustainability Management framework, commitment, approach, and performance in a way that is relevant, timely, meaningful to interested stakeholders, and that enhances PTT Group's reputation.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

31

4.10 **Stakeholder Engagement:** Stakeholders are identified and engaged to understand their needs, address their concerns, and communicate PTT Group's programs and performance. Guidelines are developed to manage the balance of stakeholders' differing priorities in an equitable way. Effective, transparent, and open communication is maintained with all stakeholders.

PTT Group companies always ensure that asset, facility, and equipment inspection and maintenance activities are systematically planned and executed to ensure the highest standards of reliability and asset integrity that guarantee safe, reliable, sustainable, and cost-effective operations throughout its lifecycle.

5.1   **Reliability and Asset Integrity Strategy:** The reliability and asset integrity strategy for all assets, facilities, and plant considers design, technical, and operations integrity, to ensure safe and reliable operations throughout its lifecycle.

5.2   **Maintenance Approach:** Select maintenance approach for each equipment according to its criticality to SSHE and operations performance. Asset registers form the core of the maintenance approach selection, and cover all equipment with particular emphasis on safety and production critical equipment.

5.3   **Reactive Maintenance:** Reactive maintenance approach ensures failing equipment is returned to safe operating conditions. Systematic analysis is done to identify root causes and mitigation actions for equipment with high impact on safety and operations performance.

5.4   **Pro-active Maintenance:** Pro-active maintenance strategies enhance reliability and ensure asset integrity. Maintenance techniques are documented, communicated, and applied according to equipment classification.

5.5   **Maintenance Planning and Execution:** Maintenance planning and execution optimize the deployment of resources and minimize disruption to normal operations. Planning includes consideration for potential corrective maintenance, work execution prioritization, tracking, and spare-parts management.

5.6   **Autonomous Maintenance:** Operators are actively involved in minor maintenance to prevent equipment deterioration and to keep equipment maintained at a basic level of condition.

5.7   **Turnaround Management:** Turnaround plans align with overall business objectives whilst ensuring safe, efficient, and cost-effective completion. Turnaround activities follow a stage-gate milestones approach and are carried out by an integrated turnaround team with clear roles and responsibilities.

5.8   **Maintenance Review and Improvement:** Systematic review of maintenance activities ensures continuous improvement of maintenance strategy, execution activities, and outcomes.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

33

6 OPERATE: Operations

PTT Group companies operate with a focus on preventing injury to people and harm to the environment. Operations are committed to ensure safe and optimized operations over the lifecycle of asset, facilities, and equipment.

6.1 Operations Strategy: An operations strategy for all assets and facilities is defined and clearly communicated. The strategy is developed in full alignment with overall business objectives.

6.2 Standard Operating Procedures (SOP): SOP addresses safety concerns, minimizes work variation and possibility of miscommunication, and facilitates quality output through consistent implementation of processes and procedures. Procedures include the management of potential abnormal operations.

6.3 Operating Window: Operating equipment within its operating windows guarantees safe and reliable operations. Upper and lower limits for critical parameters are identified for equipment covered by standard operating procedures, or under inspection plans.

6.4 Permit to Work (PTW): A permit to work (PTW) incorporates checks and authorizes work in a way that minimizes SSHE risks and takes into account simultaneous operations, if applicable.

6.5 Operations Efficiency: Operations planning and activity execution optimize energy utilization and cost efficiency. Loss management strategy supports PTT Group eco-efficiency targets of improving ecological and economical efficiency.

6.6 Technology: Operations strive to be at the forefront of technical innovations, and assimilate new technology that can improve safety, reliability, sustainability, and operating performance, in a cost-effective way.

6.7 Integration with Other Functions: Operations, Engineering and Maintenance, Technology Department and other support functions collaborate to facilitate the harnessing of collective experience and expertise of individuals within the organization.

PTT GROUP COMPANIES MANAGE THE UPSTREAM LIFECYCLE AND VALUE CHAIN TO DELIVER QUALITY PRODUCTS THAT ALWAYS MEET CUSTOMER EXPECTATIONS WHILST SATISFYING BUSINESS REQUIREMENTS, OPTIMIZING OPERATIONS AND INVENTORIES.

7.1 **Planning:** Field development and long term plans are developed to translate strategic priorities into full lifecycle actionable plans for all functions and assets. Activity plans integrate and optimize activities across functions and assets to ensure business delivery through effective allocation of resources. Asset schedules contain all activities across functions for an asset and ensure an optimized and executable short term plan.

7.2 **Materials and Inventory Management:** Processes for the inventory management of hydrocarbons and non-hydrocarbons must be in place to ensure stable and reliable operations and optimize working capital requirements across the upstream lifecycle and value.

7.3 **Logistics:** Processes are established to efficiently and effectively transfer hydrocarbon and non-hydrocarbon between point of origin and point of use throughout the value chain. Processes are in place to safely move goods and people to ensure availability where and when needed across assets.

7.4 **Quality Management:** A quality management system is established to enhance customer satisfaction by managing product quality throughout the value chain from suppliers to end customers to ensure products always meet customer service levels and applicable statutory and regulatory requirements.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

35

PTT GROUP COMPANIES MANAGE THE END TO END VALUE CHAIN TO DELIVER QUALITY PRODUCTS THAT ALWAYS MEET CUSTOMER EXPECTATIONS WHILST SATISFYING BUSINESS REQUIREMENTS, OPTIMIZING OPERATIONS AND INVENTORIES.

7.1 **Asset Operations Planning:** Medium and long term activity plans are developed to integrate and optimize activities across functions and assets in line with strategic priorities. Demand forecasts, available production capacities, and operations planning processes balance supply and demand. Production plans and schedules are optimized to maximize output value, plan feedstock supply (where applicable), and fulfill customer service levels.

7.2 **Materials and Inventory Management:** Processes for the inventory management of hydrocarbons and non-hydrocarbons must be in place to ensure stable operations, reliable supply and optimize working capital requirements across the value chain.

7.3 **Logistics:** Processes are established to efficiently and effectively transfer hydrocarbon and non-hydrocarbon between point of origin and point of use throughout the value chain. Processes are in place to safely move goods and people to ensure availability where and when needed across assets.

7.4 **Quality Management:** A quality management system is established to enhance customer satisfaction by managing product quality throughout the value chain from suppliers to end customers to ensure products always meet customer service levels and applicable statutory and regulatory requirements.

PTT GROUP COMPANIES ENSURE THAT MATERIALS AND SERVICES PROVIDED BY CONTRACTORS AND SUPPLIERS COMPLY WITH ALL CONTRACTUAL REQUIREMENTS, POLICIES, STANDARDS, AND BUSINESS OBJECTIVES DEFINED AT PTT GROUP LEVEL.

8.1 **Procurement and Contract Strategy:** Procurement and contract strategies are established, endorsed, and aligned to provide an operating framework that maximizes economic value and minimizes risks for all procurement activities.

8.2 **Category Management:** Category management sets materials and services sourcing groups and strategies based on planned demand with the objective of maximizing value, ensuring on-time delivery, and ensuring quality standards while complying to SSHE and sustainability management.

8.3 **Operational Procurement:** Operational procurement accurately controls and manages purchasing requests and purchase-to-pay process to comply with existing contracts and category strategies while minimizing handling and costs.

8.4 **Management of Contractors:** Management of contractors is a set of standardized practices that control, manage, and assess contractors' performance and associated risks to ensure delivery of required services. The practices ensure compliance with SSHE requirements, sustainability management requirements, service levels agreements, and contractual agreements.

8.5 **Supplier Relationship Management:** Supplier relationship management manages suppliers' performance based on supplier classifications (e.g. tiers of criticality, relationship, and objectives) to ensure alignment with category strategies and contractual requirements.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

37

PTT GROUP COMPANIES' LEADERS ARE COMMITTED TO SAFE, RELIABLE, SUSTAINABLE, AND COST-EFFECTIVE OPERATIONS. THEY MAXIMIZE SYNERGIES ACROSS PTT GROUP COMPANIES TO ACHIEVE AND SUSTAIN TOP-QUARTILE PERFORMANCE.

9.1   **OpEx Vision:** Leaders provide clarity on OpEx Vision, principles, and strategic priorities to ensure alignment and integration of OpEx with PTT Group.

9.2   **Strategy Planning:** Leaders formulate a sound OpEx strategy in alignment with PTT Group business objectives.

9.3   **Strategy Implementation:** Leaders ensure that OpEx strategy is converted into concrete action plans. They also assess progress relative to the action plan with the aim of ensuring that strategic goals are achieved.

9.4   **Leadership Behaviors:** Leaders exhibit exemplary behaviors in line with the OEMS Code of Conduct and PTT Group 'SPIRIT' values. Leaders communicate and embed the OpEx Vision and Values in the organization. They gain trust, respect, motivate, and inspire people in the organization.

9.5   **Leadership Commitment:** Leaders are committed to achieving sustainable Top-Quartile performance. They embed and maintain a culture of performance excellence in line with 'SPIRIT'. Leaders are accountable for all business results.

10   LEAD: Performance Management

PTT Group companies aspire to achieve and sustain Top-Quartile performance. Performance management drives progress towards Top-Quartile performance through assessment, benchmarking and prioritized implementation of preventative, corrective, and improvement initiatives.

10.1   **Top-Quartile Plan:** A plan to achieve Top-Quartile performance for each asset, facility, and operation is defined and clearly communicated. The plan covers targets, resources required, and the timeline to Top-Quartile performance.

10.2   **Performance Targets:** PTT Group OpEx key performance indicators (KPIs), leading and lagging, are defined and cascaded to all companies. Company-specific KPIs are also defined. Indicators shall reflect applicable legal requirements, impact, risks, and business priorities.

10.3   **Performance Accountability:** Accountabilities for specific KPIs are assigned to employees to achieve OpEx objectives and targets.

10.4   **Performance Monitoring and Reporting:** Operations performance, variances to target, and root causes of performance gaps are monitored and reported consistently.

10.5   **Performance Benchmarking:** External and internal benchmarking is used to regularly assess operations performance and gaps. Best-practices from benchmarking within PTT Group are shared.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

39

> PTT GROUP CAPITAL PROJECT MANAGEMENT PROCESS SELECTS AND PROGRESSES THE RIGHT PROJECTS THROUGH DISCIPLINED DECISION-MAKING AND ENSURES PROJECTS ARE DELIVERED SAFELY, TO SPECIFICATION, ON TIME, AND WITHIN BUDGET.

11.1   **Project Management:** A cross-functional project team is established to ensure that each project is completed safely within specifications, on time, and within budget while ensuring safe, reliable, and sustainable operations.

11.2   **Identify and Assess:** Identify and assess business opportunities to ensure they are in line with strategic objectives and have the potential to be technically and commercially viable.

11.3   **Select:** Evaluate the alternative concepts to identify the optimum technical and commercial concept.

11.4   **Define and Develop:** Define selected concept and develop execution plan of the project to firm up business case and performance targets before the final decision to launch construction.

11.5   **Execute:** Implement the plans developed during the Define and Develop phase, deliver an asset safely, on time, on budget, and to specification, and ensure a safe and smooth transition from a project model to an operational model.

PTT GROUP COMPANIES ARE COMMITTED TO ENSURE THAT ALL TEMPORARY OR PERMANENT CHANGES IN OPERATIONS, ADMINISTRATION, OR ORGANIZATION ARE SYSTEMATICALLY MANAGED TO A LEVEL OF RISK THAT REMAINS AS LOW AS REASONABLY PRACTICABLE (ALARP).

12.1   **Management of Change System:** The management of change system provides a standardized company-wide management of change process and requirements to manage all temporary and permanent changes.

12.2   **Initiation:** Change initiation is critical to identify changes that could potentially pose risks to the organization and to frame the proposed change in order to facilitate the subsequent management of change process.

12.3   **Review:** Changes are assessed and risks and benefits are evaluated in detail to enable PTT Group companies to make well-informed change approval.

12.4   **Approval:** Before implementation, all changes are consistently evaluated for prioritization and approval.

12.5   **Implementation:** Approved changes are implemented in accordance with the change proposal to ensure that the desired outcomes are achieved.

12.6   **Close-out:** All implemented changes are closed out to verify the completion of change actions and the achievement of the desired change impact.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

41

OPEX GOVERNANCE

OpEx governance ensures that the OpEx program is implemented and embedded in all PTT Group assets. OpEx governance consists of two key elements:

1. **OpEx organization:** A structure at PTT Corporate and PTT Group company level that ensures OEMS is implemented, maintained, and updated.

2. **OEMS review:** A process that ensures PTT Group companies comply with OEMS principles and expectations.

OpEx organization

OpEx governance model: The governance model lays out the responsibilities of the corporate functions and the PTT Group Company OpEx teams as laid out in *Figure OG.1.*

The Corporate Functions ensure their respective OEMS elements are designed and implemented.

The PTT Group company OpEx teams cascade OEMS to Level 3, 4, and 5, support the corporate functions in implementing OEMS and drive the implementation of RD and CPI initiatives.
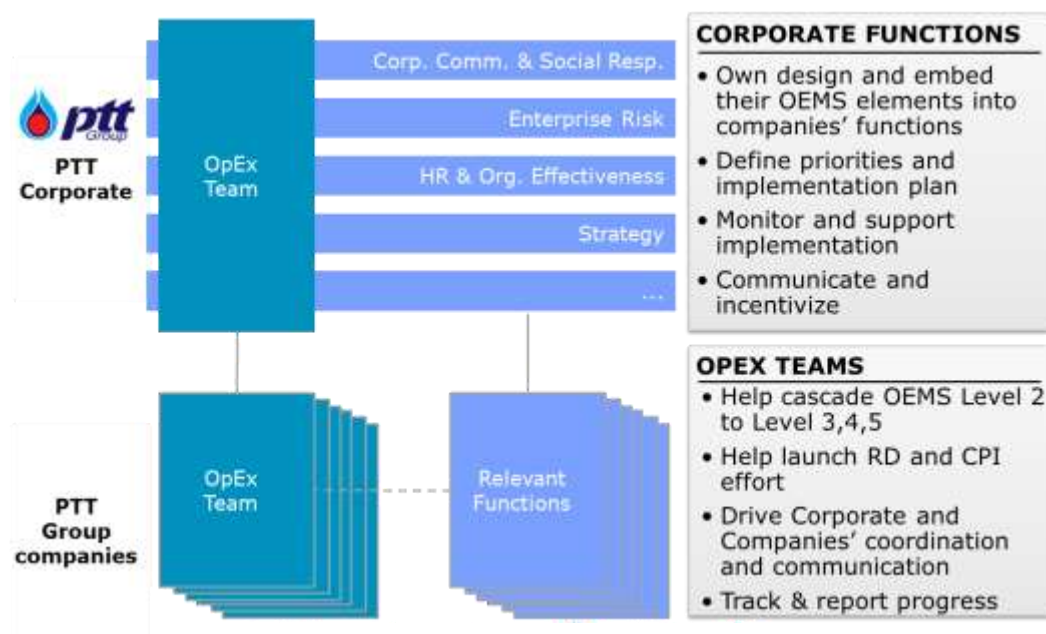

Figure OG.1: OpEx Governance model

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

42

Key roles: Each OEMS element is assigned an OEMS Champion who is the owner and custodian of the element for PTT Group. OEMS Champions inspire PTT Group employees to implement OEMS and hold them accountable for results.

A network of Functional Leaders interacts and coordinates at company level to support the implementation of OEMS and drive RD and CPI initiatives. At least one Functional Leader per element is appointed by each company.

A network of Experts (Community of Practitioners) facilitates the translation of OEMS principles, expectations, and recommendations, to company and asset specific procedures and work instructions. Experts share best-practices and are involved in the OEMS review process.

Dedicated PTT Corporate and PTT Group company OpEx teams monitor and support overall OEMS deployment.

Figure OG.2: OpEx roles and responsibilities

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

43

OEMS Review

The **OEMS review** is a process that ensures PTT Group companies comply with OEMS principles and expectations.

OEMS review teams assess the OEMS implementation gaps of every asset. Both external and internal OEMS review teams are deployed.

- An **external independent OEMS review team** visits the assets for 3-5 weeks every three years to identify OEMS implementation gaps. The outcome of this assessment is an OEMS gap closure action plan.

- An **internal OEMS review team** self-assesses the site and its compliance with each of the 12 elements at least every 12 months to track progress against the OEMS gap closure plan. If a problem is discovered, the team revisits the site 3-6 months after its first visit for a follow-up.

The internal and the external OEMS review teams **perform the following activities**: (a) objectively evaluate existing capabilities across the OEMS dimensions; (b) check progress on actions from previous OEMS gap closure plan; (c) support site management to draw up a new OEMS gap closure plan.

OEMS **measurements** are issued at the end of every review cycle. Every site receives an overall **OEMS maturity score**, which is the average of the scores received on each of the 12 OEMS elements.

INTELLECTUAL CAPITAL

Intellectual capital at PTT Group consists of best-practices and innovations (including new technology and intellectual property) to improve operations and create a competitive advantage. The creation of intellectual capital is supported by knowledge management. Knowledge management comprises of the process and enablers to create, capture, organize, and transfer knowledge.
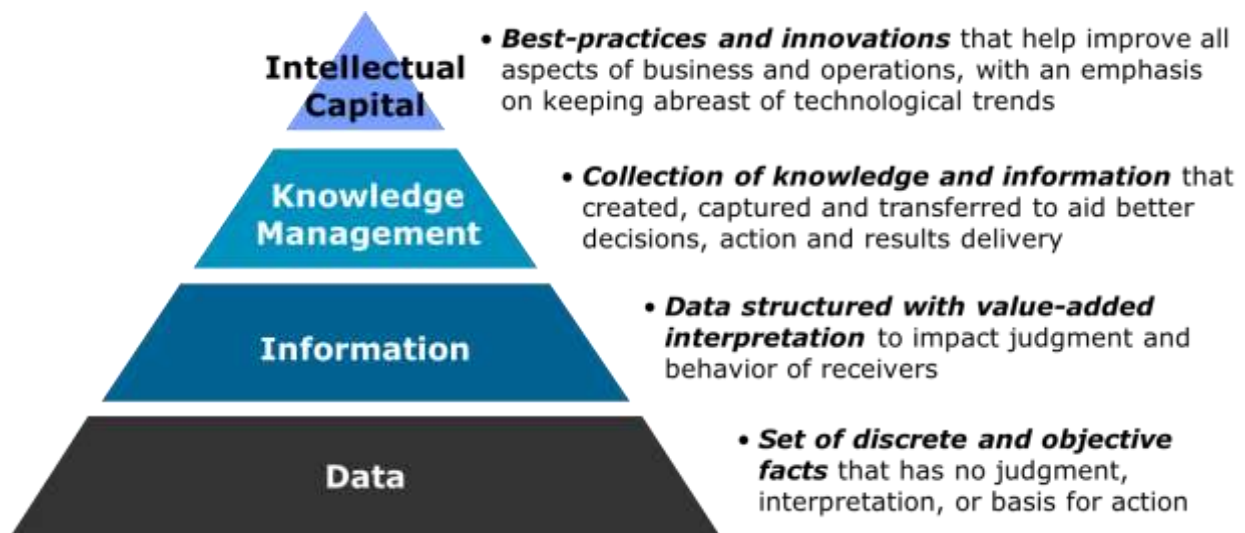
Figure IC.1: Hierarchy of intellectual capital

PTT Group companies facilitate activities that enable creation, accumulation, and sharing of best-practices across PTT Group through robust knowledge management process. PTT Group OpEx Knowledge Management portal (http://km.pttgrp.com/OpEx) is used as a single-access point for knowledge management of operations related topics.

OpEx's knowledge management framework is aligned with PTT Group's strategy and knowledge management framework. Both OpEx and PTT Group's knowledge management framework share the same vision of "*Creating an effective knowledge base to leverage organization capability and enable an innovative and learning organization*".

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

45
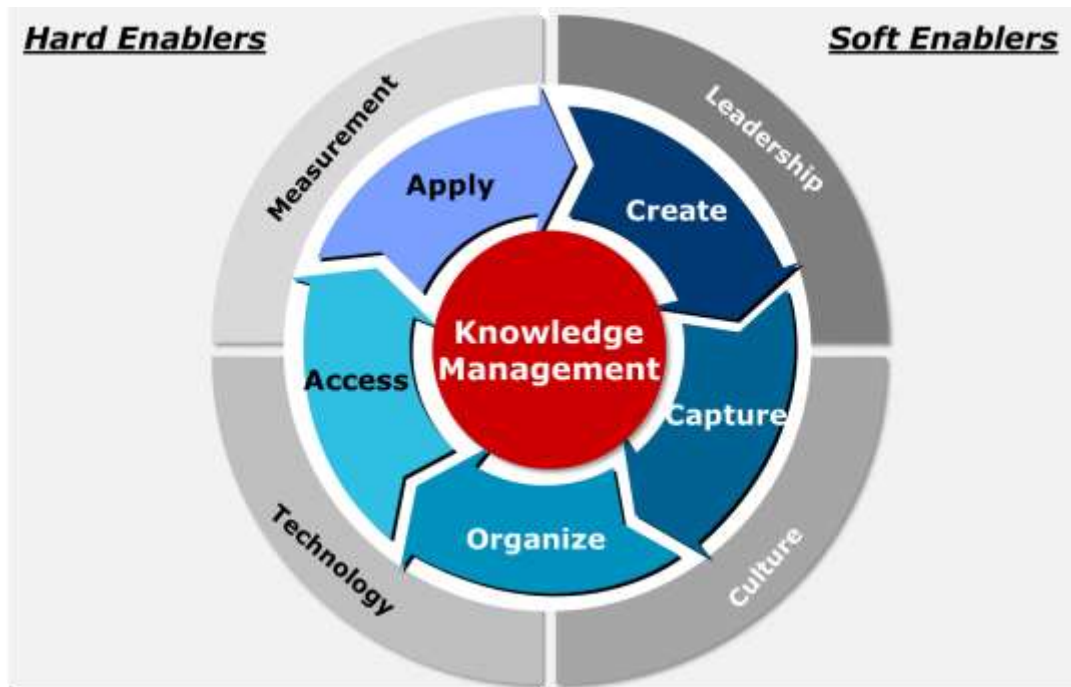
Figure IC.2: OpEx's knowledge management framework

Innovations are fostered to improve all aspects of operations with an emphasis on keeping abreast with technological trends. PTT Research & Technology Institute and other PTT Innovation and Technology entities within each of the PTT Group Companies are responsible for guiding the development and implementation of innovations that improve safety, reliability, sustainability, and cost efficiency.

RESULTS DELIVERY (RD)

By winning the hearts and minds of our employees, the OpEx values become embedded in our attitudes – ensuring the OpEx program is not just a one-off success, but a truly sustainable transformation that moves PTT Group forward into the future.

Results Delivery is a cohesive and integrated approach applied during OpEx implementation to systematically identify and mitigate key implementation risks. It ensures changes in behavior and resistance to change are carefully managed.

Foundation of Results Delivery

Successful change programs must ensure leadership and communication across 5 key dimensions, as represented in *Figure RD.2*.
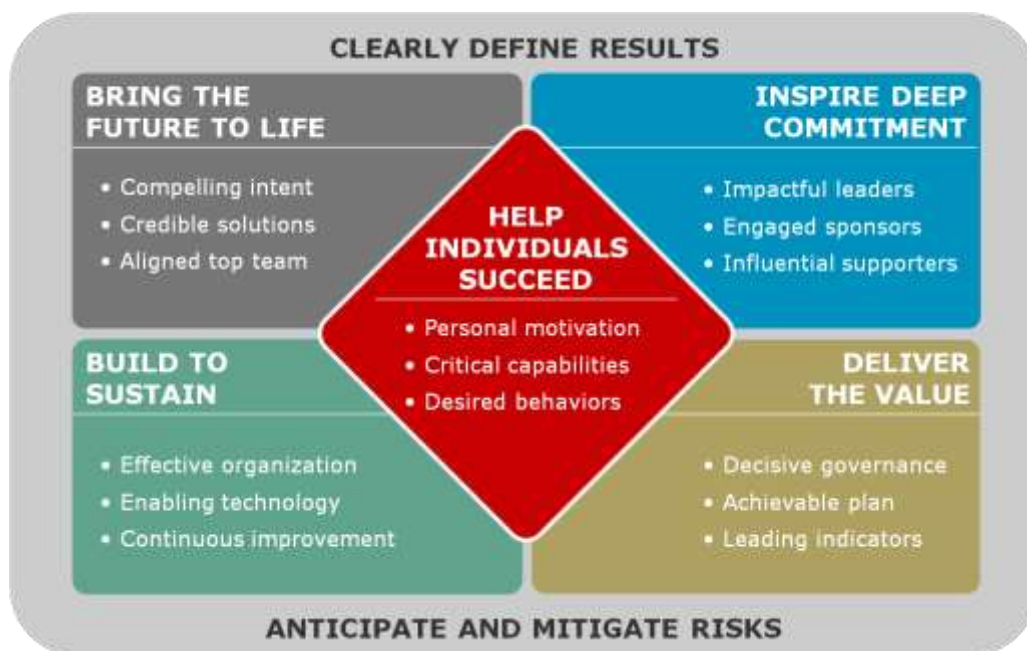
Figure RD.2: Results Delivery Framework

PTT Group companies will consider all these elements, and individually prioritize their efforts based on an initial risk assessment. Different organizations may have different implementation gaps due to their specific situations. Results Delivery provides the tools to execute a comprehensive risk assessment for the OpEx transformation program.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

47

How good looks like if Results Delivery is executed within OpEx program

AIM: Bring the Future to Life	**LEAD:** Inspire Deep Commitment	**ACT:** Help Individuals Succeed	**GUIDE:** Deliver the Value	**EMBED**: Build to Sustain
Employees understand and align on potential OpEx benefits for PTT Group.	Stakeholders within PTT Group identified. Commitment built from top down along the sponsorship spine.	Consistent communication and evaluation system implemented within PTT Group to manage change.	OpEx implementation sequenced for optimized results and put into action. Critical risks identified and mitigated.	Feedback actively managed. Continuous improvement embedded within PTT Group.

BRING THE FUTURE TO LIFE

- Employees at all PTT Group companies have a clear picture of what the OpEx future state looks like, not just at a corporate level but on a company level as well
- OpEx related communications and actions from leaders and key stakeholders exhibit alignment to the change

INSPIRE DEEP COMMITMENT

- The right people for the OpEx program are appointed to ensure that the correct decisions are made and executed
- Stakeholders at each level, who are most affected by the changes are identified and commitment is built down the sponsorship spine

HELP INDIVIDUALS SUCCEED

- Communication is clear, consistent, and timely throughout the change
- Appropriate training is conducted for relevant personnel
- Behaviors critical to the change are identified, shaped, and reinforced

DELIVER THE VALUE

- OpEx execution plans ensure there is adequate resourcing and implementation is sequenced for optimized results
- OpEx goals are defined, measured, and monitored
- A boundary is defined around the change in order to protect core business performance during the OpEx transformation
- Critical execution risks for OpEx are identified and mitigation plans are developed
- Leaders encourage a speak-up culture to ensure OpEx execution risks are surfaced and potential course changes are addressed early

BUILD TO SUSTAIN

- Talent and expertise required to deliver OpEx results are reviewed to identify gaps
- Organization structure, roles, and systems are aligned with the desired OpEx results
- A fast-feedback loop is developed to capture learning, allowing dynamic changes to be made to the design of the OpEx solution

CONTINUOUS PERFORMANCE IMPROVEMENT (CPI)

CPI is a systematic method that drives sustained progress towards Operational Excellence, while ensuring every individual has the tools and motivation to support this journey.

For continuous improvement to be successful, every individual needs to understand "**Where to go**" (END) and "**How to get there**" (WAY), and possess the "**Required tools**" (MEAN).

PTT Group defines its "Where to go" (END) aspirations along two dimensions:

- **World-class practices** - The OEMS manual describes world-class practices which will result in world-class performance when implemented.

- **Top-Quartile performance** - World-class performance is measured by benchmarking industry-wide Top-Quartile performance using PTT Group KPI framework.

Every PTT Group company draws up a **Roadmap of achievable targets** (WAY). Starting from their current performance level (Point of Departure), a medium term roadmap of achievable targets is set for each company.

The required tools for CPI implementation (MEAN) are the:

- **Operational Excellence assurance process:** An independent verification process that regularly assesses the progress towards implementing Operational Excellence and assists the leadership team in drawing up an Operational Excellence gap closure plan.

- **OEMS maturity assessment toolkit:** A self-assessment toolkit that identifies OEMS gaps and progress against gap closure plan.

- **CPI process:** A rigorous process to identify and implement changes to improve and sustain performance.

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

49

GLOSSARY

ALARP: As Low As Reasonably Practicable

Best-practice: The best solution to a common problem, which has been trialed, tested, and proven. Best-practices are usually represented in the form of practice, standard, processes, procedure, tools, or framework.

CPI: Continuous Performance Improvement

KM: Knowledge Management

KPI: Key Performance Indicator

OEMS: Operational Excellence Management System

OpEx: Operational Excellence

PTW: Permit to Work

RD: Results Delivery

SOP: Standard Operating Procedure

SPIRIT: SPIRIT is a framework which lays out the way we work together at PTT Group

TAGNOC: Technologically Advanced and Green National Oil Company

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

50

PICTURE OF THE BEACH WORKSHOP PARTICIPANTS

The OpEx Transformation Team would like to thank the following executives for their participation in Picture of the Beach Workshop:

Name of Participants	Title	Company
Pailin Chuchottaworn	President & Chief Executive Officer	PTT
Tevin Vongvanich	President & Chief Executive Officer	PTTEP
Bhawana Suphavilai	President	PTTES
Bowon Vongsinudom	President	PTTGC
Jakchai Barlee	President	PTTUT
Atikom Terbsiri	President	IRPC
Suwanunt Chatiudompunth	President	PPCL
Anon Sirisaengtaksin	Chief Executive Officer	PTTGC
Veerasak Kositpaisal	Chief Executive Officer	TOP
Chaiwat Damrongmongkolgul	Deputy Managing Director	TOP
Nuttachat Charuchinda	Chief Operating Officer	PTT
Wichai Pornkeratiwat	Chief Operating Officer	PTT
Peerapong Achariyacheevin	Senior Executive Vice President	PTT
Pitipan Tepartimargorn	Senior Executive Vice President	PTT
Sarun Rungkasiri	Senior Executive Vice President	PTT
Sukrit Surabotsopon	Senior Executive Vice President	PTT
Supattanapong Punmeechaow	Senior Executive Vice President	PTT
Sahaschai Panichapong	Senior Executive Vice President	IRPC
Boobpha Amornkiatkajorn	Executive Vice President	PTT
Chaicharearn Atibaedya	Executive Vice President	PTT
Charcrie Buranakanonda	Executive Vice President	PTT (GSP)
Chawalit Tippawanich	Executive Vice President	PTT
Siriwan Chierapong	Executive Vice President	PTT
Somchai Monopinives	Executive Vice President	PTTEP
Suphit Suwagul	Executive Vice President	PTT
Kumpol Chaikitkosi	Executive Vice President	PPCL
Kun Patumraj	Executive Vice President	PTTGC
Pongpraphan Titathavewatana	Executive Vice President	IRPC
Woravuth Sivapetranart	Executive Vice President	IRPC
Arawadee Photisaro	Vice President	PTT
Hongsri Charoenvaravoot	Vice President	PTT
Jeeranee Pimthanothai	Vice President	PTT
Suthep Ruangpornwisuth	Vice President	PTTUT
Naruepon Lecksiwilai	Manager	PTTEP
Taweelarp Pornkul	Technical Service Manager	PTTES

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

52

OPEX TRANSFORMATION TEAM

The PTT leadership would like to thank the OpEx Transformation Team for their contribution in the OpEx Transformation Project:

Team Members	Company
Jeeranee Pimthanothai	PTT
Natchanakarn Kullavanijaya	PTT
Chanwut Lertbannaphong	PTT
Pongwisute Nissaichareon	PTT
Teeratas Krungkaew	PTT
Nipa Luangtangvarodom	PTT
Sirikarn Suwanthawit	PTT
Piti Srisuksombut	PTT
Ngamjit Boribalburibhand	PTT
Chayo Kunathai	PTT
Sidtipong Sathapornanon	PTT
Somjate Photong	PTT
Thanaphat Luemunkong	PTT
Nattanich Thongtaveechaikit	PTT
Pongsabutt Auychaiwatt	PTT
Cholathis Cholpraves	PTT

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

53

OEMS WORKING GROUP

The PTT leadership would like to thank the following people for their contribution in developing this OEMS manual:

Name of Participants	Company	Name of Participants	Company
Achara Varadharmapinich	PTTEP	Cheep Launloy	IRPC
Adisak Wararuktanaurn	PTTGC	Cherdchai Boonchoochauy	PTT
Aim Arayaskul	PPCL	Chitchanok Veshasitt	PTT
Akekasit Leardsakulthong	TOP	Chokchai Oransirikul	IRPC
Alissara Kitirotphari	PPCL	Chris Wheeler	PTTEP
Amnat Leethanawat	PTTUT	Chudchai Petpornprapas	PTTGC
Amorntep Sawanitigul	PTT	Chumporn Jaranai	IRPC
Anake Chatsatthar	PTT	David Antony John	PTTEP
Anan Chamsakran	PTTEP	Decha Boonwan	PTT
Anan Thongluea	PTT	Dhanapat Nitisvarodom	PTT
Anawat Chansaksoong	TOP	Duangsuda Ariyawongwiwat	IRPC
Aniroot Rittiyong	PTTUT	Ekapoj Limtrakul	TOP
Apichat Chaicharnatee	PTT	Ekarat Faithasaeng	PPCL
Apichaya Akkharawinek	TOP	Ektana Manjahuna	PTTGC
Apirom Pongnoppa	IRPC	Hans Bodewes	PTTES
Attaporn Siewphukiew	PTTGC	Hongsri Charoenvaravoot	PTT
Awiroot Rittiyong	PTTUT	Jakkawal Permyanwanthana	IRPC
Bhathaneeya Kiratipaiboon	PTT	Jakrapong Boonrasri	PPCL
Bongkoch Mahanukul	PTT	Jarinee Jiraphan	TOP
Booncherd Suwantip	PTTGC	Jariya Onnachai	PTTES
Boondej Phuriyakorn	IRPC	Jittima Nittayawan	PTTEP
Boonyarat Narongwongwattana	PTTES	Kaiangphong Harichirahtiwong	PTTEP
Brinda Klasnimi	PTTGC	Kamol Kosawiboonphol	PTTES
Burinthorn Thong-O	IRPC	Karun Chawalitwongporn	PTTUT
Bussarin Khongseri	PPCL	Kasana Lacharoj	IRPC
Chackrit Lekthamai	PTTUT	Kasemsuk Kittichotirat	IRPC
Chaiyapat Pinsiri	IRPC	Keerati Sangtianchai	PTT
Chakapong Pilaisangsuri	PTTGC	Kheam Boonme	IRPC
Chana Thapplee	PTTGC	Khwanchai Chaiyarerk	TOP
Chanansiri Panpanit	PTT	Kitja Chainarong	TOP
Chanchai Choonhapun	IRPC	Kittichai Boonteam	PPCL
Chanin Dangthongdee	PTTES	Kittirat Laohalertsakda	IRPC
Chared Wuttigul	TOP	Klot Boonyawattana	PTT
Charn Kulpatnirun	PPCL	Komgrit Lohpetch	PTT
Charnyut Wetpanyawong	TOP	Komkrit Phiwthong	PTTUT
Chawalit Boonbumrungchai	PTT	Kongsit Kaewpila	PTTUT
Chayo Kunathai	PTT	Kowit Chuengsatiansup	PTTUT

54

Name of Participants	Company	Name of Participants	Company
Kraisri Phankitnirundon	IRPC	Panuwat Srihayrun	PPCL
Kriangsak Trirongjithoa	TOP	Pareena Arsirawajana	TOP
Kriengkrai Kittiwarawut	TOP	Parichart Tanthakit	PTTES
Kriengkrai Nakapong	TOP	Parichat Karnpracha	PPCL
Krit Kumpsbocth	PTTGC	Parichat Thonggug	IRPC
Kritsada Chamchalao	PPCL	Parichat Tanthakit	PTTES
Kunalai U-aksorn	PTTES	Patcharapa Tapaneeyapan	PPCL
Kunchit Rongdach	IRPC	Patipat Suputsopon	PPCL
Likit Klanarongnan	PTTEP	Pattaraporn Mahaguna	PTT
Michai Santwitikosol	IRPC	Pavana Weerasethakul	PTTUT
Mongkol Sommaichaiya	PTTEP	Pavinee Thunkarnsakul	PTTEP
Nampueng Sanguantang	PTT	Payont Ampornareekul	PTTUT
Nanta Warongdham	IRPC	Peerakait Chairatthong	PTT
Naphawadee Suebsuk	PTT	Peerapol Phadungpot	PTTUT
Naris Leartsatthakit	PPCL	Perapong Lapasathukul	PTT
Narong Suphakan	IRPC	Phikun Phuagoen	PTTEP
Narongchai Preedralertmit	IRPC	Phinyada Pitchayatanakul	PTTEP
Narongrith Proongkiat	PPCL	Phromphron Isarankura Na Ayutthaya	PPCL
Narongsak Chaviengpob	TOP	Phumchit Tatsanaprasert	TOP
Naruepon Lecksiwilai	PTTEP	Phuping Taweesarp	TOP
Narungsi Kaiwikaigumnurd	PTTGC	Pichasiree Thientaworn	PTTEP
Natravee Chotima	IRPC	Pichit Rerkchairuksa	PTT
Nattawee Putiyotin	PTTGC	Pimala Bhiromkaew	PTTEP
Nattawoot Krerpradab	PTT	Pipat Mahawattanangul	PTTES
Nattawut Piyaprachakorn	PTT	Pipatpong Chandee	PTTUT
Natteerin Limapor	PTT	Pipit Hongjinda	PTT
Niphon Siriphen	PPCL	Pirada Ngiabprasert	IRPC
Nisanart Soontarasing	PTTEP	Pirote Sangounsuk	PTTGC
Nittaya Boonyarit	PTTGC	Pirun Krimwongrut	PTTGC
Nongnapat Saisuthi	TOP	Pisit Fusiripong	PTTGC
Nuttachai Kiatsakulpon	PPCL	Pitakpong Khuananchai	PTTGC
Nuwat Thamrongwang	PTTEP	Pokkrong Chanloha	PTTUT
Oramas Pinijchob	PTT	Pongdej Pantasanyakol	PPCL
Pairush Soovan	PTTGC	Pongdet Kunasaraphun	PTT
Paisan Klailumjiak	PPCL	Pongtep Phadang	PTTUT
Paisarn Sarapee	PPCL	Ponsak Montreepila	IRPC
Panlop Limsakul	PTTEP	Pornchai Kitwimontrakul	IRPC

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

55

Name of Participants	Company	Name of Participants	Company
Pornchai Komansil	IRPC	Siridech Kumvonedee	PTTGC
Pranarch Kosayanont	IRPC	Sirigoon Nonpradit	PPCL
Prapassorn Boonjawat	PTTEP	Sittiruk Pitpreecha	PTTEP
Prapat Oudomugsorn	PPCL	Siwat Rujinarong	PTT
Praphat Keawmora	PTTGC	Siwawut Rujirakarn	PTTUT
Prapoj Kiattikomol	PTTEP	Somboon Siripetchrung	IRPC
Prasong Petcharat	TOP	Somchai Tanarukpongsakorn	IRPC
Pratch Tontirittiphol	TOP	Somkit Bunchitmongkhon	PTTGC
Prateep Jitpratak	PTT	Somnuek Woowong	TOP
Prateep Seocholit	IRPC	Sompong Wuttilaohapan	IRPC
Prateep Wattamasriroj	IRPC	Somsak Lertcharoensermsuk	PTTUT
Pravit Ployngam	IRPC	Songpon Boonmark	PTTGC
Praweak Chuadtoe	PTTUT	Sontaya Laddagul	PTTGC
Preeda Boonsilps	IRPC	Soranai Lertugsorn	PTT
Rapeepan Boonnow	PTT	Subhaniti Sangdham	PTTES
Ratchada Sawasdirak	PTTGC	Suchart Monyanont	TOP
Ratri Chingchitra	TOP	Suebpong Kongkhun	PTT
Renuka Phanitawesak	PPCL	Sukulya Veeradaechapol	TOP
Rujeenuch Vannako	PTT	Sunisa Yaiyiam	PTT
Ruksakul Srilom	PTTGC	Supachai Laorrattanasak	PTT
Sahapong Nopcharoen	PTT	Supalerk Satitthamajit	PTTES
Sakesiri Piyavej	PTTGC	Supat Arunlerktawin	PTTGC
Sakulchai Meeboongerd	PPCL	Suphit Thienmethawut	PTT
Sangjan Phanin	IRPC	Surajit Boonmamanee	IRPC
Sanvaris Uywatthana	PTT	Sureephan Pinkaew	PTT
Saochai Sookkasem	PTTUT	Suthep Roangpornwisuth	PTTUT
Saranya Lohpetch	PTTUT	Suthorn Domhom	PTTEP
Sararag Dattibongs	PTTUT	Sutthiwat Kuljittisuteeporn	TOP
Sarun Kow-ngarm	PPCL	Suvirate Pooraya	PPCL
Sasitorn Khrua-cosh	PTT	Suwat Suratchaikarn	PTTGC
Satit Thiemwat	PPCL	Tanatchaporn Yooyangyuen	PTT
Savara Kwangsopa	IRPC	Tawatchai Treenitirattanakul	IRPC
Sekxon Arttamangkura	PTTGC	Taweelarp Pormkul	PTTES
Seree Thongkong	IRPC	Teradej Vaitayaporn	PTTEP
Sermsak Nantapong	TOP	Thana Slanvetpan	PTTEP
Sirapa Prateepamornkul	TOP	Thananan Thanajaro	PTTEP
Sirawat Tanamaitreejitt	IRPC	Thanatorn Dodethai	TOP

56

Name of Participants	Company
Thanayot Prasanthai	PPCL
Thanyaphat Wongsirikajorn	PTT
Tharaphon Thirathanarojana	IRPC
Theerachai Thanupaprangsan	PPCL
Therdsak Pornwattanakul	PTTGC
Thitiwat Choocharoenprakit	PPCL
Tullaporn Daungin	TOP
Ubolrat Wannapet	IRPC
Udom Wongsirinopphakhun	TOP
Umaporn Kanawong	PTTGC
Vanida Sirilertpitak	TOP
Veerachai Tangtanasringkarn	IRPC
Vorachai Katethong	PTTGC
Waleerat Pinket	TOP
Warakhun Suwannachit	TOP
Watcharin Puttapornpasit	TOP
Werasak Chairatanasongporn	PTTGC
William Wai	IRPC
Winit Benjapholwivat	IRPC
Wiwat Damrongwiriyakul	IRPC
Woravuth Siwapatcharanart	IRPC
Worawut Sitthithanasut	PPCL
Wouter F. timmermans	PTTES
Wutichai Nipatjakaranan	TOP
Yotsaveepon Makchit	PPCL
Yuthana Pasurapunya	TOP
Yuttapun Jumphon	TOP

CONFIDENTIAL AND PROPRIETARY: PTT Group OEMS Level 1 Manual - Version 2.5 as of 6th February 2019
Any use of this material without specific permission of PTT Group company is strictly prohibited

57