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TRANSPORT & LOGISTICS

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TO OUR READERS

Welcome to the latest edition of Oliver Wyman's *Transport & Logistics* journal. We have focused in this issue on strategies designed to give transportation providers an edge in what continues to be a challenging economic environment.

Our first article examines the recent phenomenal revenue growth of leading logistics companies—mainly driven by high levels of M&A. But these activities have proven difficult to translate into profits, without parallel attention to business design.

We next feature an interview with Oscar Munoz, the Executive Vice President and CFO of CSX, a leading US Class I freight railroad. Mr. Munoz provided us with his perspectives on the current and future state of railroading in North America.

Our third article considers the issue of “e-mobility,” or transportation electrification. A recent Oliver Wyman study mapped out the potential for e-mobility through 2040—and the many new needs it will create.

We then offer a pair of short perspectives on fleet costs. For airlines, total cost of ownership needs to figure more heavily into new aircraft purchases. For public transit agencies, multiple options exist to better manage and reduce fleet costs.

Next, we discuss the concept of scheduled operations, which has revolutionized how freight railroads operate in North America and elsewhere, and which could be applicable to a wide range of other transport modes.

Our final article addresses how the risks of large infrastructure projects can be better managed through dynamic risk modeling. At a time when every dollar, euro, pound, and peso must be accounted for, reducing risk can help ensure critical development projects are approved and completed.

We hope you enjoy this issue of the *Transport & Logistics* journal and look forward to hearing your comments.

GROWTH STRATEGIES FOR PROFITABLE LOGISTICS

Merger and acquisition activity can be a boon to revenues, as many of the world's leading logistics companies have demonstrated over the past half-dozen years. But a recent international study by Oliver Wyman on industry growth strategies during 2004-2010 found that logistics companies have done less well in terms of generating profits—particularly those which have heavily focused on mergers and acquisitions while failing to optimize their core business designs.

JORIS D'INCÀ
JEFFERY ELLIOTT

In 2010, international logistics market volume topped nearly \$1.7 trillion. As shown in Exhibits 1 and 2, the largest 50 companies, which control about one-third of the market, saw revenues grow three times faster than for the industry as a whole. At the same time, however, profitability kept dropping: Even before the recent economic crisis hit, EBITDA at leading logistics companies had plummeted by nearly 25 percent from 2004 through 2008. (Although profitability increased in 2010, due to a combination of strong demand and restructuring, it is still below historic levels.)



M&A has failed to be a driver of profits for the logistics industry

Despite revenue growth, these companies were unable to increase their underlying value even during an economically robust period, and in fact, their stockholders lost money. What happened? For one, fever-pitch merger and acquisition activity in the sector. From 2004 to 2010, 19 of the top 50 companies alone carried out more than 200 acquisitions, while 21 companies were involved in about 50 mergers and acquisitions.

Almost half of the transactions Oliver Wyman studied were aimed at consolidating positions within a specific transportation mode, by taking over direct competitors and merging operations or expanding the geographical footprint. Other transactions were more oriented toward expanding the business design along the logistics value chain, as a source of competitive advantage and to gain control of critical assets.

And these acquisitions did add bulk. But profitability rose only in the most unusual cases. Indeed, logistics companies that stayed out of the M&A market during the period

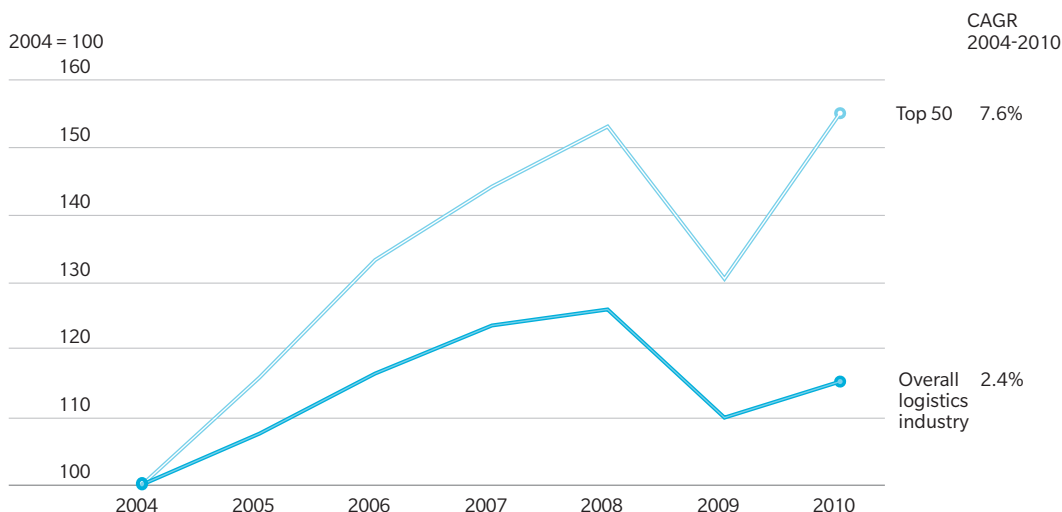
under review saw EBITDA rise significantly higher than those that jumped full bore into the transaction market.

WHY M&A CAN'T FIX WHAT'S BROKEN

The level of M&A activity in logistics is understandable, since the industry faces unrelenting consolidation pressure. The sector—which includes truckload, less-than-truckload, freight forwarders, consolidators, etc.—is highly fragmented and dominated by small and mid-sized companies, which are often unable to fulfill their customers' needs in terms of performance, know-how, and geographical footprint. These firms can be tempting takeover targets for competitors.

Meanwhile, big logistics companies with deep pockets have continued to make acquisitions despite past disappointing outcomes. There are several reasons why M&A has failed to be the profit driver expected by these firms:

EXHIBIT 1: INDEXED REVENUE, 50 LARGEST LOGISTICS COMPANIES, 2004-2010



Source: Datamonitor, Thomson One Banker, Amadeus.

- Buys are too often being driven by opportunity, rather than a sound growth strategy, backed by effective due diligence.
- Integration of acquired companies into current structures and networks, because not fully planned in advance, is often more difficult and takes longer than anticipated.
- Common internal industry problems are negatively impacting profitable baseline/organic growth and exacerbating the challenges of M&A:
 - Fragmentation of networks, structures, processes, and systems, creating redundancies and misalignment across organizations
 - Low levels of standardization of processes and underdeveloped systems to support the management of solutions, leads, tenders, contracts, and customers
 - An unbalanced business risk portfolio, with missing strategy around regions, solutions, customer segments, line/network segments

WHAT DRIVES PROFITABLE GROWTH?

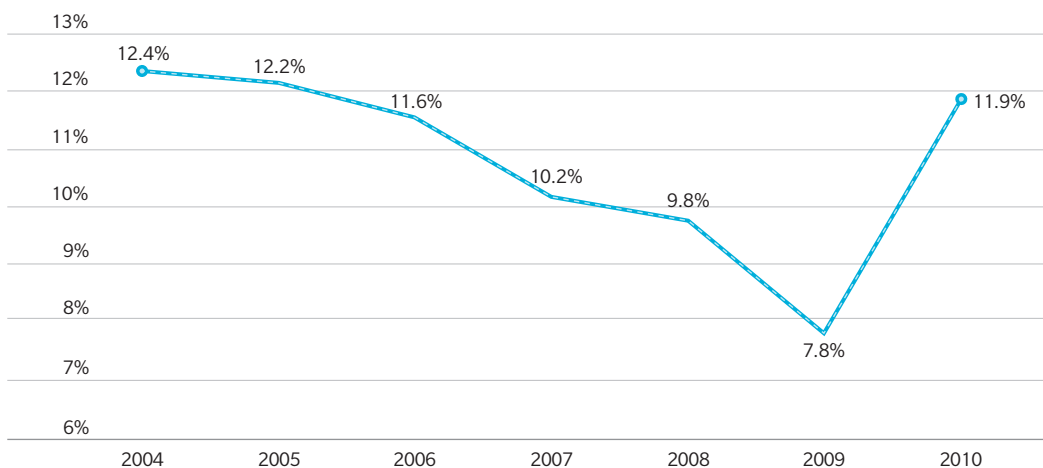
There is no doubt that logistics will continue to be a growth industry. Increasing volumes through globalization of trade and supply chains, as well as the acceleration of outsourcing in relevant key industries, will drive significant baseline growth in the coming years. The trick will be to translate this baseline growth into profits.

Rather than simply relying on M&A as a core (and poor) driver of growth, logistics companies need to see M&A as one component of a balanced strategy, capable of delivering both top-line and bottom-line results.

Oliver Wyman’s study pinpointed three core pillars for growth that a logistics company must address if it seeks to increase more than its size: strategic focus/portfolio management, network management, and implementation excellence—backed by best-in-class processes, tools, and talents.

The pillars of logistics earnings growth: portfolio balance, network leverage, and operational excellence

EXHIBIT 2: WEIGHTED AVERAGE OF EBITDA MARGINS, 50 LARGEST LOGISTICS COMPANIES, 2004-2010



Note: Limited sample for fiscal year 2009/2010.

Source: Thomson Financial Database, Amadeus.

STRATEGIC FOCUS/ PORTFOLIO MANAGEMENT

- **Innovation and differentiation:** Too often, the logistics company offer is highly commoditized. Selective development of solutions, services, and broad expertise can provide differentiation and create a competitive edge.
- **Balanced portfolio:** A company's portfolio (e.g., regional coverage, solutions offered) needs to be balanced in terms of risk versus profit. As shown in Exhibit 3, a balanced portfolio combines attractive individual business models for key industries with activities in interesting niches to improve profitability and risk positions. The two critical benefits are a more balanced ratio of risk to profitability and far-reaching synergy potential.

NETWORK MANAGEMENT

- **Integrated networks:** Globalization is still king; thus logistics companies must be able to support customers' global supply

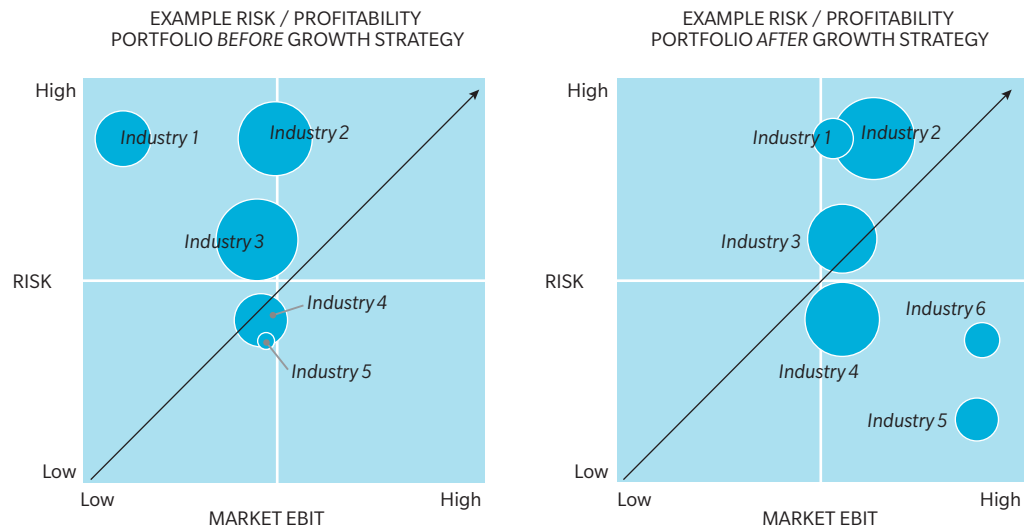
chains, by leveraging global transport networks, at the same time that they provide seamlessly integrated networks across their focus countries or regions.

- **Regional dominance:** A high-density transport and warehousing network in focus regions can support scale and improve economics, as well as enabling more cost-efficient solutions for multiple customers.

IMPLEMENTATION EXCELLENCE

- **Standardization and multiplication of solutions:** Basic products/solutions need to first be standardized. They can then be multiplied and efficiently deployed across new customers and regions.
- **Operational excellence:** Professional, standardized processes and procedures across regions (e.g., project management, transparency, risk management) are critical. In addition, implementation of "lean" techniques (e.g., zero defect, six sigma) can increase efficiency and reduce costs.

EXHIBIT 3: BALANCING VOLUMES, PROFITABILITY, AND RISK THROUGH ACTIVE PORTFOLIO MANAGEMENT



How does M&A factor into these growth drivers? First, transactions need to be targeted to address specific gaps (e.g., in capabilities or geographies), rather than simply based on opportunity. If for example, a company identifies regional dominance as a strategy it wishes to pursue, mergers can be used to increase network density. Or, an acquisition could offer an innovative product or improve network integration.

Second, as demonstrated by the recent recession, the best cure for lower profits is cutting costs, restructuring, and fully integrating acquisitions, rather than all-out buying. By stepping back and refocusing in 2009, logistics companies saw earnings improve as demand increased.

As an example, for a European client in the logistics industry, Oliver Wyman recently assisted in developing a new M&A and growth strategy. The company was buying opportunistically, rather than strategically. One issue it faced was that it was failing to do sufficient due diligence in M&A—it assumed that certain acquired solutions could easily be replicated across different geographies—only to find after the fact that profit margins by geography could be very different. And even where a solution could be successfully transferred between regions, the company’s highly decentralized structure (across many different businesses) hampered these efforts.

Oliver Wyman worked with the client to create a more centralized organization, capable of rolling out solutions worldwide yet adapted to regional structures, backed by greater process standardization and better analytical capabilities to identify risks and growth opportunities. As a result of this project, the client has been able to better pinpoint where it wants to grow, analyze how potential M&A options would fit into the portfolio/network, and integrate acquisitions into a standardized business framework.



The effect of an upswing in demand in 2010 on margins is already beginning to fade in 2011. If the past few years have proven anything, M&A is not the best or only tool for driving profitable growth. Instead, logistics companies need to continue to develop better solutions and better manage their portfolios, leverage and intensify their networks, and build across-the-board standards for operational excellence. Then M&A can be done right—when it’s right for the business.

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M&A must be driven by *need*, not simply opportunity

RAIL OUTLOOK: INTERVIEW WITH OSCAR MUNOZ, CSX

Oscar Munoz is the Executive Vice President and Chief Financial Officer of CSX and CSXT, responsible for management and oversight of all financial, strategic planning, information technology, purchasing, and real estate activities.

Q. Coming to CSX as an outsider to the rail industry, what has been your impressions of the industry?

A. I joined the rail industry in 2003 and was excited by the tremendous amount of opportunity. Industry transportation services had been underpriced for decades, but market dynamics were moving in a direction that favored rail. Specifically, the trucking industry was coming under pressure as a result of highway congestion, driver shortages, rising fuel prices, hours of service laws, and changing supply chains, among other things. This has created opportunities for us to grow our business organically, as well as enabling us to price our services more appropriately to reflect the relative value of rail transportation.

Q. Has the business of railroading changed since you started?

A. Railroading has changed in a number of positive ways. An increased use of technology has enabled railroads to be more flexible and better adapt to changing market conditions, as well as to provide a more reliable, smarter service product. As a result, customer satisfaction has risen and is fast approaching the level of the trucking industry. The rail industry is also starting to attract a new breed of talent that knows how to drive the business to new levels of performance. And as profitability has increased, the industry has been able to invest more, which not only produces value-creating returns but also helps the nation solve a growing transportation infrastructure problem. These factors have resulted in an exciting, growing business which is increasingly attractive to shareholders.

Q. What are some of the major business environment changes that you believe have most impacted the Class I railroads over the past five years? How has CSX responded?

A. *Changes in competitive dynamics:* Industry consolidation almost always brings some degree of change to the competitive landscape, and the rail industry has been no exception. The philosophy behind the CSX response was simple: become a more agile and productive competitor, able to quickly adapt to changes in the operating environment. The implementation of this philosophy was more complex—we needed to engrain it in every part of the organization to make it work, and we



were doing it during the recession. It took hard work and dedication, but ultimately we have emerged as a leaner, stronger competitor.

Propensity for government to regulate private industry: The US freight rail industry is a perfect example of an industry that needs to be allowed to contribute, without further regulation, to job growth, to manufacturing strength, to export efficiency, and to overall US global competitiveness. Transportation is a non-partisan issue and an increasing number of members of both political parties view freight rail success as an essential component of growth for the national economy.

Increased focus on environmental issues: This is not a new issue—but public focus has increased exponentially. All of our stakeholders—customers, shareholders, employees, policymakers, and neighboring communities—expect us to not only avoid harming the environment, but to actively improve and protect it. This means that railroads must focus even harder on reducing fuel consumption and emissions.

Q. There has been an upsurge in interest by large investors in railroads, as exemplified by Warren Buffet’s acquisition of BNSF. Why are railroads attractive investments?

A. The growing economy certainly provides a favorable backdrop for our industry, and freight rail has been among the first industries to see material improvement as the economy has begun to recover. It’s also difficult to argue against the efficiency of freight rail—one freight train can move a ton of goods nearly 500 miles on one gallon of fuel, and one train carries the same load as more than 280 trucks. The EPA estimates that a locomotive is three times more fuel efficient than a typical truck; if just 10 percent of the nation’s freight shifted to rail, fuel savings would approach one billion gallons annually.

But what fundamentally makes rail attractive is that what we do is integral to the future success of the US economy. Mr. Buffett himself noted that his BNSF purchase was “an all-in wager on the economic future of the United States.” Rail investments are essential to accommodating growth, creating jobs, and stimulating economic activity. I will reiterate a statistic that was highlighted in CSX’s annual report—the US DOT recently estimated that total freight movements will rise by 61 percent between 2010 and 2040. The estimated hundreds of billions of dollars of freight rail investment required to help support this growth will come from the railroads themselves—on top of the nearly \$500 billion railroads have invested since 1980 in the network.

Q. How do you think the relationship between railroads and their customers is evolving?

A. At CSX, everything begins and ends with the customer—that is one thing I can tell you for certain will not change. To grow, we need to understand our customers’ needs and figure out how we can improve our ability to deliver on those requirements. We are particularly interested in enhancing our “first mile, last mile” service, supported by our investments in intermodal transportation in the past few years. As increased cost pressure and environmental awareness impacts our business, we’re committed to working with short-haul truckers to deliver the best and most efficient service possible to our customers.

Q. What are the rail industry’s key concerns around the continuing threat of re-regulation?

A. To preserve American competitiveness, it is critical that policy makers from both parties seek to create certainty, maintain balanced policies, and encourage investment.

A ten percent shift in freight to rail equals one billion gallons of fuel saved per year

Michael Ward, CSX's chairman, spoke at the June 22 STB competition hearing, and his message was clear: partial deregulation under the 1980 Staggers Act has enabled a rail renaissance marked by record infrastructure investments, new jobs, traffic congestion relief, and new business development on rail lines. We need to preserve the economic and environmental benefits that have resulted from balanced rail regulation, as these benefits are important to helping solve some of the nation's most pressing problems.

In the past five years, the major US railroads have invested more than \$40 billion in their networks. Government studies acknowledge that even this pace will not be enough to meet the transportation needs of the next 20 years. That investment and the associated job creation will not be possible without future earnings growth to support increased demand for rail services.



Q. One of the big economic stories of the past year is the increasing volatility of global commodity prices, to which railroads have significant exposure, both demand- and supply-side. How does CSX think about commodity-related risks and exploit commodity related opportunities?

A. CSX has a unique vantage point in that our business is diversified across almost every product that industrial America needs and consumers demand. This business model drives a number of benefits for us in an expanding economy and also helps us to weather shifts in supply and demand across the global economy, as well as shifts in commodity prices.

Industrial products and inputs, such as metals, plastics, and intermediate goods are in greater demand as the manufacturing sector increases production to meet the needs of a growing population. Not surprisingly, shipments of finished products are also on the rise. For example, automobile volume for CSX increased 20 percent year-over-year in the first quarter alone.

Export coal will represent a major growth market for rail: as the world supply of coal tightens and demand increases in developing countries, the US is positioned as a stable supplier and has strong reserves of metallurgical coal. Europe remains the largest importer of US coal, but Asia's demand is growing rapidly and expected to continue, as are shipments to South America.

On the supply side, CSX, like most railroads, has a fuel surcharge recovery program that collects on a lag. Given the lag, there can be timing issues if fuel prices increase sharply that may cause a near-term adverse impact. However, over the long-term, the program will offset the losses. We do expect that this fuel lag will continue to have a negative impact in 2011.

That said, as fuel prices rise, the fuel efficiency that freight railroads offer is increasingly recognized, and increased use of freight railroads goes a long way toward easing congestion and highway maintenance costs.

Q. As we continue to emerge from the deep international financial crisis, CSX has come out of the downturn with new determination to improve performance and sharpened its messages to the market. Can you give us some insights/learnings that CSX gained during the downturn that has allowed it to come out of the blocks so aggressively?

A. Being a leading indicator of economic performance allows us to anticipate and adjust to changes in our economy faster than many industries. Over the past decade, our focus on improving our operating ratio has naturally positioned us to weather downturns in the economy—we're constantly improving our cost effectiveness and operating efficiencies with a defined strategic goal in mind. During the downturn, we committed to converting costs that had previously been considered fixed to variable, allowing for "lean" operations while still providing the high level of service and returns our customers and investors expect.

As the economy continues to expand, we are seeing volume strengthen and that, coupled with a tightening of capacity, has allowed us to maintain our ability to price at a level that reflects the relative value of rail transportation. We have redoubled our efforts to better understand our customers' needs and to anticipate changes in their demand as global consumption bounces back. Our network is particularly well positioned to capitalize on resurging growth, especially via the East Coast ports, as international demand increases, and over-the-road conversion to rail transport continues.

Q. Passenger rail, especially high-speed rail, is getting a lot of attention lately in the United States. What role do you expect the Class I's to play in the development of intercity passenger rail?

A. CSX carries more than 90,000 riders on 220 Amtrak and regional commuter trains every day. Over the years, we have devoted substantial effort to high-speed rail projects.

It's important to keep in mind that two kinds of high-speed rail have been proposed by state and federal agencies—"true" high-speed rail like the bullet trains seen in China and elsewhere around the world, and enhanced conventional passenger service, which basically involves moving faster trains on existing freight infrastructure. We have been consistent in our view that true high-speed trains need to run on safe, sealed, dedicated corridors, not freight tracks. At the same time, we have been working with government agencies to provide enhanced services at speeds of less than 90 miles per hour.

Our obligations to our stakeholders require that we take a firm stance that any new passenger services on our tracks must be as safe or safer than existing operations, and that the operations must not interfere with our ability to provide critical freight service to our customers.

Q. Any closing thoughts about the overall outlook for the rail industry?

A. The economic recovery has been choppy—perhaps even more so than originally anticipated. While we have certainly seen progress, the news has not been all positive. Important domestic indicators such as jobs numbers continue to struggle, and serious debt issues linger in Europe.

With that said, discussions with our customers and a review of leading indicators suggest a solid economic growth trend for 2011 and beyond, and we remain confident in the long-term health of our business. We see significant opportunity at CSX to create value and are working to build on that through the balanced deployment of capital, including investment in our business, dividend growth, and share repurchases.

The current pace of investment will not be enough to meet future US transportation needs

COMING TO A ROAD NEAR YOU: E-MOBILITY

GILLES ROUCOLLE
RÉMI CORNUBERT

Electromobility, or “e-mobility,” which refers to the electrification of transportation, is poised to change the face of individual transportation as we know it. A recent study by Oliver Wyman looked at the trends that will drive changes in individual transportation over the coming decades and what an e-mobility dominated landscape could look like by 2040. Ultimately, the rise of e-mobility will create many new needs—and smart companies in industries ranging from transit operators, automotive, and energy to information technology and control systems will want to be primed and ready.

GOODBYE, COMBUSTION ENGINE?

In 2010, only 20,000 all-electric vehicles were sold worldwide, and electric vehicles will account for only about 6.6 percent of the motorized transport market by 2025. By 2040, however, electrics could capture more than 30 percent of the market, as the cost of such vehicles falls—a consequence of mass production and standardization—and electricity storage technologies improve. (In European urban centers, electrics could account for 50 percent or more of the market by 2040.)

The conversion to e-mobility for individual transportation will be driven by a range of new demographic and consumer trends over the next few decades, including increasing urbanization, changing perspectives on car ownership in developed countries, and the need to sustainably satisfy burgeoning demand for transport in emerging economies.

A GROWING URBAN POPULATION

By 2009, the world had crossed an important divide: slightly more than half of the total population had become urban.¹ By 2040, the urban population is projected to be in the range of 60–65 percent. The pace of demographic development in emerging countries will continue to intensify urbanization. In China, for example, the urban population will grow from 47 percent in 2010 to 62 percent in 2025, as a consequence of the migration of 20 million people per year into urban centers. In India, the urban population will exceed 60 percent by 2040.

Rising urbanization is being accompanied by the development of megacities (cities with 10 million-plus inhabitants), principally in emerging countries. In developed countries, on the other hand, increased urbanization is more likely to take the form of large cities absorbing peripheral suburbs to form well-integrated “metropolises.”² In both cases, urban pressures will create the need for more sustainable forms of transportation, both collective and individual.

¹ “World Urbanization Prospects, The 2009 Revision: Highlights,” United Nations, 2010.

² *Metropolis ou l’avenir des villes (Metropolis or the future of cities)*, Francois Ascher, Editions O. Jacob, 1995.



CAR USAGE, NOT OWNERSHIP

In developed countries, an increasingly urban population is becoming less emotionally attached to cars and exhibiting radically different consumer priorities: the number of cars per 1,000 people has already started dropping in large Western cities.

In particular, younger generations do not place the same value on owning a car as older generations—driven by greater recognition of the environmental impact of cars, the expense and hassle of owning a car in an urban center, and the desire for more fluid mobility solutions. Vehicle usage concepts such as car sharing, which has been tested in large cities, will change the consumer transportation consumption and purchasing model in a big way (Exhibit 1).

RISING SPEND IN EMERGING COUNTRIES

The “mobility spend” is generally stable for consumers in mature countries, but is rising

fast in emerging countries. For example, mobility spend will rise from 10 percent to 14 percent in China and from 9 percent to 12 percent in India. Given the size and growing urbanization of the population of these two countries (nearly 3 billion combined by 2040), it will be critical that governments channel this spend toward sustainable solutions, such as collective transport and e-mobility, or they will face staggering environmental and infrastructure consequences.

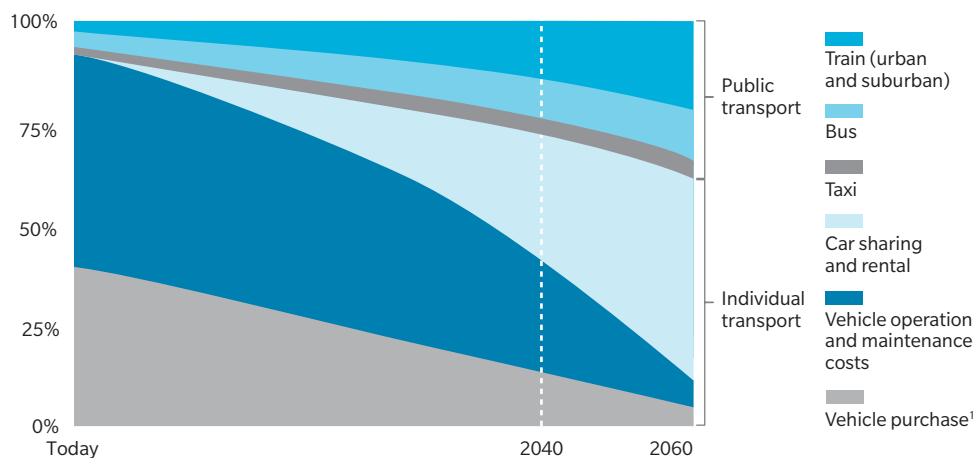
THE E-MOBILITY MARKET IN 2040

The new trends above (coupled with ongoing trends such as energy security and environmental protection) will drive the development of an e-mobility market by 2040 with five key dimensions:

- **Electric vehicles:** Electric vehicles will dominate other technologies in the

As the world’s urban population continues to expand, transportation options must become more sustainable

EXHIBIT 1: EUROPE: HOUSEHOLD TRANSPORTATION EXPENDITURES FOR MOTORIZED TRANSPORT MODES (ILLUSTRATIVE)



¹ Includes vehicle purchase and depreciation and amortization costs within leasing contracts.

Source: World Business Council for Sustainable Development, Oliver Wyman analysis.

Increased e-mobility will radically transform passenger transportation

field of individual motor-driven mobility, particularly in urban areas.

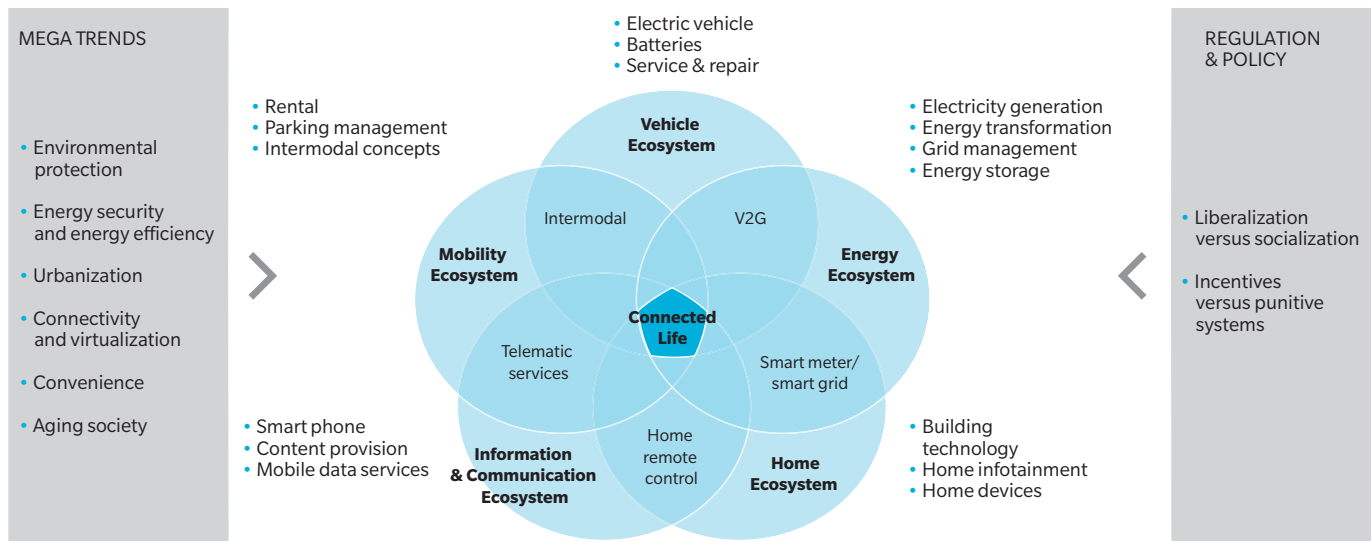
- **Mobility:** Integrated, intermodal mobility concepts will be the individual transportation model of choice in large and very large cities, and will be supported by high value-added services with links to public transit systems.
- **Electricity offering:** Renewable electricity production and distribution will be supported by a high-performance network and new forms of generation (storage/repurchase).
- **Home energy systems:** The smart home (with energy systems managed by information technology) will have become the standard in terms of energy efficiency and V2G management (battery recharge on the network).
- **Public recharge services:** Public infrastructure enabling rapid and ultra-rapid recharge will have become commonplace in urban areas.

As this market emerges, traditional value chain and economic models of existing

players in the passenger transportation space will be radically transformed. New service-driven profit zones and profitable business designs will emerge; at the same time, transportation modes will become increasingly interconnected and overall demand for transportation will become more sophisticated. In the long run, e-mobility will naturally call for the convergence of many different “ecosystems”: automotive, mobility and public transit, energy, intelligent domestic systems, information technology, and communication (Exhibit 2).

- **Customers and markets:** New mobility concepts will structure individual transportation modes and make user friendliness and user experience central. The demand for e-mobility will be met by offerings modeled around “smart home” systems. All-inclusive and flat-fee offerings will derive profits from the size of the market and will be characterized by transparent fees and prices for the end customer.
- **Competitors and partners:** Newcomers will be positioned as integrators, adding

EXHIBIT 2: THE 2040 E-MOBILITY LANDSCAPE



Source: Oliver Wyman analysis.

high value with mobility-related services at the core of their service offering, and an offering differentiated by far more than just the vehicle itself. In three decades, the mobility industry will be structured not only by competition among nations, but also among newcomers and players from non-automotive sectors.

- **Emerging profit zones and economic models:** Emerging value creation zones will erode the profits of traditional businesses, forcing competitors and new entrants to adapt existing economic models or develop new ones. New economic models will be increasingly based on asset-light strategies and focused on services as far downstream as possible to capture consumers and take advantage of customer knowledge to generate additional value.

RECOGNIZING THE E-MOBILITY OPPORTUNITY

Companies across a number of industries are already positioning themselves to take advantage of e-mobility trends and gain first-mover advantage in new opportunity spaces such as leasing, financing, and mobility services. In particular, incumbent firms in the following industries will want to consider the potential value that could be reaped by being the first to meet emerging e-mobility needs:

- *Automakers*, either on their own or with partners, will need to develop “e-mobility” packages designed to make it easier for the market and consumers to adopt all-electric and hybrid vehicles.
- *Public transportation operators* will need to focus on building intermodal mobility platforms and investing in car sharing concepts and new technologies. The

business case must be assessed locally by region/city and e-mobility integrated into long-term strategic planning. Partnerships with telecom operators and software companies will be critical to ensuring operators have necessary access to technologies and can develop seamless e-mobility solutions that will address door-to-door emerging market needs.

- *Electric utilities* will need to invest in battery recharge and infrastructure technologies to gain access to the e-mobility market. They will have to define value-added offerings around e-mobility and in the home. Partnerships will facilitate their access to innovative technologies. By relying on their role as energy and recharge specialists, these firms could form local mobility service partnerships or even serve as “active aggregators.”
- *Instrumentation and control companies* will need to consider how the management of domestic and mobile energy might provide opportunities to develop new businesses.

Fortunately, the expansion of e-mobility will not happen overnight. This will give existing businesses across industries the time to develop strategies that will ensure their continued relevance and to position them to capture a meaningful share of customers and profits once the market begins to take off. While the exact nature of the e-mobility transformation can’t be known, one thing is clear: The coming evolution of transportation will be profound.

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Many different “ecosystems” will have to converge to deliver on the promise of e-mobility

WHY AIRLINES NEED A NEW AIRCRAFT PURCHASING STRATEGY

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SETH ROSS

The next big wave of fleet renewals has begun. Having deferred large fleet refreshes through the global recession and industry turmoil, many airlines are now poised to replace their older aircraft with newer, more efficient models (innovations like the Geared Turbofan from Pratt and Whitney and GE's LEAP-X engine promise significant fuel burn benefits, for example). To make the best fleet decisions, airlines will need to adjust their purchasing strategy to meet the challenges of today's market.

Many airlines believe they incorporate total cost of ownership (TCO) into their purchase decisions. In practice, however, they tend to focus on a handful of relatively easy-to-calculate metrics, such as purchase or lease price, standard fuel burn, and OEM-reported direct maintenance costs. While critical, these measures don't reveal the whole story.

Take direct maintenance costs, for example. Using industry- or fleet-wide metrics to make these calculations can be misleading. The reported direct maintenance costs for a global fleet comprising aircraft less than five years old will not be the same as for a fleet with a mix of mature aircraft. Moreover, some aircraft age better than others and have opportunities to reduce costs as they age. Understanding the aging curve of maintenance costs allows operators to know how their operating costs will stack up over the total life cycle of the aircraft.

THE TRUE COST OF AN AIRCRAFT: MAINTENANCE

Airlines understand that they have the most leverage at the point of purchase—when the aircraft and component OEMs are eager to sell a new plane. Think of OEMs like Gillette, which famously sold razors at a low price, to lock in the lucrative blade market. Airlines that buy an aircraft without negotiating the cost of the “blades”—maintenance—will likely pay more in the long run as the fleet ages and costly replacement parts and high tech repairs are needed.

To develop a more accurate TCO estimate, airlines need to source engine, airframe, and component maintenance *while* they are making their aircraft purchase decisions. This way they can compare actual expected costs, not just “marketing” projections, at a granular level. More importantly, it gives carriers the power to negotiate each risk and cost separately at the time of purchase.

Once, airlines could afford to wait until maintenance events arose to negotiate service and maintenance contracts. Carriers could rely on high-tech Parts Manufacturer Approvals, repairs, surplus spare parts, and less expensive alternatives to OEM components. But in recent years, OEMs have made strategic moves that have protected and grown their share of the aftermarket, shifting the dynamics of the industry. Consolidation has created a new



class of “super-suppliers”—large, integrated OEMs who have been able to manage their intellectual property in the aftermarket, both in their deals with airframe OEMs and in reducing the real impact of PMAs, especially on high-tech components and non-book repairs.

THE CHANGING MRO/OEM LANDSCAPE

In a recent Oliver Wyman survey, we found that few independent MRO shops want to take on the OEMs beyond a certain level of repairs. Fifty-seven percent of MROs and half of OEMs surveyed saw their counterparts as customers or partners, not competitors. With license agreements and more cooperation, OEMs have effectively inserted themselves between airlines and MROs, which could reduce a carrier’s sourcing leverage with OEMs after an aircraft is purchased.

Specifically, we identified four areas that effectively drive maintenance costs, and on which airlines will want to focus at the time of purchase:

- The warranty period
- Complete and discounted pricing catalogues
- Material cost escalation
- Service bulletin and/or Airworthiness Directive changes

These factors together can easily make the difference between the right aircraft and one that adds unnecessary risk to the bottom line.

Of course, considering maintenance up front complicates the aircraft purchase process, since the airline must essentially conduct an aircraft RFP simultaneously with RFPs for airframe maintenance, the engine, and

multiple components. But the alternative is to hand over long-term cost-control to OEMs. In addition, airlines should look to MROs at the initial point of purchase, to both leverage the competition between aircraft manufacturers and between MROs and OEMs. Airlines need strong competitive MROs to ensure that competition between independent MROs and OEMs is maintained.

USED ISN'T BETTER

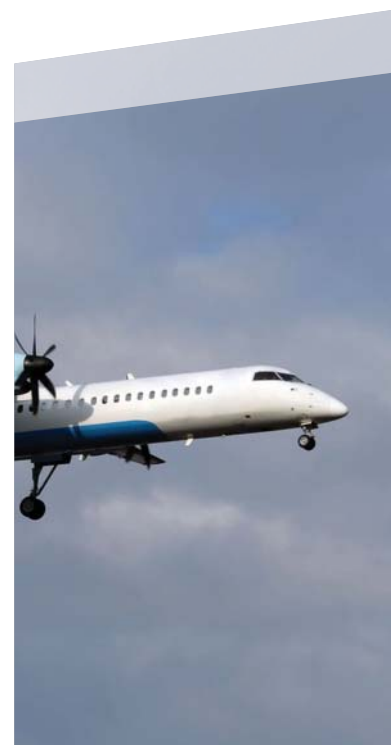
Finally, as airlines look to expand or refresh fleets, we advise them not to fall for the “siren call” of seemingly great deals on used aircraft. While some commercial and cargo carriers have successful business models that rely on optimizing productivity from older, cheaper assets, most airlines do not. They need to accurately offset leasing benefits with the operational risks and increased fuel and maintenance costs of older aircraft.



In summary, it is critical for airlines to fully understand the interplay among aircraft reliability, operating costs, spare assets (including aircraft), fuel economy, and monthly ownership costs. The deeper this understanding, the greater the competitive advantage an airline will have over rivals that stick to the old methods of aircraft purchasing.

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Strengthening competition between MROs and OEMs now requires airline involvement



OPTIMIZING FLEET MANAGEMENT COSTS IN PUBLIC TRANSIT

GILLES ROUCOLLE
GWENAEL DORVAL

Fleet management costs—including for items such as vehicle amortization/leasing, insurance, maintenance & repair, tire management, and fuel/lubricants—account for a large part of total costs for public transit operators (e.g., 30 percent for one operator recently analyzed by Oliver Wyman). With budgets today highly stretched (even leading to the reduction of transit services in the worst cases), reducing these costs where possible is critical.

Based on recent work with public transit clients, Oliver Wyman has found that optimizing fleet management costs can best be accomplished through one of two methods:

- **Lever-by-lever:** A systematic approach that aims at optimizing each cost center with appropriate but mainly independent levers
- **Total life cycle cost:** A global approach based on assessing all fleet elements together and then outsourcing fleet management to the original equipment manufacturer (OEM)

Choosing which method is right for a specific fleet primarily depends on the potential for outsourcing maintenance. Generally, the lever-by-lever approach is more suitable if maintenance must remain in-house, while a total life cycle cost will yield higher returns if maintenance can potentially be outsourced.



LEVER-BY-LEVER OPTIMIZATION

Assuming that maintenance must remain in-house, lever-by-lever optimization still requires a strong purchasing team and close coordination between the technical and purchasing teams to succeed. The key opportunities to optimize costs from a lever-by-lever approach include vehicle price, maintenance and repair costs, and fuel costs.

- **Vehicle prices:** Increasing coordination and visibility on forward looking purchasing needs in conjunction with OEMs is the key to discounted vehicle prices. The further out OEMs know the details of purchases, the more volume that is committed, and the more standardized the fleet, the greater the achievable savings.
- **Maintenance and repair costs:** An improved purchasing order organization and tools

that enable easy comparison of spare parts prices and monitoring of recurrent repair costs can greatly reduce the administrative burdens for the maintenance organization. Spare parts costs can be further optimized by reducing emergency orders and direct OEM ordering.

- **Fuel costs:** Fuel price management is a complex task, requiring specific expertise, and can have huge financial impacts. Using Platt’s contracts can optimize day-to-day prices for most of the fuel volume, while spot bid auction tools can source the remainder very efficiently. There are often a range of levers that can be used to reduce actual fuel consumption.

It is reasonable to expect this approach to generate greater than 8 percent annual savings on fleet management costs. Some of the critical levers that can be “pulled”—and the potential savings they can generate—are shown in Exhibit 1.

EXHIBIT 1: LEVER-BY-LEVER FLEET COST OPTIMIZATION: POTENTIAL LEVERS/SAVINGS (ILLUSTRATIVE)

EXAMPLES OF LEVERS	POTENTIAL SAVINGS
VEHICLE PRICE LEVERS	
<ul style="list-style-type: none"> • Longer, multi-year OEM contracts and vehicle specifics farther in advance • Concentrated volume, coordinated purchasing across entities (global purchasing framework) • Greater standardization of base vehicles and options • Negotiated spot purchases, when needed, on top of existing contracts 	<ul style="list-style-type: none"> • 2-5% on committed volumes • 3-6% (direct price); up to 8% (year-end discount) • Not assessed (high potential) • Up to 5% on spot purchases
MAINTENANCE & REPAIR COST LEVERS	
<ul style="list-style-type: none"> • Spare parts pricing tool to compare negotiated prices among all distributors • Purchasing order organization to ensure latest negotiated prices/conditions are being used and overall purchasing strategy is being followed • Direct OEM purchase of spare parts where possible • Formalized price lists for recurrent repairs to reduce need to monitor suppliers • Optimized maintenance planning to reduce emergency spare parts buying 	<ul style="list-style-type: none"> • 5-8% on spare parts spend • >2% of spare parts spend • 20-30% on direct purchased parts • 5% on recurrent repair spare parts • 7-10% of emergency spare parts prices
FUEL COST LEVERS	
<ul style="list-style-type: none"> • Platt’s contract usage to optimize day-to-day fuel prices for most of volume • Spot bid auction tools to generate ad hoc e-auctions on fuel demand to leverage local opportunities • Decreased fuel consumption through technical levers (e.g., tire inflation pressure, fuel efficient tires, robotic gears) and changing driver behavior (e.g., consumption tracking, smooth driving simulator) 	<ul style="list-style-type: none"> • 0.5-1% on fuel prices that go through contract • 2% on spot purchases • 3-7% each technical lever, up to 10-15% for driver behavior

Note: Potential savings based on observed savings or assessed potential. **Source:** Oliver Wyman analysis.

TOTAL LIFE CYCLE COST OPTIMIZATION

Given that all vehicle costs are interrelated, outsourcing fleet management to the vehicle OEM can be the most efficient solution for optimizing total life cycle costs, and generate a “win-win” for both the operator and the OEM (Exhibit 2).

Outsourcing to a vehicle OEM is the fastest way to optimize all fleet costs at once

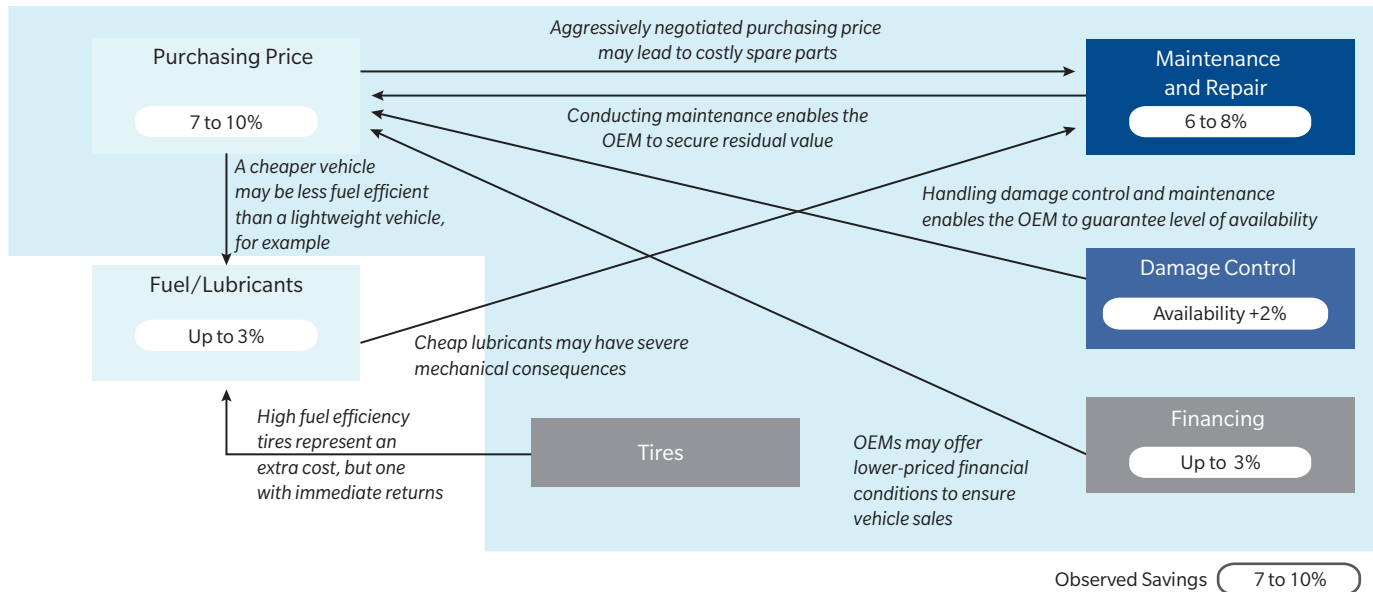
For the vehicle operator, by optimizing all cost factors simultaneously, OEM-outsourced fleet management can generate direct cost savings (i.e., the OEM can offer a lower overall price), secure the total fleet cost up-front for the contract life, and improve guaranteed availability levels. For the OEM, this solution can increase revenues, both by extending the OEM’s share of fleet activities as well as by increasing market share through a better value proposition. (Some truck and bus OEMs do already provide such fleet management services.)

The success of this approach will depend on the operator’s ability and willingness to outsource and the ability of the OEM to develop an integrated fleet management solution. In addition, the purchasing organization must coordinate closely with the technical department (a fleet management department is the ideal solution).

Generally, the major difficulty for the OEM in pursuing this type of solution is developing a maintenance garage network that is able to ensure the expected level of quality and availability of vehicles; for the transit operator, getting the agreement of all internal stakeholders (e.g., CEO, CFO, Operations, Purchasing, HR) is often the stumbling block to outsourcing.

An important initial step, of course, in determining whether outsourcing makes sense is determining the savings that could be achieved through a total life cycle cost approach. This will greatly depend on the

EXHIBIT 2: FLEET MANAGEMENT OUTSOURCING: ELEMENTS TO BE INCLUDED IN THE OEM OFFER



Source: Oliver Wyman analysis.



initial efficiency level and cost of maintenance for the current state of the fleet. Oliver Wyman has achieved savings of up to 7 to 10 percent on fleet management costs, however, based on the application of its total life cycle cost methodology.

Once the total life cycle cost has been modeled, OEMs can be asked to bid based on the model. These bids can then be compared based on a detailed understanding of the granular cost components to determine an optimal overall fleet management cost (Exhibit 3).

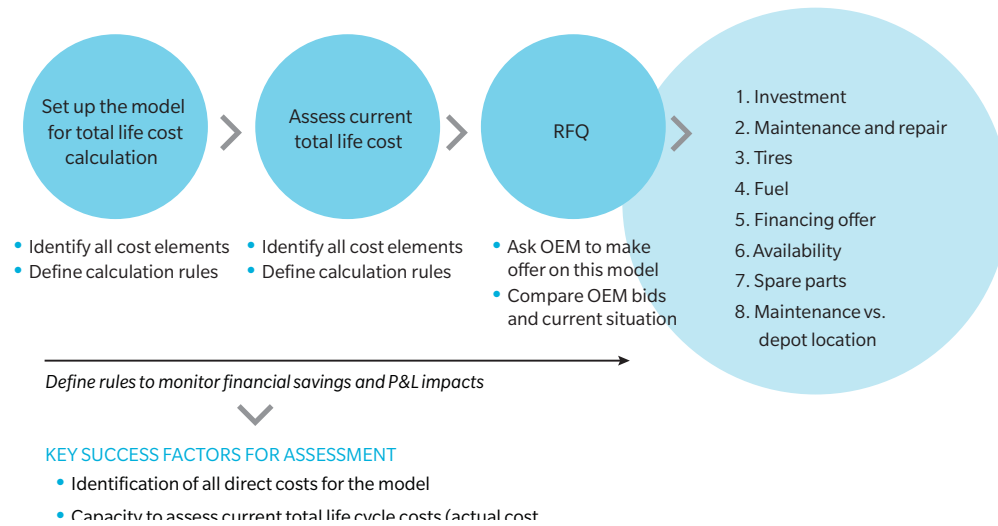
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In summary, public transit operators have multiple options to better manage and reduce fleet costs. The type of maintenance organization is not a roadblock to achieving savings: whether changes can be made only incrementally—or for fleet management as a whole—a methodology that provides a deep

dive into the fundamental components of fleet costs can yield many opportunities for significant and sustained savings.

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EXHIBIT 3: TOTAL LIFE CYCLE COST: METHODOLOGY FOR SAVINGS ASSESSMENT



SCHEDULED OPERATIONS: NOT JUST FOR RAILROADS ANYMORE

CARL VAN DYKE
RODNEY CASE
JASON KUEHN

Since the late 1990s, North American freight railroads (and some international ones) have increasingly embraced scheduled or precision operations. But while this concept started in railroading, it is not unique to it: Based on our work on six continents, Oliver Wyman believes a variety of freight transport modes could benefit from the adoption of scheduled network concepts.

Railways, LTL carriers, parcel and small shipment companies, container lines, and barge lines all operate network-based transportation systems. Network operations must be executed consistently, not tactically: Imagine what would happen to FedEx's reputation, for example, if it made network decisions solely to minimize cost. Still, all networks seek to minimize handlings. On railroads, handlings have a disproportionate impact on transit time and costs, with network shipments generally spending far more time being handled at yards than in transit. Handlings are also where reliability fails, due to the complexity of processes and the need to make planned connections between transport services. The real battles in network transportation service are often won and lost in terminal operations.

These same principles apply to other forms of freight transportation. Network transportation solutions are used by barge lines to gather individual barges into "tows" for joint movement to locations where these tows are broken up and formed into new tows for onward transport. Less-than-truckload companies build trailerloads of shipments for joint movement to other terminals or break-bulks, where these trailers can be stripped and their contents sorted and assigned to a new set of trailers for onward movement. Similarly, container lines use networks of feeder ships, mainline ships, trains, and trucks to move shipments from origin to destination.



SCHEDULED OPERATIONS BASICS

Traditionally, railroads ran trains when they had enough cars/tonnage to justify the trip, with loose schedules and low certainty that a shipment would arrive in a particular place on a particular day. In scheduled operations, trains are dispatched according to a strict schedule, even if running “light.” Scheduled railroad operation is a relatively recent phenomenon, primarily because railroads are such incredibly complex systems to operate. Building a planning process sophisticated enough to schedule huge networks, and flexible enough to respond to real-time changes, required planning tools and models that have evolved only over the past decade, supported by newer information and communications technologies and raw computing power.

The core notion of scheduled operations is to predefine the local services, the linehaul services, and the routing plan for each

shipment and to then operate according to this plan as faithfully as possible. Such an approach cannot be blind to variations in traffic volumes, or the day-to-day challenges all transportation companies face. As an example, for railroads, if the plan is short on capacity, extra resources must be found to run ad hoc extra trains. If too much capacity is provided, too many resources are consumed and inevitably a train must be canceled—often on an ad hoc basis. So it is important that the plan be based on realistic demand expectations. The goals and process of operations redesign are described in Exhibit 1.

In the end, the operating plan design process should yield an “executable” operating plan matched to traffic by day-of-week. Given normal variations in traffic, the plan can also include support for planned annulments, extras, and consolidations. Key to the entire process is adopting a fundamental philosophy shift in how service is designed, that is, basing the plan on customer demand from the bottom up.

Scheduled operations can be applied to any network-based transportation system: rail, trucks, barges, and more

EXHIBIT 1: OPERATIONS REDESIGN PROCESS: GOALS AND REQUIREMENTS

GOALS OF THE SCHEDULED OPERATIONS REDESIGN PROCESS	ACHIEVING THESE RESULTS REQUIRES:
<ul style="list-style-type: none"> Reducing intermediate shipment handlings, yard/terminal requirements and dwell time, switching costs, and claims, while increasing shipment velocity Reducing the equipment (assets) that need to be operated, congestion, crew/labor requirements, and fuel consumption, while freeing up capacity Using more direct routes for shipments and reducing excess travel distances and time Reducing traction requirements through both scheduled operations and reduction in total assets operated Improving service and reliability 	<ul style="list-style-type: none"> Building the operating plan around the traffic (customer demand) Using computer analysis to identify improvement opportunities In the example of trains, starting with the classification or railcar routing plan first, building the trains to support this plan Restructuring local service to improve gathering and distribution performance Increasing reliability and reducing delays by utilizing yard/terminal operating plans Monitoring key statistics such as railcar-days, handlings, gross-ton-kilometers, crew starts, and train kilometers throughout the design process to ensure a positive outcome

All of the major North American railroads not only use scheduled railroading but have gone beyond it to “zero-based” operating plans, which are built from the ground up, based on current traffic patterns and customer needs. (A railroad operating plan describes how railcars should move—“the routing and train plan”—and often includes the disposition of major assets needed to move the cars, such as train crews, locomotives, yards, and tracks.) Of critical importance is that by rethinking their operating plans, railroads have found that networks they once thought at or beyond capacity can be “stretched” to increase throughput without expensive capital improvements.

reliability of scheduled operations keeps customers happy—including customers that might otherwise consider other modes.

LTL HAS A PLAN

While in rail a loaded car moves from train to train, often through intermediate sorting yards, in less-than-truckload (LTL) service, small to mid-sized shipments move from trailer to trailer, through a network of terminals and intermediate sorting facilities known as break-bulks.

As in the railway business, LTL volumes can vary from day to day—from not enough to fully load a trailer to a destination terminal, to enough volume to create a trailer for a destination terminal normally served via a break-bulk. While this might seem like the perfect environment for “winging it”—dynamically deciding on a daily basis what destinations to serve—many trucking companies actually use a scheduled plan for moving tractors and trailers, to ensure service reliability and meet high customer expectations.

Beyond the scheduled plan, LTL companies look for further ways to wring as much efficiency as possible out of their operations. For example, they constantly monitor volumes and redesign the base plan to adjust to long-term trends. And, most terminals have an outbound load planner, who monitors arriving shipments and looks for high-volume situations, such as where a full trailer can be created for a destination terminal normally served via a break-bulk, or where a partial trailer-load can be created for a single destination terminal. Although the trailer in each case continues on its pre-planned route (i.e., to a break-bulk), labor requirements at the break-bulk will be reduced thanks to the



Scheduling, by keeping crews and assets in balance, creates a ripple effect throughout the system, reducing delays, downtime, and congestion. This improved resource utilization also directly impacts the bottom line: on the marketing side, scheduling tools can be used to model the feasibility and cost to serve potential customers, as well as new product offerings, indicating what business to aggressively pursue and enabling better alignment of pricing with costs. Most importantly, reduced transit times and greater

load planner's intervention. The end result is similar to that of a railway, with both focusing on minimizing handlings and costs, while protecting asset velocity and customer service.

BARGING: SLOW BUT SCHEDULED

The inland barge industry is a slow-moving, relatively low-volume industry, but it is also a network business. A single barge can hold 1,000 to 2,000 tons, meaning that 5 to 10 barges can swallow an entire unit train. Similar to a railroad's cars or an LTL trucker's packages, barges are relayed from tow to tow, using combinations of local services, feeder services, and mainline movements. Operating costs are heavily driven by the high fixed costs of tow boats; unit costs are minimized by maximizing tow size. With tows being made up of anywhere from as few as three or four barges to as many as 40, there is often the need to consolidate shipments from many customers to create an economic tow size.

Some of the commodities handled by barge lines such as grain and coal are very low value and thus don't need a highly reliable supply chain, as long as they arrive in time to meet an export vessel sailing. But higher-value industrial commodities such as steel, cement, scrap and pig iron, and liquid chemicals require a reliable supply chain. Rail is highly competitive with barge for these commodities, as rail can provide faster overall transit times.

Oliver Wyman recently developed a scheduled operation for a barge line, using grain and coal as filler commodities to increase tow size (to keep costs low), and to provide the density required to support dependable scheduled operations. This

project demonstrated that the design principles first developed for railroads could be easily adapted to develop a reliable supply chain for barge customers and improve towboat utilization, by scheduling towboat cycles while maintaining the large tow sizes of a "tonnage" based system.

SCHEDULING AROUND THE WORLD

Beyond the possibility of applying scheduled operations to a range of transportation modes, Oliver Wyman has also found that scheduled operations can work no matter what the setting and no matter how challenging the rules of the game. We have seen firsthand success in using scheduled network concepts in Western Europe, South Africa, and the CIS. Although operating plan details will vary, the core concepts of building a plan based on traffic, and then adhering to that plan, remain valid everywhere.

For example, Western European railways on the surface appear to run scheduled railroads but this can often be deceptive, as these carriers usually must live with major network capacity constraints due to passenger rail traffic and have fewer train "paths" to work with. As a result, they often schedule many more slots than they need and only use some of their paths on the day of operation. Equally, in some countries, high cancellation rates for trains due to low volume effectively destroys the scheduled nature of the operations. And too often in many countries, operating plans are locally constructed, where a systematic network design process that looked at traffic across the railroad would result in much more efficient train design and car routing.



Geography and level of economic development are not barriers to network scheduling

A scheduled network focuses on minimizing handlings and costs, while protecting asset velocity

Of particular concern for European freight rail is the poor use of available capacity. European railroads often run three or more parallel product services (on different trains) that take no advantage of existing capacity on other services. Improving capacity usage makes rail more efficient and reduces operating costs—which can be passed on in the form of lower rates and better service for customers.

In CIS countries such as Kazakhstan and Russia, scheduled operations hold out the promise of both improved customer service and asset velocity. These railways have long focused on maximizing train size, and thus minimizing the use of train slots and the unit cost per railcar of direct train operations. However, a price has been paid through inconsistent movement of traffic, excessive car handling, lower rates of locomotive and railcar utilization, and poor customer service. Recent pilot projects exploring the use of more structured and disciplined operations have been promising, however, showing improvements in all of these metrics with minimal impact on train size.

SCHEDULING SUCCESS

Oliver Wyman’s experience with major network redesigns—such as Norfolk Southern in the United States and Green Cargo in Switzerland—has led us to develop a number of critical “lessons learned” for developing a successful scheduled operating plan:

Commitment is critical. The entire organization must be committed to the new plan, understand the benefits of adhering to it as closely as possible, and be on guard against backsliding into old habits.

The operating service plan must be well defined and sufficiently detailed. The managers in the field must receive detailed planning documentation, including local service definitions and feedback from the planners during implementation.

The plan must be feasible and executable. The plan, as derived from the model, must be checked by load planners, marketing, and operations for reasonableness, prior to execution.

A measurement system is necessary to ensure that the plan is complied with when executed, and to help identify where plan adjustments may be warranted.

While significant effort is required to overhaul a freight transportation operating plan, it cannot be viewed as a one-time event. The plan must be continuously reviewed and refined as traffic patterns change, and should be completely rebuilt from scratch on a periodic basis.

The bottom line is that adopting a scheduled operating plan approach works to reduce costs and improve service and reliability, with benefits accruing to both the transportation company and its customers. It can be difficult to achieve, and requires a careful, systematic, network-focused approach to planning and operations. The tools and information usually already exist to support such an approach; success then depends on maintaining the management focus and the will to follow the plan.

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DYNAMIC RISK MANAGEMENT IN INFRASTRUCTURE FINANCE

There is a paradox at the heart of investing in infrastructure. On the one hand, investors are typically attracted to infrastructure assets because they are seeking stable cash flows over long time horizons. On the other hand, greenfield infrastructure projects represent huge and often risky bets—bets that can go spectacularly bad.

JOHN LAREW
MARK ROBSON

It's no wonder infrastructure funds in recent years have found it easier to come across interested investors than to unearth investments that suit their investment strategies—even as global infrastructure needs continue to outstrip the capacity of public sources to fund them.

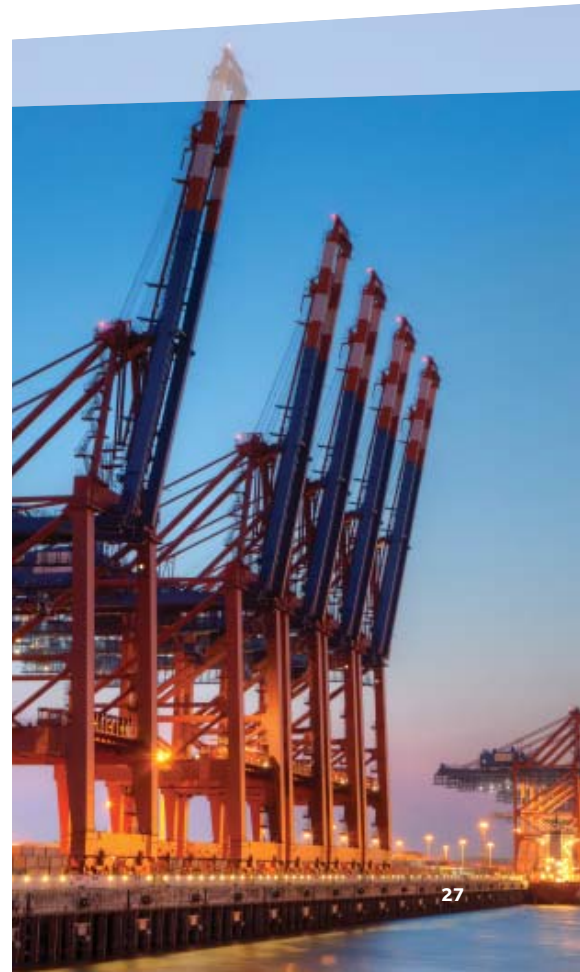
Today, more than ever, infrastructure investors need tools to bridge the gap between their risk appetite and the actual level of inherent risks of projects requiring massive capital outlays against time-distant revenue streams. In Oliver Wyman's work with large infrastructure projects, we have found a number of tools for dynamic risk modeling that are often underused, but that can be a valuable resource for project sponsors, lenders, and equity investors alike.

THE UNTAPPED POTENTIAL OF RISK MANAGEMENT

Infrastructure projects, be they roads or rail lines, ports or airports, power lines or waterworks, all share certain characteristic features. These typically include:

- High upfront investment requirements
- "Chunky" capacity, with significant scale economies
- Building ahead of demand (often uncertain or speculative demand)
- Uncertain cost to create capacity
- Uncertain timing of revenue
- High leverage (typically 60-80 percent gearing)
- Extraordinarily high sensitivity to financing costs

Numerous academic studies have come to the conclusion that greenfield infrastructure projects systematically disappoint their backers: cost overruns, schedule delays, and revenue overestimates seem to be the norm more than the exception. It is no exaggeration to say that mastering risk—understanding, quantifying, and managing it—is the key capability in successful infrastructure investment.



Mastering risk is the key to successful infrastructure investment

In this environment, sophisticated investors have learned to appreciate the value of dynamic financial modeling (e.g., Monte Carlo simulation) in assessing the likely performance of prospective investments. Unlike traditional static financial modeling, a stochastic risk model recognizes that key drivers of financial results (capital costs, operating costs, volumes, prices, timing of cash flows, etc.) are inherently uncertain and can interact in unexpected ways. Instead of assigning a discrete value to these variables in a spreadsheet, Monte Carlo models key variables in the form of a probability distribution function. This can be further extended to include the dynamic interactions between simulated outcomes of risks.

The output of such an analysis is a much richer view of the financial prospects of the investment. Instead of looking at, say, the results of three or four scenarios, a decision-maker can see the consolidated results of thousands or tens of thousands of simulation runs. And while a traditional financial model might answer the question, “What is the sensitivity of cash flows to a 1 percent change in interest rates?” it cannot reliably answer questions such as, “What is the probability that this project will meet its IRR target?” or “What is the probability that the project will remain in compliance with all its financial covenants?” The stochastic risk modeling approach, however, can answer such

questions, which is one reason it has become the acknowledged gold standard for financial analysis of infrastructure investments.

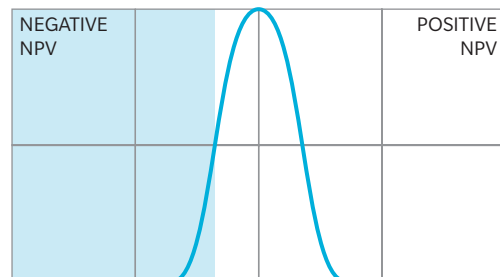
In our experience, however, many project sponsors and investors do not capture the full value that stochastic risk modeling offers. Value is typically left on the table in two ways: the risk model itself may be faulty or incomplete, or the risk model is too often abandoned after the initial investment decision has been made.

The first major pitfall in dynamic risk management is getting the model wrong. When it comes to stochastic risk modeling, there is wisdom in the old adage that a little knowledge is a dangerous thing. The very precision of the outputs (“In 95 percent of the cases, the project will meet its IRR target”) can lead to a false sense of confidence if the appropriate care has not been taken in constructing the underlying model. The recent proliferation of easy-to-use spreadsheet add-ons such as Crystal Ball and @Risk may have encouraged a tendency toward overreliance on unreliable models.

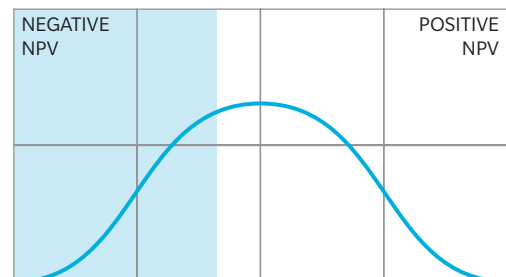
There are many ways to go wrong in modeling risk (just ask anyone who invested in collateralized mortgage obligations), but one example serves to illustrate this point. Imagine a project in which the net present value is sensitive to two variables: the price

EXHIBIT 1: UNCORRELATED VERSUS CORRELATED RISKS

UNCORRELATED RISKS



CORRELATED RISKS



of crude oil and the dollar exchange rate. It's a simple exercise to generate a probability distribution function for both variables based on historical ranges. After running a Monte Carlo simulation of the project, the expected NPV of the project might look like the figure on the left in Exhibit 1.

But this analysis implicitly assumed that the oil price and dollar exchange rate are independent of one another, when in fact they are correlated. After modifying our model to account for this correlation, our expected NPV might look more like the figure on the right. What once appeared to be a sure thing is revealed to have a nontrivial chance of failure. Across many projects in diverse industries, Oliver Wyman has seen our belief confirmed that there is no substitute for a disciplined modeling approach, rigorously applied by skilled practitioners.

The second major pitfall in dynamic risk management is getting the model right, but not doing the right things with it. A common shortcoming is a disconnect between the risk analysis for the concept, design, and finance phases and the risk management approach that guides the engineering, procurement, construction, and operating phases.

Oliver Wyman's approach to risk analytics looks at the variability of cash flow versus plan ("cash flow at risk") as the primary metric. While this metric usually makes intuitive sense to project sponsors and investors, it stands in contrast to the engineering-driven approach to risk analytics that often prevails in a contracting and construction environment. To be sure, there can be value in the tools used in engineering-driven risk management, such as comprehensive risk registers, heat maps, and the like. But this approach falls short of the needs of senior management, as it fails to distinguish the merely important from the absolutely critical. And it leaves

senior decision-makers without the tools to understand potential tradeoffs in risk and reward.

FEWER RISKS, MORE REWARDS

Our experience has shown that investors and sponsors who incorporate a dynamic risk management approach can avoid these pitfalls and extract substantial additional value from their investment. The benefits of a more robust risk management approach are numerous, and accrue to infrastructure funders, operators, and users alike:

Focuses on the right risks. A dynamic risk management framework gives management visibility into the impact of risks on the bottom line. In one recent engagement, the project sponsor intuited that the major risk to cash flow was demand risk, and was prepared to sacrifice substantial revenues to mitigate that risk through takeoff agreements. Oliver Wyman's risk analytics showed that risks related to internal execution were far more important, leading the client to devote more resources to those risks.

Supports a wide range of management decisions. Armed with the right analytical tools, management can compare and contrast the value created by investing in different risk mitigation measures for different risks. Funding strategies, hedging strategies, sourcing strategies, and technology choices are among the tools that become more effective with a reliable understanding of cash flow at risk. As an example, we used a stochastic risk model to quantify an underappreciated supply risk. The client subsequently modified its technology strategy to focus on a more expensive, but more secure source of raw material.

Dynamic risk modeling can bridge the gap between risk and reward in infrastructure projects



Supports efficient allocation of risk.

Infrastructure projects increasingly involve multiple investors and stakeholders, for example, through public-private partnerships and customer-supplier co-investment. Efficient allocation of risk can be a significant lever of value creation, not to mention a vehicle for making deals possible that might otherwise founder on stakeholder resistance. In a recent deal involving a major expansion to a transportation asset, risk analytics revealed that the infrastructure developer faced substantial exposure to steel price inflation—which could not be conveniently hedged. Faced with the prospect of paying for the steel risk through a price premium, the infrastructure users found it more efficient to accept the risk themselves, as they had some upside risk exposure to steel prices.

Prioritizes value improvement opportunities.

Dynamic risk management is not just about avoiding downside risks, but enabling upside opportunities. By comparing multiple investments across the dimensions of risk and return, companies often can find “free lunch” opportunities: higher return for the same level of risk.

Lowers financing cost. Dynamic risk management is ultimately about making risk transparent—to sponsors, operators, and investors. Bank regulators, following the capital adequacy standards in the Basel II and Basel III accords, are pushing lenders in the direction of greater reliance on dynamic risk evaluation. Project sponsors increasingly

find that they need to have access to dynamic risk models to access the widest possible capital pool.

Based on concrete project experience, Oliver Wyman believes the following factors underpin the success of risk management in infrastructure projects or, indeed, any large capital project:

- Adopt a cash flow at-risk framework, and apply it consistently throughout the project life cycle
- Get the model right. Take a rigorous approach to constructing a pyramid of risks that describes the network of interrelated risk drivers
- Calibrate the model carefully. Pay attention to the choice of statistical distributions, to the impact of “tail risks,” and the correlation of risks
- Anchor the responsibility for risk management in the organization. Decision-making processes and governance should adhere to the risk framework

The universe of infrastructure investment opportunities grows larger every day. But comparatively few opportunities have the “ideal” risk profile investors seek. If every infrastructure investment had known capital costs, predictable revenues, and stable margins, there would be no need for sophisticated risk management techniques. Until then, savvy sponsors and investors need to use the best tools they can find to master risk.

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Oliver Wyman's Transportation Practice, part of the Manufacturing, Transportation, and Energy (MTE) unit, is one of the largest consultancies in the world dedicated to the transportation industry, with a professional staff of more than 100 partners and consultants worldwide. It provides a comprehensive set of services and capabilities to transportation carriers, and to the users and regulators of transportation services, across the full range of the transportation sector.

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Oliver Wyman has also developed a Corporate Finance & Restructuring practice that capitalizes on our strong credentials in the transportation sector. The practice provides strategic and transaction expertise to complement the in-depth market and industry knowledge of our expert industry groups. The practice offers a full range of services for financial sponsors, creditors, and management teams, including support for investment, divestment, M&A, project finance, restructuring/workouts, privatization/PPP, and asset performance improvement.

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ABOUT OLIVER WYMAN

With offices in 50+ cities across 25 countries, Oliver Wyman is a leading global management consulting firm that combines deep industry knowledge with specialized expertise in strategy, operations, risk management, organizational transformation, and leadership development. The firm's 3,000 professionals help clients optimize their businesses, improve their operations and risk profile, and accelerate their organizational performance to seize the most attractive opportunities. Oliver Wyman is part of Marsh & McLennan Companies [NYSE: MMC]. For more information, visit www.oliverwyman.com.

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