Point of View

Smart Industrialization

An Integrated Approach to Increasing Value of Downstream Oil and Petrochemical Investments

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The oil refining and petrochemical business (referred to as "downstream") is marginal compared to the "upstream" exploration and production business. This historically is due to low-cost oil and gas "feedstocks"[1] and traditional technology used in oil production. This situation has enabled many downstream businesses to realize a profit. Lower prices have also enabled some oil- and gas-rich nations to support their operations with subsidized oil and gas supply. This age of "easy oil" has allowed relatively inefficient downstream companies to continue to operate.

There is, however, broad agreement in the industry that this era is coming to an end; the price of oil and gas feedstocks has increased due to rising exploration costs, and is likely to stay that way. Because of this, feedstock subsidies are increasing and are no longer commercially viable. As a result, oil and petrochemical companies are looking to develop more efficient, profitable business models, and asset owners are deciding how to lower the cost of operations.

This economic shift is coupled with two trends: 1) existing facilities in emerging non-OECD (Organisation for Economic Co-operation and Development) regions are undergoing upgrades, and 2) new, integrated downstream "industrial cities" in the Eastern world are in development to align with population growth and demand for both basic and advanced refined products. Rather than buy downstream products from the West, countries in emerging regions are building industrial cities locally that not only comprise refineries, but also communities, public services, and more. Because of this, downstream business processes are become more integrated and, as a result, investments in industrial cities are creating opportunities for downstream companies to address the fundamental issue of industrial efficiency and effectiveness.

This integrated approach is replacing many traditional, discrete fuel refineries and petrochemical installations, and will drive investments of US$1 trillion annually for the next 20 to 30 years, according to projections from BP.[2] Implementing new operating models that replace outdated ones (in which industrial processes were run separately) is the next challenge for this price-sensitive, cyclical industry. New models would provide a platform for a step change in plant availability and throughput, while lowering operations costs.

Shared and national asset ownership also amplifies the need for operational reform. Equity in these new developments can range from a single stakeholder, such as a nationalized oil and gas entity, to multiple stakeholders, such as foreign investors who have equity in some industrial assets, with overall site control residing at a national oil and gas company or government-controlled entity. At best, this fragmented approach reduces economies of scale and efficiencies that can be delivered by new operating models.

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[1] Feedstocks are raw materials required for industrial processes.

[2] Projections were stated by then CEO of BP, Tony Hayward, during a talk at the Oil and Money Conference in London, October 2009, http://www.bp.com/genericarticle.do?categoryId=98&contentId=7057148

Given this outlook, what role does technology play in process integration? In the industrial domain, technology solutions are usually process-specific (point solutions). Existing suppliers typically lack expertise needed to provide such solutions across the entire industrial facility, so capabilities remain fragmented. To create a significant change in the performance and capability of new downstream investments, businesses must be able to use existing industrial processes (such as one process with dual roles) and separate them from their embedded technologies (those that support a single, specific process) and architectures. Change can occur by considering these two facets concurrently and rearchitecting the way they are used by the overall business.

This Point of View from the Cisco® Internet Business Solutions Group (IBSG) highlights how "smart industrialization"—a unified infrastructure and services strategy—can transform industrial economic development, increasing the value of integrated refining and petrochemical manufacturing investments.

Current Downstream Industry

Historically, OECD countries have supplied the majority of the world's downstream industrial capacity. This situation has resulted in a global supply chain where oil and gas are shipped to OECD countries for processing, and refined fuels and finished petrochemical products are shipped to non-OECD countries for consumption. The latter countries are abundant in hydrocarbon reserves but, until recently, deficient in major downstream capacity, as shown in Figure 1.

Figure 1. Downstream and Upstream Refining and Petrochemical Industries in Emerging Regions

Country	Capacity as % of Total Global Capacity	
	Downstream	Upstream (oil only)
Kuwait	1.1%	3.2%
Iraq	0.8%	3.2%
UAE	0.8%	3.2%
Saudi Arabia	2.4%	12.0%
Brazil	2.2%	2.4%
Mexico	1.7%	4.2%

Source: "BP Industry Statistics," 2009; specific data was extracted and compiled by Cisco IBSG, 2010

Furthermore, industrial downstream facilities in these countries are managed on a limited basis. Because of this, they are producing lower-value products at a cost of operation that requires government subsidies or other external financial support. In many cases, these "legacy" facilities are the locales for new industrial city developments. Many of these businesses are realizing that feedstock subsidies—for maintaining business efficiency and providing an alternative to investing in new processes, procedures, and technology—no longer represent a viable business model. Taking an innovative approach to implementing downstream industrial processes that can be highly integrated and digitally enabled will help ensure the viability of new developments.

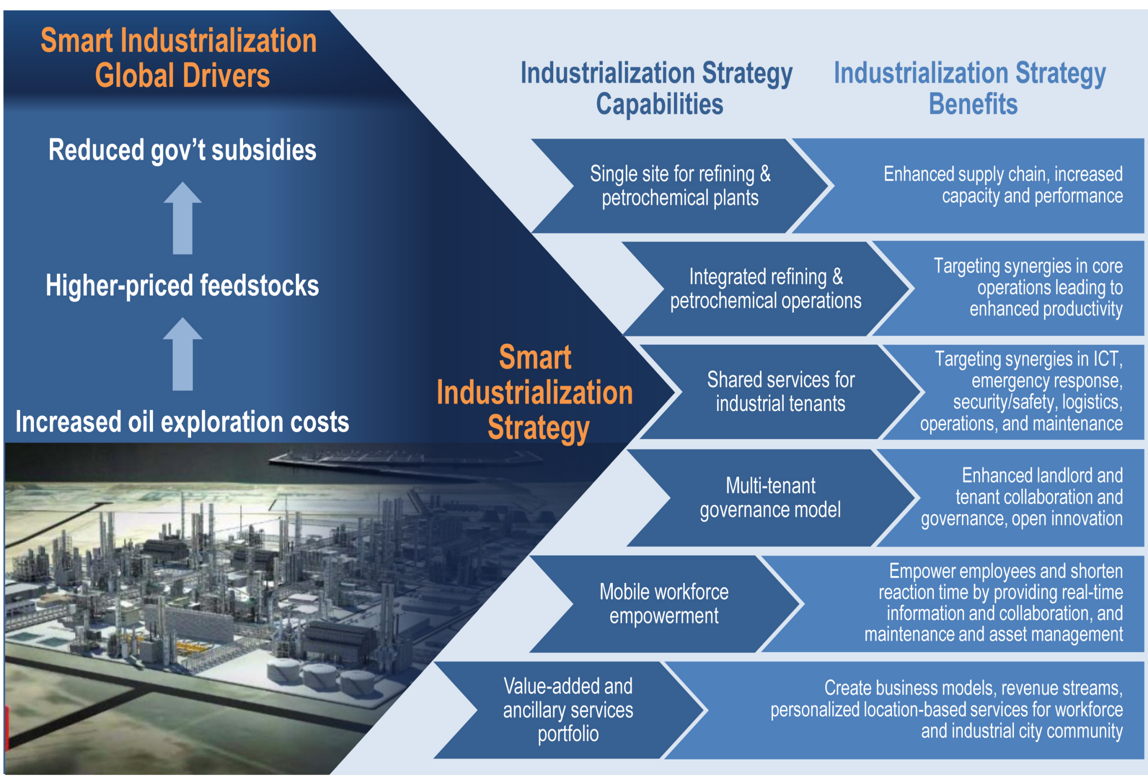
Fundamental efficiencies of downstream business must now be examined and re-engineered. Smart industrialization enables companies to build more efficient business models that realize profits without the use of subsidies over a greater portion of the business cycle.

Smart Industrialization: A New Paradigm for Downstream Industrial Developments

We have established that traditional downstream industrial process models are marginal from an efficiency perspective. Digital technology, while pervasive in the industry and necessary for future development, is still designed to support old processes. Changing processes or technology, however, is not enough. Integrating them is the answer. Integrated processes that can use existing infrastructure to deliver "everything as a service" will transform operating costs and efficiencies. This approach is enabled by smart industrialization.

Smart industrialization is a business strategy that 1) drives process integration and alignment across all industrial city stakeholders, and 2) enables a unified infrastructure and associated services. The results are improved operating margins and long-term performance—attractive propositions for foreign investors—and decreased dependency on external subsidies and support. Ideally, such a strategy should be adopted early in the master planning stage and considered throughout the industrial development lifecycle—planning, designing, building, and operating. Figure 2 shows the business and technology architectures and benefits derived from a smart industrialization strategy.

Figure 2. Smart Industrialization Vision



Source: Cisco IBSG, 2010

Smart industrialization focuses on world-class business architecture across a number of key areas ripe for innovation and value creation, such as business resiliency, emergency response, security, operations, maintenance, work management, and supply chain integration.

Smart industrialization consists of two major architectures: industrial services and integrated business.

Industrial Services Architecture

The traditional industrial domain is divided into multiple business functions, each with processes and procedures that operate independently. This segregated approach is compounded by technology applied to a single function only. Industrial services architecture comprises three principle capabilities that integrate processes and procedures:

1. Service-Delivery Organization—Service-level agreements (SLAs) for industrial applications are complex. For example, if a downstream facility is in the midst of a "turnaround," such as a large-scale maintenance investment that involves a large temporary workforce, the required SLAs will also be great—for instance, applications and infrastructures used by hundreds or thousands of engineers and supervisors must be available 24 hours a day, seven days a week. If the facility is in "normal operations" mode, fewer SLAs are required. By implication, an industrial service-delivery organization must be capable of varying SLAs and associated delivery costs in near-real time.

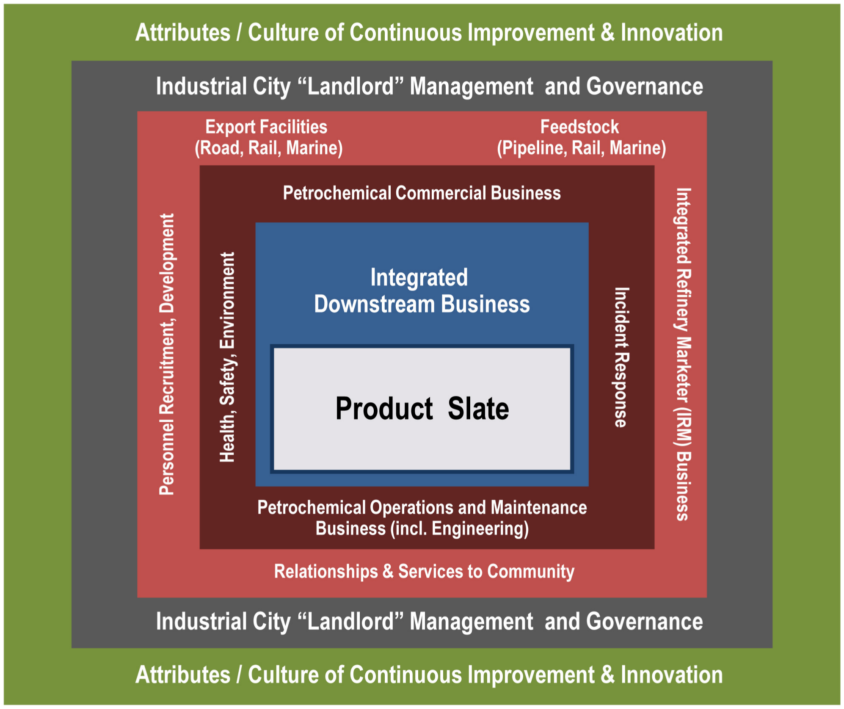
2. Mobility—In order to create digital industrial work processes, an organization must be able to retrieve data/information at the point where work is performed. Processes that require mobile solutions include turnaround tracking, work management, inventory control, operator and maintenance rounds, and scaffold tagging. Currently, it is not uncommon for workers to use different industrial handheld devices for each process. A smart industrialization service operation would reduce the number of devices and associated infrastructures to one, with a unique business logic for each mobile application (for example, an application that manages valve maintenance or tracks scaffolding) and all other parts of the IT process embedded in a single infrastructure.

3. Collaboration—Collaboration may be the biggest contributor to greater efficiency and effectiveness in the industrial space, but only when aligned with process consolidation. Health, safety, and environmental functions all require multiple agencies (local, national, specialist, international, and so on); this is where the ability to collaborate effectively is impacted the most by segregated processes and technologies.

Integrated Business Architecture

Implementing world-class capability in an industrial downstream context is a major task that requires a common view of standard functions (see Figure 3). These functions are a clear measure of current capability, underlying business architecture alignment, and opportunities for business performance.

Figure 3. Common Downstream Business Functions



Source: Cisco IBSG, 2010

Building on the fundamental attributes of the operation, it is important to have a common understanding of the business model and the main areas of an integrated downstream operation. Downstream business relies on five major functions important to enabling tighter integration:

1. Attributes/Culture of Continuous Improvement and Innovation—The company's culture will determine an industrial city's ability to innovate in a collaborative and holistic way with landlords, governments, and tenants.

2. Industrial City "Landlord" Management and Governance—A nationalized organization in the context of the refining and petrochemical industry typically is an oil and gas company owned by a state or national government. This model encourages an "us" and "them" mentality that prevents change, innovation, and collaboration. To encourage integration, a set of value propositions is required that contributes to the business objectives of both parties. Shared industrial services play a critical role in this regard.

3. Incident Response—Incident response is one of the most important components of the industrial city business architecture because it requires complete collaboration of all parties to build capability and operate in an emergency response situation. Incident response is fundamental to the inherent resiliency of the integrated business.

4. Export Facilities (Road, Rail, Marine)—Industrial city logistics are vast and a major concern when it comes to safety, security, or core business order fulfillment. In addition, logistics often are amplified during construction, development, shutdown, or turnaround, which can escalate risk to the overall business.

5. Communities and Services—Most industrial cities have both a transient worker community and a resident operations staff living in close proximity to the industrial city. The

provision of information and communications technology (ICT) such as Internet access, fiber-to-the-home, centrally managed facilities, telemedicine, and evacuation and emergency contact services needed to communicate with residents/staff is important. Such value-added services can also generate revenue.

Smart Industrialization: Opportunities

Smart industrialization opportunities exist for new facilities under construction and those being upgraded. Due to the industry's history of segregated processes, regulatory concerns, and fragmented technology implementations, changes must overcome a degree of inertia.

Of the five integrated business architecture functions described above, we will focus on business resiliency and incident response because they are two of the industry's highest priorities, and because they demonstrate the value of smart industrialization.

It is important to understand the relationship between business resiliency and incident response, and why these processes should be integrated. The downstream refining and petrochemical business is a high-risk proposition that requires proportionate resiliency to ensure safety. In the event that embedded resiliency fails and an incident occurs, a response is required to protect business assets. By their nature, resilience capabilities are proactive and preventative measures that affect business operations.

Incident response is passive by nature. Consider a typical downstream industrial city owned by a national landlord that has multiple industrial tenants. Many of these tenants may have foreign investors. The only legal basis for collaboration among the vested parties usually lies in the land lease agreements signed at the time the tenant occupies a plot in the industrial city. Old agreements do not address health, safety, or operations, and most include minimal environmental concerns. The typical result is that tenants view the "wire fence" around their plot as the perimeter of their business responsibility—but wire fences mean nothing when it comes to business resiliency and incident response. Unless all parties involved overcome this mentality, the fundamental resiliency of each business cannot be achieved and the ability to respond to an incident becomes compromised.

Smart industrialization combines the vested interests of multiple owners, enabling a business case for an aligned initiative that integrates business and technical architectures to build world-class resiliency and incident response capability across the industrial city. The fundamental business and architectural components of an integrated downstream industrial operation are:

Strategy

- Develop a municipality-wide strategy for resiliency and response defined by all key stakeholders

People

- Understand the requirements of each stakeholder to communicate and ensure that all messages are clear, aligned, and timely

Organization

- Implement mechanisms that identify critical resources that will benefit from resiliency and emergency management program operations

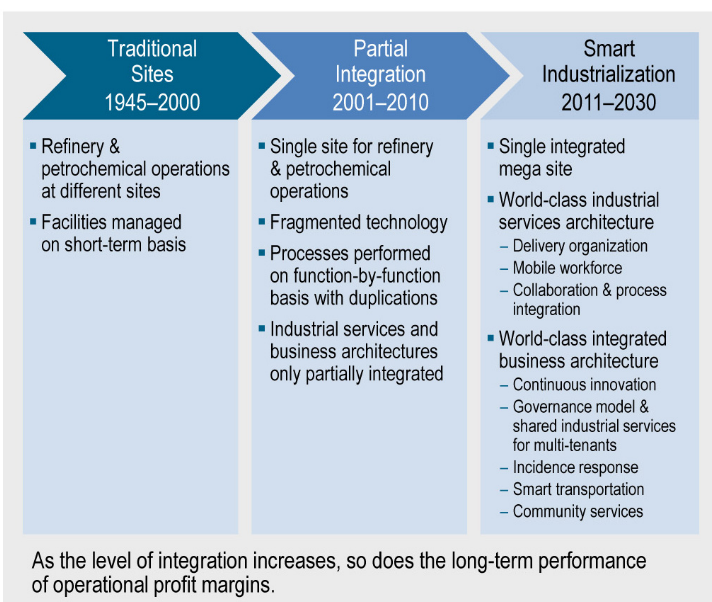
Processes and Operations

- Ensure that all inputs and outputs are traceable and contain mechanisms that ensure the highest levels of confidentiality, integrity, and availability
- Design and implement digital libraries that address issues such as crisis conditions, resulting scenarios, operational impacts, and anticipated loss estimates
- Design methods that unify resiliency and emergency-response resources with communication requirements within the incident coordination center, such as video surveillance equipment or real-time procedural information
- Create a standardized, consistent method of evaluating and prioritizing all resources for a resiliency and emergency management program
- Design methods to aggregate current and future communication requirements within a centralized resiliency and emergency-response coordination center
- Develop methods and technologies to acquire and maintain contextual and meta information (such as location of on-site workers) that can be augmented with various ICT solutions
- Design a collaboration and mobility architecture that offers real-time information and interaction capabilities to employees, tenants, and third parties

The benefits of integrating these components and pursuing smart industrialization are significant. For example, countries/corporations that integrate traditional downstream refining, petrochemical manufacturing, and other continuous, energy-intensive industrial processes at one location, and use smart industrialization to further integrate and optimize the overall business, can realize huge cost savings.

Figure 4 shows the evolution of integration in downstream industrial facilities.

Figure 4. Smart Industrialization Evolution



Cisco IBSG, 2010

Companies/countries planning or building refining and petrochemical facilities based on an integrated business architecture include Qatar Petroleum (Qatar), the Petrobras Comperj Refinery (Brazil), Chemicals Industrial City Chemaweyaat Complex (United Arab Emirates), Ras Tanura Integrated Petrochemical Complex (Saudi Arabia), and Jubail City (Saudi Arabia).

Next Steps

A number of guiding principles must be established as part of a smart industrialization project:

- Develop a solid vision and strategy, with buy-in and support from major stakeholders
- Choose a single location for integrating downstream refining, petrochemical manufacturing, and other relevant, continuous, high-energy-consumption processes
- Establish smart industrialization as a catalyst for business change, including developing and aligning technology with business architectures
- Develop governance models and adopt real-time technology to enable closer collaboration among landlords and tenants to ensure safety, security, operations, maintenance, and logistics

It also is important for governments/energy ministers and business/functional leaders to take specific actions. Governments and energy ministers responsible for nationalized oil and gas developments must ensure that related investments will support world-class levels of efficiency, effectiveness, safety, technology, and, most important, economic return. They should assess the country's situation in regard to smart industrialization and understand the potential impact it has on investments countrywide. Based on analysis from Cisco IBSG, a roadmap that includes the development of (or upgrades to) master plans for economic development is necessary for countrywide development and transformation.

Business and functional leaders of downstream international and national oil and gas organizations should identify specific opportunities based on the phase of the project. For projects in the master planning stages, it is important to develop a business architecture that includes strategy, organization, processes, and operating models that match the unique requirements of a specific industrial city's operations.

For projects in the building and operating stages, organizations must continue to assess master plans and business architectures and, if necessary, redesign them so that they include smart industrialization capabilities.

Smart industrialization is about integrating processes with technology—as opposed to just deploying new technology—and is the missing piece that will allow the downstream oil and petrochemical industry to move forward.

For more information regarding smart industrialization strategies for the downstream oil and petrochemical industry, please contact:

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