Executive Talking Points for Asset Management Professionals

Talking points for building a communication channel to C-Level Executives

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Business-focussed Asset Management for Industrial Facilities

(Executive Talking Points)

Introduction

The purpose of this paper is to provide concise "talking points" or ***entry points for discussion with senior executives,*** to create awareness, interest and support for asset-related operational initiatives. It is designed to provide a conceptual framework for asset management professionals in their quest to develop a business case for investment in operational and reliability improvements to their industrial facilities.

The intended audience is senior executive staff of large industrial organisations, and of large-scale service providers to such organisations. The paper is particularly applicable for organisations involving:

- Multiple industrial sites, multiple jurisdictions (sometimes international)
- Hazardous materials, and pervasive lethal energy in use
- Environmental and safety impacts beyond site boundaries
- Large community presence (both interest from & impact upon)
- Many generations of industrial technologies in use
- Vulnerability to legal jeopardy, and/or reputation damage

The following short chapters are crafted to provide ***entry points*** for a discussion with C-level executives. Of course, such entry points may quickly lead to discussions about subjects from the other entry-point material and beyond:

Chapter 1. Discussion with CFO - Chief Financial Officer
Chapter 2. Discussion with COO - Chief Operating Officer
Chapter 3. Discussion with CEO - Chief Executive Officer
Chapter 4. Discussion with Board-member, Legal Counsel or Risk Executive

It is axiomatic that the performance of existing physical assets is foundational to the success of asset-intensive enterprises. However, the sheer scale, interconnectedness and complexity of contemporary industrial facilities often obfuscates the objectives and strategies for managing those assets, particularly within the dimensions of people, processes, and supporting information technology.

The information provided herein will provide a cohesive framework for the ***asset management strategies*** that directly support typical business objectives of large industrial facilities. As such, this paper provides a brief summary of key concepts within my white paper entitled "The Loss Prevention Imperative" [1].

Please note that these chapters are not presented "linearly". That is, due to interdependence of the subject material, entry at any point in the body of the text is as good as any other point.

[1] My paper titled "The Loss Prevention Imperative" demonstrates that there are substantial un-tapped opportunities for operational initiatives that address both systematic and unexpected losses that bedevil manufacturing operations. That paper describes a cohesive strategy for identifying industrial losses, and proactively establishing organisational structures, processes and knowledge-based technology to minimize those losses.

Chapter 1

For Discussion with the CFO

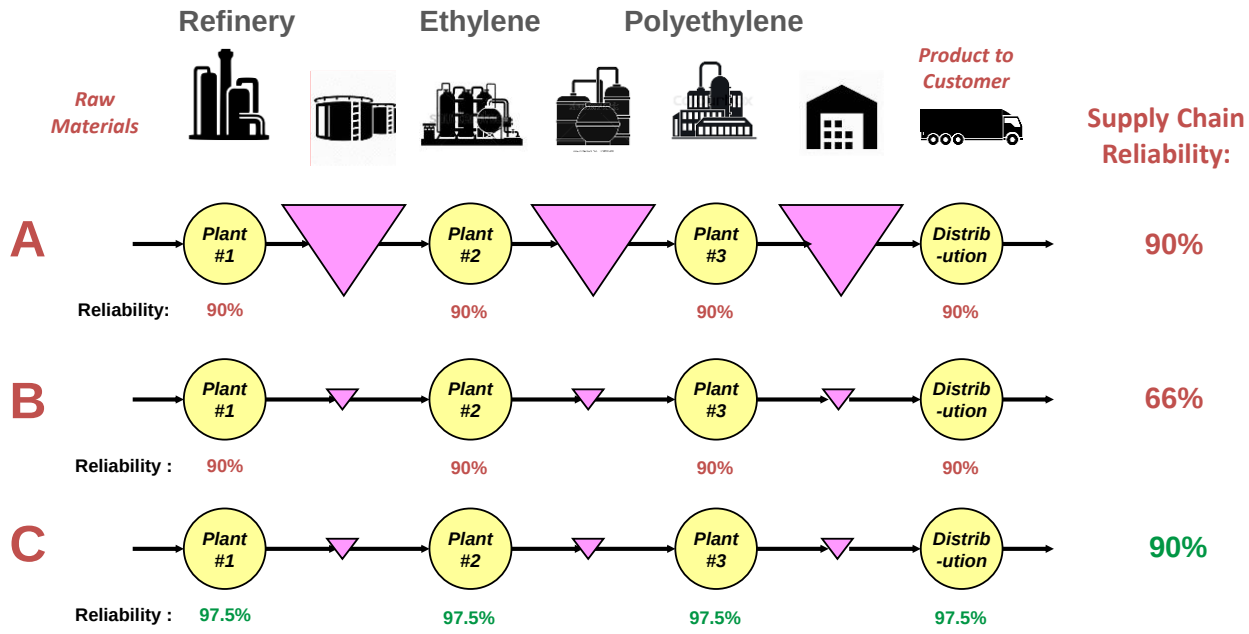
One prime responsibility of the CFO is to manage Order-to-Cash to ensure solvency.

In all manufacturing facilities, the the purpose of physical assets is to affect a *material transformation* such that *value* is created or added. However, Instability and/or disruptions suffered by the physical assets create waves of variation upstream and downstream in the Order-to-Cash cycle. This variation manifests as additional inventory, processing, and procedural waste, not only adding to variable and fixed costs, but also adding to the working capital needed to support the business.

When reliability of the physical asset is stable, then the business may operate in a much "leaner" state overall, leading to reductions of DIO (Days of Inventory Outstanding), and DSO (Days of Sales Outstanding), thereby enabling shorter Order-to-Cash time.

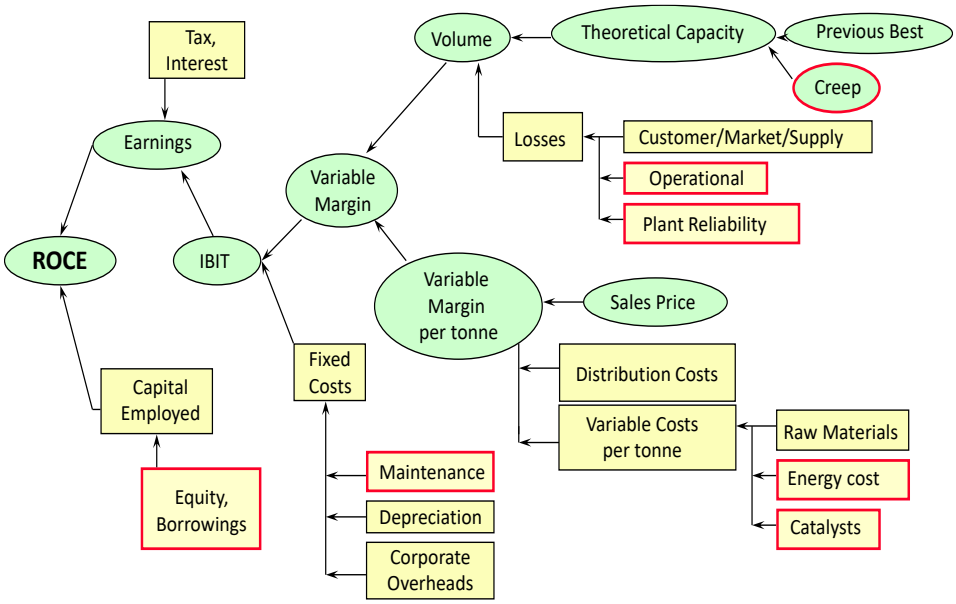
Indeed, operational reliability of the Physical Assets must be improved if product inventory is to be reduced whilst simultaneously maintaining the same level of customer supply, as illustrated below.

- In this example, to maintain Case A's Supply Chain Reliability at 90%, the reliability of the individual plants must increase to 97.5% if the buffer inventory is to be eliminated (Case C). If individual plant reliabilities do not improve, then without the buffer inventory, supply chain reliability falls to 90% x 90% x 90% x 90% = 66% (Case B).



In addition to its stabilizing contribution to the "Order-to-Cash" cycle, the *operational reliability* of Physical Assets has a profound effect on the performance of the business as measured by ROCE (Return on Capital Employed).

Reliable industrial facilities not only deliver capacity exactly when required, but also provide flexibility in exploiting opportunities of supply and demand. Reliability of Physical Assets can be mapped directly to financial performance via the factors that contribute to ROCE, as illustrated below:



ROCE driver-tree for typical refinery, petrochemical or continuous process:

Positive effect

Negative effect

Asset impact

"Capital Employed" - the amount of long and short term borrowings and equity required to sustain a manufacturing operation

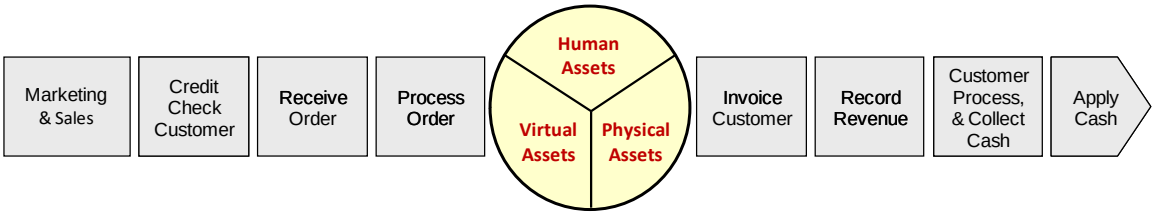
Reliability of Physical Assets positively impacts ROCE by:

- Reducing production losses, by optimizing the use of existing capacity,
- Reducing fixed costs with better reliability and fewer breakdowns,
- Reducing variable costs of energy, process disruption, and rework,
- Reducing Capital Employed by reducing spare parts inventory, and by extending equipment life (thereby reducing the frequency of capital replacements),
- Reducing raw material and intermediate product inventory when assets are in series within a facility, or along a supply chain,
- Reducing instability in the Order-to-Cash cycle.

Chapter 2

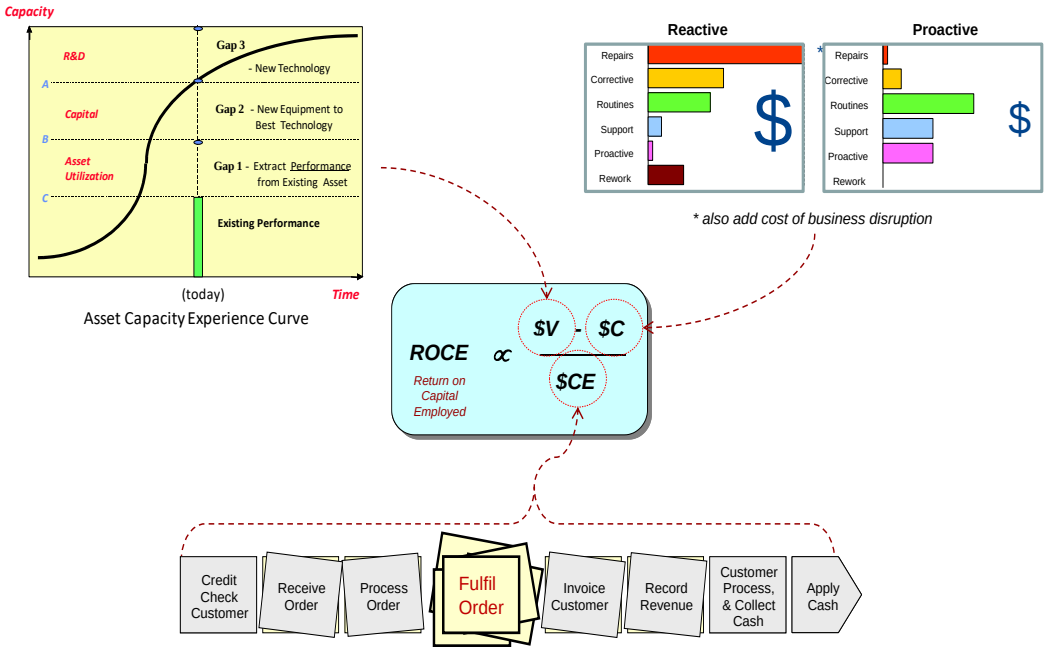
For Discussion with the COO

In fulfilling the purpose of physical assets, namely to affect a *material transformation*, among the COO's prime responsibilities is to ensure that the daily *transformation* delivers right quality, right quantity, at the right time.



However, in today's hi-tech industries, the Physical Assets cannot act in isolation. Seamless performance requires the harmonious close-coupled cooperation with both Human Assets (people), and Virtual Assets (the knowledge embedded in artefacts, drawings and software, including procedures, models, and visualizations describing the physical assets).

The COO's contributions to business success may be quantified by the three major factors influencing ROCE (Return on Capital Employed), namely values of Production Volume, Production Cost, and Capital Employed (which is the amount of long- and short-term borrowings and equity required to sustain the manufacturing operation). The combined effect on ROCE is illustrated and described below:



$V *Increase production volumes via increased utilization, without using additional capital or overhead. Improves the attainment of start-up targets for new plant.*

$C *Reduce operating and maintenance costs with fewer breakdowns, better quality, and smoother running.*

$CE *Reduce Capital Employed with reliable plant and dependable operations that require less production inventory, with less disruption to overall order-to-cash cycle (Days of Inventory, and Days of Sales both significantly reduced).*

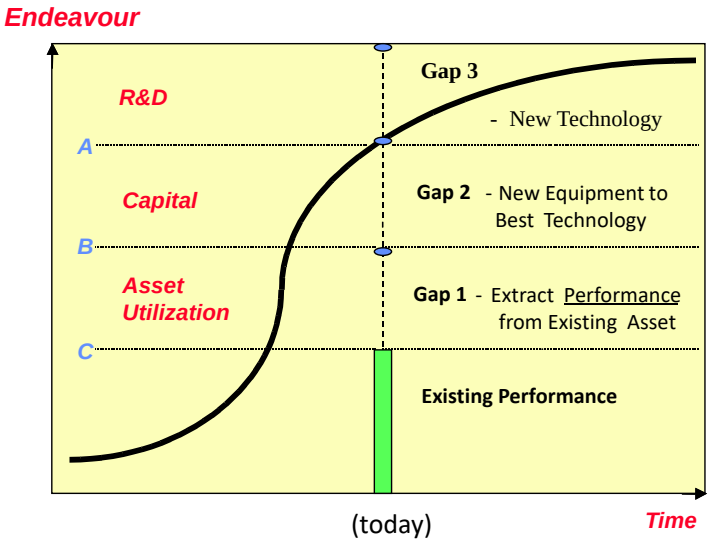
A more specific description of the *material transformation* required of an industrial facility is to deliver First Quality Product, at the agreed Volume, at exactly the agreed time. The COO must do this *on a daily basis,* within the capacity of existing facilities.

ROCE improves as *"Asset Utilization"* is maximized. That is, by increasing production volume by ***removing the causes of production losses*** – represented by Gap 1 in the diagram below:

In this diagram, the evolving performance of a large facility is conceptually represented by an "experience curve", which implies that capacity improves over time through human learning and application of smart technology.

The existing level of performance (first quality production volume) is represented by the green bar at level C.

For existing (brownfield) facilities, the ideal performance would be at level B – the best that could be achieved with existing assets and operating personnel.



Asset Capacity Experience Curve

For new (green field) facilities, or for upgrading existing assets, the ideal performance would be at level A, taking advantage of the best currently available technology.

Furthermore, if additional capacity is required, then it behoves Owners to reduce Gap 1 prior to injecting new capital into Gap 2, otherwise the existing Gap 1 ratio (C/B) will continue to prevail in the upgraded scenario. Owners with multiple facilities may use this argument to preferentially allocate new capital to sites with better Asset Utilization.

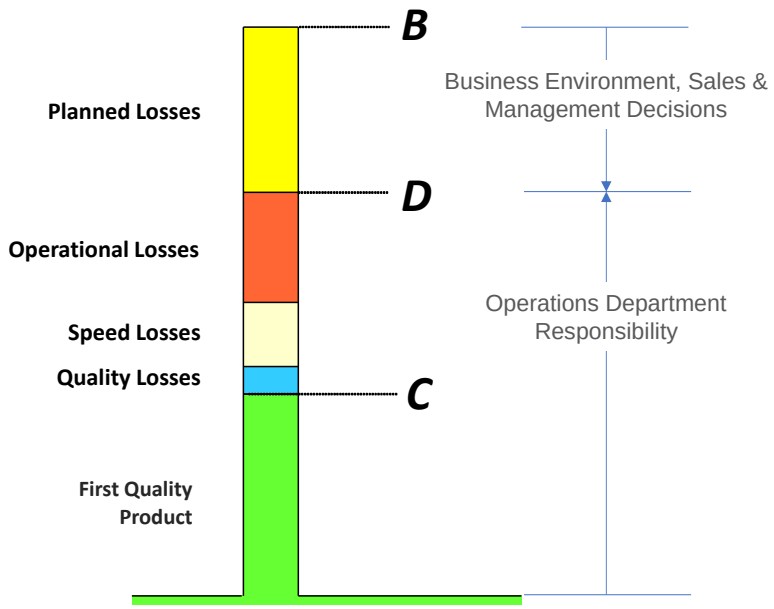
Gap 1 above is more precisely defined by the sum of Planned, Operational, Speed and Quality Losses, where all quantities in this bar chart are in **<u>units of production</u>.**

The key performance measures are:

***Asset Utilization* = C / B %**

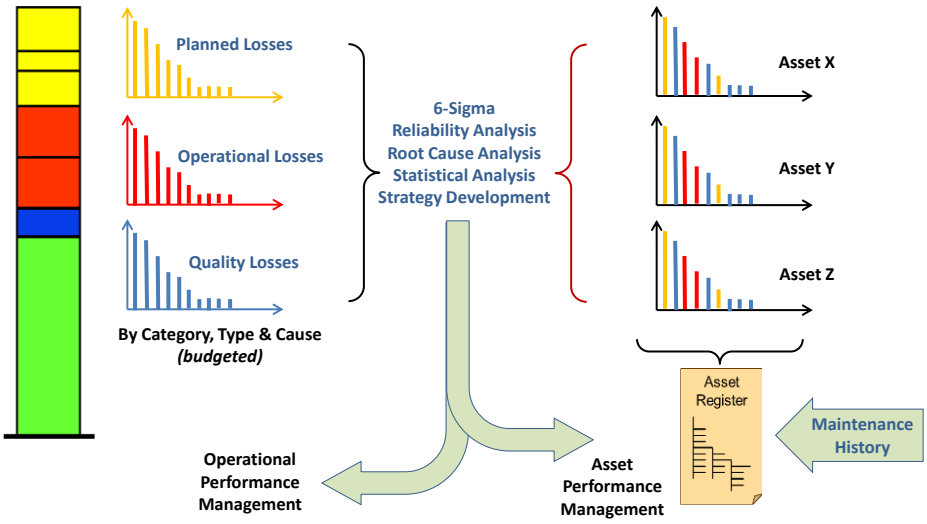
Overall Equipment Effectiveness:
***OEE* = C / D %**

OEE indicates how effective the facility is at meeting demand (D), after managers exclude the external effects of prevailing business conditions, namely, the "planned" quantities within gap (B – D).



The task of maximizing ***Asset Utilization*** can be managed with the aid of contemporary "Asset Management Systems". A combination of software-based systems can be configured to monitor and illuminate the ongoing daily production losses, including their categories and causes.

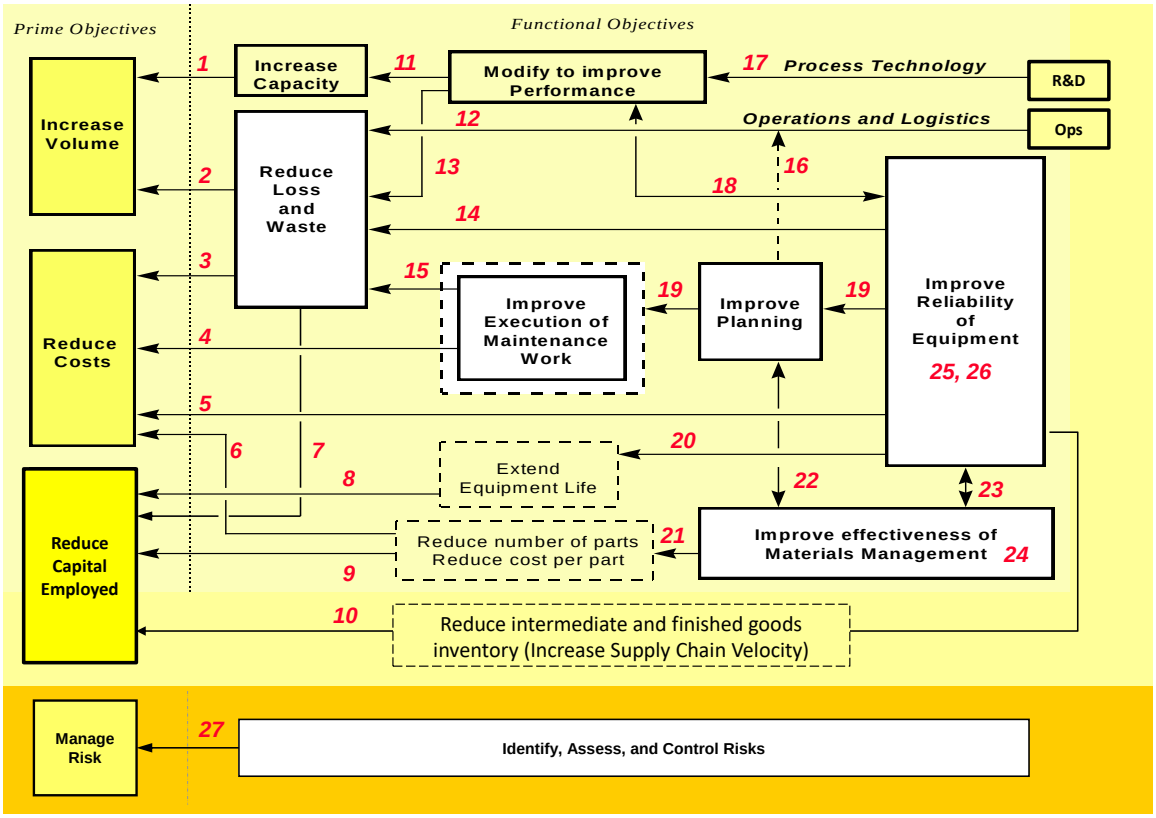
Duly configured, the resulting knowledge-base will provide insightful guidance for both Operational Performance Management, and Asset Performance Management (aka "Maintenance").



With this scheme, remedial action can be readily prioritized based upon the magnitude of production loss (by operational category, and/or by the assets associated with production loss).

Furthermore, drilling down into the realm of Asset Performance Management (aka Maintenance), it is possible for the COO to define ***functional objectives*** within "Maintenance" that directly contribute to ROCE, as well as the reduction of operational risks.

The diagram below illustrates relationships between these functional objectives and their contribution to the prime objectives of increasing **$V**, and reducing **$C**, **$CE**, and **Risk**.



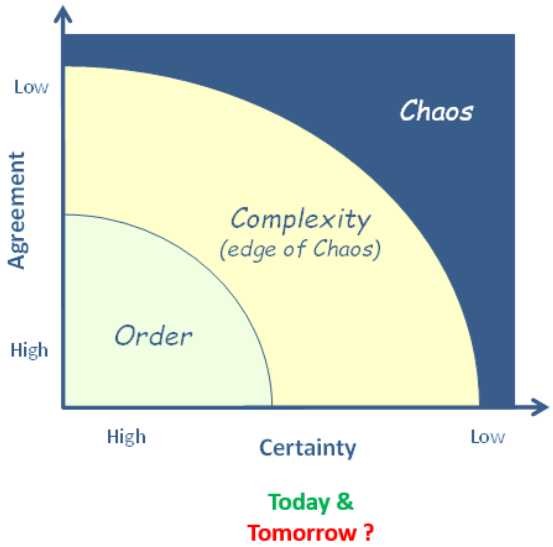
The influencing mechanisms (numbered in red) are provided in the Appendix.

Chapter 3

For Discussion with the CEO

The business life of the CEO is, in an abstract sense, navigating a balance between Order & Chaos. Order is a desired stable (yet unrealistic) state, whereas Chaos is the domain of new opportunities, risks, and unforeseen obstacles.

In a business context, "Order" prevails when there is high Certainty (of issues), and high Agreement about issues (within the organisation). Whereas "Chaos" may be defined as the state of low Certainty and low Agreement. "Complexity" is the well-populated borderlands between Order and Chaos, as illustrated in the diagram below.



Source:
Stacey RD. "*Strategic management and organisational dynamics: the challenge of complexity*". 3rd ed. Harlow: Prentice Hall, 2002.

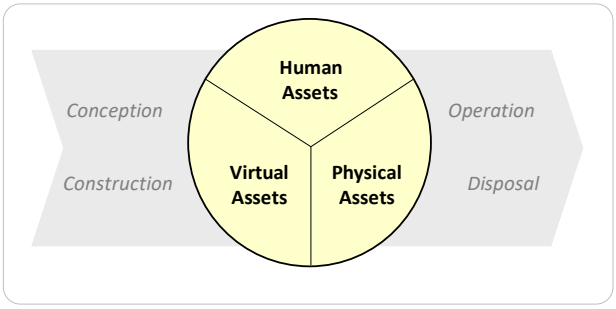
Pure "Order" is aspirational, as the ingress of "Chaos" is inevitable, whether from changing external environments, or internal decay and infighting.

The COO and CFO drive their organisations and systems towards the space of "Order". They are guided by the array of Risk Management methodologies which endeavour to defend against complexity, variation and the uncertainties that threaten Order on a daily basis.

The more complex the industrial facility, the more opportunity for Chaos to threaten stability of operation. Accordingly, the Asset Management function must be constantly vigilant of emerging risks.

Given that Chaos is eternally present (today, and forever) the CEO's role is to develop and facilitate ***organisational resilience and maturity*** in the presence of this uncertainty.

Given the real-world fluidity of Order, Complexity and Chaos, the CEO must balance investment in the health of the overall organisation in general, to build resilience in the face of endemic uncertainty. A useful conceptual model for industrial facility in such circumstances shown here.



Snitkin.S, *Asset Lifecycle Management*, (ARC Advisory Group White Paper, May 2009)

In this model, the *asset system* consists of the interdependent and evolving combination of:

- the **physical assets**,
- the **virtual assets** - knowledge embedded in artefacts and software (models, procedures, visualizations) describing the physical assets,
- the **human assets** - people operating and maintaining the physical assets.

Today's industrial asset systems are so large and complex that people rely on the accuracy of virtual assets to interpret and control the daily behaviour of physical assets. In this regard, *it is critical that the information flowing between the three aspects is always synchronized, to enable the asset system to* ***operate with resilience***. Indeed, this synchronization invokes the biological virtues of integrity, endurance, and resilience.

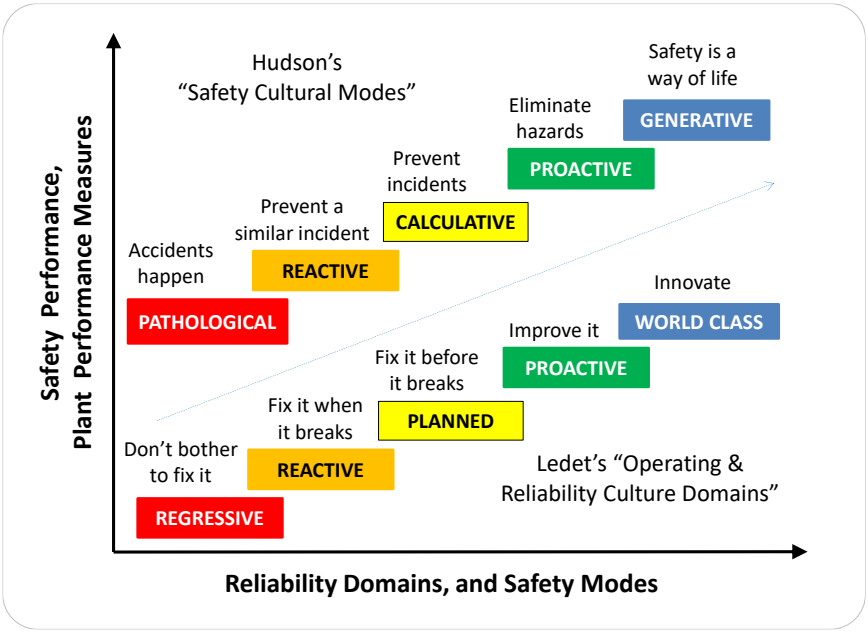
The **virtual assets** are particularly critical for major issues such as:

- Catastrophic internal or external events (avoidance / mitigation / recovery).
- Milestone transitions from construction to commissioning, and from commissioning to operations, as well as for subsequent modifications and/or major maintenance projects.
- High turnover of operating staff, where corporate knowledge is the binding agent.

Likewise, **human assets** (the workforce), need to be constantly well-informed, alert and proactively-engaged in order to absorb the variety (or Chaos) in daily operations, that constantly challenges the productivity, and the very existence of industrial facilities.

In the balancing act between Order and Chaos, the CEO strives for ***organisational resilience and maturity***. In this quest, the literature clearly identifies the concept of "High Reliability Organisation" (HRO)[2]. These are organisations which are able to avoid losses most of the time, despite operating in environments where there is a high potential for error and losses. *When unexpected events do happen, HRO's are resilient in containing losses and recovering from the event.*

A useful model for resilience and maturity is shown here[3], illustrating progressive stable domains of maturity for asset-intensive and hazardous industrial facilities.



Research shows that the cultural domain in which an organisation operates influences both safety outcomes and asset performance. In particular, the more mindful and proactively-engaged the workforce, the better is the organisation's reliability, safety, and asset performance.

Indeed, High Reliability Organisations, and those successfully practising Lean Manufacturing exhibit the characteristics generally identified by benchmarking studies as Best in Class.

[2] Weick, C & Sutcliffe, K "*Managing the Unexpected – Assuring High Performance in an Age of Uncertainty*" John Wiley & Sons, 2001

[3] Patrick Hudson – *"Safety Management and Safety Culture - The Long, hard and Winding Road",* First National Conference on Occupational Health and Safety Management Systems, Sydney 2000
Winston Ledet – *"Making the Move Toward a Learning Organization – A Classic Journey of Change", 2002*

Chapter 4

For Discussion with a Board-member, Legal Counsel, or Risk Executive

Consider ***"Governance"*** of asset-intensive facilities from a legal viewpoint:

"Philosophically, the law adopts the view of legal causation, which is necessarily hindsight-based".[4]

> *In the event of catastrophic failure, our community's sense of justice requires that blame must be assigned. Specifically, it is [the corporation's] duty of care to take every reasonable precaution [against failure].*

After a catastrophic asset failure, a legal investigation will consider at least (1) what is the **evidence** for governance of the integrity and safety of assets, and (2) *how was that governance applied?*

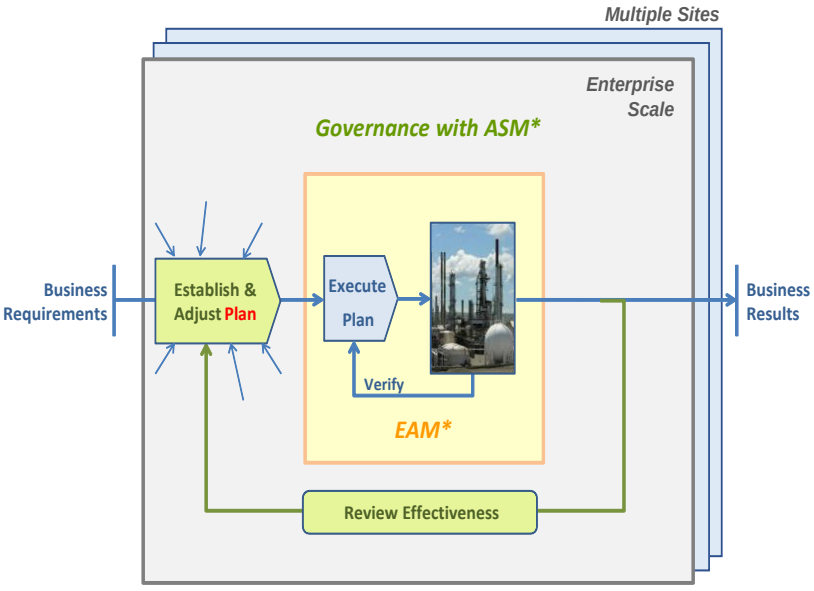
In order to demonstrate proper governance, executives must be able to provide:

- *Evidence* that a strong and defendable **Plan** is in place,
- *Evidence* that the organization is complying with the **Plan**, and
- *Evidence* that the **Plan** is effective.

For large asset-intensive facilities, the quality of the [Asset Management] Plan is crucial. **The Plan must be technically strong and defendable**, and demonstrate that:

- the Plan is based on good science, and accurate information,
- the Plan is prepared by competent people,
- the Plan is relevant to current operational conditions,
- the Plan is approved by an accountable person,
- the Plan is consistently applied and regularly assessed for relevance & compliance,
- the Plan is regularly adjusted and improved as necessary, and
- the Plan is periodically reviewed for effectiveness.

With many thousands of assets (aka equipment items) to control, best practice in asset management employs two broad categories of software tools to provide evidence that a strong and defendable Plan is protecting the integrity of the facilities, as illustrated below:



Enterprise Asset Management (EAM) emerged from the CMMS class: tools that are designed to execute a pre-defined plan, assist in managing work orders & budgets, and to solicit worker measurements & feedback.

Asset Strategy Management (ASM) accepts manual observations and instrumented inputs to monitor plant health, and enables experts to design and create governance strategies (such as mitigation of risk, and proof of performance), and analytical tools to assess the effectiveness of those strategies.

[4] Robinson RM and Francis G, *"Engineering Due Diligence"* 11th Edition 2019, ISBN 978-0-9875016

In order to test whether a strong and defendable Asset Management Plan is in place, the table below provides some examples of specific questions that senior executives and/or auditors would wish to know:

	Governance Questions (at Enterprise Level) put to Asset Managers
1. Integrity	¬ Do we have a *valid* Plan ? ¬ Have my assets been subjected to a *valid* Criticality Assessment ? ¬ Are all *High-Consequence-of-Failure* assets covered by *valid* Risk Assessments (RCM, HAZOP, FMECA etc) ? ¬ Are all *High-Consequence-of-Failure* assets covered by *valid* Preventive Maintenance and/or Mitigation plans ? ¬ Can production performance be correlated with the asset register, and asset history ? ¬ What is the cost of maintenance (in various scenarios) over the next X years ? Can I smooth the cash-flow ?
2. Compliance	¬ Are we doing what we promised to do ? ¬ Are our resources working on the right things (firstly, covering our risks) ? ¬ Is the Plan being refreshed with new information ? ¬ Is the Plan being regularly reviewed, amended and improved ? ¬ Are production losses being recorded (daily) against my assets ?
3. Effectiveness	¬ Are asset-related safety incidents increasing or decreasing ? ¬ Are asset-related losses stable, improving, or deteriorating (considering both frequency and magnitude) ? ¬ Is the risk profile of assets stable, improving, or deteriorating ? ¬ Is the productivity of assets stable, improving, or deteriorating ? ¬ How do I judge the effectiveness of new capital installations ? ¬ Is the current maintenance regime cost-effective ?

Appendix

Relationships between Asset Management Objectives.

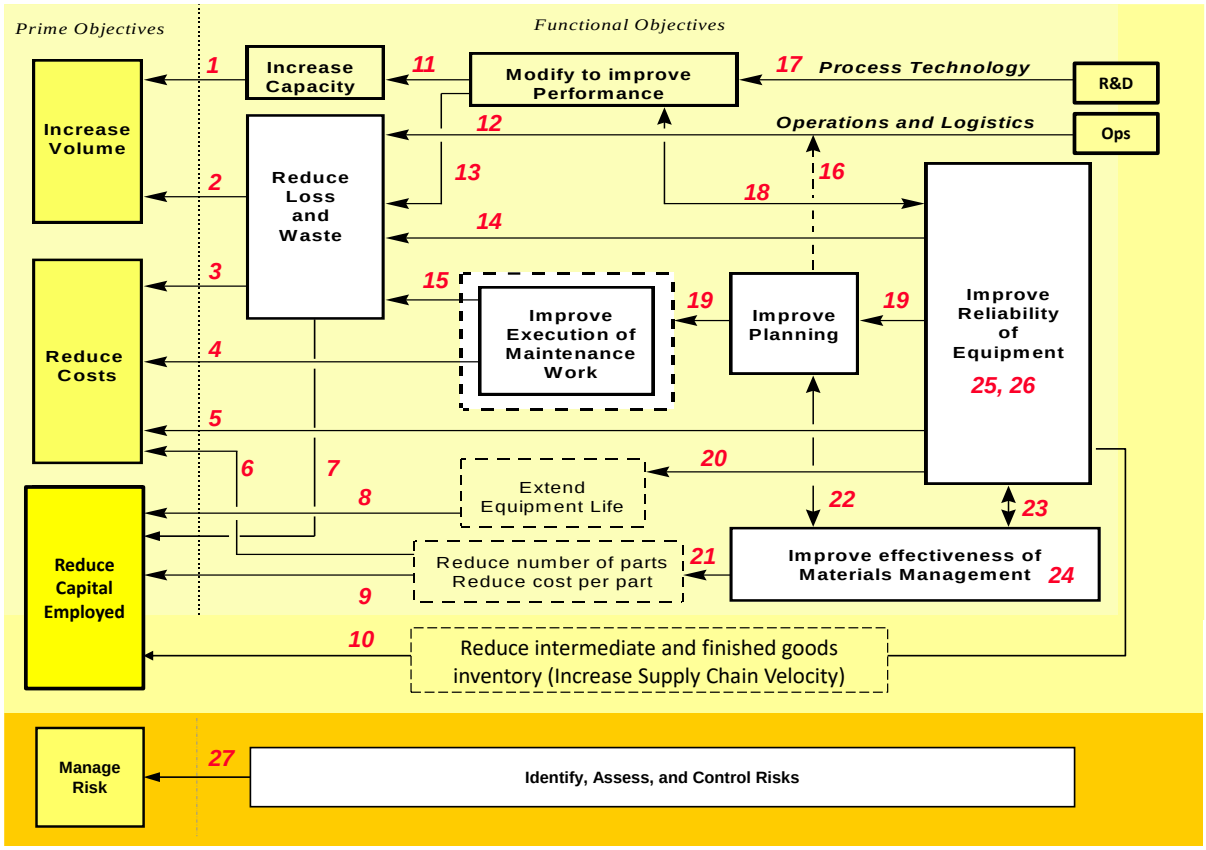
Return on Capital employed (ROCE) refers to a financial ratio that can be used to assess a company's profitability and capital efficiency. It shows how well a company is generating profits from its capital as it is put to use, and as such, provides a major metric for capital-intensive industrial facilities.

Formally, ROCE is defined as EBIT/CE, where EBIT is Earnings before Interest and Tax, and CE is Capital Employed (the amount of long- and short-term borrowings and equity required to sustain the facility). At the industrial plant level, however, the contribution to ROCE can be simplified by the proportional effects of ($V less $C) / $CE, where:

- $V is the value of production
- $C is the cost of production
- $CE is Capital Employed as defined above

Thus, the prime business objectives of the industrial facility, and accordingly for Asset Management, are to increase $V, and decrease $C and $CE, in addition to managing the Risk of operations.

In direct support of these *Prime Objectives*, a network of ***Functional Objectives*** can be defined for Asset Management activities (predominantly operational and maintenance functions) – as shown in the diagram below:



- The following table describes the numbered relationships (or “influencing mechanisms”) between the various objectives.

Relationships between Objectives

In Order to.....		*Actions.....*	*Influencing Mechanism (s)*
Increase Volume	***1***	*Increase Capacity*	*Increase size, power, efficiency.*
	2	*Reduce Loss & Waste*	*Reduce waiting time, over-processing, defects/rejects/rework, unnecessary motion.*
Reduce Direct Costs (fixed & variable)	***3***	*Reduce Loss & Waste*	*Reduce over-production, transportation, waiting time, over-processing, and unnecessary motion.*
	4	*Improve Maintenance efficiency & effectiveness*	*Less cost per activity - preparation, supervision, labour (and contractors) via planned and packaged work. Relevant skills deployed with precision.*
	5	*Improve Reliability of equipment*	*Less activity on equipment - maintain only what is needed, when it is needed.* *Reduce material/parts consumption.* *Remove redundant equipment. Eliminate chronic costs.*
	6	*Reduce cost per replacement part*	*Outcome of superior Materials Management (see below).*
Reduce Capital Employed	***7***	*Reduce Loss & Waste*	*Reduce transportation, and inventory of raw material, WIP, and finished goods.*
	8	*Reduce rate of capital investment, by extending equipment life*	*Obviate need to finance capital replacements, by optimizing utilization of existing assets (OEE).*
	9	*Reduce number of spare parts, cost per part, and cost of storing parts.*	*Reduce working capital required to finance storage costs. Remove redundant equipment and associated spare parts.*
	10	*Increase Supply Chain Velocity (aka DIO, Days of Inventory on Hand)*	*Improving reliability of processes in manufacturing chain reduces required quantity of intermediate and finished goods inventory.*
Increase Capacity	***11***	*Improve equipment performance by modification*	*Increase size, power, efficiency.* *Improve operability, ergonomics, maintenance techniques.*

In Order to.....		*Actions.....*	*Influencing Mechanism (s)*
Reduce Loss & Waste	***12***	*Supply issues, Customer Issues, Operating Issues.*	*Address manpower, materials, and methods – in the operating context.*
	13	*Improve equipment performance by modification*	*Improve efficiency, longevity, dependability, reduce variation.*
	14	*Improve Reliability of equipment*	*Less downtime - better longevity, and dependability. Reduce variation, energy consumption, Reduce opportunity for introduced defects (via repair, spare parts, operator adjustments).*
	15	*Improve Maintenance efficiency & effectiveness*	*Less downtime, rework.* *Right First Time, and faster handback.*
	16	*Improve Production and Maintenance scheduling*	*Schedule maintenance to coincide with production opportunities.* *Avoid unplanned (forced) shutdowns.*
Improve equipment performance by modification	***17***	*Improve Process Technology*	*Capital investment, and small scale operational and/or equipment improvements.*
	18	*Improve Reliability of equipment*	*Capital investment, and small scale operational and/or equipment improvements.*
Increase Planned and Scheduled work	***19***	*Improve Reliability of equipment*	*Dependable equipment allows greater confidence & predictability in planning & scheduling. Less incidence of breakdowns and injected work.*
	19	*Improve planning and scheduling skills*	*Not just for planners, but also for customers (field action groups) and beneficiaries (production).*
	22	*Improve Materials Management*	*Reservation, purchasing, delivery of materials to meet the plan of work.*
Improve Maintenance efficiency & effectiveness	***19***	*Increase planned and scheduled work*	*Better preparation for field work.* *Better use of contractors.* *Consistency of practices & procedures.*
	19	*Improve planning and scheduling skills*	*Better coordination and use of resources.*

In Order to.....		*Actions.....*	*Influencing Mechanism (s)*
Improve Maintenance efficiency & effectiveness (cont'd)	***19***	*Employ procedures, maintenance history, and CMMS*	*Availability of information - history, materials, procedures.* *Better knowledge base - do better next time.* *Consistency of practices & procedures.*
		Develop cooperative work teams	*Improve deployment of resources.* *Dispense with artificial demarcation - on shopfloor and amongst staff / management.*
		Match skills to needs	*Apply appropriate skills to tasks.* *Train accordingly.*
		More effective contracting	*Import contractor flexibilities, best practices and ideas.* *Transform fixed costs into variable costs.*
Extend equipment life	***20***	*Improve Reliability of equipment*	*Steady, predictable performance (reduced variation) reduces wear.* *Reduce breakdowns - reduces excessive wear.* *Reduce opportunity to inject defects.*
Reduce cost per part	***21***	*Improve Materials Management*	*Use CMMS & BOM's to aid purchasing practices.*
Reduce number of spare parts, cost per part, and cost of storing parts.	***21***	*Increase planned and scheduled work*	*Parts purchased according to a plan - i.e. when needed.*
	21	*Improve Materials Management*	*Rationalize stock holdings according to need.*
Improve Materials Management	***22***	*Synchronize with Maintenance Planning*	*Reservation, purchasing, delivery of materials to meet the plan of work.*
	23	*Employ procedures, maintenance history, and CMMS*	*Provide history of usage as a basis for rationalization.*
	23	*Life-cycle cost purchases*	*Minimize proliferation by short-sighted lowest cost policy.*
	23	*Eliminate obsolete parts*	*Reduce overheads. Simplify task.* *Focus on customer requirements.*

In Order to.....		*Actions.....*	*Influencing Mechanism (s)*
Improve Materials Management (cont'd)	***24***	*Reduce insurance stock*	*Risk assessment and clarification of policy.*
		Converge equipment types	*Risk assessment and clarification of policy.*
	24	*Form supplier alliances*	*Better use of capital, space, expertise.*
		Use supplier inventories	*Better use of capital, space, expertise.*
		Rationalize parts within and between sites	*Reduce overheads.* *Simplify task.* *Focus on customer requirements.*
Improve Reliability of equipment	***25***	*Eliminate the causes of equipment failure: malfunction, maloperation and imported defects*	*Vision and commitment.* *Management support for a High Reliability Organization.*
Eliminate the causes of equipment failure: malfunction, maloperation and imported defects	***26***	*Review operating practices*	*Identify operating actions which introduce defects.* *Eliminate causes of defects, variations & inconsistencies.*
		Improve maintenance practices	*Identify maintenance actions which introduce defects.* *Eliminate causes of defects, variations & inconsistencies.*
		Restore equipment condition	*Must have and adequate description of "as new" - i.e. a specification.*
		Examine root-cause of failure	*Address problems, not symptoms.*
		Establish maintenance policy per equipment type / group.	*Criticality review of failure modes.* *Decide on form of maintenance: - planned, preventive, predictive, breakdown.* *Identify and publicize reasons for doing the maintenance.* *Establish long range maintenance plans.*

In Order to.....		*Actions.....*	*Influencing Mechanism (s)*
Manage Risk	***27***	*Identify, Assess and Control Risks*	*Establish the governance plan that verifies Compliance to agreed risk mitigation tasks. Apply ongoing Due Diligence to review periodically that mitigation tasks are (a) relevant to current and future risks, and (b) effective in providing protection.*
			Apply consistent Risk Characterization across all disciplines.
			Deal with High-Consequence Failures ahead of all other risks when prioritizing risk mitigation tasks.
			A single administration system (such as Enterprise Asset Management, or CMMS) is far superior for verifying compliance than multiple risk registers in separate administration vehicles.